A CENTRAL VALLEY PROJECT IMPROVEMENT ACT IMPLEMENTATION PLAN FOR FISH PROGRAMS

Prepared for the

U.S. Fish and Wildlife Service and Bureau of Reclamation

under the direction of the

Central Valley Project Improvement Act Core Team

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Acknowledgements

The initial draft of the *CVPIA Implementation Plan For Fish Programs* was prepared by the CVPIA Technical Team. The CVPIA Core Team then reviewed and provided comment on the draft implementation plan, and the final implementation plan was updated to reflect those comments. As such, the final *CVPIA Implementation Plan For Fish Programs* reflects a collaborative effort by multiple agencies and a diverse range of staff expertise.

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Executive Summary

The purpose of this Plan is to describe the approach for prioritizing and implementing the anadromous fish-related provisions under the CVPIA over the next 5-10 years. This Plan will build upon the Final Restoration Plan (FRP, USFWS 2001) to integrate a decision-making framework across all programs with the goal of making all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley on a long-term, sustainable basis. The Plan develops an annual process for setting priorities and funding projects across CVPIA fish-related provisions and watersheds in the Central Valley. The new process uses an Adaptive Resource Management (ARM) approach with support from Decision-Support Models (DSMs) to prioritize implementation of management actions that have the highest probability of achieving biological objectives for wild populations of native anadromous fish. The ARM approach will also guide plans for monitoring and research by synthesizing existing monitoring data, annually updating DSMs using new information, and estimating the value of new information to the decision making process.

The Plan proposes a transparent process for setting priorities and developing projects, an integrated governance structure for Central Valley anadromous fish restoration, and specific ways for stakeholders to participate. Management actions and projects will be implemented within an adaptive management framework that is iterative and can be adjusted over time. The Plan allows for monitoring data to be collected and incorporated according to guidelines developed by a Center for Data Management (CDM), stored in a comprehensive database, and used to update the DSMs with the goal of improving decision-making over time to meet watershed-specific biological objectives and broader Central Valley-wide goals for anadromous fish. This Plan is responsive to recommendations made by the Fisheries Independent Review Panel (Independent Review Panel 2008) to increase the efficiency and effectiveness of actions within the CVPIA towards achieving fisheries goals, including: (1) update and improve the program's science-based framework, (2) reorganize program structure and management, and (3) improve collaboration with all related programs in the Central Valley. A fourth recommendation, to improve implementation by making full use of CVPIA water operations authorities, is beyond the scope of this Plan.

This Plan will not replace the Final Restoration Plan (FRP), which includes comprehensive lists of all the specific restoration actions that should be completed on individual tributaries to make all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley on a long-term, sustainable basis. Rather, this Plan develops and documents science-based decision making to evaluate alternative management actions available under the FRP, refine actions or develop new actions when appropriate, and prioritize actions within and across watersheds according to expected outcomes. Science and management priorities for CVPIA fish-related provisions will be documented on a 5-year cycle and used to guide development of projects and Annual Work Plans. This Plan outlines four key tasks necessary for successful implementation of CVPIA fish-related provisions:

1. Develop and implement an ARM process to prioritize, implement, and learn from projects. ARM incorporates uncertainty due to competing hypotheses about the effects of alternative management actions on anadromous fish populations and uses an adaptive management approach to reduce uncertainty and increase effectiveness. The ARM process will prioritize actions and monitoring at a landscape-scale, across the Central Valley, to determine which types of actions should be implemented in which watersheds to have the best predicted benefit to native anadromous fish. However, specific projects will be designed and implemented at the watershed-scale, based on expertise of local staff, partners, and watershed groups.

2. Construct, refine, and maintain DSMs for the Central Valley to support prioritization of categories of management actions and the watersheds in which they should be implemented. Along with a coarse-scale resolution of the DSMs, watershed-specific biological objectives will be developed for freshwater life stages of Chinook Salmon, steelhead, White Sturgeon, and Green Sturgeon to supplement doubling goals. These watershed-specific objectives can be used to define and measure success of in-river management actions without uncertainty due to Delta and ocean conditions.

3. Develop a revised governance structure that integrates all CVPIA fish-related activities into one Anadromous Fish Program (AFP, including Service and Reclamation staff), efficiently manages the ARM process, effectively incorporates new and existing monitoring data into the decision making process, and develops a 5-year plan for priorities to guide project development and implementation. The 5-year plan will be a guiding document to articulate science, monitoring, and project priorities in watersheds and create Annual Work Plans that support these priorities. And,

4. Facilitate a scientific process that incorporates agency partners and stakeholders to support collaborative priority setting, project generation, and implementation. Key stakeholders include water and power contractors, commercial and sport fishing interests, local and national NGOs and environmental interests, and private individuals and entities.

ARM is the application of the scientific method to natural resource management and is an iterative application of Structured Decision Making (Williams et al. 2007, Conroy and Peterson 2013). ARM requires specific, quantitative predictions of the effects of alternative management actions, generally in the form of alternative hypotheses or models. Following implementation of actions, predictions are compared to actual outcomes, as measured by monitoring data. Information about how the system works is systematically updated using this monitoring data. This improved knowledge of system dynamics is then used to make future decisions. Support of the ARM process and the integration of analyses and associated monitoring data to improve knowledge of system dynamics will be a fundamental responsibility described by the revised CVPIA governance structure and priority-setting and project implementation.

One of the fundamental steps in the ARM process is development of models that can help decision makers evaluate the consequences of alternative management actions and weigh trade-offs between possible decisions. Models used for this purpose may take many forms, from simple conceptual models to complex quantitative analyses. However, assigning numerical values to predicted outcomes greatly improves the potential for objective comparisons of management actions. The Core Team built an initial set of species-specific DSMs to estimate the relative effectiveness of eight categories of CVPIA fisheries management actions that are implemented across the suite of CVPIA fish-related provisions and the consequences of implementing the management actions on focal anadromous species (specifically, Chinook Salmon, steelhead, and Green and White sturgeons) on a watershed scale. These DSMs are expected to be refined over time, with additional data, expert elicitation, and input from a broader group of agency partners and stakeholders.

Watershed-specific biological objectives will be developed and used to evaluate progress in establishing resilient, self-sustaining populations for the freshwater life stage of Chinook Salmon, steelhead, and sturgeons, and used in conjunction with the DSMs to link in-river management actions to measurements of program effectiveness. These watershed-specific objectives should be developed as metrics of success to help guide how the coarse-resolution DSM predictions should be applied within a watershed. Watershed-specific biological objectives can be used as benchmarks to indicate progress for freshwater life stages in each river, such as improvements in survival and growth as restoration actions are implemented. They can also be used to guide development of local or watershed-scale conceptual and quantitative models to evaluate project design and implementation.

One of the key tasks of this Plan is to propose a governance structure for CVPIA fish-related provisions and stakeholder involvement, which supports a transparent decision making process informed by the best available science. To achieve this task, the proposed governance structure includes: (1) a revised governance structure for all CVPIA fish-related provisions and (2) a new priority-setting and project implementation framework that outlines the groups and processes involved in incorporating science and data into ARM, refining and revising the DSMs with this new information, recommending science-based priorities over a 5-year time period, and designing and implementing projects. The resulting governance structure is intended to integrate all CVPIA fish-related activities into one AFP, efficiently manage the ARM process, including the DSMs, and effectively incorporate new and existing monitoring data into decision making.

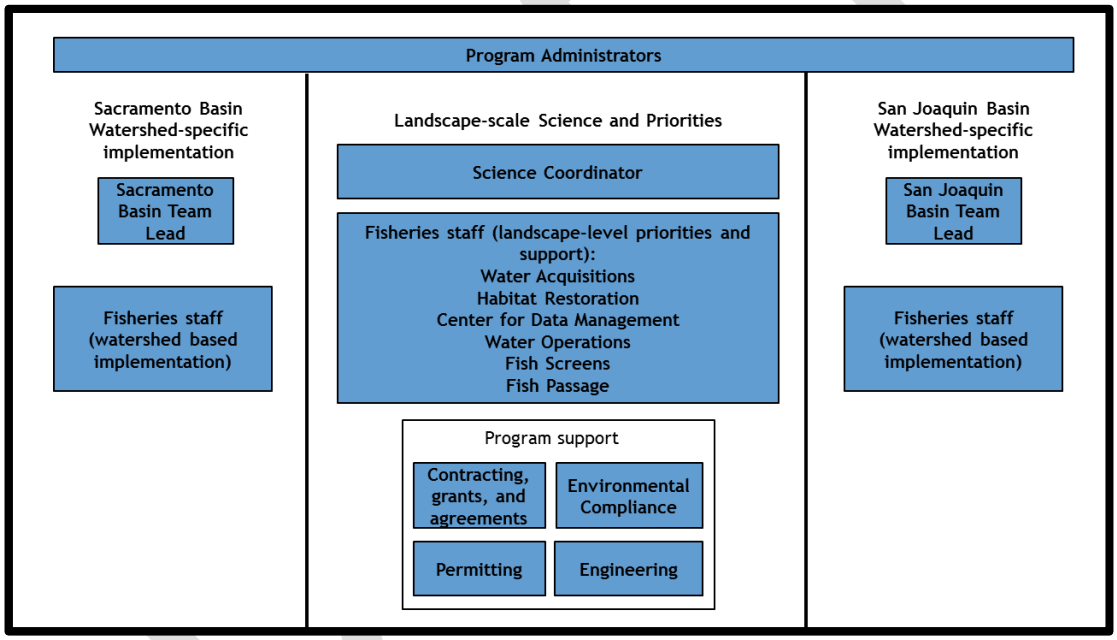
Development of science priorities will be facilitated by the Science Integration Team (SIT, which includes agency technical staff and stakeholders) and the Science Coordinator. Staff and stakeholders will develop proposals in response to priorities in the 5-year plan and submit them to the Core Team, either individually or in coordination.

The AFP will comprise three offices: (1) science and program support, (2) Southern Central Valley area field program staff, and (3) Northern Central Valley area field program staff. Science

and program support staff will collaborate with field program staff and stakeholders in providing a landscape-scale prospective and technical support when developing project proposals. The AFP will no longer fund individual Work Plans for each provision, but rather implement CVPIA authorities across watersheds with a landscape-scale perspective.

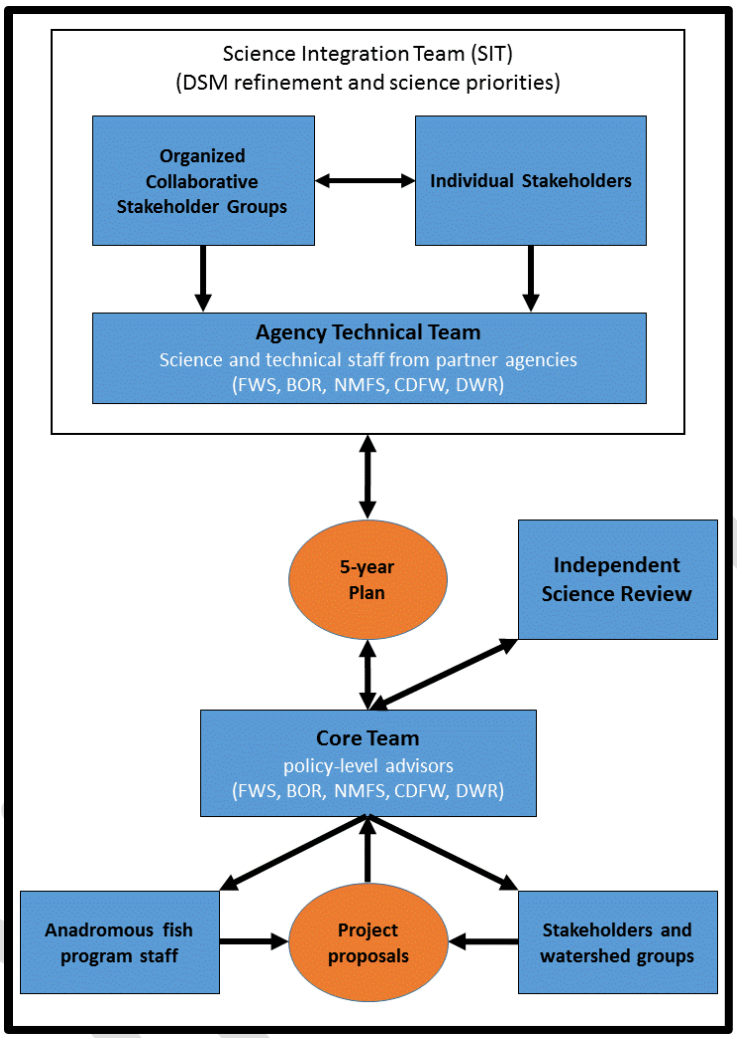
The various components in the new Anadromous Fish Program are identified in the figure below. Most of the AFP staff will reside in the Southern and Northern area offices. Because the CVPIA will not receive additional funding, it is expected that any new roles and responsibilities will be accomplished through a re-allocation of existing staff and resources.

Proposed structure for the Anadromous Fish Program. Each box is a proposed role and implies responsibility for a program area, but does not imply staffing levels or supervisory relationships. Each box is explained in detail in the text.



In addition to a revised program structure, this Plan describes a new process for setting priorities for funding and implementing CVPIA fish-related projects and clarifies how program priorities are established and used to inform decision making. The proposed structure specifies the groups and processes involved in incorporating new science and data into the ARM, refining and revising the DSMs with this new information, and setting the AFP priorities for science, monitoring, and projects over a 5 year time horizon. A key goal for this priority setting framework is to collaborate with stakeholders in the SIT to ensure the best available science from all sources is incorporated into the ARM process and that priorities and projects address common goals for anadromous fish restoration in the Central Valley.

Priority-setting and project identification framework for the Anadromous Fish Program. The overall process and each box are explained in detail in the text.



The priority-setting process will consist of science-based recommendations made by the SIT and additional considerations related to policy, opportunity, funding, and other logistics made by the Core Team. The SIT will have three primary responsibilities: (1) maintenance and refinement of the DSMs, (2) development of a 5-year plan for science and management priorities that will be reevaluated on a 5-year cycle, and (3) annual updates to the DSMs and ARM process with new data and information, with results documented in an annual tech memo. The Core Team will also have three primary responsibilities: (1) review and incorporate addendums to the 5-year plan, if necessary; (2) evaluate project proposals and recommend implementation of projects based on criteria derived from the 5-year plan, based on recommendations by the SIT and incorporating funding and other constraints; and (3) solicit an independent science review of the DSMs and 5-year plan, to occur after each revised 5-year plan is released (i.e., on a 5-year cycle).

Science based priorities, project proposals, and monitoring will be guided by the ARM process, using the DSMs to synthesize monitoring data and other scientific information and predict biological outcomes of alternative management actions. The current version of the DSMs will be further refined by adding data to replace expert opinion, where possible, and the DSMs are expected to rely more heavily on data over time. Sensitivity analyses will be used to determine where monitoring would be expected to reduce uncertainty and potentially lead to different decisions.

Project development will be an iterative process guided by science and monitoring priorities. The DSMs will indicate priority project types and areas of uncertainty that can be addressed through monitoring. The DSM output will be refined through SIT discussions, with input from AFP and agency technical staff and other experts as needed, and documented in the 5-year plan for science and monitoring priorities. The Core Team will use the 5-year plan to develop an annual call for project proposals. Proposals will be developed that reflect the priorities, and proposals will be evaluated and implemented according to how well they align to those stated priorities. Projects may be developed by AFP staff, watershed groups, or other stakeholders.

In general, this Plan outlines a collaborative approach to restore self-sustaining populations of native, naturally-produced anadromous fish in the Central Valley. This approach is science-based, transparent, and collaborative with agency partners and stakeholders to achieve common goals. Our intent is to engage more broadly within the community of agency partners and stakeholders working to restore native anadromous fish and leverage information, talent, and resources to achieve our vision:

The CVPIA anadromous fish program will work with others to protect and restore channel and riparian habitat and promote natural riverine and watershed processes to support resilient, self-sustaining populations of native, naturally-produced anadromous fishes in the Central Valley of California. Our vision is a healthy and sustainable river, floodplain, and estuarine network, defined by high quality spawning, rearing, and holding habitats; migratory corridors; and floodplain complexes to support the productivity, survival, and diversity necessary to achieve healthy populations of native anadromous fish from spawning grounds to the ocean.

Glossary

Adaptive management. A structured, iterative process of robust decision making in the face of uncertainty, with an aim to reducing uncertainty over time via systematic monitoring.

Adaptive management framework. A set of ideas or facts that provide support for conducting adaptive management.

AFP - Anadromous Fish Program. The collective suite of CVPIA programs that undertake actions designed to meet the CVPIA fish production targets.

AFRP - Anadromous Fish Restoration Program. A program authorized pursuant to CVPIA section 3406(b)(1), and that has the lead responsibility for conducting habitat restoration activities that result in anadromous fish production levels that are sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967 -1991.

ARM - Adaptive Resource Management. A structured, iterative process of robust decision making that involves natural resource values and uncertainty. It is an application of the scientific method to natural resource management and is an iterative application of structured decision making.

Biological objectives. Specific, measurable outcomes that are expected to occur if one or more management actions are undertaken.

Biological performance metrics. Discrete, well-defined parameters that can be used to measure an organization's activities and performance in relation to biological species or their habitats.

CAMP -Comprehensive Assessment and Monitoring Program. A program authorized pursuant to CVPIA section 3406(b)(16), that has the lead responsibility to monitor fish and wildlife resources in the Central Valley to assess the biological results and effectiveness of actions implemented pursuant to subsection 3406 of the CVPIA.

CDFW - California Department of Fish and Wildlife. The California Department of Fish and Wildlife (CDFW) manages California's diverse fish, wildlife and plant resources, and the habitats upon which they depend. This agency is within the larger California Natural Resources Agency. CDFW staff work closely with USFWS AFRP staff to implement activities and partner with landowners/other agencies to implement AFRP projects.

CDM - Center for Data Management. A proposed centralized science and support program designed to collect, analyze, report, and disseminate anadromous fish data with the goal of providing information that can be used to evaluate the biological response to habitat restoration activities, and provide actionable information that can be used to improve the success of future habitat restoration projects.

Core team. Staff from multiple agencies that meet regularly and make policy level decisions on funding priorities for CVPIA fish-related management actions. Those agencies include the CDFW, DWR, NMFS, Service and Reclamation.

CVP - Central Valley Project. The combination of dams, canals, and facilities that were constructed in the Central Valley as a result of legislation authorized in 1933, with the purpose of providing flood control; water for municipal, industrial, and agricultural uses; and the generation of electrical power.

CVPIA - Central Valley Project Improvement Act. Legislation authorized in 1992, with purposes that include, but are not limited to protecting, restoring, and enhancing fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California; addressing impacts of the Central Valley Project on fish, wildlife and associated habitats; and achieving a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial and power contractors.

Decision making framework. A set of ideas or facts that provide support for making decisions.

Doubling goal - fish production target(s) - natural production goals. The Central Valley Project Improvement Act defines the goal as making all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley on a long-term, sustainable basis. In the context of adult Chinook Salmon, the combination of CVPIA watershed/salmon run-specific goals that reflect the number of adult Chinook Salmon that should result from habitat restoration activities. In the context of non-Chinook Salmon taxa the number of individuals that should result from habitat restoration activities.

DPS - Distinct Population Segment. A subdivision of a vertebrate species that is treated as a species for purposes of listing under the Endangered Species Act (ESA).

DSM - Decision-support model. An integrated series of conceptual theories or representations that support, and lend themselves to, organizational decision-making activities.

DWR – California Department of Water Resources. A state agency aligned with California Natural Resources Agency that has primary responsibility to manage State of California facilities that deliver water to various users in Central Valley.

ESU - Evolutionarily Significant Unit. A Pacific salmonid stock that is substantially reproductively isolated from other stocks of the same species and which represents an important part of the evolutionary legacy of the species.

Governance structure. Processes of interaction and decision-making among the entities involved in a collective problem. The governance structure leads to the creation, reinforcement, and implementation of organizational goals and objectives.

NGOs - Non-governmental organizations. Organizations that are neither a part of a government nor a conventional for-profit business. In some cases, NGOs are stakeholders that are affected by government-related activities, or are advocates for particular actions, e.g., specific habitat restoration activities.

NMFS - National Marine Fisheries Service. A division of the National Oceanic and Atmospheric Administration (NOAA) which is in the cabinet-level Department of Commerce. The NMFS is informally known as NOAA Fisheries. NMFS is responsible for the stewardship of the nation's ocean resources and their habitat. They provide vital services for the nation: productive and sustainable fisheries, safe sources of seafood, the recovery and conservation of protected resources, and healthy ecosystems.

OCAP - Operations, Criteria, and Plan (OCAP) for the Central Valley Project (CVP) and the State Water Project (SWP). A plan that describes the facilities, maintenance, and operation of infrastructure designed to collect, store, and distribute water that is collected within California's Central Valley. The plan involves Federal and state of California infrastructure, and was the focus of Endangered Species Act Section 7 consultations by the Service and NMFS that analyzed the effects of those facilities, maintenance/operation activities, and provided reasonable and prudent alternatives to avoid the likelihood of jeopardy to listed species or adverse modification of critical habitat.

OMB - Office of Management and Budget. An entity that periodically reviews the actions taken by, and budgets allocated, to different Federal agencies. Historically, the OMB issued a Program Assessment and Rating Tool evaluating the performance of different Federal agencies in the context of their mandates.

Panel - Fisheries Independent Review Panel. The group of scientists that collectively developed a report providing recommendations on how CVPIA restoration activities, data collection activities, and governance structure should be modified to increase the likelihood that the CVPIA fish doubling goals would be met. Those recommendations were described in the *Listen to the River* report finalized in December 2008.

PART - Program Assessment and Rating Tool. A program run through the United States Office of Management and Budget instituted by President George W. Bush in 2002 to rate all federal programs on their effectiveness. The Obama administration discontinued the use of PART assessments.

Plan. The CVPIA Implementation Plan for Fish Programs.

Program. The collective aggregate of programs that are authorized pursuant to the CVPIA, and that work to achieve the purposes of that Act.

Reclamation - Bureau of Reclamation. A Federal Department of the Interior bureau that has primary responsibility is to manage Federal facilities that deliver water to various users.

RPAs - Reasonable and Prudent Alternatives. Actions that are taken in the course of a biological opinion undertaken pursuant to an Endangered Species Action Section 7 consultation, and that are meant to avoid the likelihood of jeopardy to a species or result in adverse modification of designated critical habitat.

Science-based management framework. A set of ideas or facts that facilitate management decisions using scientific principles.

SIT - Science Integration Team. A technical group made up of agency staff and stakeholders that will maintain and refine the DSMs and recommend 5-year science and management priorities for CVPIA fish programs.

Service - U.S. Fish and Wildlife Service. A Department of the Interior bureau that has primary responsibility to undertake and facilitate activities that conserve fish/wildlife resources and their habitats.

SDM - Structured Decision Making. A process for systematically evaluating alternatives and making decisions where objectives and decision alternatives are explicitly defined, connected, and analyzed using a model.

VSP - Viable Salmonid Population. An independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Introduction

The federally-operated Central Valley Project (CVP) is one of the world's largest water storage and conveyance systems. The CVP was built to protect the Central Valley of California from water shortages and floods; however, construction of facilities and consumptive use of water has had environmental consequences. Water development within the Central Valley has had significant impacts on native anadromous fishes, including Central Valley Chinook Salmon *Oncorhynchus tschawytscha,* steelhead *O. mykiss,* Green Sturgeon *Acipenser medirostris* and White Sturgeon *A. transmontanus*. Construction and management of reservoirs created barriers to upstream movement and changed the habitat downstream of dams (Yoshiyama et al. 2001), contributing to population declines.

As a response to declines in anadromous fish populations, Congress passed the Central Valley Project Improvement Act (CVPIA) in 1992 (CVPIA 1992). CVPIA changed management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife and to address the impacts of the CVP on fish, wildlife, and associated habitats. CVPIA listed fisheries management actions that should be implemented for the benefit of anadromous fish, with the goal of doubling natural production of anadromous fish populations over average levels during 1967-1991. Implementation of fisheries management actions authorized under CVPIA has yet to achieve the program's fish doubling goals.

In 2007, as part of the Office of Management and Budget (OMB) Program Assessment and Rating Tool (PART) process, Reclamation and the Service assembled a Fisheries Independent Review Panel (Panel) to evaluate the efficiency and effectiveness of actions within the CVPIA towards achieving fisheries goals (i.e., fish doubling) and provide recommendations for improvements in the program. In its December 2008 "Listen to the River" report, the Panel noted that progress towards the CVPIA fish doubling goals for anadromous fishes so far has been challenging and changes in the program are necessary to improve performance (Independent Review Panel 2008). A brief summary of recommendations relevant to this plan included: (1) update and improve the program's science-based framework, (2) reorganize program structure and management, (3) improve implementation by making full use of CVPIA water operations authorities, and (4) improve collaboration with all related programs in the Central Valley. In particular, the review identified the need to develop a new comprehensive, science-based approach that explicitly links CVPIA activities with Program objectives. The review also recommended the new framework incorporate uncertainty and allow for integration of new information to improve scientific understanding and increase the effectiveness of CVPIA activities.

The Service and Reclamation have taken important steps to address recommendations made by the Panel. A Core Team, established in the Spring of 2012, comprises staff from the Service, Reclamation, NMFS, CDFW, and DWR, and was created to support the CVPIA program's science-based framework and improve collaboration with related anadromous fish restoration programs

in the Central Valley. The Core Team makes recommendations on funding for CVPIA fish-related management actions. The Core Team concurred with the Panel that improvements to the program's science-based framework were needed, and recommended a more explicit linkage between the fish management actions available within CVPIA and biological performance metrics that are measurable within individual watersheds. The Core Team and CVPIA staff have identified the need for the CVPIA fisheries program to have a transparent framework that describes how decisions are made and how different stakeholder groups can influence decisions. Each stakeholder group should be able to participate in the development of science-based priorities, advise on existing or propose new activities, and understand the overall process through which decisions are made.

This CVPIA Implementation Plan for Fish Programs (Plan) is responsive to the recommendations of the Core Team and the Panel by:

1. Promoting ARM to guide program implementation and monitoring at the landscape scale. The ARM framework will more explicitly link monitoring to decision making to determine progress toward watershed-specific objectives and evaluate management actions.

2. Developing DSMs to evaluate alternative management actions that may be implemented within tributaries and help prioritize implementation according to expected outcomes.

3. Supplementing the fish doubling goal with watershed-specific quantitative objectives for productivity, life history and genetic diversity, and spatial structure of freshwater life stages of native anadromous fish. And,

4. Proposing a CVPIA governance structure and stakeholder process that supports transparent, science-based decision making.

The Panel recommended improving CVPIA implementation by making full use of CVPIA water operations authorities and to encourage Reclamation to elevate restoration goals of CVPIA as an implementation priority. There may be existing authorities under CVPIA or other Reclamation law that could be more effectively used to evaluate and provide a more natural, fish friendly system-wide flow regime in the Central Valley and Delta by implementing an ecosystem approach to water operations and water acquisitions. CVPIA staff should continue to work closely with Reclamation's operations division and participate in other efforts where flow decisions are made (e.g., State Water Resource Control Board; Federal Energy Regulatory Commission; Bay Delta Conservation Plan; Operations, Criteria, and Plan (OCAP) for the Central Valley Project; Delta actions; etc.) to support an ecosystem approach to water management in the Central Valley. In addition, this Plan supports enhanced collaboration with partner agencies to implement common restoration and monitoring projects involving flows to meet ecosystem needs.

The Panel had also noted the costs of priority fish restoration actions identified in CVPIA greatly outweigh available funding through the Restoration Fund. Additional factors related to funding

that need to be considered and addressed to ensure effective and efficient implementation of CVPIA programs include: stabilization of CVPIA funding within and between years, alignment of CVPIA funding availability with annual Reclamation and Service financial assistance timelines, and limiting the use of the CVPIA Restoration Fund to CVPIA priorities to the fullest extent possible.

This Plan does not specifically address the Panel recommendations to make full use of CVPIA authorities and to address the current CVPIA funding constraints, since these recommendations are outside the scope of this Plan. However, this Plan will increase the efficiency and effectiveness of limited funding by implementing a science-based approach to setting program restoration priorities, with associated monitoring to assure the critical limiting factors are being addressed in the most cost effective manner. In addition, the proposed science-based approach to decision making would increase the potential for management actions to meet broader CVPIA ecosystem goals with full consideration of existing authorities.

Background

On October 30, 1992, President George H. W. Bush signed Public Law 102-575, the Reclamation Projects Authorization and Adjustment Act, including Title 34, the CVPIA. The CVPIA amends previous authorization of the Central Valley Project (CVP) to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic uses, and fish and wildlife enhancement as a project purpose equal to power generation. Reclamation and the Service jointly implement the Act on behalf of the U. S. Department of Interior. Active provisions related to fisheries occur under section 3406(b) of the Act and include flow modifications, habitat restoration, facility improvements, and monitoring and assessments.

To guide fish related actions of CVPIA, the Final Restoration Plan for the Anadromous Fish Restoration Program (FRP, USFWS, 2001) built upon a 1995 “Working Paper” entitled Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California (USFWS, 1995). The FRP established a list of reasonable restoration actions for watersheds that, if implemented, would be expected to double the natural production of anadromous fish. Restoration actions identified in the FRP include potential actions that might be implemented by all of the CVPIA Fisheries provisions and applicable partners. The implementing agencies have not yet completed all reasonable actions. On streams where the agencies and partners have substantially addressed limiting factors (Battle Creek, Butte Creek, and Clear Creek), fish populations have substantially increased and achieved watershed-specific CVPIA fish doubling targets. This Plan builds upon the FRP by developing watershed-specific biological objectives, identifying mechanisms to explicitly link management actions to these objectives, incorporating new and existing information to prioritize implementation of

management actions, and determining what additional information needs to be collected (research and monitoring).

In addition to the CVPIA, numerous state and federal laws, programs, and plans call for restoring healthy anadromous salmonid populations in the Central Valley. This Plan is consistent with the restoration objectives of the following laws, programs, and plans, most of which call for fish recovery or enhancement compatible with the CVPIA fish doubling goals (SEP and Anchor 2014): California Fish and Wildlife Code Sections 6900-6924 (The Salmon, Steelhead Trout, and Anadromous Fisheries Program Act); California Fish and Wildlife Code 2760-2765 (Keene-Nielsen Fisheries Restoration Act of 1985); State Water Resources Control Board's (State Water Board) 2006 Water Quality Control Plan (Bay-Delta Plan); Endangered Species Act (ESA) Determinations and Plans, including a NMFS Recovery Plan (NMFS 2014) for the Central Valley winter-run and spring-run Chinook Salmon Evolutionarily Significant Unit (ESUs) and the Central Valley steelhead Distinct Population Segment (DPS); The Ecosystem Restoration Program (ERP); California Endangered Species Act (CESA) and associated recovery plans. As collaborators in anadromous fish restoration, representatives from agencies referenced above are typically members of the CVPIA Core Team and are considered partners in project prioritization and planning efforts.

Different sections of the CVPIA describe a variety of authorities that collectively should contribute to meeting the anadromous fish production goal described in the statute. Those authorities have been addressed with different provisions involving fish, fish habitat, or water. Some of the provisions of the CVPIA have completed their respective work (i.e., they have been completed) or are inactive due to changing priorities, while other programs are ongoing and active at the present time. An accounting of the different CVPIA authorities that relate or have related to fisheries is provided in Table 1.

Table 1. CVPIA authorities that fall under the scope of this Plan and are included in the proposed Anadromous Fish Program. Only authorities with a status listed as "ongoing" will be considered as potential management actions for implementation.

Action	Section of the CVPIA	Status as of December 2014
Anadromous Fish Restoration Program	3406(b)(1)	Ongoing
Dedicated Project Yield	3406(b)(2)	Ongoing
Instream Water Acquisition	3406(b)(3)	Ongoing
Tracy Fish Facility	3406(b)(4)	Ongoing
Contra Costa PP No.1 Mitigation	3406(b)(5)	Complete
Shasta Temperature Control Structure	3406(b)(6)	Complete
Red Bluff DD Fish Passage	3406(b)(10)	Complete
Coleman National Fish Hatchery	3406(b)(11)	Complete
Clear Creek Fish Restoration	3406(b)(12)	Ongoing
Restoration of Spawning Gravels	3406(b)(13)	Ongoing
Delta Cross Channel Structure	3406(b)(14)	Inactive
Georgiana Slough Control Structure	3406(b)(14)	Inactive
Old River Barrier	3406(b)(15)	Inactive
Comprehensive Assessment and Monitoring Program	3406(b)(16)	Ongoing
ACID DD Fish Passage	3406(b)(17)	Complete
Striped Bass Restoration	3406(b)(18)	Inactive
Glenn Colusa ID PP Entrainment	3406(b)(20)	Complete
Screen Diversions	3406(b)(21)	Ongoing

Plan Purpose

The purpose of this Plan is to describe the approach for prioritizing and implementing the anadromous fish-related provisions under the CVPIA over the next 5-10 years. This Plan will build upon the FRP to integrate a decision-making framework across all programs with the goal of making all reasonable efforts to at least double natural production of anadromous fish in California's Central Valley on a long-term, sustainable basis. The Plan develops an annual

process for setting priorities and funding projects across CVPIA fish-related provisions and watersheds in the Central Valley. The new process uses an Adaptive Resource Management (ARM) approach with support from Decision-Support Models (DSMs) that synthesize existing monitoring data and are annually updated using new information.

The Plan proposes a transparent process for setting priorities and developing projects, an integrated governance structure for Central Valley anadromous fish restoration, and specific ways for stakeholders to participate. Management actions and projects will be implemented within an adaptive management framework that is iterative and can be adjusted over time. The Plan allows for monitoring data to be collected and incorporated according to guidelines developed by a Center for Data Management (CDM), stored in a comprehensive database, and used to update the DSMs with the goal of improving decision-making over time to meet watershed-specific biological objectives and broader Central Valley-wide goals for anadromous fish.

CVPIA will continue to look comprehensively at the entire Central Valley ecosystem, including upstream river systems and the Sacramento-San Joaquin Delta (Delta) and water project operations, with the broader goal of restoring anadromous fish while balancing water supply needs. From a biological standpoint, the Delta remains a high priority area for fish restoration because it is highly degraded, native Delta species have shown significant declines, many anadromous fish rear in the Delta, and all anadromous fish in the Central Valley must pass through it as both juveniles and adults. Potential limiting factors in the Delta include the loss of physical habitat, highly altered flows, physical migration barriers, false migratory pathways, contaminants, invasive species, and direct losses at the Federal and State pumping facilities. The CVPIA program has an interest in mitigating the adverse effects of the Central Valley Project on species and their habitats. Specifically, the Program will focus on improving fish passage and survival in the Delta through the implementation of the following actions:

1. Continue the Program's significant role in managing Delta water operations to reduce impacts to fisheries.

2. Plan, evaluate, and implement critical structural and/or operational changes that support Delta anadromous and non-anadromous fish restoration.

3. Coordinate actions with existing and future planning and regulatory programs and priorities in the Delta.

4. Support continued investigations of the critical limiting factors in the Delta. And,

5. Operate CVP Delta water facilities to minimize fish entrainment and maximize survival of anadromous and native resident fish species.

Currently the ARM and accompanying DSMs do not explicitly include the Delta because there are other ongoing planning and regulatory efforts, such as the State Board's Bay-Delta Plan and Bay Delta Conservation Plan. CVPIA staff are actively contributing to these efforts and, once they have concluded, we will partner with other agencies and stakeholders to implement specific priorities identified through these processes. Additionally, we intend to explicitly include the Delta in our DSMs, once we have better data to identify the key factors limiting anadromous fish survival.

This Plan will not replace the FRP (FRP, USFWS, 2001), which includes comprehensive lists of all the specific restoration actions that should be completed on individual tributaries to achieve doubling the natural production of anadromous fish. Rather, this Plan develops and documents science-based decision making to evaluate alternative management actions available under the FRP, refine actions or develop new actions when appropriate, and prioritize actions within and across watersheds according to expected outcomes. Science priorities will be incorporated into a 5-year plan for CVPIA fish-related provisions that will be evaluated annually in response to an ARM process and used to support development of Annual Work Plans. This Plan outlines four key tasks necessary for successful implementation of CVPIA fish-related provisions:

1. An ARM process to prioritize, implement, and learn from projects. ARM recognizes uncertainty due to competing hypotheses about the effects of alternative management actions on anadromous fish populations and uses an adaptive management approach to reduce uncertainty and increase effectiveness. The ARM process will prioritize actions and monitoring at a landscape-scale, across the Central Valley, to determine which types of actions should be implemented in which watersheds to have the best predicted benefit to native anadromous fish. However, specific projects will be designed and implemented at the watershed-scale, based on expertise of local staff, partners, and watershed groups.

2. Development of DSMs for the Central Valley to support prioritization of categories of management actions and the watersheds in which they should be implemented. Along with a coarse-scale resolution of the DSMs, watershed-specific biological objectives should be developed for freshwater life stages of Chinook Salmon, steelhead, White Sturgeon, and Green Sturgeon to supplement doubling goal targets. These watershed-specific objectives can be used to define and measure success of in-river management actions without uncertainty due to Delta and ocean conditions.

3. A revised governance structure that integrates all CVPIA fish-related activities into one Anadromous Fish Program, efficiently manages the ARM process, and effectively incorporates new and existing monitoring data into setting priorities and developing a 5-year plan to implement priorities. The 5-year plan will be a guiding document to articulate science, monitoring, and project priorities in watersheds and implement projects that support these priorities. However, the Plan will not replace any existing

plans or decision making processes for the Trinity River and San Joaquin River Restoration programs. And,

4. Incorporation of agency partners and stakeholders into a scientific process to support collaborative priority setting, project generation, and implementation. Key stakeholders include water and power contractors, commercial and sport fishing interests, local and national NGOs and environmental interests, and private individuals and entities.

CVPIA Anadromous Fish Program Vision

The CVPIA anadromous fish program will work with others to protect and restore channel and riparian habitat and promote natural riverine and watershed processes to support resilient, self-sustaining populations of native anadromous fishes in the Central Valley of California. Our vision is a healthy and sustainable river, floodplain, and estuarine network, defined by high quality spawning, rearing, and holding habitats, migratory corridors and floodplain complexes, to support the productivity, survival, and diversity necessary to achieve healthy populations of native anadromous fish from spawning grounds to the ocean.

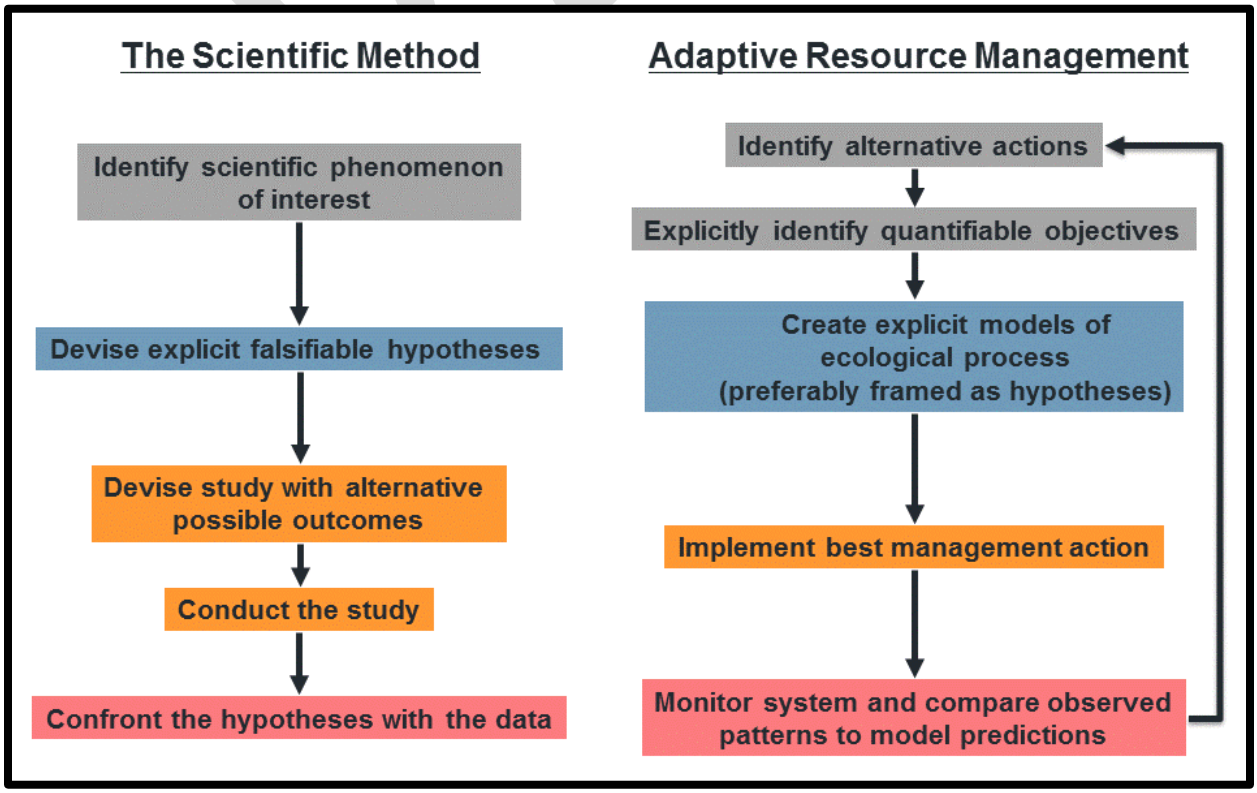
Adaptive Resource Management (ARM)

Adaptive Resource Management is the application of the scientific method to natural resource management (Figure 1) and is an iterative application of Structured Decision Making (Williams et al. 2007, Conroy and Peterson 2013). ARM requires specific, quantitative predictions of the effects of alternative management actions, generally in the form of alternative hypotheses or models. Following implementation of actions, predictions are compared to actual outcomes, as measured by monitoring data. Information about how the system works is systematically updated using this monitoring data. This improved knowledge of system dynamics is then used to make future decisions. Support of the ARM process and the integration of analyses and associated monitoring data to improve knowledge of system dynamics will be a fundamental responsibility described by the revised CVPIA governance structure and priority-setting process.

OBJECTIVES OF THE ARM PROCESS

- Apply the scientific method to natural resource management.
- Set biological objectives and management alternatives, then predict the consequences of each management alternative in terms of the biological objectives.
- Use predicted consequences and additional information (logistics, policy, etc.) to decide which action(s) to implement.
- Use monitoring data and scientific studies to update models and improve effectiveness over time.
- Establish a collaborative and transparent process for developing priorities and implementing adaptive management.

Figure 1. Comparison between the scientific method and adaptive resource management.



CVPIA staff, the Core Team, and USGS/Oregon Cooperative Fish and Wildlife Research Unit collaboratively developed the first in a set of DSMs (the coarse-resolution model, see Peterson et al. 2014) for Chinook Salmon, steelhead, and sturgeons in the Central Valley. This set of DSMs incorporates current knowledge and data to provide science-based predictions for management actions at the watershed scale. These models will be refined over time within the ARM framework by incorporating additional monitoring data and new information as it becomes available. As management actions and associated monitoring plans are implemented, actual outcomes will be compared to predictions and the resulting new information will be incorporated into the models to improve decision making over time. This ARM process and model refinement will take place within the proposed governance structure and priority-setting process.

The set of DSMs includes a model for each native anadromous fish species (all runs of Chinook Salmon, White and Green sturgeons, and steelhead) for all subbasins in the Central Valley (Peterson et al. 2014). Each model consists of a set of sub-models for different life stages (e.g., juvenile survival, adult holding, etc.) and will predict biological outcomes resulting from categories of management actions. The models are intended to synthesize knowledge and help make management decisions. Predictions of biological metrics (e.g., Peterson et al. 2014) are intended to be used to compare the relative benefits of alternative management actions. The ARM framework will use the models to provide a science-based process for prioritizing: (1) management action categories within and across watersheds and (2) associated monitoring and research. The current version of the models will provide the SIT a prioritized list of categories of management actions for each of the Central Valley watersheds based on current information. The current list of management categories in the DSMs was developed by the Core Team and is intended to represent categories that can be implemented by CVPIA fish provisions (Peterson et al. 2014). The list may be revised in the future as a result of DSM model refinement. The current list of management categories include:

1. Screen diversions.
2. Change diversion timing.
3. Increase adult holding habitat.
4. Increase spawning habitat.
5. Increase in-channel rearing habitat.
6. Increase floodplain habitat.
7. Remove physical obstructions. And,
8. Increase water availability.

The resolution of available information and monitoring data is different for each watershed and category of management action. For example, the CVP rivers tend to have more available monitoring data than other rivers in the Central Valley. In addition to prioritizing management actions, the DSMs will be used to evaluate the value of new information in the decision making process, which will inform monitoring that can be used to refine the models in the future. The Expected Value of Information (EVI) can be calculated within the DSM framework to assess the expected value of implementing a decision with uncertainty relative to implementing a decision if uncertainty is reduced through monitoring or research (Conroy and Peterson 2013). For example, the DSMs can be used to calculate a biological response (e.g., the number of juvenile outmigrants per spawner) of implementing a management action (e.g., increase floodplain habitat) with (1) current information and (2) if uncertainty were reduced regarding the relationship between acres of floodplain habitat and juvenile growth and survival. After accounting for the cost of collecting information, managers can determine whether the value of reducing uncertainty is higher than implementing a management action with a potentially uncertain biological response. In short, acquiring information is most valuable when it may cause a manager to make a different decision.

Once categories of management actions have been prioritized for individual watersheds, CVPIA staff will develop detailed plans for implementation and monitoring. Plans for implementing management actions within watersheds will be developed using a different set of decision support tools that account for local conditions, opportunities, and constraints. Implementation plans for individual projects (project proposals) will include details on the category of action, site-specific project information, predicted outcomes, and monitoring necessary to compare actual outcomes to predictions. The degree of detail in local-scale decision support tools and implementation plans depends on the data and resources available for individual watersheds. In watersheds with little available information, decision-support tools could be simple conceptual models based on expert opinion. Development of additional fine-scale decision support tools for watersheds will be encouraged but not required. Decisions on funding for new tools will be guided by the value of new information in the coarse-resolution model. Staff are encouraged to work with watershed groups and other stakeholders to identify project opportunities and develop projects for implementation.

Stakeholders are encouraged to participate in, and contribute to, the development and refinement of the current DSMs. The DSMs are modular and comprise both data and parameterized “best professional judgment”. The addition of models or submodels with scientific support and quality, well documented, empirical data is needed. A collaborative, science-based stakeholder group, such as a Central Valley Salmon Partnership, would provide a useful forum for participating in the ARM process and developing AFP priorities.

The ARM process will be supported by a Science Integration Team (SIT), comprising stakeholders and technical staff from CVPIA and partner agencies. The SIT will refine and maintain the DSMs and use DSM analyses to develop 5-year priorities for science, monitoring, and project development. The SIT will make recommendations on priorities to the Core Team, who will

refine the 5-year priorities, solicit projects that reflect the priorities, and prioritize projects for implementation. The Core Team is already established, and was initiated in July of 2012 to work in support of the Department of the Interior's CVPIA fish restoration goals and objectives. This Core Team represents a reinvigoration of the original CVPIA-AFRP Core Group who authored the Working Paper on restoration needs (USFWS 1995), and served as an interagency scientific and policy review team for the AFRP program. The current Core Team differs fundamentally from the Core group because it serves as an interagency scientific and policy review team and decision making body for all of the CVPIA fisheries provisions rather than just the AFRP provision. The Core Team is led by the Service and is comprised of representatives from Reclamation, NMFS, CDFW, and DWR. The Core team has already contributed and will continue to contribute to review, discussion and input on key aspects of the CVPIA such as the:

1. Development of the science-based management framework.
2. Development of a 5-year plan of AFP priorities.
3. Application of ARM through the use of science; monitoring and assessment; and performance measures and indicators.
4. Prioritization of projects and implementation timeframes. And,
5. AFP Annual Work Plan process.

Areas of interagency program overlap described in related documents such as Interior's FRP, the Ecosystem Restoration Program's (ERP) Conservation Strategy, and the NMFS Central Valley Chinook Salmon and Steelhead Recovery Plan will be coordinated by the team.

The Core Team will use recommendations made by the SIT to inform development of funding priorities for the AFP. Other factors in establishing priorities include willing partners for projects, cost-share availability, and complementary programs and activities (NMFS Recovery Plan, Ecosystem Restoration Program, Reasonable and Prudent Alternatives and Measures, etc.). The SIT will propose priorities in a 5-year plan that will be reviewed by the Core Team in a Priorities Workshop. The 5-year plan will also propose a comprehensive monitoring strategy to track progress and reduce uncertainty by refining the DSMs as projects are implemented over time. AFP staff will work with partners and stakeholders to develop projects that implement priorities in the 5-year plan. The Core Team will review project proposals and prioritize projects for funding. Final Annual Work Plans will be presented at an Annual Work Plan Open House. Table 2 summarizes key activities for implementation of ARM and the planned time of year that the activities would occur.

Table 2. Implementation annual milestones and schedule.

Month	Actions
March	Science, monitoring, and project Priorities Workshop (SIT); draft technical memo and any revisions to the 5-year plan are released by the SIT and discussed with Core Team at a workshop (SIT and Core Team).
April	Core Team comments on the SIT technical memo and 5-year plan; development of project proposals begins (for initiation in the next Fiscal Year).
May	
June	Project proposals due to Core Team for evaluation according to project selection criteria. Core Team prioritizes projects for funding.
July	Draft Annual Work Plans with final proposed projects released for 30 day stakeholder feedback.
August	Annual Work Plan Open House held (Public, SIT, Core Team, AFP).
September	Finalize Annual Work Plans; prepare previous years' accomplishments.
October	
November	Finalize Accomplishments Report for previous Fiscal Year; Perform independent reviews (as needed) and revise Decision Support Models (Core Team and SIT).
December	
January	
February	
March	*(Repeat with Priorities Workshop)*

Incorporating Stakeholders: a collaborative approach to anadromous fish restoration

The ARM process provides a science-based framework for prioritizing, implementing, and monitoring management actions for native anadromous fish restoration under the CVPIA authority. The DSMs provide species-specific tools for synthesizing and actively learning from monitoring data and information collected about CVPIA projects. However, many stakeholder

groups are also actively collecting data and learning from restoration actions that are meant to benefit native anadromous fish in the Central Valley. The AFP would benefit from incorporating stakeholder input into the ARM process and using the DSMs to evaluate management actions proposed by stakeholder groups. Stakholders will be invited to participate in the SIT as part of a collaborative process to refine and maintain the DSMs, develop watershed-specific biological objectives, and prioritize management actions across Central Valley watersheds. Stakeholders will also be invited to develop project proposals that reflect management and monitoring priorities.

OBJECTIVES FOR STAKEHOLDER INVOLVEMENT

- Incorporate stakeholders into decision making through the ARM process.
- Promote stakeholder collaboration in priority setting and project development.
- Support a collaborative approach to anadromous fish restoration in the Central Valley.

To date, effectively incorporating stakeholder science and objectively evaluating stakeholder project proposals has been challenging. To overcome current challenges, we recommend:

1. The AFP provide a timeline that clearly describes when project priorities will be released and the deadlines for input. Project priorities will be similar to a request for proposals; they will outline what types of projects and which rivers are highest priority for implementation in a given budget cycle. Project proposals that address the priorities for project types, rivers, and/or monitoring will have higher priority for possible implementation.
2. Program staff should support organization of stakeholder groups to provide comprehensive input on science and monitoring. One possible example of a collaborative stakeholder group is the Central Valley Salmon Partnership, described in more detail below.
3. Include stakeholders outside the program in regular and opportunistic discussions about refining the DSMs as part of the SIT. Model refinements should include updates of the science, comprehensive evaluations of monitoring data, and scenario development.

Example of a Collaborative Stakeholder Group: Central Valley Salmon Partnership

CVPIA fish-related programs currently lack an integrated, transparent framework that describes how different stakeholder groups can participate in the restoration process. Non-governmental stakeholder groups include the commercial salmon fishing industry, recreational anglers, environmental NGOs, landowners, water rights holders, irrigation districts, CVP contractors, and the general public. The AFP would benefit from supporting a collaborative group that would organize stakeholders with disparate interests to participate in the AFP science-based process as: (1) members of the SIT and (2) potential partners for project design, implementation, and monitoring. One possible model for a collaborative stakeholder group is the proposed Central Valley Salmon Partnership (CVSP).

If established, a CVSP could contribute stakeholder expertise on biology of salmon and steelhead, science or monitoring themes, and management concerns. A CVSP may assist in development of watershed-based biological objectives for Central Valley watersheds. Involvement of stakeholder and agency scientists in the Stanislaus SEP process was key to the development of biological objectives that are supportive of relevant regulatory, recovery, and restoration activities for anadromous fish in the Stanislaus and San Joaquin basin (SEP and Anchor 2014). A CVSP could formalize a structure similar to the SEP workgroup as a scientific, multi-organizational team for other Central Valley rivers.

Some considerations for the formation of a CVSP include:

1. A CVSP would be beneficial to the ARM process if it provided input on watershed-specific objectives, species-specific science, monitoring needs, technology, and implementation as a member of the SIT.

2. A CVSP could also develop projects and/or provide recommendations about projects or types of projects that would be expected to address limiting factors and achieve biological objectives.

3. Stakeholder science could be internally reviewed within the CVSP. The structure of the organization and its committees could ensure that recommendations and proposals endorsed by the group are based on the best available science.

4. A CVSP should be complementary to watershed groups currently involved with AFP programs. Watershed groups are important for development of local relationships, opportunities, and knowledge.

Decision-Support Models

One of the fundamental steps in the ARM process is development of models that can help decision makers evaluate the consequences of alternative management actions and weigh trade-offs between possible decisions. Models used for this purpose may take many forms,

from simple conceptual models to complex quantitative analyses. However, assigning numerical values to predicted outcomes greatly improves the potential for objective comparisons of management actions.

OBJECTIVES OF THE DSMs

- Use DSMs as tools to evaluate predicted outcomes of alternative watershed-scale management actions.
- Improve DSM performance over time by replacing expert elicitation with monitoring data and information.
- Improve DSM over the short-term by cataloging and incorporating available data and completing another round of expert elicitation where gaps exist.

Restoration of anadromous fish under CVPIA involves a relatively large number of fisheries management actions that can be applied at multiple scales in space and time. For example, spawning habitat restoration can be applied at the watershed scale by determining spawning habitat is a key limiting factor for anadromous fish populations and total amount of available spawning habitat should be increased. Once spawning habitat has been identified as a limiting factor for a watershed, spawning habitat restoration can be applied at the site-specific scale by identifying locations that have the opportunity and potential for adding gravel and/or modifying hydraulics. The DSMs described here address the types of actions that should be applied to watersheds (e.g., increase spawning habitat), rather than the site-specific decision of how that action should be implemented.

The Core Team built an initial set of species-specific DSMs to estimate the relative effectiveness of eight categories of CVPIA fisheries management actions implemented across the suite of CVPIA fish-related provisions (Table 1), and the consequences of implementing the management actions on focal anadromous species (specifically, Chinook Salmon, steelhead, and Green and White sturgeons) on a watershed scale. For modeling purposes, management actions are evaluated by biological response at 20 years from the present time period, thus prioritizing management actions in a given year that are predicted to maximize modeled anadromous fish populations at 20 years in the future. The models will be applied over the entire CVPIA geographical area (Central Valley) and are intended to be used by managers as a first step in multi-resolution assessments. Thus, the predictions will prioritize CVPIA activities and watersheds where management actions have the greatest predicted likelihood of achieving

CVPIA objectives. These watersheds may require additional analyses at finer resolution to identify specific locations (e.g., reaches) and actions (e.g., gravel injection, channel modifications, floodplain creation) within the watersheds that have the greatest potential for meeting program objectives. The DSMs under development by the Core Team consider only the greatest drivers of watershed dynamics at large scales, rather than all the factors known to affect fish populations.

The DSMs are intended to help decision makers prioritize funding for management actions predicted to result in the best outcome as measured by the model utility function which, in general, is an aggregated estimate of population attributes (including spatial structure, production, abundance, and diversity) per unit cost (Table 3). Using the model utility function to rank management actions and watersheds is an objective way to prioritize decisions based on CVPIA program objectives and current scientific information incorporated into each species-specific model. The structure of the DSMs was created by the Core Team and additional technical staff from participating agencies, in a collaborative and consensus-driven process that was led by Dr. Jim Peterson (USGS Corvallis). The model structure and parameterization are described in more detail in Peterson et al. (2014).

Table 3. Population attributes used to score the relative value of candidate CVPIA actions and their relative importance weights (in bold) in the DSMs (Peterson et al. 2014). Weights were obtained from members of the Core Team.

Chinook salmon	Green and White sturgeon
Spatial structure, **26.3%**	*Spatial structure,* **15.5%**
Number of spawning Chinook salmon populations per diversity group as defined by Lindley et al. (2007).	Number of reproducing populations
Production **26.4%**	*Production,* **20.9%**
Adult natural spawner per adult naturally spawned recruit (ratio), **57%**	Number of naturally spawned age 1 fish per spawner adult ratio
Naturally spawned juvenile per naturally spawner recruit (ratio), **43%**	
Abundance **25.5%**	*Abundance,* **25.9%**
Total number of adults produced, **63%**	Total number of adults (reproductive size) produced
Total number of juveniles produced, **37%**	
Diversity **21.8%**	*Diversity,* **21.3%**
Proportion of out-migrating juveniles in each life history stage as indexed by the coefficient of variation in abundance among the 3 stages, **39%**	Distribution of individuals among the age classes (stages) as indexed by abundance CV
The proportion of spawning fish that are naturally produced, **61%**	*Growth,* **16.4%**
	The growth of subadult sturgeon, **44%**
	The growth of juvenile (age 1-2) sturgeon, **56%**

The feasibility and relative effectiveness of many of these activities depend largely on fine resolution information, such as spatial context, accessibility, opportunity, etc., that will not be incorporated into the coarse-scale models built through this effort. Ranked management actions and watersheds based on model results should be used to inform decision-makers; however, the final decision on which management actions to implement can be based solely on the model outcome or modified by additional information (i.e., prioritizing a management action that may not have been chosen as the optimal decision based on model results). The results of the DSMs are not intended to provide the final decision; rather, the results should inform decision-makers on the prioritization of management actions.

Our knowledge of ecological systems and the response of populations to management actions are always imperfect. Therefore, uncertainty is directly incorporated into the DSMs by including alternative models that represent either competing hypotheses of ecological dynamics and/or

statistical distributions that represent error in model parameters. Each of these alternative models (hypotheses) is assigned a plausibility or probability. The optimal decision then is selected based on the predicted consequence of a management decision (i.e., the predicted change from a current system state to the expected future state, using the utility function described above), taking into account sources of uncertainty.

Monitoring to Inform Decision Making

Under ARM, when management decisions recur over space or time, probabilities in the decision-support model are updated through time by comparing predictions generated by the model to observed (actual) conditions based on data collection. The updated model probabilities then can be used to improve predictions of future conditions, thus improving the choice of the optimal decision. This cyclical adaptive feedback (i.e., adaptive management) explicitly provides for learning through time, helping to resolve competing hypotheses with monitoring data and research. In this adaptive approach, data serve two purposes: (1) providing an estimate of the current system state, and (2) updating information for alternative models and/or parameter values. Thus, monitoring data are used to learn about system dynamics, thereby improving future decision-making. As an example, the decision model might predict that if we add 3 acres of spawning habitat for winter-run Chinook in the Sacramento River, we might expect a predicted increase in spawning success for returning adults, resulting in a certain number of additional winter-run redds and additional juveniles being produced and leaving the river. Through monitoring, we can measure one or more of those parameters and can compare the model prediction to observed results. Actual observations will be added to the data used to inform the model and will improve the accuracy of future predictions.

LANDSCAPE-LEVEL MONITORING OBJECTIVES

- Coordinate landscape-level monitoring across CV rivers and ensure data are accessible, standardized, and scientifically robust for updating the DSMs and supporting the ARM process.

- Support use of the DSMs to inform decision making by improving management and synthesis of data related to CVPIA fish programs.

- Support a framework for assessing the expected value of information and use that framework to identify the additional information needed to make more productive, cost-effective decisions.

- Where feasible and appropriate, integrate and aggregate site- and watershed-scale information to provide landscape-scale inferences that guide future management actions. Project-specific monitoring activities would be informed by local-scale decision support processes.

- Develop, enhance, and sustain partnerships with non-CVPIA programs and partners, with the goal of developing collaborative relationships that maximize the ability to collect high quality data needed to improve and refine the DSM.

Using the ARM approach, monitoring should be targeted for the purpose of improving the predictions of the DSMs to better assess the consequences of management actions over time. In addition, the DSMs should be used to identify and prioritize important research and monitoring activities by estimating the expected value of the information that can be gained to the decision making process (Conroy and Peterson 2013). Monitoring should not be a goal in itself, but should provide information that is expected to improve future decisions (Lyons et al. 2008). Performing sensitivity analyses on the parameters in the decision model can provide guidance on useful research and monitoring, by identifying relationships where high uncertainty greatly influences model results. In this case, the value of gaining information from research and monitoring is high, in that reducing uncertainty may cause a decision-maker to make a different decision. Continuing with the winter-run example in the Sacramento River, there may be high uncertainty in egg-to-fry survival that could influence decisions on implementation of spawning habitat restoration. If this uncertainty was reduced through research and monitoring, decision-makers would have better information on how many fry are produced from eggs laid at each redd, depending on conditions such as flow, temperature, and spawning substrate. This

information may lead to different decisions, such as the sizes of gravel used to restore spawning habitat or flow conditions during incubation. The crucial step is to identify where uncertainty can be reduced through research and monitoring, and where reductions in that uncertainty may lead to different management decisions.

The amount of CVPIA funding that can be used to collect new data to incorporate into the DSMs is limited. The efforts to collect new data will therefore be focused: (1) on high priority data deficiencies (objective-specific monitoring), (2) the datasets needed to assess progress toward AFP goals (long-term monitoring), and (3) collaborative efforts with partners and programs inside and outside of the CVPIA. The emphasis on the collection of data addressing high priority data deficiencies and AFP goals will ensure the critical data needed to refine the model are addressed before lower priority data collection efforts are undertaken. The focus on working with partners and programs inside and outside of the CVPIA will be designed to pool financial and human resources so each party has strong incentives for collaborating on data collection activities and working in a unified, synergistic manner that benefits all parties. That approach will be critical because several non-CVPIA programs collect data needed to refine the DSM outputs, e.g., the adult salmon escapement surveys conducted by the CDFW and Reclamation-funded adult steelhead redd surveys on the American River. Ultimately, the SIT will recommend data collection priorities to the Core Team and the Core Team and implementing agencies will make funding decisions.The collection of data to monitor anadromous fish populations across the Central Valley (i.e., landscape-scale) and infer the biological response to habitat restoration activities will be more unified, efficient, and effective if the effort is coordinated within a CDM within the AFP. With that approach in mind, Congress authorized subsection 3406(b)(16) of the CVPIA, which directed the Secretary of the Interior to "...establish, in cooperation with independent entities and the State of California, a comprehensive assessment program to monitor fish and wildlife resources in the Central Valley to assess the biological results and effectiveness of actions implemented pursuant to this subsection." The Comprehensive Assessment and Monitoring Program (CAMP) was developed to address that requirement, and it is therefore logical to expect the CAMP will refine its structure to support development of a framework for monitoring anadromous fish resources and assesses the effectiveness of habitat restoration activities. As such, the CAMP would function as a CDM in the context of the overall AFP to fulfill a role where it serves as a centralized location for receiving and storing data that are collected by AFP staff as well as other entities. The CDM would work with a broad diversity of programs and partners to identify the specific kinds of data that are needed to update the DSMs and provide technical support that enables those entities to provide that data in a robust, standardized manner. The CDM will differ from CAMP in that its main purpose will be to support the DSMs and other information needs identified by the SIT.

Developing a Comprehensive Monitoring Framework

To support the process of collecting, analyzing, and disseminating the data relevant to this Plan, the CDM will facilitate development of a monitoring framework that articulates:

1. How and which biological and environmental data will be collected to support the DSMs and ARM process.

2. How data will be analyzed and integrated across different watersheds and restoration projects.

3. How data will be managed and stored. And,

4. A strategy and mechanism for providing the data that are then incorporated into the ARM process.

The CAMP is already positioned to lead such an effort, and in 2009 developed a draft framework that addressed these concepts (USFWS 2009). That framework was described in a document titled "Draft Proposal For A Central Valley Project Improvement Act Comprehensive Fisheries Assessment And Monitoring Program (CFAMP)". With further outreach and discussion, that document could be expanded and enhanced to provide a framework for developing the CDM. It is important to note the 2009 document highlights the need to expand the CAMP's scope, funding, and staff levels to create a CDM that can perform its increased level of responsibility.

Development of Watershed-specific Biological Objectives

The CVPIA fish doubling goals were established as abundance targets that represent self-sustaining populations of anadromous fish in Central Valley rivers (CVPIA 1992, USFWS 2001). However, other population parameters, including productivity, life history and genetic diversity, and spatial structure are necessary to achieve healthy, self-sustaining populations and are collectively referred to as viable salmonid population (VSP) parameters (McElhany et al. 2000). The independent review (Independent Review Panel 2008) criticized the doubling goals as problematic because of: the lack of a scientific rationale for doubling goal calculations; errors inherent in estimating naturally produced adults overall and for individual watersheds; continued reliance on hatchery fish to contribute to natural production; lack of coordination between harvest practices and production targets; the inconsistency of increasing production of native salmonids and exotic predators; and that many factors beyond control of the CVP affect survival through returning adults, making it difficult to measure program effectiveness.

The CVPIA fish doubling goals (overall and by watershed) are valuable for establishing abundance targets for achieving restoration of native anadromous fish in Central Valley rivers. Metrics of adult abundance synthesize environmental conditions and harvest over the entire life cycle and are necessary to ensure sufficient adult returns to spawning grounds to sustain and grow a population. However, to address concerns with the CVPIA fish doubling goals, we recommend they should be supplemented by watershed-specific biological objectives defined for freshwater life stages and linked directly to environmental conditions within a watershed.

Additionally, the biological objectives will be used in conjunction with the DSMs to link in-river management actions to measurements of program effectiveness. These watershed-specific objectives should be developed as metrics of success to help guide how the coarse-resolution model predictions should be applied within a watershed. Watershed-specific biological objectives can be used as benchmarks to indicate progress for freshwater life stages in each river, such as improvements in survival and growth as restoration actions are implemented. They can also be used to guide development of finer-scale conceptual and quantitative models to evaluate project design and implementation.

WATERSHED-SPECIFIC OBJECTIVES

- Provide metrics to evaluate response of in-river management actions on freshwater life stages of native anadromous fish.
- Quantify attributes of watershed-specific restoration goals of Chinook Salmon, steelhead, and sturgeon (what does success look like).
- Guide development and monitoring of individual projects.

Abundance objectives are important criteria to guide development of in-river management actions, especially in conjunction with supplemental objectives. For example, enough spawning habitat must be available to support the expected number of adults returning to a river. The CVPIA fish provisions are based on the biological objective of doubling natural production in individual watersheds, as well as the Central Valley as a whole (Table 4). Abundance should be retained as one metric of program success.

Table 4. Natural production goals, estimated current natural production, and the estimated difference between current natural production and the baseline period for Central Valley watersheds.

River	Taxon	Natural production goal	Estimated current natural production (average 1992-2013)[1]	Estimated difference from baseline period (1967-1991)[2]
Sacramento	Fall-run Salmon	230,000	69,069	-40%
Sacramento	Late-fall-run Salmon	68,000	16,964	-50%
Sacramento	Winter-run Salmon	110,000	6,273	-88%
Sacramento	Spring-run Salmon	59,000	653	-98%
Clear Creek	Fall-run Salmon	7,100	10,956	206%
Cow Creek	Fall-run Salmon	4,600	2,117	-9%
Cottonwood Creek	Fall-run Salmon	5,900	2,145	-28%
Battle Creek	Fall-run Salmon	10,000	17,564	250%
Battle Creek	Late-fall-run Salmon	550	676	147%
Paynes Creek	Fall-run Salmon	330	n/a	-100%
Antelope Creek	Fall-run Salmon	720	n/a	-100%
Mill Creek	Fall-run Salmon	4,200	1,896	-10%
Mill Creek	Spring-run Salmon	4,400	1,198	-46%
Deer Creek	Fall-run Salmon	1,500	898	17%
Deer Creek	Spring-run Salmon	6,500	1,949	-41%
Misc. creeks above	Fall-run Salmon	1,100	78	-86%
Butte Creek	Fall-run Salmon	1,500	2,288	199%
Butte Creek	Spring-run Salmon	2,000	10,327	915%
Big Chico Creek	Fall-run Salmon	800	0	-100%
Feather	Fall-run Salmon	170,000	94,314	10%
Yuba	Fall-run Salmon	66,000	30,670	-8%
Bear	Fall-run Salmon	450	n/a	-100%
American	Fall-run Salmon	160,000	104,296	29%
Mokelumne	Fall-run Salmon	9,300	8,731	87%
Cosumnes	Fall-run Salmon	3,300	768	-54%
Stanislaus	Fall-run Salmon	22,000	5,167	-52%
Tuolumne	Fall-run Salmon	38,000	6,474	-66%
Merced	Fall-run Salmon	18,000	6,484	-28%
Sacramento	Central Valley steelhead	13,000	1,282	-80%
Delta	White Sturgeon	11,000	6,237	12%
Delta	Green Sturgeon	2,000	2,946	200%

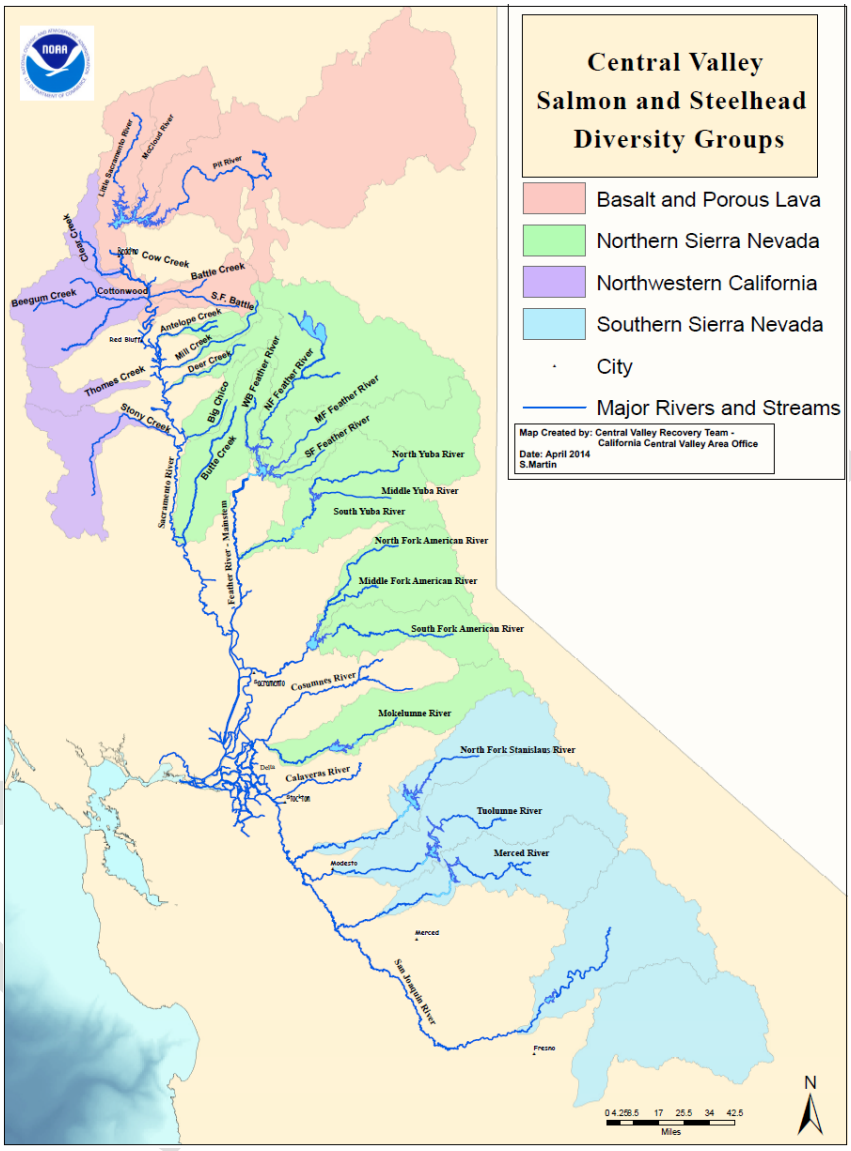
[1]Estimated by Chinookprod, accessed on the AFRP website. [2]A 200% or greater difference from the baseline period indicates that the watershed has achieved the CVPIA fish doubling goal for a particular run.

Productivity is the attribute most closely linked to abundance targets, as it establishes the ability of a population to grow to a desired abundance. Productivity goals can be set to: (1) support attainment of the CVPIA fish doubling goals within a specified timeframe, (2) support population resilience, or the ability of a population to rebound from low escapement within a single generation, or (3) reflect what is characteristic of the species across its range (SEP and Anchor 2014). Productivity goals should be reflective of freshwater survival (egg to Chipps Island), with watershed-specific productivity objectives specified to achieve necessary survival at key monitoring locations along the in-river corridor.

Life history and genetic diversity are attributes closely linked to population resiliency. Local adaptation of genetically distinct populations improves the survival of offspring (Waples 1991). Multiple populations with varying life history strategies can have abundances that fluctuate independently of each other, reducing extinction risk and long-term variation in metapopulation or regional abundances (Roff 1992; Hanski 1998; Hilborn et al. 2003; Schindler et al. 2010). This "portfolio effect" can also improve resiliency within a single population or watershed, because juveniles leaving natal rivers at different sizes, ages, or time of year can reduce overall risk to the population and improve the resilience of a population (Schindler et al. 2010). Loss of buffering from the portfolio effect is a concern for anadromous fish in the Central Valley and should be considered in restoration planning (Carlson and Satterthwaite 2011).

A broad spatial structure, composed of self-sustaining populations widely distributed throughout rivers in the Central Valley, contributes to species persistence by: (1) reducing the chance of catastrophic loss of an entire species or run, (2) increasing the chance locally extirpated or dwindling populations will be rescued by re-colonization, and (3) buffering a meta-population from future environmental changes (Fresh et al. 2009). Fall-run doubling goal targets provide for adequate spatial structure throughout Central Valley rivers. However, late-fall-run, winter-run, spring-run, and steelhead populations were significantly impacted by dams and habitat alteration prior to the doubling goal baseline period and populations had already been extirpated from historical habitat (Yoshiyama et al. 1998). Of the four Chinook Salmon runs, fall-run is the only run to spawn and rear in lower-elevation rivers and tributaries. Winter-run typically spawn in spring-fed headwaters, spring-run in upper tributary streams, and late-fall-run in upper main-stem rivers, all habitat types that have been disproportionately affected by human impacts on Central Valley rivers (Yoshiyama et al. 1998). Spring-run, in particular, was historically the most abundant run in the Sacramento-San Joaquin system and has undergone the most dramatic decline. To address these concerns, whenever possible this Plan will support priorities from the NMFS final recovery plan for winter-run and spring-run Chinook Salmon and steelhead (NMFS 2014; Figure 2) to guide where existing populations should be supported and new self-sustaining populations should be established.

Figure 2. Diversity groups for the Sacramento River Winter-run Chinook Salmon ESU, the Central Valley Spring-run Chinook Salmon ESU, and the Central Valley steelhead DPS. The Winter-run Chinook Salmon ESU historically occurred in the basalt and porous lava diversity group, while Spring-run Chinook Salmon and steelhead occurred in all of the diversity groups shown. From NMFS (2014).



Abundance, productivity, life history and genetic diversity, and spatial structure should be used to guide development of watershed-specific biological objectives that supplement the CVPIA doubling goal. The DSMs use a utility function that is an aggregate of biological metrics that address these parameters to predict biological response of alternative types of management actions that may be applied to watersheds (Table 3). These biological metrics have the potential to be further refined as biological objectives through the development of quantitative targets

for individual watersheds. The DSMs maximize the utility function; thus, management actions are prioritized that would increase the utility by the largest amount. The components of the utility function (e.g., the proportion of spawning fish that are naturally produced) could be assigned target values (e.g., 80%) that quantify success in a particular watershed and across the Central Valley. Assigning quantitative values of "success" to components of the utility function would assure biological metrics of success for individual watersheds are compatible with the DSMs and that the same metrics are used for all watersheds. The SIT will examine the utility functions in the DSMs and determine how they should be refined to develop biological objectives for individual watersheds.

Restructuring CVPIA Fish Programs to Implement ARM

One of the key tasks of this Plan is to propose a restructuring for CVPIA fish-related provisions and stakeholder involvement, which supports a transparent decision making process informed by the best available science. To achieve this task, this Plan includes a revised structure for all CVPIA fish-related provisions listed in Table 1 The resulting structure is intended to integrate all CVPIA fish-related activities into one Anadromous Fish Program (AFP); efficiently manage the ARM process, including the DSMs; effectively incorporate new and existing monitoring data into decision making; and support a landscape-scale approach to deciding which projects to prioritize and implement. The restructured AFP is not intended to increase the total number of Service or Reclamation staff working on CVPIA fish-related provisions. Instead, the restructuring will eliminate redundancy in the program structure and allow for greater flexibility for staff to work across programs and watersheds to prioritize and implement projects that have the greatest overall predicted benefit to naturally-produced anadromous fish in the Central Valley. The restructuring will eliminate the lead and co-lead structure for individual fish programs currently in place, but will enhance collaboration among agencies by establishing a co-located office for AFP staff from the Service and Reclamation.

A primary goal of this Plan and the restructured AFP is to coordinate with other groups and programs working to restore anadromous fish in the Central Valley. To achieve this goal, the AFP will:

- Lead the SIT team and participate as appropriate to facilitate and guide implementation of the ARM process
- Work with watershed groups, agency partners, and other stakeholders to design and implement projects and monitoring according to ARM priorities

- Coordinate with agency partners and other groups working to restore naturally-produced anadromous fish in the Central Valley and participate in related programs and activities, such as NMFS recovery efforts and OCAP related actions.

The Anadromous Fish Program

This Plan proposes the CVPIA fish-related provisions (Table 1) be reorganized into one AFP. The AFP will comprise three offices: (1) science and program support, (2) Southern Central Valley field program staff, and (3) Northern Central Valley field program staff (Figure 3). Development of science priorities will be facilitated by the SIT and Science Coordinator, with support from AFP staff and technical representatives from other agencies and stakeholders represented in the SIT. Specific project proposals will be developed by field program staff with support from the science and program support office in Sacramento. The science and program support office will include (1) a Science Coordinator, with responsibility for implementing the ARM process and leading the SIT; and (2) staff with expertise in specific management areas, with responsibility for providing a landscape-level perspective and guidance on best practices for designing and implementing projects. In general, the AFP will move away from provision-specific implementation and toward broader implementation of CVPIA authorities on the watershed and landscape scale. Figure 3 is not meant to describe specific staffing levels or supervisory structure, but rather the functional roles that will be provided by each office and how they support the ARM process. A specific organizational chart will be developed by the Service and Reclamation at a later date.

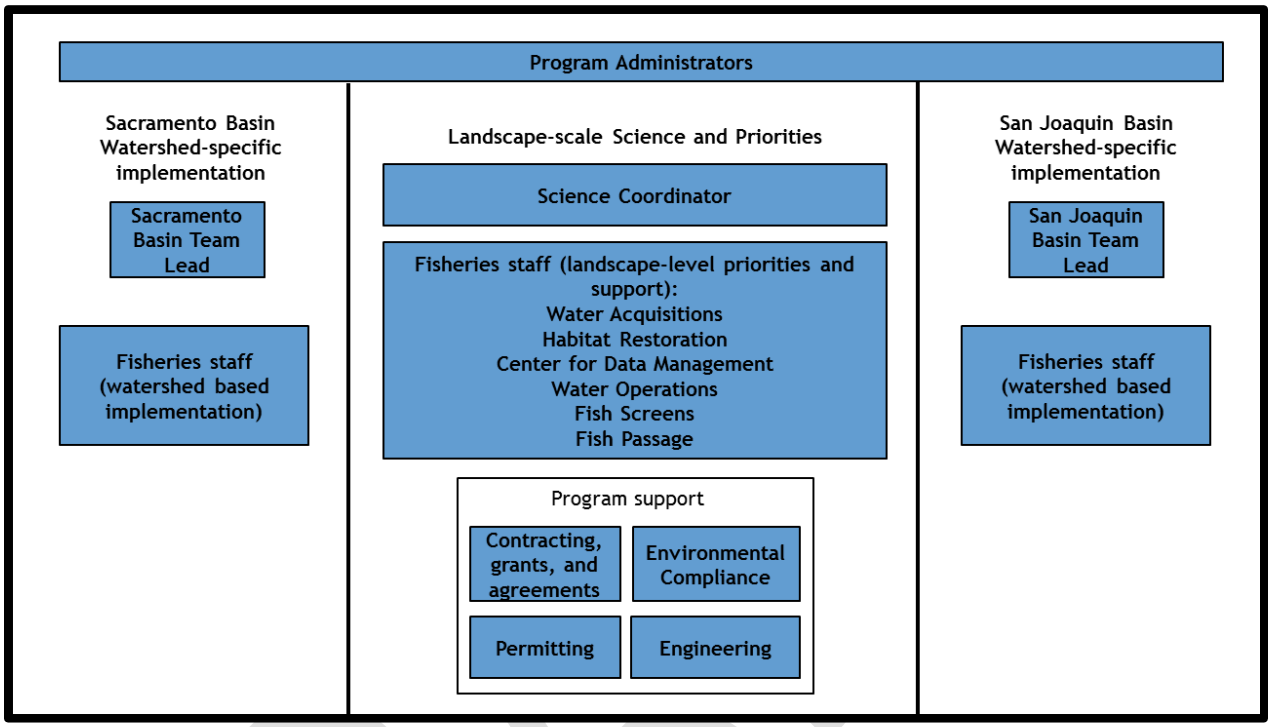
The three AFP offices will include co-located Service and Reclamation staff committed to collaborative approaches to support the ARM process and project implementation. One goal of the AFP is to reduce redundancy in the CVPIA program by eliminating the need for the lead and co-lead structure that often has a staff member in each agency filling similar roles. Instead, we envision functional roles within the AFP filled by qualified staff, regardless of agency affiliation. In addition, all staff should work collaboratively with other efforts supporting native anadromous fish restoration in the Central Valley, including efforts associated with the NMFS Recovery Plan, OCAP Biological Opinion, the SEP process, and others. The science and program support office will comprise staff who will lead and facilitate the ARM process and coordinate with other efforts that support anadromous fish restoration (i.e., Science Coordinator), support ARM with monitoring and analyses (Center for Data Management), and apply landscape-level perspective and broad expertise to restoration project design and implementation (e.g., habitat restoration, passage, fish screens, water operations, water acquisition). The three AFP offices will comprise staff that will develop relationships with watershed groups and other stakeholders to apply ARM guidance to develop and implement on-the-ground projects in individual watersheds. Field staff will be responsible for site selection, design, implementation, and monitoring, in coordination with stakeholders and staff from the science and program support office. Permitting, environmental compliance, and other support staff will be available to support field staff in development and implementation of projects.

Most of the AFP staff will reside in the Southern and Northern area offices. Because the CVPIA will not receive additional funding as it is re-organized, it is expected any new roles and responsibilities will be accomplished through a re-allocation of existing staff and resources.

OBJECTIVES OF THE REVISED AFP STRUCTURE

- Coordinate efforts across watersheds to improve monitoring, better create and incorporate new information, and ensure individual projects align with science priorities.
- Retain technical expertise from program areas and apply more broadly across watersheds.
- Retain watershed-specific knowledge and relationships and apply to project development and implementation.
- Balance landscape-level and watershed-specific strategies.
- Maximize flexibility for implementing types of management actions across watersheds.
- Coordinate with other agency partners, stakeholders, and programs working to restore naturally-produced anadromous fish in the Central Valley.

Figure 3. Proposed structure for the Anadromous Fish Program. Each box is a proposed role and implies responsibility for a program area, but does not imply staffing levels or supervisory relationships. Each box is explained in detail in the text.



Science and Program Support (Co-located Office with Service and Reclamation Staff)

- Who:
  - Program Administrators.
  - Science Coordinator.
  - Program coordination and technical expertise with Central Valley-wide scope, addressing the following areas :
    - Fish screens, predation, and passage (sources of mortality and barriers to movement).
    - Spawning, rearing, and holding habitat restoration (physical habitat needs for freshwater life stages).
    - Instream water acquisition and instream flow (increasing water availability and functional flows for freshwater life stages).
    - CVPIA Section 3406(b)(2)/water operations and temperature (coordination between river and Delta water operations and associated temperature considerations).
    - Center for Data Management (data management, statistics, and modeling to support the DSMs).

    - Engineering, contracts/grants/agreements, permitting, and environmental compliance support. Discussions are needed to determine the best way to provide needed support for project implementation while managing workload.

- Role:
    - Provide science and technical guidance to field staff on overall science priorities and strategies (Science Coordinator), specific management actions and environmental conditions evaluated by the DSMs (fish screens, habitat, water acquisitions, water operations), and monitoring and data needs (Center for Data Management).
    - Provide logistical and technical support to field staff for engineering, contracting, permitting, and environmental compliance.
    - Program Administrators: As outlined in memorandums dated March 15, 1993 and February 10, 2006 to the Director of the Fish and Wildlife Service and the Commissioner of the Bureau of Reclamation, the lead in implementation of CVPIA will be shared by the Service and Reclamation to support a collaborative approach to anadromous fish restoration. Each agency will designate a Program Administrator who will serve as their agency's primary point of contact. These individuals will coordinate the efforts of their respective agency personnel and will represent their agency on matters for which that agency has primary responsibility. Reclamation will have primary responsibility for budget submissions for both agencies; for appropriations, finance, and accounting from an overall program perspective; and for engineering, operational design, and construction for specific project features. The Service will have primary responsibility for decisions on biological resource issues; for studies on fish and wildlife, their populations and habitat requirements; for fishery restoration program direction; and for the planning, design, and decisions on the administration of fish and wildlife facilities. Program Administrators will have decision authority for CVPIA-related issues. Any unresolved issues that arise will be addressed by regional management in the Service and Reclamation.
    - Science Coordinator: Responsible for ARM, the DSMs, developing science priorities and strategies across watersheds (projects, monitoring, and research), and coordinating and communicating science priorities to staff and stakeholders. The Science Coordinator will lead the SIT and the Agency Technical Team. The Science Coordinator will be the primary contact for the DSMs and will have the primary responsibility for working with DSM staff and/or consultants and producing: (1) a 5-year plan on science priorities as discussed by the SIT that undergoes independent science review and is revised every 5 years and (2) an annual technical report on the ARM process, modifications to the DSMs, and any implications for program priorities and the 5-year plan.
    - Fish Screen and Passage, Spawning and Rearing Habitat, Water Acquisitions, and Water Operations Coordination: Staff members will be the scientific and technical experts for their respective expertise across watersheds. Coordination positions are functional roles and may be filled by a person or team, will communicate science priorities to stakeholders and field program staff, and will collaborate with field staff, the Science Coordinator, and the CDM to develop project proposals and associated monitoring plans. Coordinators will ensure data and information in their program area is submitted to the CDM and will support the Science Coordinator in efforts to refine and maintain the DSMs. Coordinators will participate in the Agency Integration Team.

- Center for Data Management: Coordination for data collection and analysis will be filled by one or more people and will develop, coordinate, review, and implement monitoring and other landscape-scale data collection activities across watersheds with a special focus on acquiring, standardizing, and providing high quality data that will be used to inform the ARM process and the DSMs. All monitoring plans and activities implemented through AFP will be coordinated with, developed by, or reviewed by the CDM's staff. All data that can be used to inform the DSMs will be stored by the CDM and will be accessible to the SIT. Staff will participate in the SIT to ensure: (1) all AFP data and information are available to the SIT for use in the DSMs, (2) all proposed projects have appropriate plans for monitoring and data storage, and (3) DSM data and information needs are addressed as priority projects for implementation. The CDM will work with AFP staff and partners to develop standardized protocols for collecting/reporting data and future data collection activities. CDM will acquire data from data collection entities (Department of interior staff, CDWF, DWR, other partners with monitoring data, consultants), evaluate/characterize data quality, and transfer data to databases and DSMs on a timely basis.

- Responsibilities: The Science and Program Support office will have primary responsibility for program administration; implementing the ARM process; refining and maintaining the DSMs; developing and communicating program priorities in the form of a 5-year plan; managing, storing, and analyzing landscape-level data; providing technical support or expertise for proposed projects; providing other science, technical, and logistical support to field program staff, other agencies, and stakeholders with a broader programmatic and geographic focus.
- Process: Science and Program Support staff will provide guidance and assistance for field program staff to develop projects. Science, monitoring, and program coordinators will participate where indicated, or as needed, in the Agency Technical Team. This office provides the necessary support to ensure the ARM process is adopted, the DSMs are maintained and used, data and monitoring are implemented to inform decision making, and projects are evaluated for their contribution to science priorities, watershed-based biological objectives, and overall restoration goals. The CDM receives data and information from AFP staff, partners, and stakeholders. The CDM will process, standardize, and interpret data when necessary and provide information as a member of the SIT for incorporation into the DSMs. The coordinator(s) and staff will also review proposed monitoring plans developed as part of project proposals.

Field Program Staff with Watershed-specific Knowledge

- Who:
  - Field-based (Sacramento basin and San Joaquin basin) watershed restoration staff that implement the suite of CVPIA-related authorities.
  - Field-based watershed restoration staff team leads in the Sacramento basin and San Joaquin basin.
- Role:

- Coordinate watershed-specific CVPIA Fisheries science and monitoring priorities with partners at the local level.
- Identify site-specific projects and watershed-specific monitoring that meet CVPIA priorities and solicit assistance from Science and Program Support office for development and execution.
- Assist other entities in project implementation (i.e., development, design, permitting, and construction) and monitoring, as applicable and needed.
- Coordinate with stakeholders and local landowners.
- Organize, facilitate or actively participate in watershed teams.
- Follow guidance of science coordinator and SIT team to ensure design, implementation and monitoring of projects will inform the DSMs.
- Contribute data and information to the DSMs and ARM framework, as needed.
- Work with Engineering, Contracting, Permitting, and Environmental Compliance staff as needed for implementation of projects and monitoring.

- Responsibilities: Field program staff will work with stakeholders and watershed groups to coordinate program priorities. Staff will participate in local watershed groups, work with additional local partners, provide support for landowners and local stakeholders, support portions of project implementation led by other entities and directly implement projects where needed. Staff will ensure data and information will be submitted to the SIT (if data will inform the DSMs) and will coordinate with the appropriate program coordinators when needed. Field team leads will participate on the Agency Technical Team. Each field team lead and watershed staff will be responsible for developing projects in collaboration with program coordinators and reflecting SIT priorities.
- Process: Field staff will develop project proposals in coordination with the science and program coordinators and stakeholders to reflect SIT priorities. When possible, proposals should include projects or monitoring developed in coordination with watershed groups and other partners. Proposals will be reviewed and prioritized by the Core Team.

Setting Priorities and Implementing Projects

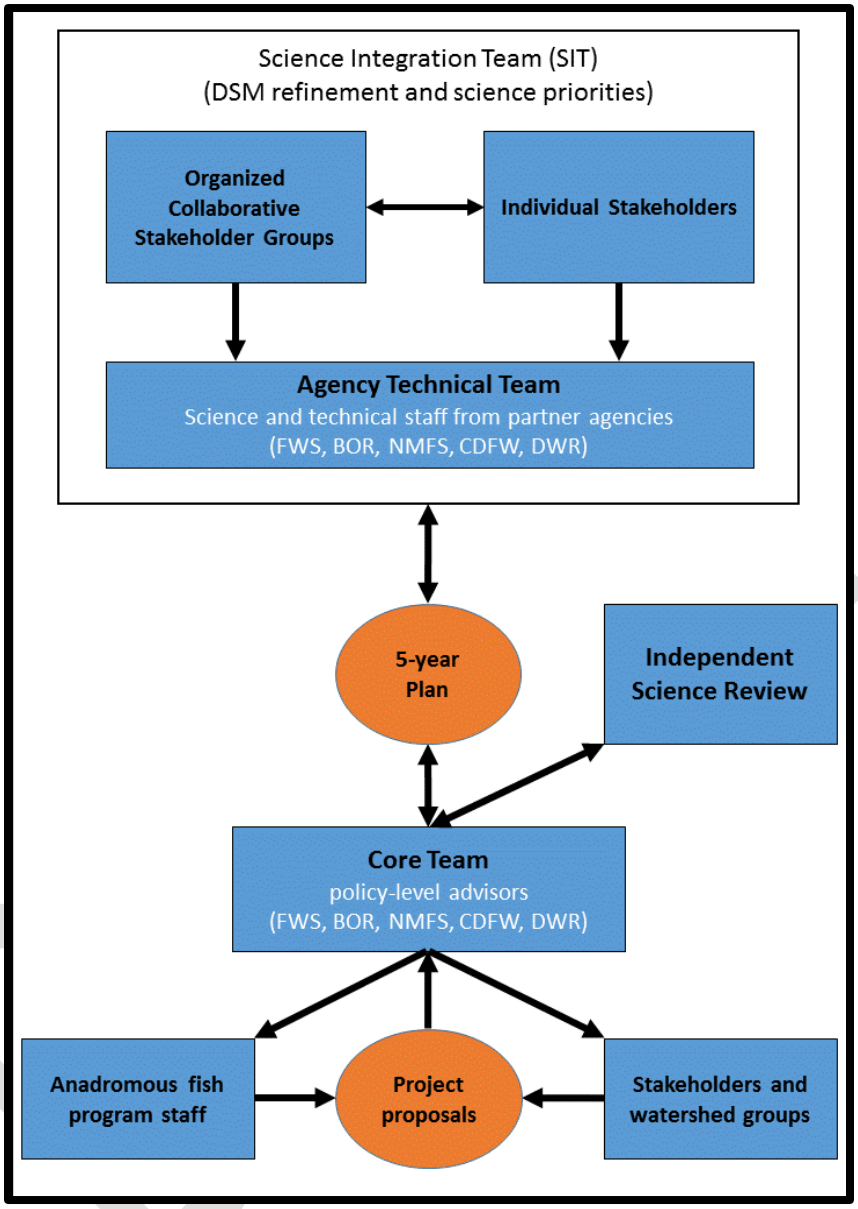
This Plan describes a new priority setting framework for CVPIA fish-related programs, clarifies how priorities are established and used to inform decision making, and outlines a process for generating, funding, and implementing projects. The proposed structure (Figure 4) specifies the groups and processes involved in incorporating new science and data into the ARM, refining and revising the DSMs with this new information, and setting the AFP priorities for science, monitoring, and projects over a 5-year time horizon. A key goal for this priority setting framework is to collaborate with stakeholders in the SIT to ensure the best available science from all sources is incorporated into the ARM process and that priorities address common goals

for anadromous fish restoration in the Central Valley. The SIT will include agency technical staff and stakeholders and will be responsible for (1) refining and maintaining the DSMs, (2) incorporating new and existing data information into the ARM process, (3) developing watershed-specific biological objectives to set restoration goals and measure success, and (4) recommending priorities for management actions, research, and monitoring to the Core Team. The Core Team will be responsible for (1) revising priorities and issuing an annual call for proposals, (2) evaluating proposals based on the priorities and using clear criteria, (3) recommending annual work plans to the implementing agencies, and (4) facilitating independent reviews of the SIT process and DSMs.

OBJECTIVES FOR SETTING PRIORITIES AND IMPLEMENTING PROJECTS

- Use collaborative ARM process to develop and refine intermediate-term (5-year) management priorities and incorporate annual data collection and analysis into decision making.
- Articulate priorities in a Plan that will be updated every 5 years and will guide project development and monitoring plans.
- Incorporate partner agencies and stakeholders in priority-setting, project generation, and project implementation processes to use the best available science and achieve common goals for anadromous fish restoration.
- Use 5-year priorities to guide development and funding of projects.
- Maintain and strengthen relationships among stakeholders involved with anadromous fish restoration in the Central Valley to facilitate successful development and implementation of projects.
- Ensure that the Expected Value of Information (EVI) is used to determine when funding for information (science and monitoring) is expected to increase the success of restoration projects. Otherwise, priority should be given to implementation of restoration actions.

Figure 4. Priority-setting framework for the Anadromous Fish Program. The overall process and each box are explained in detail in the text.



The priority-setting process will consist of science-based recommendations made by the SIT and additional considerations related to policy, opportunity, funding, and other logistics made by the Core Team. The SIT will have three primary responsibilities: (1) maintenance and refinement of the DSMs, (2) development of a 5-year plan for science and management priorities that will be reevaluated on a 5-year cycle, and (3) annual updates to the DSMs and ARM process with new data and information, with results documented in an annual tech memo. The Core Team will also have three primary responsibilities: (1) review and incorporate addendums to the 5-year

plan, if necessary; (2) evaluate project proposals based on criteria derived from the 5-year plan, ensure work plans adequately implement the 5-year plan based on recommendations by the SIT and incorporating funding and other constraints, and (3) solicitation of an independent science review of the DSMs and 5-year plan, to occur after each revised 5-year plan is released (i.e., on a 5-year cycle). The priority-setting process is described in more detail, below.

Science based priorities, project proposals, and monitoring will be guided by the ARM process, using the DSMs to synthesize monitoring data and other scientific information and predict biological outcomes of alternative management actions. The current version of the DSMs will be further refined by adding data to replace expert opinion, where possible, and the DSMs are expected to rely more heavily on data over time. Sensitivity analyses will be used to determine where additional monitoring would be expected to reduce uncertainty and potentially lead to different decisions. Stakeholder groups may contribute data or peer-reviewed science for incorporation into the DSMs and participate in refining the DSMs as part of the Science Integration Team. All projects implemented by the AFP are expected to contribute relevant data and information to the DSMs. In the early iterations of the DSMs, the SIT will work with a consultant to further refine the model and integrate monitoring data and information. In the future, it is expected that the AFP will have the capacity to maintain and further refine the model, under close coordination with the Science Coordinator and with the assistance of fisheries staff. An independent science review panel will periodically evaluate the entire ARM process, including DSM refinement and prioritization by the SIT, and will provide their recommendations to the Core Team.

Project development will be an iterative process guided by science and monitoring priorities. The DSMs will indicate priority project types and areas of uncertainty that can be addressed through monitoring. The DSM output will be refined through SIT discussions, with input from AFP and agency technical staff and other experts as needed. The AFP Science Coordinator will lead the SIT process and the Agency Technical Team and will be responsible for incorporating SIT advice into the refinement and maintenance of the DSMs. After each annual priorities workshop, the Science Coordinator will produce a technical memo describing the current state of the DSMs, any changes made to the DSMs in the past cycle, and any major changes in the science, monitoring, and project priorities suggested by the DSMs and supplemented by additional science and expert input as a result of new data or information. It is expected DSMs will be updated and refined on an annual basis by incorporating new data and information and the process will be documented in the annual technical memo. However, science and project priorities for the AFP will change on a longer time cycle. A 5-year plan for Science and Management Priorities will be developed and refined every 5 years. The priorities for watersheds and types of monitoring and management actions stated in the 5-year plan will be used to guide development of projects, work plans, and monitoring activities over a 5-year time horizon.

The Core Team will select projects for funding and implementation, based on the 5-year priorities recommended by the SIT. The Science Coordinator will hold an annual workshop with

the Core Team to discuss the SIT priority recommendations. These priorities will form the basis for project development and the Annual Work Plan process. The Core Team will use the 5-year plan for Science and Management Priorities to develop an annual call for project proposals. Proposals will be developed that reflect the science and management priorities as stated by the Core Team and proposals will be evaluated according to how well they align to those stated priorities (Appendix A). Projects may be developed by AFP staff, stakeholders, or watershed groups. AFP staff will be available to work with stakeholders and watershed groups to develop projects that address the 5-year plan and selection criteria. Project proposals will be submitted to the Core Team for review and comment, and the Core Team will evaluate projects using published project selection criteria that reflect priorities from the 5-year plan and incorporating scientific and technical feedback from the SIT. All project proposals recommended for CVPIA funding will presented for feedback at an annual open house. Stakeholders will have the opportunity to comment to the Core Team on how well the projects reflect the priorities described in the 5-year plan and propose alternative approaches that may better achieve the objectives.

The Science Integration Team (SIT) will include stakeholders and agency staff (Agency Technical Team). The Core Team will use the SIT 5-year plan to solicit project proposals, evaluate those proposals, and fund projects for implementation. The SIT and Core Team, including their roles and responsibilities, are described below.

We intend this priority-setting process to begin with FY2017 priorities and project development. The Core Team went through an interim process to identify and define CVPIA priorities for the fisheries resource area restoration-related provisions in Section 3406 in fiscal year 2016 (Appendix B). This 2016 Plan represents a transition between the previous way priorities, and ultimately projects, were selected and the ongoing Adaptive Resource Management Process (ARM) currently underway in the CVPIA Program.

SIT

- Who: The SIT will comprise various Stakeholders and the Agency Technical Team.
    - Stakeholders: All individual stakeholders or collaborative stakeholder groups with the ability and interest to engage in a science-based process to set priorities. A Central Valley Salmon Partnership has been proposed as one possible example of a group that would facilitate collaboration among stakeholders with science capacity. If formed, a CVSP would be a model for stakeholder science engagement in the SIT.
    - Agency Technical Team: Science and technical staff from Implementing and Core Team agencies (FWS, BOR, NMFS, CDFW, DWR). The team will provide State and Federal support to assist in implementing the ARM framework, maintaining and refining the DSMs, and recommending priorities.
- Role: Provide data and information to maintain, update, and refine the DSMs. Evaluate the status of the DSMs, necessary refinements, and interpretation of DSM output. Discuss

implemented projects, lessons learned, and how to incorporate data and information into the DSMs to improve decision making. Plan strategies for developing watershed-specific biological objectives. Comment on how well monitoring and project implementation reflects program priorities recommended by the SIT. SIT members can also propose projects, but project proposals would be developed in response to management priorities and a call for proposals by the Core Team.

- Responsibilities: Provide all relevant data and information and use the best available science to inform SIT discussions and DSM refinement, and provide scientific and technical expertise when necessary. The team will produce an annual technical memo that describes updates to the DSMs, including any data additions and evaluations and corresponding impacts on DSM output. The memo will also include an evaluation of the DSM priorities for science, monitoring, and project types (5-year plan) and how or if these priorities were adjusted by the SIT according to expert opinion or other information. This technical memo and 5-year plan will be made available to AFP staff and stakeholders to guide development of project proposals. The Core Team will use the technical memo to guide evaluation of proposals.
- Process: The AFP Science Coordinator will organize annual (or more frequent) priorities workshops and will invite all members that have expressed interest in participating in the SIT. At the annual workshop, the SIT will discuss the current state of the DSMs, the model's strengths and weaknesses, data necessary to improve model performance, current model output, and whether implementation of projects and monitoring over the previous year addressed SIT priorities. Updated program priorities will be set by reviewing model output and refining (if necessary) based on peer-reviewed science and expert input. In between priorities workshops, members will provide data and information to the AFP monitoring program that are expected to improve the model performance. During early use of the DSMs, priorities from the model will be supplemented by expert opinion from members of the SIT. As new information is incorporated into the model, the SIT will rely more on the model prioritization and less on expert opinion from members of the team.

Core Team

- Who: Policy-level advisors from implementing agencies and other resource agencies (FWS, BOR, NMFS, CDFW, DWR). The team will be led by the CVPIA Program Administrator from the Service with assistance from Reclamation.
- Role: The Core Team works with the SIT and a periodic Independent Science Review Panel to ensure the ARM process and DSMs are based on the best available science. The Core Team will participate in an annual priorities workshop with the SIT and will review the 5-year plan and AFP project proposals for policy considerations and comments from stakeholders.
- Responsibilities: The Core Team approves the SIT's 5-year plan, prioritizes project proposals, and organizes periodic Independent Science Review of the ARM process and

DSMs. The Core Team will provide direction to the SIT and receive feedback on an annual basis and more frequently if needed.

- Process: The Core Team will approve the SIT tech memo and 5-year plan, participate in a SIT priorities workshop, and receive project proposals for review. The Core Team will prioritize project proposals.

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APPENDIX A

CVPIA Project Proposal Selection Criteria

These criteria, posed in the form of questions for project proposers, form the basis for Core Team selection of projects for funding. All project proposals should address these criteria in a concise and complete manner. These criteria should be considered early in the project development phase as a guide for preparing a successful project proposal. The Core Team may periodically update these criteria to reflect changing priorities and/or needs related to project selection criteria.

Project Name:

Applicant(s):

1. **Description.** Give a short overall description of the project.
    - How does this project relate to prior restoration actions?

2. **Priorities.** Which DSM derived priority(s), as identified in the current CVPIA 5-Year plan, does the project aim to accomplish, partly or in whole?

3. **DSM Integration.** How does the project fit within the SIT & DSM process?
    - What fundamental objective does it fulfill?
    - Explain the hypotheses addressed by the project and associated model support.
    - Describe the associated monitoring plan and if/how monitoring will inform the DSMs.
    - Are there elements of the project added to support specific DSM and SIT purposes?
    - Will monitoring data be consistent with CVPIA data management standards, including submittal to data managers?
    - Are performance metrics defined?

4. **Outreach.** How has stakeholder input had a direct impact on the formulation of this project?
    - Explain whether this project proposal addresses alternative hypotheses or supplemental data. If so, how?
    - Explain collaboration with or among stakeholders and agency partners in development and/or implementation of this project.
    - Are there stakeholder objections to the project as proposed?

5. **Project Readiness.** Describe the timeframe for the project to demonstrate measurable results beyond documenting as-built conditions.
    - What is the funding plan?
    - What is the cost-share?
    - What is the budget?
    - What is the project schedule?
    - What are the deliverables?

6. **Value.** Is the project cost-effective relative to its complexity, regulatory environment, and potential ecological and community benefits?
    - Are the proposed costs substantiated and will the majority of funding support on-the-ground restoration?
    - If the project is focused primarily on science or monitoring, how will the results inform the DSMs or reduce uncertainty in decision making?
    - What are the impacts of not doing the project?

7. **Permitting.** Is the project likely to successfully complete the regulatory process (local, state, and federal) within a reasonable timeframe?
    - Does the proposal include information on the status of necessary permits and consultations?
    - Are there any regulatory issues that may be insurmountable or cause long-term delays (e.g., historic and cultural, impoundment water rights, endangered species issues)?

8. **Project Management.** What is the past performance of the project manager, project team, and associated project work experience?
    - Are periodic progress reports one of the project deliverables?

9. **Anadromous Benefits.** How does the project contribute to an open, connected river system with increased access to suitable anadromous fish habitat?

10. **Overall Ecological Benefits.** How does the project yield broad ecological benefits?
    - Ecosystem enhancements
    - Support for multiple life stages of aquatic and terrestrial species - including anadromous fishes
    - Improved riverine functions and processes
    - Improved riparian/floodplain connectivity?

11. Other Factors Recommended by the SIT and Adopted by the Core Team
    - TBD on an annual basis

APPENDIX B

2016 Interim Priorities for the Fisheries Provisions

of the

Central Valley Project Improvement Act

Internal Review Draft

Fish & Wildlife Service, Pacific Southwest Region

Bureau of Reclamation, Mid-Pacific Region

April 29, 2015

Introduction

The purpose of this Interim Plan (2016 Plan) is to define Central Valley Project Improvement Act (CVPIA) priorities for fiscal year 2016 for the fisheries resource area restoration-related provisions in Section 3406. This 2016 Plan represents a transition between the traditional process of funding individual CVPIA authorities, and the ongoing Adaptive Resource Management (ARM) approach currently underway in the CVPIA Program, as described in "A Central Valley Project Improvement Act Implementation Plan for Fish Programs" (2015). The 2016 Plan defines objectives, strategies, and priorities intended to achieve the CVPIA's purposes and the program's vision.

The purposes of CVPIA were articulated in Section 3402 of the CVPIA and serve as the foundation of the Program's mission. These purposes are:

a. To protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California;

b. To address impacts of the Central Valley Project on fish, wildlife and associated habitats;

c. To improve the operational flexibility of the Central Valley Project;

d. To increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation;

e. To contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary;

f. To achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial and power contractors.

The Department of the Interior, Bureau of Reclamation (Reclamation) and Fish and Wildlife Service (Service), in collaboration with Federal, State and local governments, Tribes, non-governmental organizations, and stakeholders, implement activities to: protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California; address impacts of the Central Valley Project on fish, wildlife, and associated habitats; improve the operational flexibility of the Central Valley Project; increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation; and contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta).

The CVPIA Program vision is the operation of the Central Valley Project in ways that achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife; agricultural; municipal and

industrial; and power contractors; in the most cost-effective manner, with a focus on efficiency, effectiveness, transparency, and accountability.

Since Congress passed the CVPIA in 1992, Reclamation and the Service have worked with numerous partners to advance the Act's purposes. Together, tremendous progress in protecting and restoring the regional ecosystems has been made. While a great deal has been achieved, the agencies recognize that much work remains. The water-related environmental problems the agencies are facing are more complex than ever before, and implementing solutions is more challenging. The agencies recognize that the Central Valley problems cannot be solved by one agency alone; they will require combined expertise, perspectives, and resources of many partners and non-CVPIA agencies. More than ever before, the agencies need to look forward and establish clear objectives and strategies to address them.

Defining Key CVPIA Fish Program Terms

Priority: A state or condition that is regarded or treated as more important to act upon.

Action: The fact or process of doing something to achieve a goal. An action usually lasts through some time and may consist of more than one act. Equivalent to "Activity" in this document. An action may include one or more projects.

Project: A specific endeavor (or act) that is carefully planned and designed to achieve a particular goal

Core Team

A "Core Team" was established in 2010 to identify important issues and assist the implementing agencies in developing objectives, strategies, and priorities for the fisheries resource area. The Core Team is a reconceived version of the Anadromous Fish Restoration Program (AFRP) Core Group that developed the Working Paper (1995). The Working Paper acts as the foundation for the AFRP *Final Restoration Plan* that guides many of the CVPIA-funded habitat restoration activities. The Core Team is comprised of program managers and key staff from Reclamation, the Service, NOAA Fisheries, the California Department of Fish and Wildlife (CDFW), and California Department of Water Resources (CDWR).

Related Processes

Several ongoing related processes and plans were taken in to consideration in the development of this interim 2016 Plan (2016 Plan). These include the AFRP's *Final Restoration Plan* (2001), NOAA Fisheries' California Central Valley Salmon & Steelhead Recovery Plan (2014), NOAA Fisheries' Reasonable & Prudent Alternatives from the

OCAP Biological Opinion (2009), the Ecosystem Restoration Program's Conservation Strategy, and California Water Action Plan.

Fisheries Resource Area Goals, Objectives, and Strategies

This chapter describes the goals, objectives, and strategies for the CVPIA Fisheries Resource Area in the Central Valley.

Goals

The Fisheries Resource Area Goals in the Central Valley are:

(1) Implement reasonable efforts to at least double the natural production of anadromous fish in Central Valley Rivers and streams on a sustainable, long-term basis (compared to the period of 1967-1991) (Title 34, Public Law 102-575, 1992)

As such, this goal is reflected in estimated anadromous fish natural production targets or "doubling goals" pertaining to several watersheds, and anadromous fish taxa in the Central Valley. And,

(2) Mitigate the adverse effects of the Central Valley Project on species and their habitats, including other, non-anadromous fish species.

Central Valley Fisheries Objectives and Strategies

The CVPIA Program Administrators with the Service and Reclamation met with the Core Team to develop priorities for 2016. The Core Team agreed to adopt several objectives to meet goals 1 and 2 stated above. The objectives were developed in 2009 during a series of Fisheries Focus Group (FFG) meetings that included the participation of program managers, a subset of Habitat Restoration Coordinators from the AFRP 3406 (b)(1) program, water acquisition specialists, and CVPIA modeling and monitoring program staffs. During the FFG process, objectives and strategies were developed to address the limiting factors in the Delta, increase anadromous fish natural production throughout the Central Valley, complete planned commitments, and improve monitoring and modeling.

For objectives to increase anadromous fish natural production throughout the Central Valley, five watersheds were identified with the highest potential to contribute to valley-wide fish "doubling goals", four watersheds were identified with the highest likelihood to achieve their watershed "doubling goals", and eight watersheds were identified where consideration should be given to benefits for special status species, e.g., taxa listed pursuant to the Federal Endangered Species Act. Because several of

these watersheds contribute to multiple objectives (i.e. both "doubling goals" and have special status species), the CVPIA Fisheries Program will prioritize and focus its efforts on a total of eleven watersheds in 2016.

Central Valley Fisheries Objective A: Complete Ongoing Activities

The Program has commitments in progress throughout the Central Valley and some of these commitments are not in watersheds that were selected as highest priorities for future work in this 2016 Plan. These activities are identified as "Ongoing Activities". The Program objective is to complete these ongoing activities to fulfill the obligations already made in these watersheds and not strand investments already committed and obligated. These Ongoing Activities will be considered along with the Program's priorities in the watersheds that support objectives C, D, and E (see below).

Strategies

Strategy A-1 **Complete Ongoing Commitments -** Complete all ongoing activities in CVPIA watersheds to fulfill obligations

The Program has ongoing commitments that are not projects occurring in watersheds that support objectives C, D, and E. The Program proposes to consider these activities, along with other actions not specifically identified in this 2016 Plan, to determine whether they warrant further investment and completion. See Table 4 for the complete list of proposed ongoing activities.

Central Valley Fisheries Objective B: Contribute to Delta Protection and Enhancement

Because a primary goal of CVPIA is mitigate the adverse effects of the Central Valley Project on species and their habitats, the Program will focus on improving fish passage and survival in the Delta through the implementation of operational and structural actions.

Strategies

Strategy B-1 **Manage Operations** - Continue the Program's significant role in managing Delta water operations to reduce impacts to fisheries

Strategy B-2 **Structural and Operational Changes** - Plan, evaluate, and implement critical structural and/or operational changes that support Delta anadromous and non-anadromous fish passage and survival

Strategy B-3 **Planning and Regulatory Programs** - Coordinate actions with existing and future planning and regulatory programs and priorities in the Delta

Strategy B-4 **Investigate Limiting Factors** - Support continued investigations of the critical limiting factors in the Delta

Strategy B-5 **Water Facilities** - Operate CVP Delta water facilities to minimize fish entrainment and maximize survival of anadromous and native resident fish species

From a biological standpoint, the Delta remains the highest priority area for fisheries restoration in the Central Valley because it is highly degraded, native Delta species have shown significant declines in recent years, many anadromous fish rear in the Delta, and all anadromous fish in the Central Valley must pass through it as both juveniles and adults. Mitigating limiting factors to fish production and survival in the Delta remains a critical issue for restoration. Potential limiting factors in the Delta include the loss of physical habitat, highly altered flows, contaminants, passage impediments, diversions, invasive species direct losses at the pumping facilities, and indirect losses from flows altered by the pumping facilities.

CVP operations will continue to be a significant influence in efforts to protect and restore the Delta. Reclamation and the Service will continue to participate in long-term planning to explore potentially significant changes in water management and CVP and State Water Project operations to protect and restore fisheries. The Program will maintain its critical role in water operations to mitigate the impacts of the CVP and contribute to species and habitat protection and restoration through the water operations provisions of CVPIA. The Program also will continue to mitigate the impacts of CVP facilities through structural improvements.

Central Valley Fisheries Objective C: Contribute to Overall Central Valley Doubling of Chinook Salmon in Five Large Watersheds

The Program objective is to make maximum progress on increasing natural production of Chinook salmon by focusing future efforts on five watersheds. Three of these are Central Valley Project streams and the remaining two streams have significant unmet capacity that can contribute to the overall Central Valley-wide doubling goal of natural production of adult fall run salmon on a sustainable basis. Those watersheds are: American River, Feather River, Sacramento River, Stanislaus River, and Yuba River.

Strategies

Strategy C-1 **Increase Central Valley-wide Fall Run Chinook Salmon Natural Production** - Focus restoration planning and priorities on the most critical limiting factors in selected watersheds, and coordinating strategies with others to leverage funding and support

While there are natural production targets for multiple fish species, this objective focuses on fall run Chinook salmon because of the considerable opportunity to contribute to the fall run Chinook salmon doubling goal, the presence of watershed-specific doubling goals that can serve as targets, the possibility of credible monitoring,

and because of the opportunity to support the recovery of two runs of Chinook salmon that are ESA listed (winter-run and spring-run). In addition, many actions to restore Chinook salmon populations will benefit the other anadromous fish species listed in the CVPIA.

This objective emphasizes working in watersheds that have the greatest capacity of producing substantial increases in natural production over the long-term to maximize progress toward meeting the overall Central Valley-wide Chinook Salmon doubling goal of 990,000 adult Chinook Salmon as defined in the *Final Restoration Plan* (2001). Five watersheds were selected based on the following factors: their ability (i.e. greatest capacity) to contribute to the overall Central Valley Chinook Salmon adult natural production doubling goal, the presence and/or absence of anadromous fish species, the implementability of actions in the watershed, and a streams numeric proximity to its watershed adult natural production doubling goal. "Capacity" refers to the magnitude of contribution an individual watershed would contribute to the Central Valley adult natural production doubling goal. "Implementability" was a metric comprised of whether the stream was a Central Valley Project Stream (Yes = 1, No = 0), whether the stream had adequate flows to support all the Salmon runs and their associated life stages (Yes = 2, Mostly = 1, No = 0), whether there were willing partners (Yes = 2, Mostly = 1, No = 0), and whether there was water acquisition potential (High = 1, Medium = 1, Low = 0). "Presence/absence" was a summed composite score for each anadromous fish species present in a watershed. Using these factors, the American River, Sacramento River, Stanislaus River, Feather River, and Yuba River were identified as the most productive watersheds to focus on for this 2016 Plan (Table 1).

Table 1 – Objective C Chinook Targets, 1992-2013 Average and Unmet Capacity

Watershed	Target/1992-2013, Average, Unmet Capacity[2]	Chinook Species/ Run			
		Fall	Late-fall	Winter	Spring
American River	Doubling Target	160,000	N/A[3]	N/A[3]	N/A[3]
	1992-2013 Average	104,296	N/A[3]	N/A[3]	N/A[3]
	Unmet Capacity[2]	55,704	N/A[3]	N/A[3]	N/A[3]
Feather River	Doubling Target	170,000	N/A[3]	N/A[3]	CVT[4]
	1992-2013 Average	94,314	N/A[3]	N/A[3]	unavailable[5]
	Unmet Capacity[2]	75,686	N/A[3]	N/A[3]	unavailable[5]
Sacramento River	Doubling Target	230,000	68,000	110,000	59,000
	1992-2013 Average	69,069	16,964	6,273	653
	Unmet Capacity[2]	160,931	51,036	103,728	58,347
Stanislaus River	Doubling Target	22,000	CVT[4]	N/A[3]	N/A[3]
	1992-2013 Average	5,167	unavailable[5]	N/A[3]	N/A[3]
	Unmet Capacity[2]	16,833	unavailable[5]	N/A[3]	N/A[3]
Yuba River	Doubling Target	66,000	CVT[4]	N/A[3]	CVT[4]
	1992-2013 Average	30,670	unavailable[5]	N/A[3]	unavailable[5]
	Unmet Capacity[2]	35,330	unavailable[5]	N/A[3]	unavailable[5]
Total of All Watersheds[1]	Doubling Target	648,000	68,000	110,000	59,000
	1992-2013 Average	303,516	16,964	6,273	653
	Unmet Capacity[2]	344,484	51,036	103,728	58,347

[1]The Total was derived from the values in this table, and do not reflect the Central Valley wide fish production target of 990,000 contained in the AFRP's *Final Restoration Plan*.
[2]Difference between the Watershed Doubling Goal Target and the 1992-2013 average in a watershed.
[3]The salmon run does not occur in the watershed.
[4]Doubling target for this run has not been established; however, this run may occur in this watershed in the future and could contribute to the Central Valley doubling target.
[5]Data for this Salmon run is not available.

Central Valley Fisheries Objective D: Show Progress in Achieving Watershed Doubling Goals for Chinook salmon in Four Small Watersheds

This CVPIA Program objective is to make maximum progress toward increasing the watershed adult natural production of Chinook salmon by implementing restoration actions on the four streams that have the closest numeric proximity to their watershed adult natural production doubling goals. Those watersheds are: Cottonwood Creek, Cow Creek, Deer Creek, and Mill Creek.

Strategies

Strategy D-1 **Increase Chinook Salmon Production in Four Small Watersheds** - Focus restoration planning and priorities on the most critical limiting factors in selected watersheds, and coordinating strategies with others to leverage funding and support.

While there are natural production targets for multiple fish species, this objective focuses on Chinook salmon because of the considerable opportunity to contribute to the fish doubling goal, the presence of watershed-specific doubling goals that can serve as targets, the possibility of credible monitoring, and because of the opportunity to support the recovery of two runs of Chinook salmon that are ESA listed (winter-run and spring-run). In addition, many actions to restore Chinook salmon populations will benefit the other anadromous fish species identified in the CVPIA.

The purpose of this objective is to achieve success in specific watersheds by increasing the natural fish production to meet the Chinook salmon doubling targets in each watershed on a long term sustainable basis. Four watersheds that had the greatest potential to contribute to their watershed specific doubling targets for Chinook salmon were selected. These watersheds were prioritized by selecting those streams that had the closest numeric proximity to their watershed adult natural production doubling goals. The watersheds selected under this program objective were: Cottonwood Creek, Cow Creek, Deer Creek, and Mill Creek (Table 2).

Table 2 – Objective D Chinook Targets, 1992-2013 Average and Unmet Capacity

Watershed	Target/1992-2013, Average, Unmet Capacity[2]	Chinook Species/ Run			
		Fall	Late-Fall	Winter	Spring
Cottonwood Creek	Doubling Target	5,900	CVT[4]	N/A[3]	CVT[4]
	1992-2013 Average	2,145	unavailable[5]	N/A[3]	unavailable[5]
	Unmet Capacity[2]	3,755	unavailable[5]	N/A[3]	unavailable[5]
Cow Creek	Doubling Target	4,600	N/A[3]	N/A[3]	CVT[4]
	1992-2013 Average	2,117	N/A[3]	N/A[3]	unavailable[5]
	Unmet Capacity[2]	2,483	N/A[3]	N/A[3]	unavailable[5]
Deer Creek	Doubling Target	1,500	CVT[4]	N/A[3]	6,500
	1992-2013 Average	898	unavailable[5]	N/A[3]	1,949
	Unmet Capacity[2]	602	unavailable[5]	N/A[3]	4,551
Mill Creek	Doubling Target	4,200	CVT[4]	N/A[3]	4,400
	1992-2013 Average	1,896	unavailable[5]	N/A[3]	1,198
	Unmet Capacity[2]	2,304	unavailable[5]	N/A[3]	3,202
Total of All Watersheds[1]	Doubling Target	16,200	N/A[3]	N/A[3]	10,900
	1992-2013 Average	7,056	N/A[3]	N/A[3]	3,147
	Unmet Capacity[2]	9,144	N/A[3]	N/A[3]	7,753

[1]The Total was derived from the values in this table, and do not reflect the Central Valley wide fish production target of 990,000 contained in the AFRP's *Final Restoration Plan*.
[2]Difference between the Watershed Doubling Goal Target and the 1992-2013 average in a watershed.
[3]The salmon run does not occur in the watershed.
[4]Doubling target for this run has not been established; however, this run may occur in this watershed in the future and could contribute to the Central Valley doubling target.
[5]Data for this Salmon run is not available.

Central Valley Fisheries Objective E: Support Recovery of Special-Status Anadromous Species

The Program objective is to contribute to increasing the populations of special-status anadromous species in the Central Valley.

Strategies

Strategy E-1 **Prioritize Actions for Multiple Special-Status Species Recovery** - Prioritize actions that will benefit multiple special-status species in watersheds with the greatest capacity for recovery

Strategy E-2 **Prioritize Watersheds** - Prioritize watersheds where individual species are most at risk for population decline

Strategy E-3 **Prioritize Actions with a Significant Contribution -** Prioritize actions that have the capability to make a significant contribution to the recovery of special-status species

Strategy E-4 **Recovery Plans** - Coordinate priorities and actions with species recovery plans

Special status species include any species which is listed, or proposed for listing, as endangered or threatened under the provision of the Endangered Species Act (ESA). An endangered species is defined as a species which is in danger of extinction, while a threatened species is any species which is likely to become an endangered species within the foreseeable future. Placing priority on actions that benefit special status native fish species and races will help maintain the biological and genetic diversity in the Central Valley. Maintaining biological and genetic diversity supports ecosystem adaptability and resilience, which are essential if natural production is to be sustainable on a long-term basis.

Based on the current status, the following species are targeted in this objective. These species are considered to be of equal priority.

- Sacramento River winter-run Chinook salmon
- Central Valley spring-run Chinook salmon
- Central Valley steelhead
- Green sturgeon

Other non-anadromous fish species, such as Delta smelt, are considered part of the Delta objective and strategies, as discussed above.

Several watersheds were selected for this objective. These watersheds were selected based on the presence of the species in the watershed, the potential for the species to increase in population, the implementability of actions on the watershed, and watershed production capacity. While these watersheds are not ranked, the top

watersheds for supporting the natural production of special-status anadromous fish species include the Sacramento River, Yuba River, Clear Creek, Battle Creek, Feather River, Deer Creek, Mill Creek, and Cottonwood Creek. Several of the focused watersheds for special-status recovery are included in other objectives of this Plan. Sacramento River, Yuba River, and Feather River are discussed in Objective C. Deer Creek, Mill Creek, and Cottonwood Creek are discussed in Objective D. Battle and Clear Creeks are the only two streams covered exclusively under this objective.

Central Valley steelhead and green sturgeon do not have watershed-specific doubling targets; since there is a lack of watershed specific targets for these species, the performance measure for this objective is to contribute to the Central Valley wide doubling goal for green sturgeon and Central Valley steelhead (see Table 3).

Table 3 – Objective E Special Status Species Targets

Species/ Run	Central Valley Doubling Target
Winter-run Chinook Salmon	**110,000**
Spring-run Chinook Salmon	**68,000**
Steelhead	**13,000**
Green Sturgeon	**2,000**

Methods

The text that follows provides four steps describing how the list of FY 2016 funding priorities discussed in this document was developed in coordination with the Core Team, based on the objectives and strategies developed through the 2009 FFG process.

In Step 1, a list of priorities was developed by identifying collecting project descriptions or actions from the following list of resource agency source documents, and those project descriptions were incorporated into an "Action" field in a database titled "Potential 2016 CVPIA Priorities". Those source documents were:

1. The Anadromous Fish Restoration Program's *Final Restoration Plan*.
2. The Ecosystem Restoration Program's *Conservation Strategy For Restoration of the Sacramento- San Joaquin River Delta, Sacramento Valley, and San Joaquin Valley Regions*.
3. The National Marine Fisheries Service's *Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook salmon and Central Valley Spring-run Chinook salmon and the Distinct Population Segment of California Central Valley Steelhead*.

4. A list of Reasonable and Prudent Alternatives identified in the National Marine Fisheries Service's *Biological Opinion on the Operations, Criteria, and Plan (OCAP) for the Central Valley Project and the State Water Project*.
5. The Decision Management Alternatives contained in draft CVPIA Decision Support Model (Peterson 2014).
6. The *California Water Action Plan*. That plan describes high priority management activities the state of California is proposing to undertake as it manages resources within its boundary.

In Step 2, and for each Action in the database, the following attributes were defined:

1. Geographic Area: one of 36 watershed names or water bodies in the Central Valley.

2. Taxon: Chinook salmon, steelhead, white sturgeon, etc.

3. Priority: the High, Medium or Low priority assigned to the Action in the source document.

4. Ongoing Status: a Yes or No option. Yes applies to an Action that was ongoing in FY 2015 and was expected to continue in FY 2016.

5. Fish Focus Group Watershed: a Yes or No option. The 11 watersheds that were identified in objectives C-E of this document.

6. Source Document: the document containing an Action.

7. Determination of whether the project "Needs Funding": one of the following options was assigned to that field:

    a. Already funded in 2016: funding is already obligated to conduct the Action in 2016, and the Action does not need CVPIA funding in 2016.

    b. No - operational actions: an Action not requiring additional CVPIA funding beyond staff time for operations.

    c. No - staff reports and studies: an Action not requiring additional CVPIA funding to conduct data analyses/write reports because the staff time to conduct those activities is already available.

    d. Not yet determined: this lookup option: (1) refers to Actions that were not classified with a Suggested Core Team Priority = High attribute, or (2) was used if other lookup options did not appear to be applicable in the context of the Needs Funding field.

e. Yes: the project needs CVPIA funding in 2016.

8. Determination of whether the priority "Is Feasible": one of the following options was assigned to that field:

   a. Project already completed: the option is used to indicate a project that is already complete (finished) in 2016.

   b. No - opportunity is not available: the Action has not or cannot be developed. Examples include water not available from willing sellers.
   c. No - outside CVPIA scope: examples include regulatory responsibility of non-CVPIA agency, artificial propagation, actions to move fish above rim dams.

   d. No - project not mature: a reasonably complete CVPIA charter for an Action within the scope of CVPIA cannot be developed within the timeframe for submitting CVPIA charters during the annual CVPIA annual work plan process (currently April 2, 2015), or an Action cannot be contracted or initiated within FY 2016.

   e. Not yet determined: this lookup option: (1) refers to projects that were not classified as Suggested Core Team priority = High, or (2) was used if other lookup options did not appear to be applicable in the context of the Is feasible field.

   f. Yes: a reasonably complete CVPIA charter for an Action within the scope of CVPIA can be developed within the timeframe for submitting CVPIA charters during the annual CVPIA annual work plan process (currently April 2, 2015), and the Action can be contracted or initiated within FY 2016.

In Step 3, each Action in the database was assigned an attribute indicating if it was a Suggested Core Team Priority. Actions that were classified with a Suggested Core Team Priority attribute = Yes received that classification if they met the following criteria:

1. Fish Focus Group Watershed = Yes
2. Taxon = Chinook salmon
3. Priority = High

Actions that were classified with a Suggested Core Team Priority attribute = High were reviewed a second time to ensure their initial Ongoing, Needs Funding, and Is Feasible attributes were correctly assigned.

In Step 4, priorities were identified using the database to sort and filter actions based on the criteria identified in the previous steps. Two groups of priorities that would receive serious consideration for receiving FY 2016 funding were developed. These two groups were: (1) "ongoing CVPIA actions", and (2) actions based on Objectives C-E. The attributes used to develop those lists were as follows:

1. Ongoing CVPIA Actions:

    a. Needs Funding = Yes
    b. Is Feasible = Yes
    c. Ongoing = Yes

    The Clear Creek and Battle Creek records resulting from these criteria were then trimmed to eliminate records with duplicate Actions.
2. Priorities for Objectives C-E:

    a. Suggested Core Team Priority = High
    b. Needs Funding = Yes
    c. Is Feasible = Yes
    d. Ongoing = not Yes

    The Clear Creek and Battle Creek records resulting from these criteria were then trimmed to eliminate records with duplicate Actions.

Results

The following narrative explains some of the information in Table 2. It identifies the unmet capacity to reach the doubling goal in each watershed and discusses future priorities in this Plan to increase fish production.

Ongoing CVPIA Actions

Out of the 896 priorities contained in the CVPIA 2016 Potential Priorities database, 43 were identified as high priority ongoing CVPIA Actions (Table 4). Ongoing Actions proposed in this Plan to increase fish production include habitat restoration, gravel addition, evaluating instream flows, modifying operations, fish passage, evaluating limiting factors, and monitoring. These forty three actions address priorities related to winter-, spring-, and fall-run Chinook salmon, as well as steelhead and sturgeon.

Table 4. List of CVPIA Ongoing Actions. Identified as 2016 Priorities.

RecordID	Watershed	Action	Taxon	Source Document
176	American River	Replenish spawning gravel and restore existing spawning grounds.	Chinook salmon fall-run	AFRP Final Restoration Plan
232	American River	AFRP - American River Structured Decision Making (SDM) Monitoring Studies	Chinook salmon fall-run	AFRP Ongoing Project
1886	American River	Adult escapement and juvenile monitoring for steelhead on the American River	Steelhead	OCAP BO RPA actions
223	Antelope Creek	AFSP - Antelope Creek Fish Passage Improvement Project	fall-run Chinook salmon	AFSP Ongoing Project
1901	Battle Creek	Adult escapement and juvenile monitoring for spring-run, winter-run, and steelhead on the Battle Creek	Steelhead; Chinook salmon winter-run; Chinook salmon spring-run	OCAP BO RPA actions
224	Butte Creek	AFSP - Diversion 55 Fish Screen	Chinook salmon spring-run; Chinook salmon fall-run	AFSP Ongoing Project
299	Central Valley-wide	Screen unscreened diversions to protect all life states of at-risk fish species.	Green Sturgeon; White Sturgeon; American Shad; Striped Bass; Steelhead; Chinook salmon	Ecosystem Restoration Program
412	Central Valley-wide	In coordination with the Central Valley Project Improvement Act Anadromous Fish Screen Program, the Department of Fish and Wildlife will create and publish a Priority Unscreened Diversion List in the Central Valley area	Chinook salmon	California Water Action Plan

RecordID	Watershed	Action	Taxon	Source Document
2174	Central Valley-wide	Pacific States Marine Fisheries Commission rotary screw trap database support.	Steelhead; Chinook salmon fall-run; Chinook salmon late-fall; Chinook salmon winter-run; Chinook salmon spring-run	CAMP Ongoing Project
2175	Central Valley-wide	CAMP rotary screw trap Platform maintenance, metadata documentation, and new reports	Chinook salmon spring-run; Chinook salmon late-fall; Steelhead; Chinook salmon fall-run; Chinook salmon winter-run	CAMP Ongoing Project
91	Clear Creek	Halt further habitat degradation and restore channel conditions from the effects of past gravel mining.	Chinook salmon spring-run	AFRP Final Restoration Plan
1877	Clear Creek	Reclamation shall coordinate with NMFS, FWS, and DFW to continue implementing and funding fisheries monitoring of spring-run and CV steelhead in Clear Creek to aide in determining the benefits and effects of flow and temperature management.	Steelhead; Chinook salmon spring-run	OCAP BO RPA actions
1946	Clear Creek	Reclamation shall replace the Spring Creek Temperature Control Curtain in Whiskeytown Lake by June 2011	Chinook salmon spring-run; Steelhead	OCAP BO RPA actions
247	Cosumnes River	Cosumnes River Juvenile Outmigration Monitoring	Chinook salmon fall-run	AFRP Ongoing Project
222	Cow Creek	AFSP - Clover Creek Millville Fish Passage and Fish Screen Project	Chinook salmon fall-run	AFSP Ongoing Project
226	Deer Creek	AFRP - Deer Creek Dam Fish Passage Project	Chinook salmon spring-run	AFRP Ongoing Project

RecordID	Watershed	Action	Taxon	Source Document
230	Deer Creek	AFRP - Lower Deer Creek Falls Fish Passage Improvement Project, Phase 2	Chinook salmon spring-run	AFRP Ongoing Project
245	Deer Creek	Deer Creek Impacts of Illegal Marijuana Activity on Fish	Chinook salmon spring-run	AFRP Ongoing Project
442	Deer Creek	Develop and implement instream flow agreements with the Deer Creek Irrigation District and the Stanford-Vina Ranch Irrigation Company designed to provide flows that best support all life stages of spring-run Chinook salmon and steelhead	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
521	Deer Creek	Implement a Deer Creek monitoring program to identify the abundance and the temporal and spatial distributions of immigrating and holding spring-run Chinook salmon and steelhead	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
999	Deer Creek	In coordination with technical advisors from the natural resource agencies, implement the Deer Creek Flood Improvement Project, and other projects to increase Deer Creek floodplain habitat availability	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1704	Deer Creek	Modify the Cone-Kimball Diversion, Stanford-Vina Dam, and the Deer Creek Irrigation District Dam in order to provide unimpeded passage for adult and juvenile Chinook salmon and steelhead	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1898	Deer Creek	Adult escapement and juvenile monitoring for spring- and winter-run salmon, and steelhead on the Deer Creek	Steelhead; Chinook salmon winter-run; Chinook salmon spring-run	OCAP BO RPA actions

RecordID	Watershed	Action	Taxon	Source Document
227	Merced River	AFRP - Merced River Snelling Channel and Floodplain Restoration Project at Henderson Park	Chinook salmon fall-run	AFRP Ongoing Project
233	Merced River	Merced River Juvenile Outmigration Monitoring	Chinook salmon fall-run	AFRP Ongoing Project
235	Merced River	Merced River Ranch Floodplain and Side-Channel Restoration Project	Chinook salmon fall-run	AFRP Ongoing Project
440	Mill Creek	Develop and implement instream flow agreements with Mill Creek diverters designed to provide flows that best support the life stages of spring-run Chinook salmon and steelhead that occur in the flow control reach	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1895	Mill Creek	Adult escapement and juvenile monitoring for spring-run, winter-run, and steelhead on the Mill Creek	Steelhead; Chinook salmon winter-run; Chinook salmon spring-run	OCAP BO RPA actions
84	Sacramento River	Continue to implement Anadromous Fish Screen Program	Chinook salmon winter-run	AFRP Final Restoration Plan
88	Sacramento River	Develop and implement a program for restoring and replenishing spawning gravel	Chinook salmon winter-run	AFRP Final Restoration Plan
221	Sacramento River	Anadromous Fish Screen Program - RD-2035 Fish Screen	Chinook salmon	AFSP Ongoing Project
229	Sacramento River	AFRP - Wild Chinook Juvenile Acoustic Tagging	Chinook salmon winter-run	AFRP Ongoing Project
246	Sacramento River	Sacramento River Redd Dewatering Study	Chinook salmon fall-run	AFRP Ongoing Project

RecordID	Watershed	Action	Taxon	Source Document
1883	Sacramento River	Adult escapement and juvenile monitoring for spring- and winter-run salmon, and steelhead on the Sacramento River	Green Sturgeon; Steelhead; Chinook salmon winter-run; Chinook salmon spring-run	OCAP BO RPA actions
1928	Sacramento River	Sacramento River new juvenile monitoring station: The exact location to be determined, between Red Bluff Diversion Dam and Knights Landing	Chinook salmon spring-run; Chinook salmon winter-run; Steelhead	OCAP BO RPA actions
1969	Sacramento River	Reclamation shall direct discretionary funds to implement the Battle Creek Salmon and Steelhead Restoration Project. Phase 1A	Chinook salmon spring-run; Chinook salmon winter-run	OCAP BO RPA actions
234	San Joaquin River	San Joaquin River Sturgeon Habitat Assessment	White Sturgeon	AFRP Ongoing Project
237	San Joaquin River	San Joaquin River Sturgeon Acoustic Study	White Sturgeon	AFRP Ongoing Project
244	San Joaquin River	San Joaquin River Habitat Mapping (IA w/ USGS)	White Sturgeon	AFRP Ongoing Project
238	Stanislaus River	Stanislaus River Floodplain Restoration Project at Buttonbush	Chinook salmon fall-run	AFRP Ongoing Project
240	Stanislaus River	Stanislaus River Knights Ferry Floodplain Restoration Project	Chinook salmon fall-run	AFRP Ongoing Project
1935	Stanislaus River	San Joaquin River monitoring shall include: Juvenile monitoring for steelhead on the Stanislaus River	Steelhead; Chinook salmon fall-run	OCAP BO RPA actions
231	Yuba River	Anadromous Fish Restoration Program - Yuba River Narrows Restoration Project	Chinook salmon spring-run	AFRP Ongoing Project

Priorities that address Objectives C-E

Out of the 896 priorities contained in the CVPIA 2016 Potential Priorities database, 35 were identified as high priority for consideration (Table 5). Priorities selected in this Plan include habitat restoration, gravel addition, evaluating instream flows, modifying operations, fish passage, evaluating limiting factors, monitoring, and modeling. The Feather River was the only watershed not represented out of the 11 watersheds identified in objectives C-E. The primary reason there were no Feather River priority actions identified for consideration was that many of the actions are identified as being funded through the State of California and their associated State Water Project operations.

Table 5. FY 2016 Priorities based on Objectives C-E.

RecordID	Watershed	Action	Taxon	Source Document
66	Battle Creek	Remove/improve one temporary adult passage obstruction on Battle Creek	Chinook salmon winter-run	SDM coarse resolution model
603	Battle Creek	Implement a water quality monitoring program throughout the Battle Creek watershed to identify areas of concern. The program should monitor for sediment loading and include detection of chemical/nutrient inputs from illegal plant cultivation operations.	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
780	Battle Creek	Fully fund and implement the Battle Creek Restoration Project through Phase 2	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1569	Battle Creek	Develop an Adaptive Management Plan for Coleman National Fish Hatchery and continue to integrate hatchery operations with Battle Creek Salmon and Steelhead Restoration Project activities	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1782	Battle Creek	Develop and implement a winter-run Chinook salmon reintroduction plan to re-colonize historic habitats made accessible by the Battle Creek Restoration Project.	Chinook salmon winter-run	NMFS Salmonid Recovery Plan
35	Butte Creek	Remove/improve one temporary adult passage obstruction on Butte Creek	Chinook salmon spring-run	SDM coarse resolution model

RecordID	Watershed	Action	Taxon	Source Document
1275	Clear Creek	Develop a new spawning gravel budget and implement a long-term gravel augmentation plan in Clear Creek, including acquisition of a long-term gravel supply (per CVPIA and RPA action I.1.3 of the 2009 Biological Opinion for OCAP	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1538	Clear Creek	Operate the Clear Creek segregation weir to create reproductive isolation between fall-run Chinook salmon and spring-run Chinook salmon	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1540	Clear Creek	Develop water temperature models to improve Clear Creek water temperature management as described in RPA action I.1.5 of the OCAP 2009 Biological Opinion	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1942	Clear Creek	Reclamation shall re-operate Whiskeytown Glory Hole spills during the winter and spring to produce channel maintenance flows of a minimum of 3,250 CFS mean daily spill from Whiskeytown for one day, to occur seven times in a ten-year period	Steelhead; Chinook salmon spring-run	OCAP BO RPA actions
104	Cottonwood Creek	Establish, restore, and maintain riparian habitat on Cottonwood Creek	Chinook salmon fall-run	AFRP Final Restoration Plan
98	Cow Creek	Fence select riparian corridors within the watershed to exclude livestock.	Chinook salmon fall-run	AFRP Final Restoration Plan
124	Deer Creek	Improve spawning habitats in lower Deer Creek for fall- and late-fall-run chinook salmon	Chinook salmon late-fall; Chinook salmon fall-run	AFRP Final Restoration Plan

RecordID	Watershed	Action	Taxon	Source Document
446	Deer Creek	Based on instream flow study results, develop an adaptive management strategy to provide a flow regime in the lower watershed that best supports spring-run Chinook salmon and steelhead during fish migration and rearing periods	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1588	Deer Creek	Increase monitoring and enforcement in order to eliminate/minimize illegal plant cultivation operations and anadromous fish poaching in the Deer Creek watershed	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
113	Mill Creek	Improve spawning habitats in lower Mill Creek for fall-run chinook salmon	Chinook salmon fall-run	AFRP Final Restoration Plan
114	Mill Creek	Establish, restore, and maintain riparian habitat the riparian habitat along the lower reaches of Mill Creek	Chinook salmon fall-run	AFRP Final Restoration Plan
1417	Mill Creek	Increase monitoring and enforcement in order to eliminate/minimize illegal plant cultivation operations and anadromous fish poaching in the Mill Creek watershed	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
67	Sacramento River	Modify flood bypass control structure at Fremont Weir	White Sturgeon; Green Sturgeon	SDM coarse resolution model
963	Sacramento River	In an adaptive management context, implement short- and long-term solutions to minimize the loss of adult Chinook salmon and steelhead in the Yolo bypass, and Colusa and Sutter-Butte basins	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan

RecordID	Watershed	Action	Taxon	Source Document
1195	Sacramento River	Restore and maintain riparian and floodplain ecosystems along both banks of the Sacramento River to provide a diversity of habitat types including riparian forest, gravel bars and bare cut banks, shady vegetated banks, side channels	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1269	Sacramento River	Develop and implement a long-term gravel augmentation plan consistent with CVPIA to increase and maintain spawning habitat for winter-run Chinook salmon, spring-run Chinook salmon, and steelhead downstream of Keswick Dam	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1272	Sacramento River	Study the merits and investigate feasibility of modifying the altered channel morphology at Turtle Bay in Redding to eliminate the gravel "sink" created by historic gravel mining activities	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1371	Sacramento River	Develop and implement a river flow management plan for the Sacramento River downstream of Shasta and Keswick dams that considers the effects of climate change and balances beneficial uses with the flow and water temperature needs of winter-run Chinook salmon	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1374	Sacramento River	Operate and maintain temperature control curtains in Lewiston and Whiskeytown Reservoirs to minimize warming of water from the Trinity River and Clear Creek	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan

RecordID	Watershed	Action	Taxon	Source Document
1377	Sacramento River	Avoid full power peaking at Trinity and Carr Power plants during sensitive periods for water temperatures to reduce water temperatures in the Sacramento River. Evaluate impacts of power peaking operations in the Trinity River, Sacramento River and Clear Creek	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1808	Sacramento River	Identify and implement any required projects to assure the M&T Ranch water diversion is adequately screened to protect winter-run Chinook salmon, spring-run Chinook salmon, and steelhead	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
1811	Sacramento River	Install NMFS-approved, state-of-the-art fish screens at the Tehama Colusa Canal diversion. Implement term and condition 4c from the biological opinion on the Red Bluff Pumping Plant Project	Steelhead; Chinook salmon spring-run; Chinook salmon winter-run	NMFS Salmonid Recovery Plan
201	Stanislaus River	Implement an interim river regulation plan that meets the following flow schedule by supplementing the 1987 agreement between USBR and CDFG, through reoperation of New Melones Dam, use of (b)(2) water, and acquisition of water from willing sellers	Chinook salmon fall-run	AFRP Final Restoration Plan
202	Stanislaus River	Improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel	Chinook salmon fall-run	AFRP Final Restoration Plan

RecordID	Watershed	Action	Taxon	Source Document
70	Yuba River	Create/improve passage at Daguerre Point Dam	Green Sturgeon	SDM coarse resolution model
72	Yuba River	Increase spawning habitat 10% at Yuba River	Green Sturgeon	SDM coarse resolution model
1076	Yuba River	Develop programs and implement projects that promote natural river processes, including projects that add riparian habitat and instream cover	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1297	Yuba River	Improve spawning habitat in the Englebright Dam Reach (Englebright Dam [RM 24] downstream to the Deer Creek confluence [RM 23]) through habitat rehabilitation and a long-term gravel injection program	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan
1618	Yuba River	Implement flow fluctuation and ramping rates found to be protective of embryos and juveniles	Steelhead; Chinook salmon spring-run	NMFS Salmonid Recovery Plan

Discussion

The purpose of this 2016 Plan is to identify and define CVPIA priorities for the fisheries resource area restoration-related provisions in Section 3406 in fiscal year 2016. This 2016 Plan has been characterized as a temporary measure because it represents a transition between the traditional way priorities, and ultimately projects, were selected and the ongoing development of the Adaptive Resource Management Process (ARM) currently underway in the CVPIA Fisheries Program.

In 2012, the Core Team agreed to embark on an Adaptive Resource Management (ARM) process for CVPIA in an effort to: (1) update and improve the program's science-based framework, (2) reorganize program structure and management, (3) improve implementation by making full use of CVPIA authorities, and (4) improve collaboration with all related programs in the Central Valley. The ARM process and associated Decision Support Model (DSM) were viewed as the best approach to develop a new comprehensive, science-based approach that explicitly links CVPIA activities with Program objectives. Furthermore, the Core Team agreed that the ARM and DSM tool would allow for the integration of new information and uncertainty to improve scientific understanding and increase the effectiveness of CVPIA implementation. However, progress on the ARM did not proceed as quickly as was anticipated, and there was a pressing need to identify focused priorities for 2016.

The Core Team decided that the assumptions, methods, and decisions described in this 2016 Plan represent a reasonable transitional approach because it considers and adopts priorities taken from the AFRP's *Final Restoration Plan* (2001), NOAA Fisheries' California Central Valley Salmon & Steelhead Recovery Plan (2014), NOAA Fisheries' Reasonable & Prudent Alternatives from the OCAP Biological Opinion, the Ecosystem Restoration Program's Conservation Strategy, and California Water Action Plan. This 2016 Plan also promotes agency collaboration through the Core Team as it intentionally only identifies priorities, hence collaboration is essential in order to proceed from identification of priorities to implementation of specific projects.

The list of 43 ongoing actions and 35 watershed-based priorities identified in this 2016 Plan should be viewed as a tool to guide CVPIA staff and their agency and stakeholder partners as they develop projects for funding consideration in fiscal year 2016.