
# 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

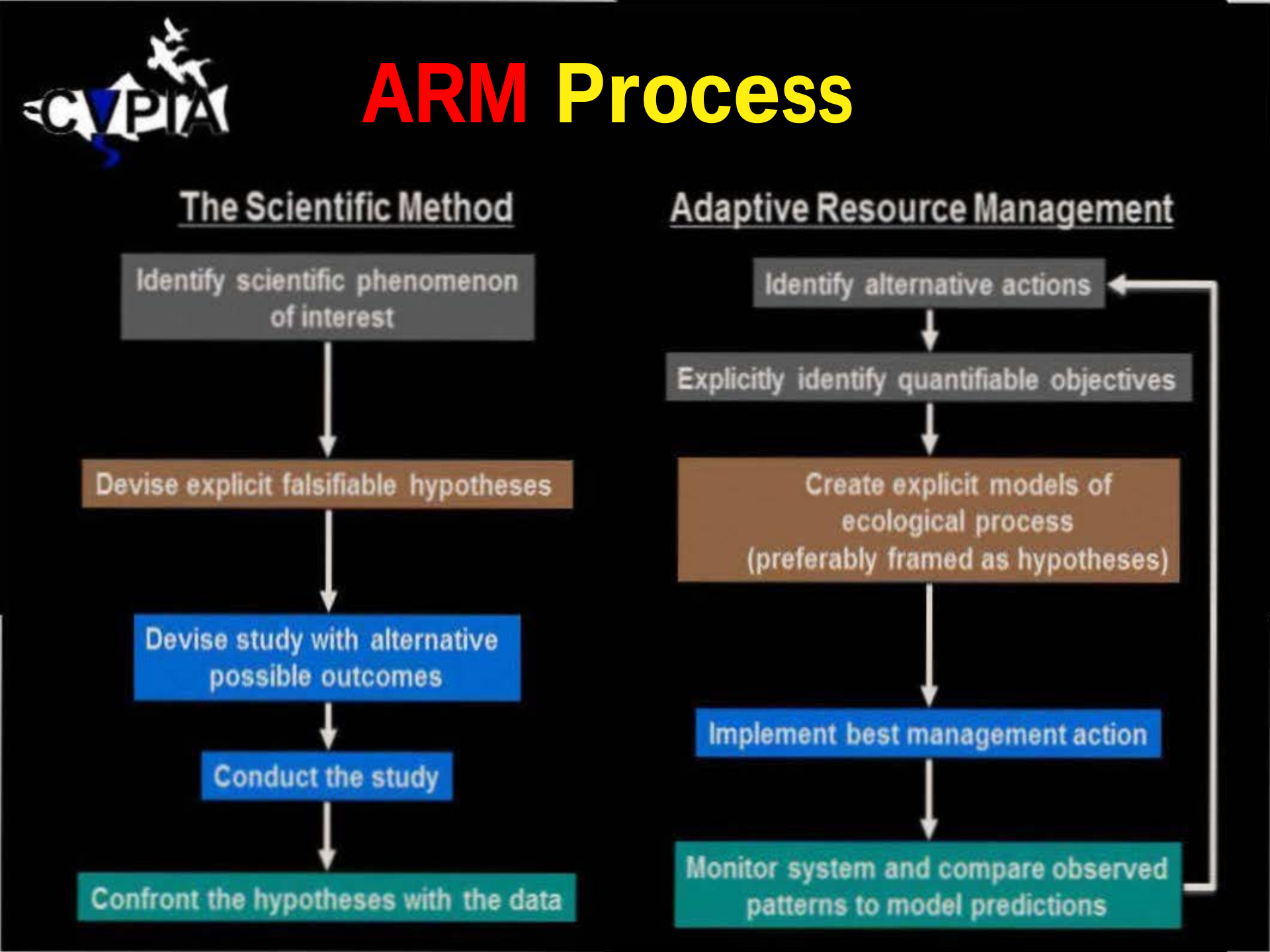
- Apply the scientific method to natural resource management
- Set biological objectives and alternative actions
- Predict outcomes/consequences of alternatives
- Use predictions and additional information to prioritize projects

# The ARM Process (2)

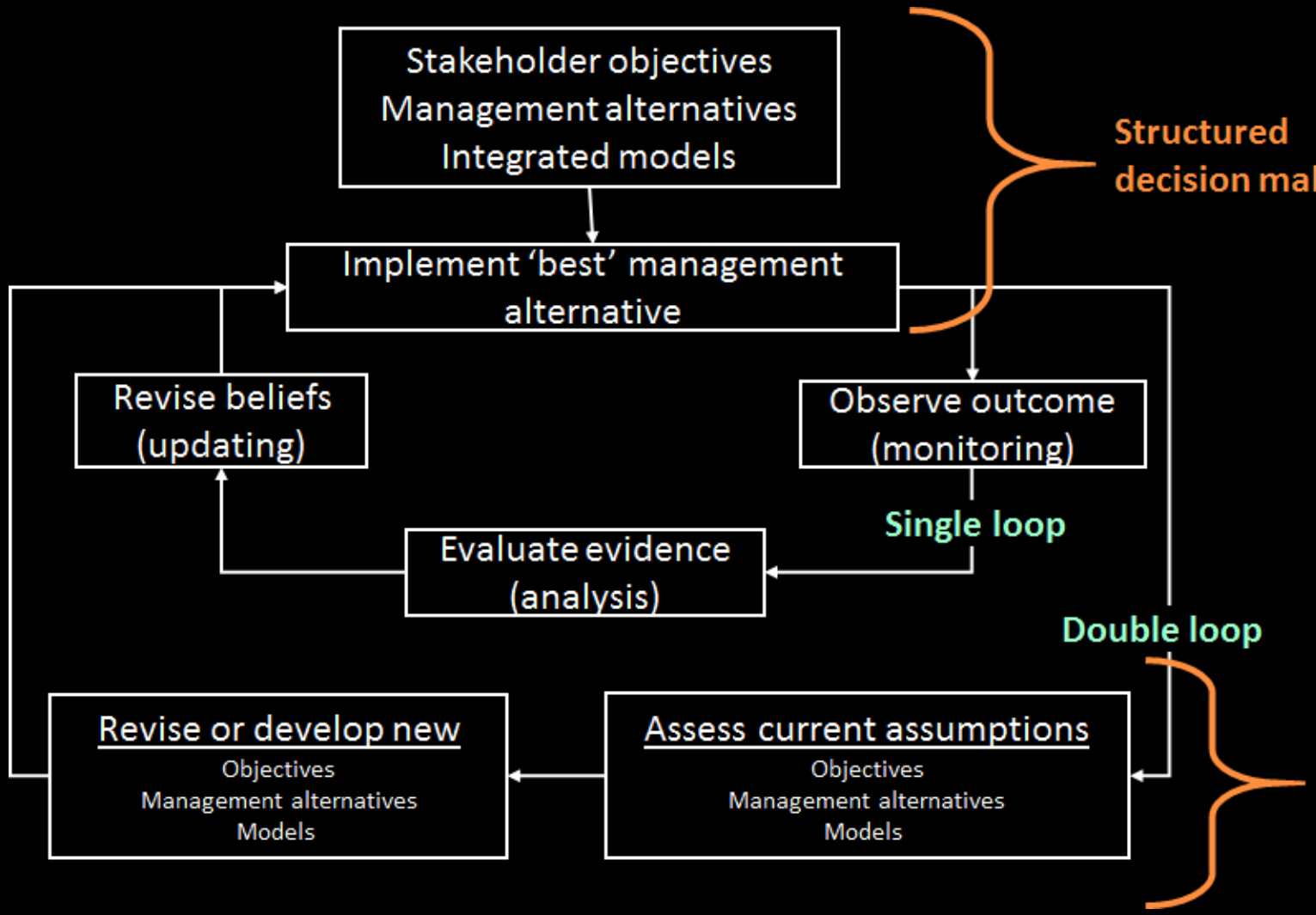
- Coordinate monitoring to learn from projects


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

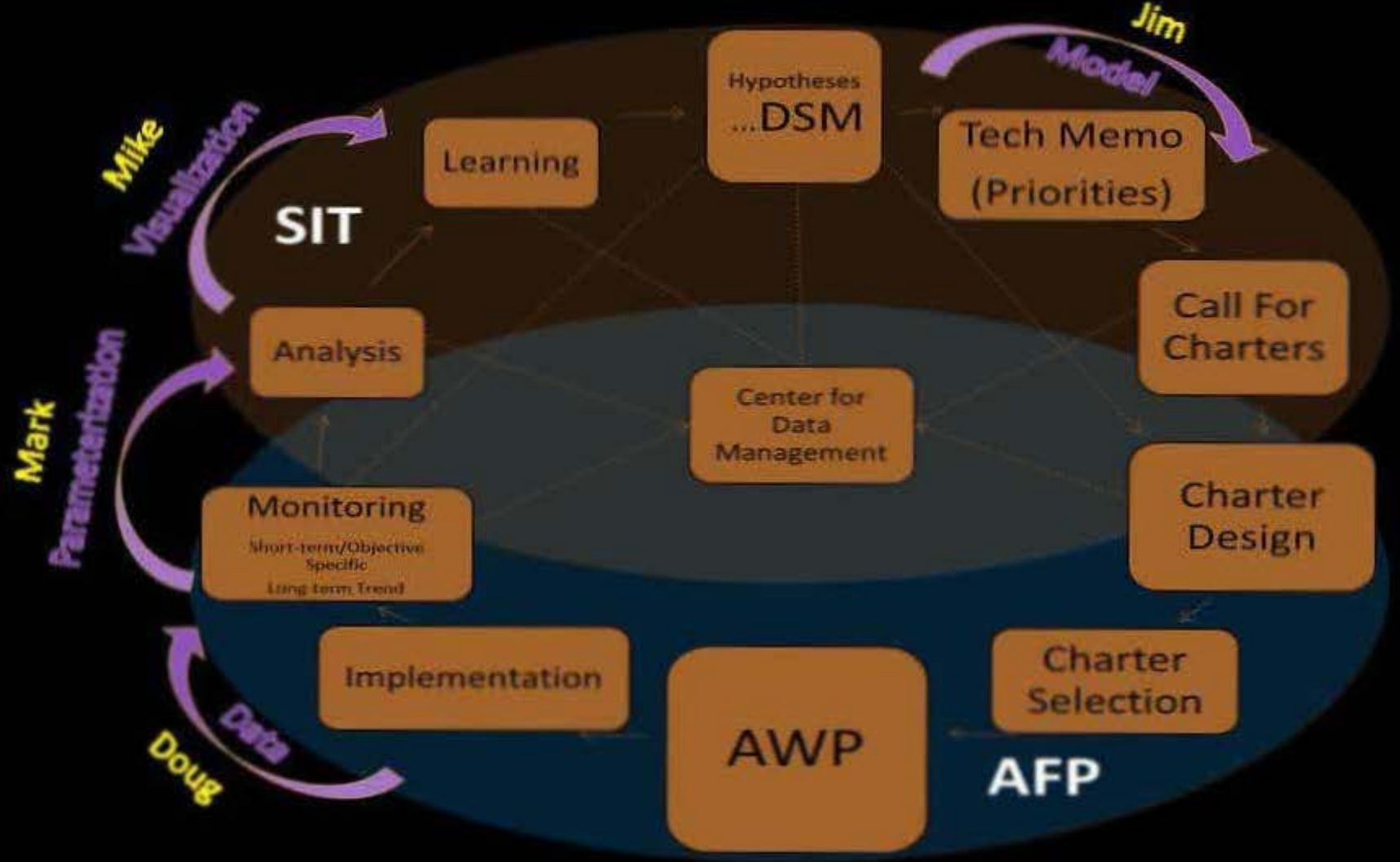
# ARM Process


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

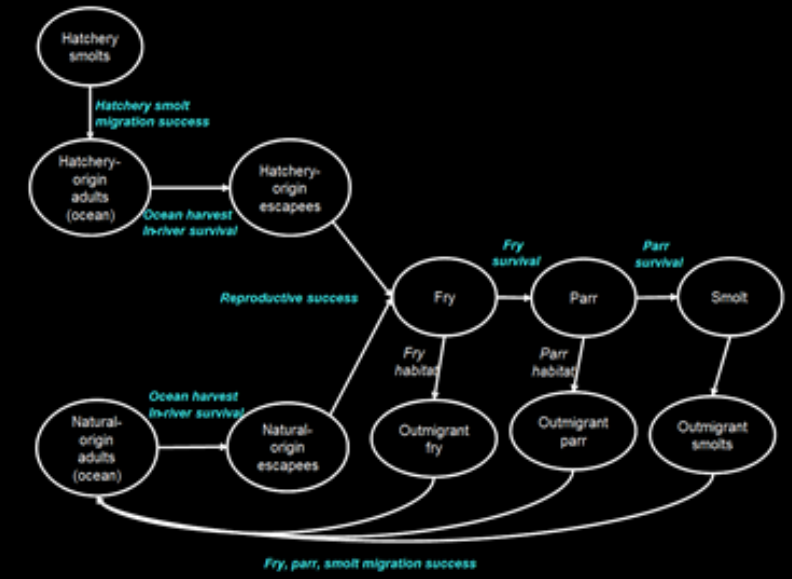


# CVPIA ARM Process: Progress

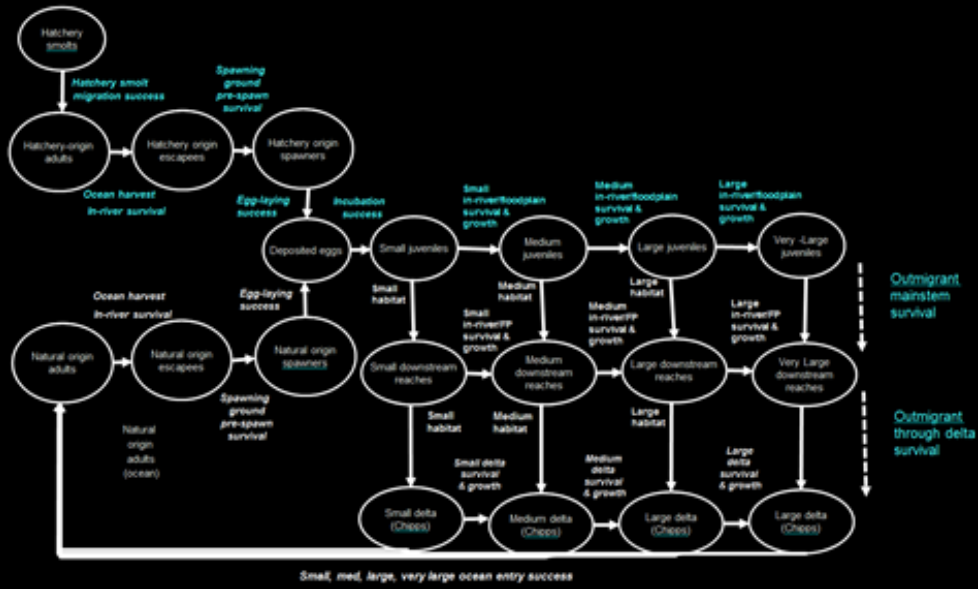


# Decision Support Models (DSM's): Fall-run

Fall Chinook Salmon Base Conceptual Model (v. 2014)




Fall Chinook Salmon Base Conceptual Model (v. 2016)

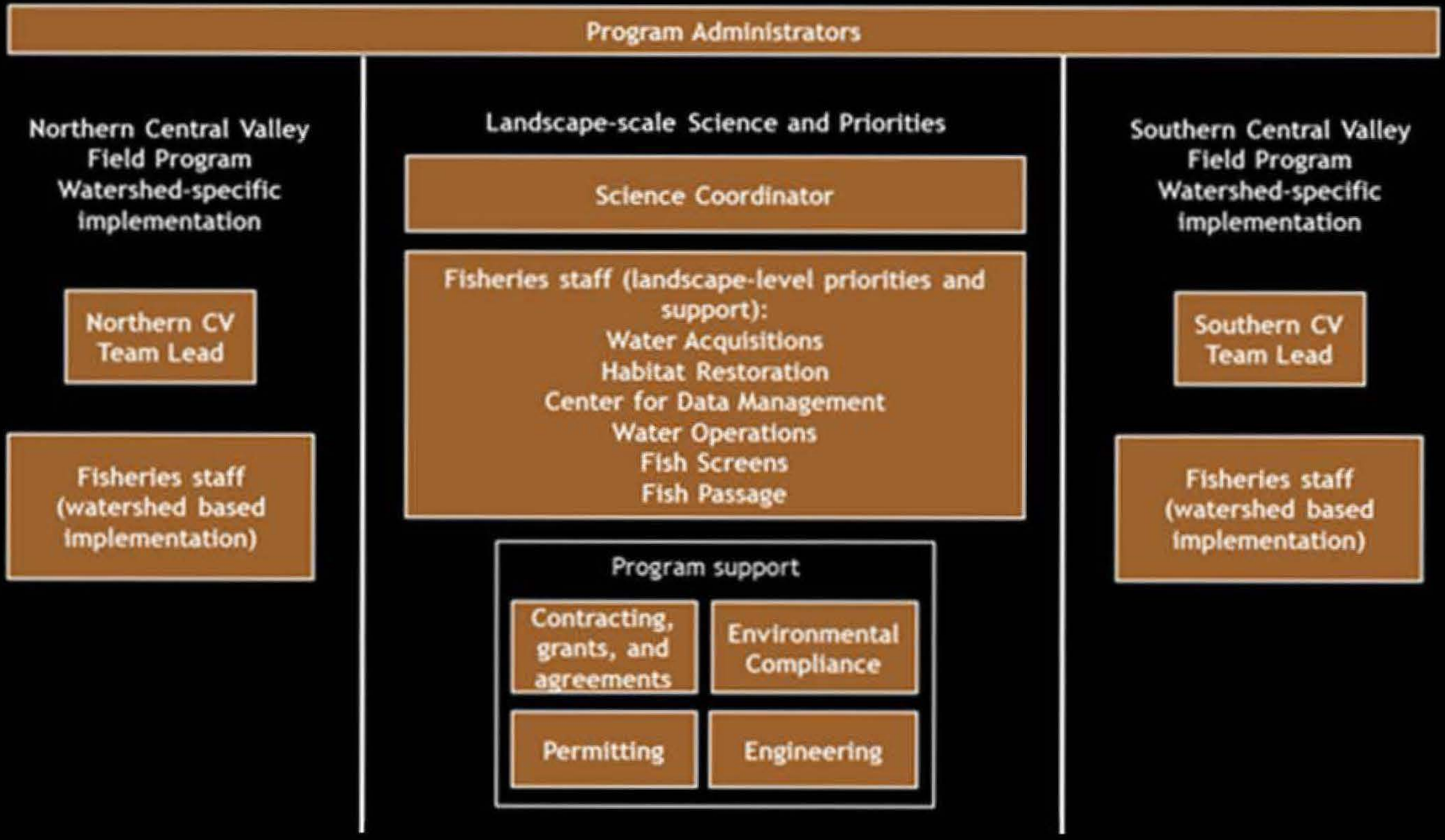


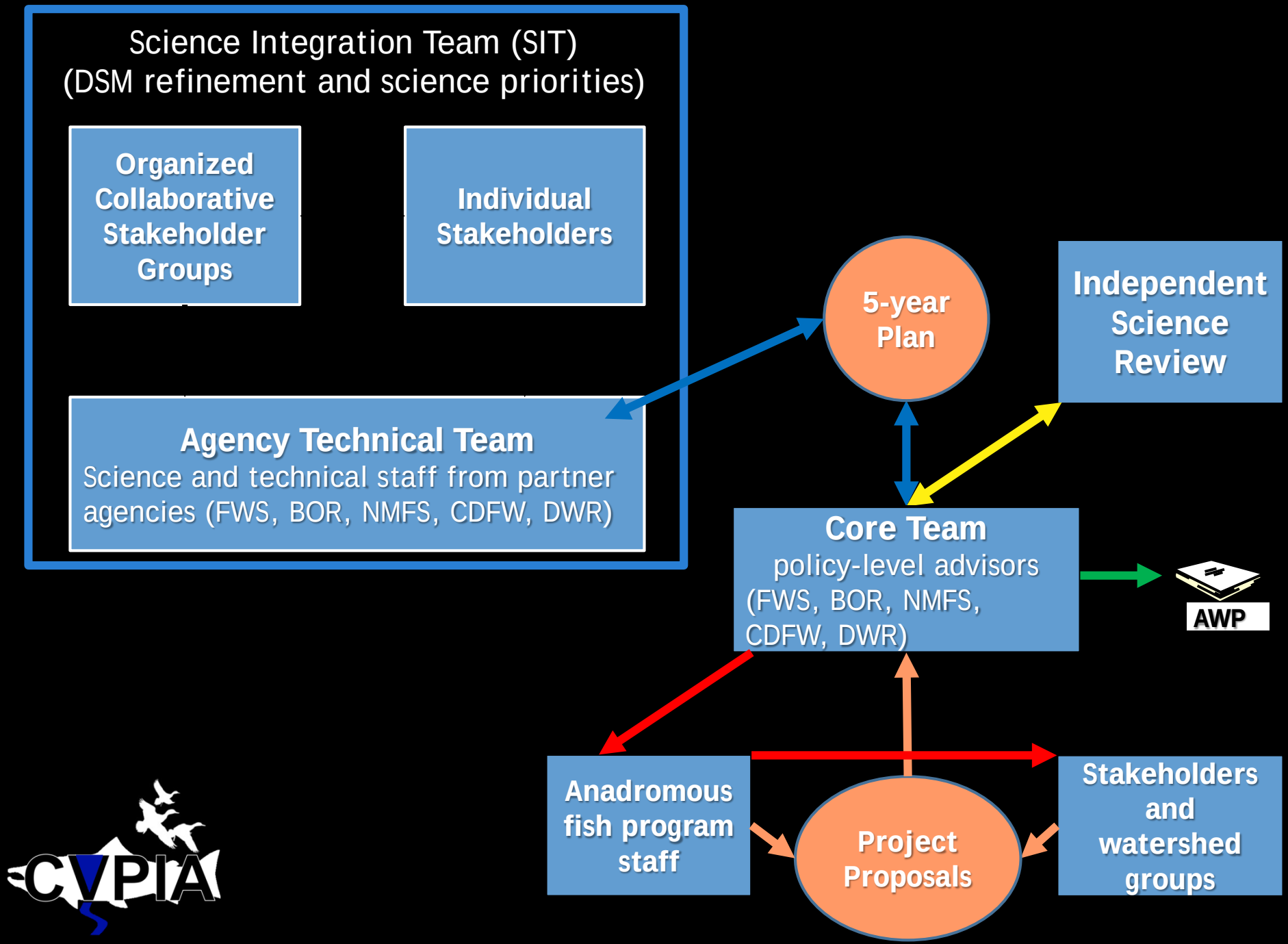

- Use DSMs to evaluate outcomes of alternative watershed-scale management actions
- Develop DSM for each native anadromous species, 26 watersheds
- Refine structure of DSMs, including objectives
- Improve performance by replacing expert elicitation with data

# 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

# CVPIA Anadromous Fish Program




Science Integration Team (SIT)
(DSM refinement and science priorities)
Organized Collaborative Stakeholder Groups
Individual Stakeholders
Agency Technical Team
Science and technical staff from partner agencies (FWS, BOR, NMFS, CDFW, DWR)
5-year Plan
Independent Science Review
Core Team
policy-level advisors (FWS, BOR, NMFS, CDFW, DWR)
AWP
Anadromous fish program staff
Project Proposals
Stakeholders and watershed groups
CVPIA

# 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

# CVPIA ARM Process