The ARM of the CVPIA: Putting Science into Action
Summary

- Adaptive Resource Management (ARM) Overview
- Elements of ARM in CVPIA Fish Program Process
- Progress to Date
- Next Steps
Science need for CVPIA Fish Programs

- Responsive to CVPIA Independent Review (Listen to the River)
- Collaborative, science-based process to restore native anadromous fish in the Central Valley
- Prioritize, implement, learn from projects
- Watershed-specific biological objectives and associated management actions
- Acquisition, QA/QC, storage and analysis of high quality monitoring data to compare to our modeling predictions
- Revised governance structure:
  - Integrated CVPIA fish program - AFP
  - Science-based priorities
Reducing uncertainty: Learning how a system works

Experimentation
- Replication, randomization, treatments
- Feasibility (labor intensive)
- Expensive

Retrospective study
- analyze existing data
- correlative, usually basis initial models

Problems with additional study
- Competition for management resources
- Decisions can’t wait
Learning how a system works

- Learn while managing (Adaptive Management)
  - Decisions are made
  - Requires *sequential* dynamic decision-making: time and/or space
    Learn across watersheds/projects
  - Requires monitoring
    Current state of the system (where are we?)
    Actual outcome of the decision (where did we end up?)
    Prefer ‘high’ quality data (faster learning)
The ARM Process

- Apply the scientific method to natural resource management
- Set biological objectives and alternative actions
- Predict outcomes/consequences of alternatives
- Use predictions and additional information to prioritize projects
- Coordinate monitoring to learn from projects

- Establish a collaborative and transparent process for developing priorities, implementing projects, learning from outcomes, and adapting management actions
ARM Process

The Scientific Method
- Identify scientific phenomenon of interest
- Devise explicit falsifiable hypotheses
- Devise study with alternative possible outcomes
- Conduct the study
- Confront the hypotheses with the data

Adaptive Resource Management
- Identify alternative actions
- Explicitly identify quantifiable objectives
- Create explicit models of ecological process (preferably framed as hypotheses)
- Implement best management action
- Monitor system and compare observed patterns to model predictions
ARM Single and Double Loop Learning

- Stakeholder objectives
- Management alternatives
- Integrated models

Structured decision making

- Implement 'best' management alternative

- Revise beliefs (updating)
- Observe outcome (monitoring)

Single loop

- Evaluate evidence (analysis)

Double loop

- Revise or develop new
  - Objectives
  - Management alternatives
  - Models

- Assess current assumptions
  - Objectives
  - Management alternatives
  - Models
CVPIA ARM Process: Progress
Decision Support Models (DSM’s): Fall-run

- Use DSMs to evaluate outcomes of alternative watershed-scale management actions
- Develop DSM for each native anadromous species, 26 watersheds
- Refine structure of DSMs, including objectives
- Improve performance by replacing expert elicitation with data
CVPIA Governance Structure

Revisions: Concepts

- Coordinate efforts across watersheds to improve monitoring, incorporate new information, ensure projects align with priorities
- Retain technical expertise from program areas and apply them more broadly across watersheds
- Retain watershed-specific knowledge and relationships, apply to project implementation
- Balance landscape-level and watershed-specific strategies
- Maximize flexibility for implementing types of management actions across watersheds
Independent Science Review

5-year Plan

Core Team
policy-level advisors
(FWS, BOR, NMFS, CDFW, DWR)

Individual Stakeholders

Science Integration Team (SIT)
(DSM refinement and science priorities)

Organized Collaborative Stakeholder Groups

Agency Technical Team
Science and technical staff from partner agencies (FWS, BOR, NMFS, CDFW, DWR)

Anadromous fish program staff

Project Proposals

Stakeholders and watershed groups

AWP
Setting Priorities

- Use ARM to develop and refine 5-year management priorities to guide project development and monitoring plans
- Incorporate data and analysis into decision making
- Incorporate partner agencies and stakeholders to achieve common goals for anadromous fish restoration
Additional Products to be Developed

- Core Team Governance
- SIT Governance
- Internal and External Review
- Center for Data Management and Data Analysis
- Organizational Structure Revamp
- Timeline
Next Steps

- Complete “Additional Products to be Developed” documents
- Recommend FY18 priorities
- Independent review of fall-run Chinook DSM
- Development of winter- and spring-run Chinook DSM
- Development of green & white Sturgeon DSM’s