Transitioning the CVPIA Fisheries Program to a Science-Based Prioritization and Adaptive Management Process …Progress?

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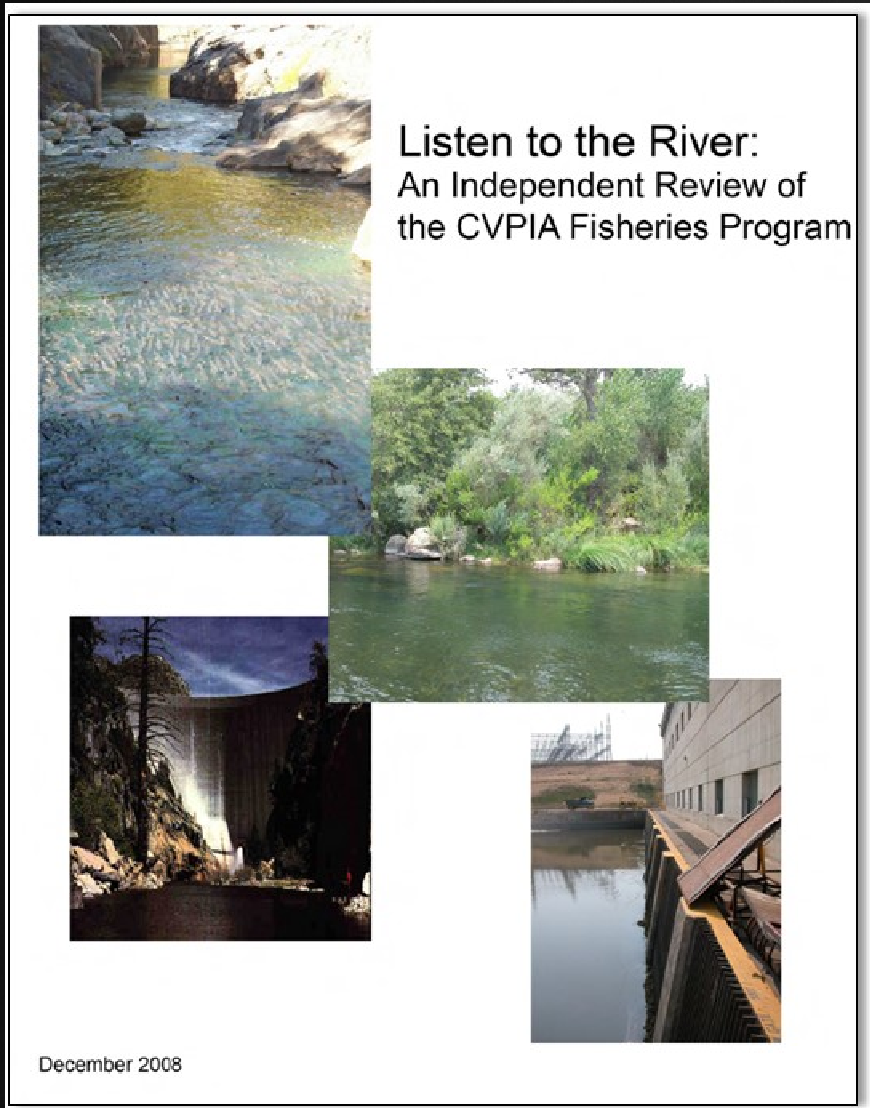
BUREAU OF RECLAMATION

Oregon State University

Cooperative Research Units
Research • Education • Technical Assistance

U.S. FISH & WILDLIFE SERVICE

Tough Love

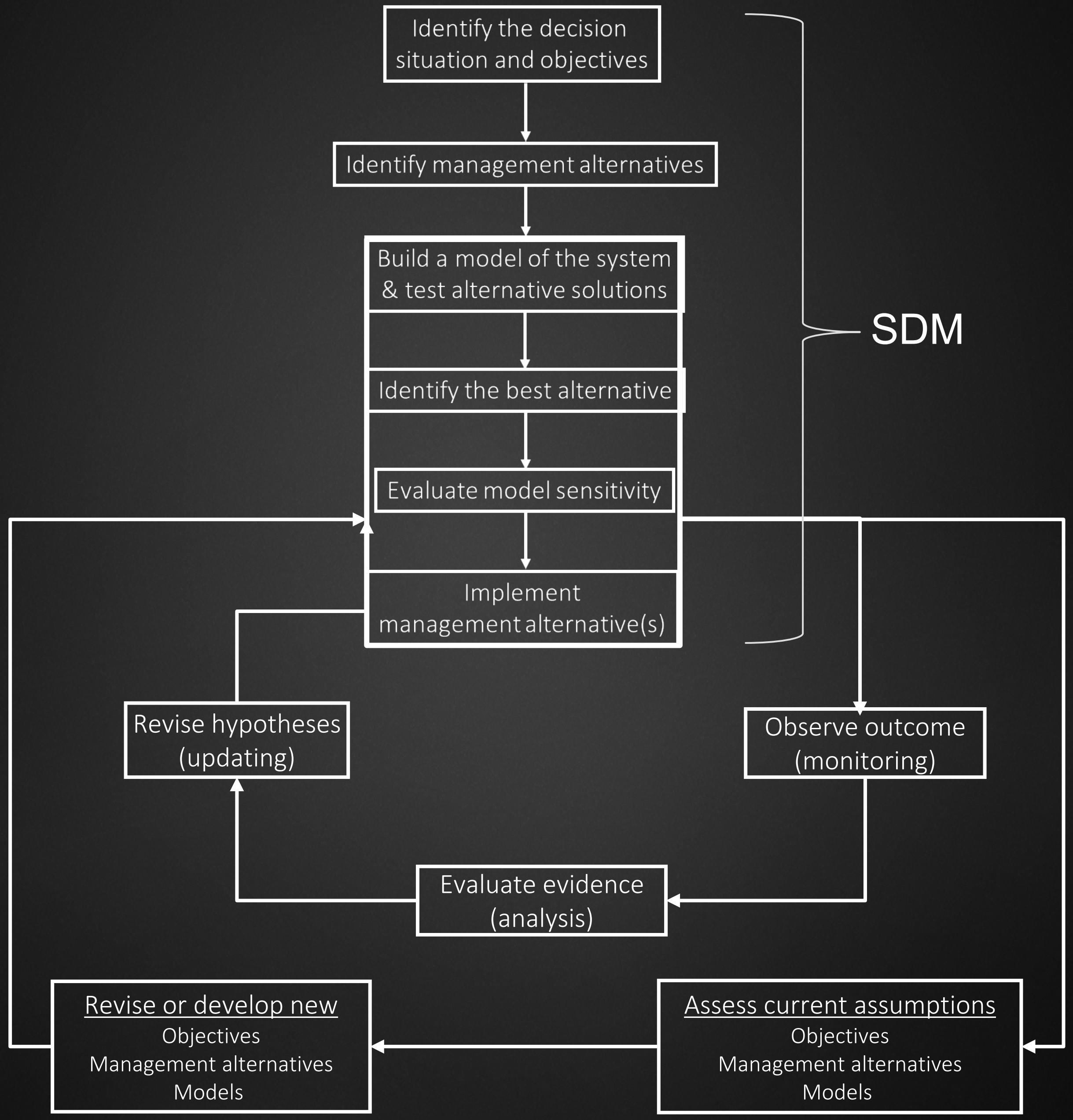


…rethink the entire approach

…do a fundamentally better job

Our primary recommendation is that the agencies develop an integrated science based conceptual foundation and framework for the CVPIA anadromous fish program, incorporating an ecological risk assessment/adaptive ecosystem management approach

Adaptive Management



The CVPIA Process: Phase I

Timeline < 2013-14 - 9 months

Core Team members, experts

Series of workshops

- Identified objectives
- Built <u>prototype</u> models
- Peer review of models
- Refined models

Fundamental Objectives

1) Naturally reproducing self-sustaining population
   - Anadromous fish and at-risk species
     - o Chinook and steelhead
     - o Green and white sturgeon
   - No adverse affects on American shad and striped bass

2) Optimize the use of project funds

Fundamental Objective Attributes

- Naturally reproducing self-sustaining populations
  Chinook salmon: Spring, Fall, Late-Fall, Winter
  - Spatial structure
    - No. of spawning popn per diversity group
  - Abundance
    - No. of returning adults
    - Juvenile abundance
  - Adult/juvenile natural production
    - No. natural juveniles/Natural returning adults
    - Nat. returning adult/natural spawner
    - Size at emigration
    - Juvenile size distribution
  - Diversity
    - Prop of natural spawners vs hatchery
    - Outmigration timing
    - Age structure
    - Return timing

Spatial Dimensions

Coarse resolution

- Lumped watersheds
- Lumped mainstems
- Delta in 2 sections
    - (north & south)

Spatial extent:

- Focus outside the Delta

Grain/resolution

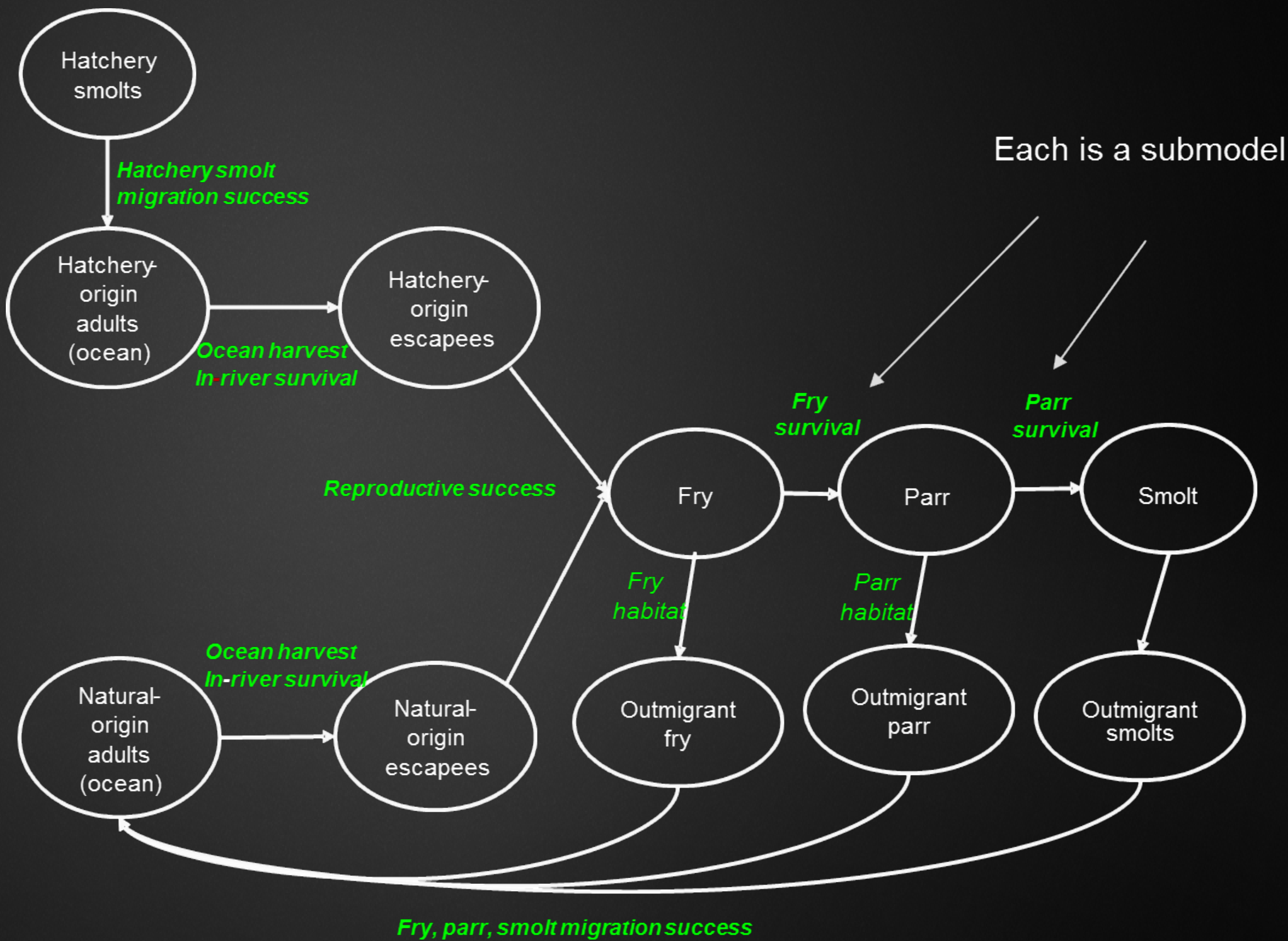
- 26 CVPIA watersheds
- Migratory corridors

Coarse Resolution
Fall-run Chinook Model

Iterative process

~ 10 iterations

Predicted the fundamental objective attributes



51 total parameters

Model Parameterization

Where did we get the information?

- Empirical data
- Published reports
- Expert elicitation

Fall Run Chinook Salmon

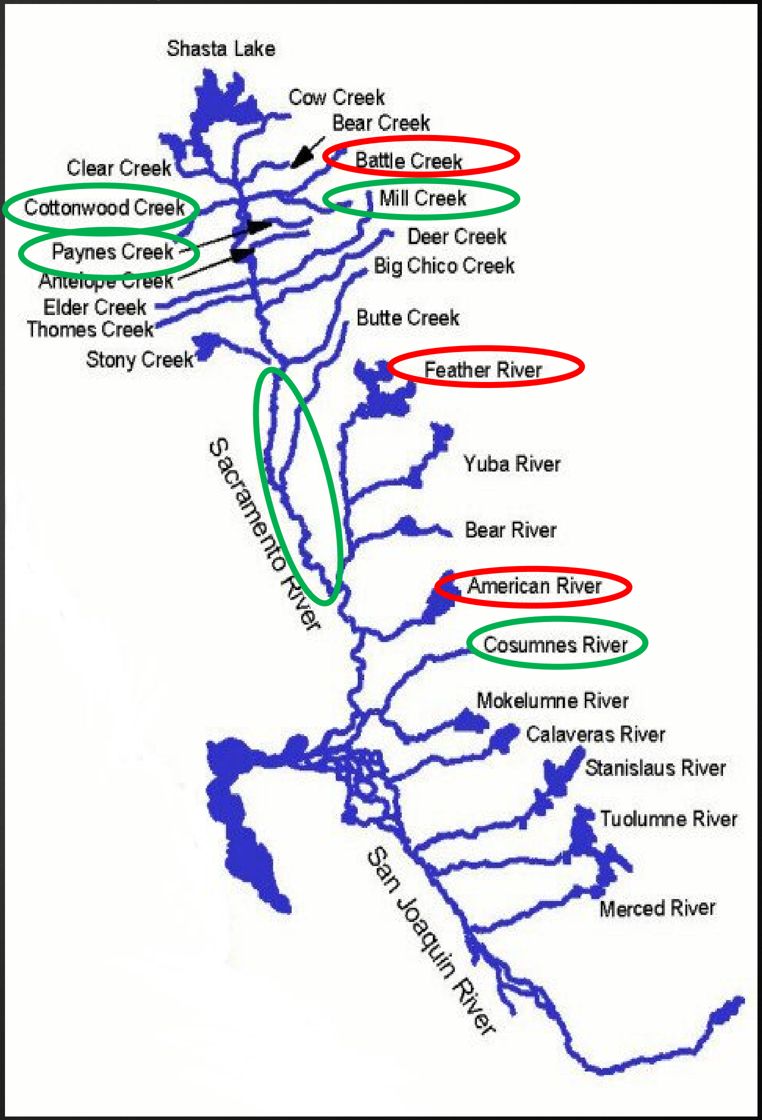
Result Summary

Top ranked decisions

- Increase in-channel habitat
- Manipulate temperatures for juveniles

Lowest ranked decisions

- Increase floodplain habitat
- Increase spawning habitat



Sensitivity analysis summary

Juvenile Survival

Rearing and Outmigration

Current Habitat Availability

Spawning, Fry, and Parr Habitat

Hydro-Thermal Regime

What did we learn?

The process – systems analysis

Data availability

Key uncertainties with limited information

- Factors affecting early life history stages (wild fish)
- *Empirical estimates of current conditions in watersheds needed*

It gets better with more stakeholders and disciplines in the room

The CVPIA Process: Phase II

Science Integration Team (SIT)
2015 - 2018

Series of workshops, calls

- Identified objectives
- Built <u>new</u> prototype model
  - Fall run Chinook salmon
- Refined models
- Scenario evaluation

http://cvpia.scienceintegrationteam.com

Governance Guidelines

Deciding how we decide

Identify roles and responsibilities

- All decision makers are stakeholders, but not all stakeholders are decision makers

CVPIA Science Integration Team
Draft Guidance for Members
April 2017

Responsibilities

The SIT is a technical team composed of stakeholders and agency scientists with the responsibility of:

- Incorporating science and data into the Adaptive Resource Management (ARM) process;
- Refining and revising Decision Support Models (DSMs) with new and existing information;
- Recommending Anadromous Fish Program (AFP) priorities for types of actions, science, and monitoring over a 5-year time horizon. The SIT is responsible for

Fundamental Objectives & Attributes

Naturally reproducing self-sustaining populations Fall Chinook

Spatial structure
- Total no. of viable spawning populations per diversity group

Abundance
- Total no. of spawning natural origin adults
- Naturally-spawned juvenile abundance at Chipps
- Naturally produced fish in the ocean

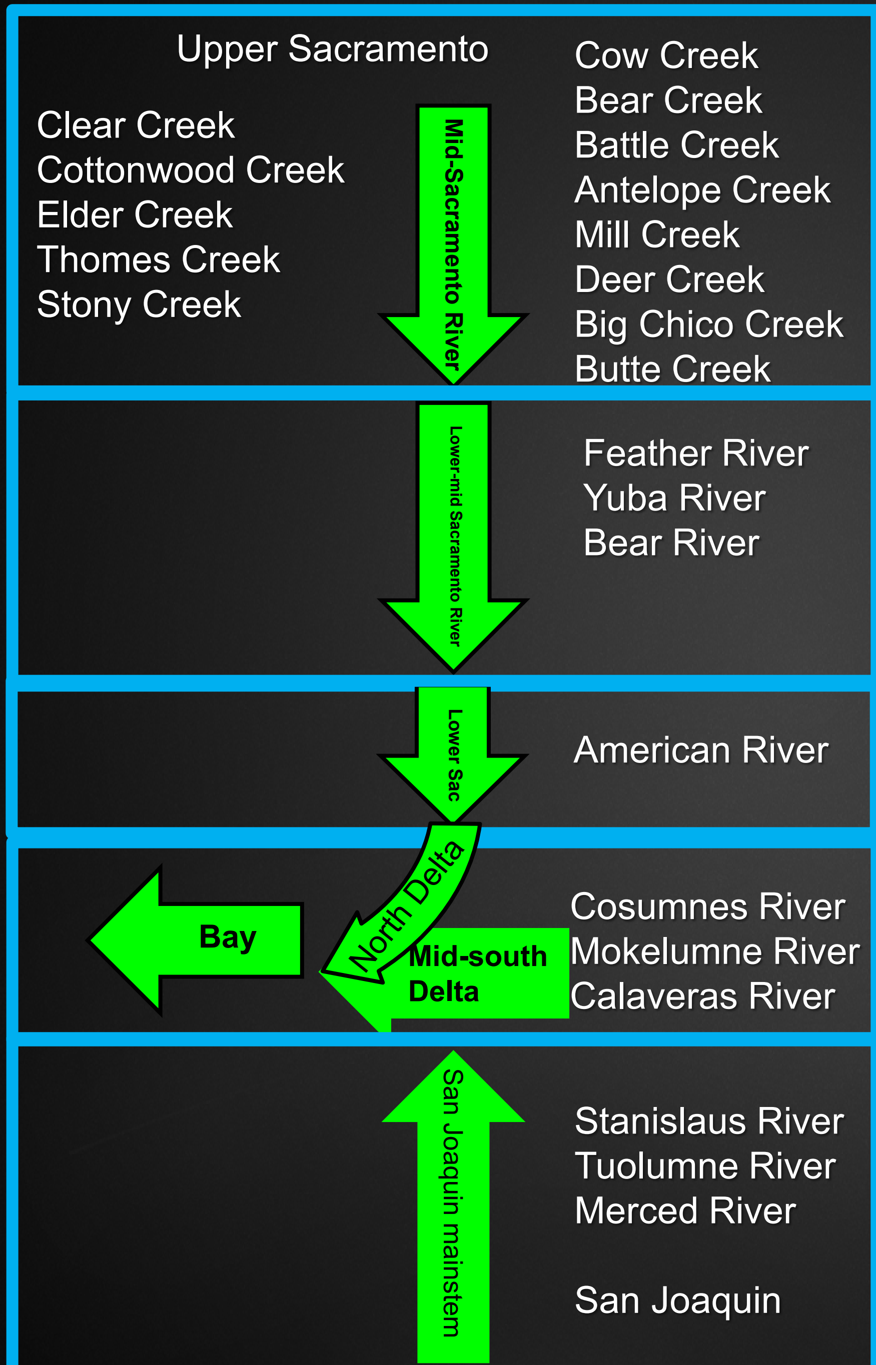
Natural productivity
- Total number of natural origin spawning adults per natural origin escapement
- Nat. returning adult/natural spawner
- No. natural juveniles at Chipps /Natural origin spawning adults

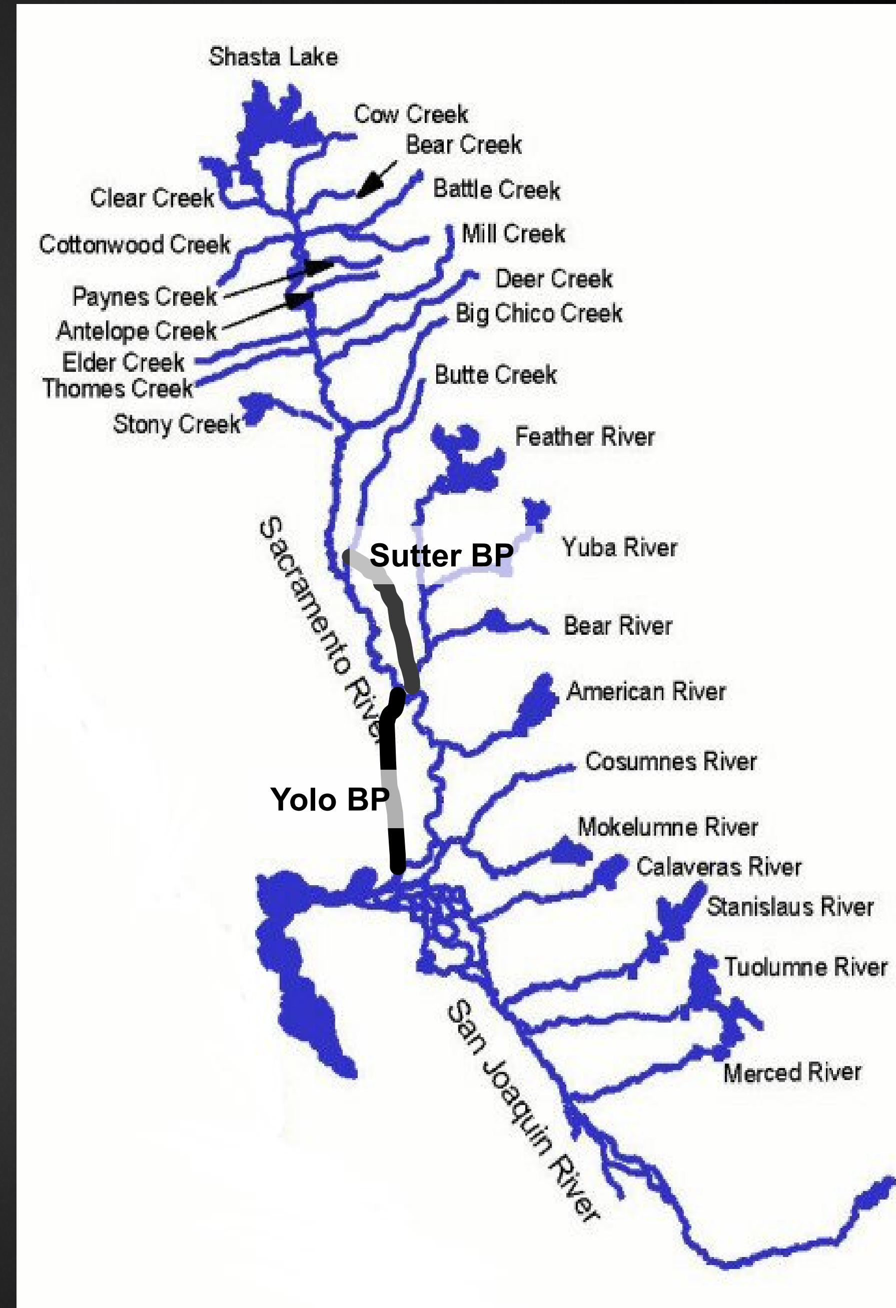
Life history diversity
- Timing of outmigration by juvenile stage at Chipps
- Variation of timing of peak outmigration among screw traps
- Outmigrating proportion juvenile stages (size classes) size/developmental stage at Chipps

Genetic diversity
- Prop of hatchery fish that are strays
- Note: Metric of genetic diversity among populations (wait for future iteration)

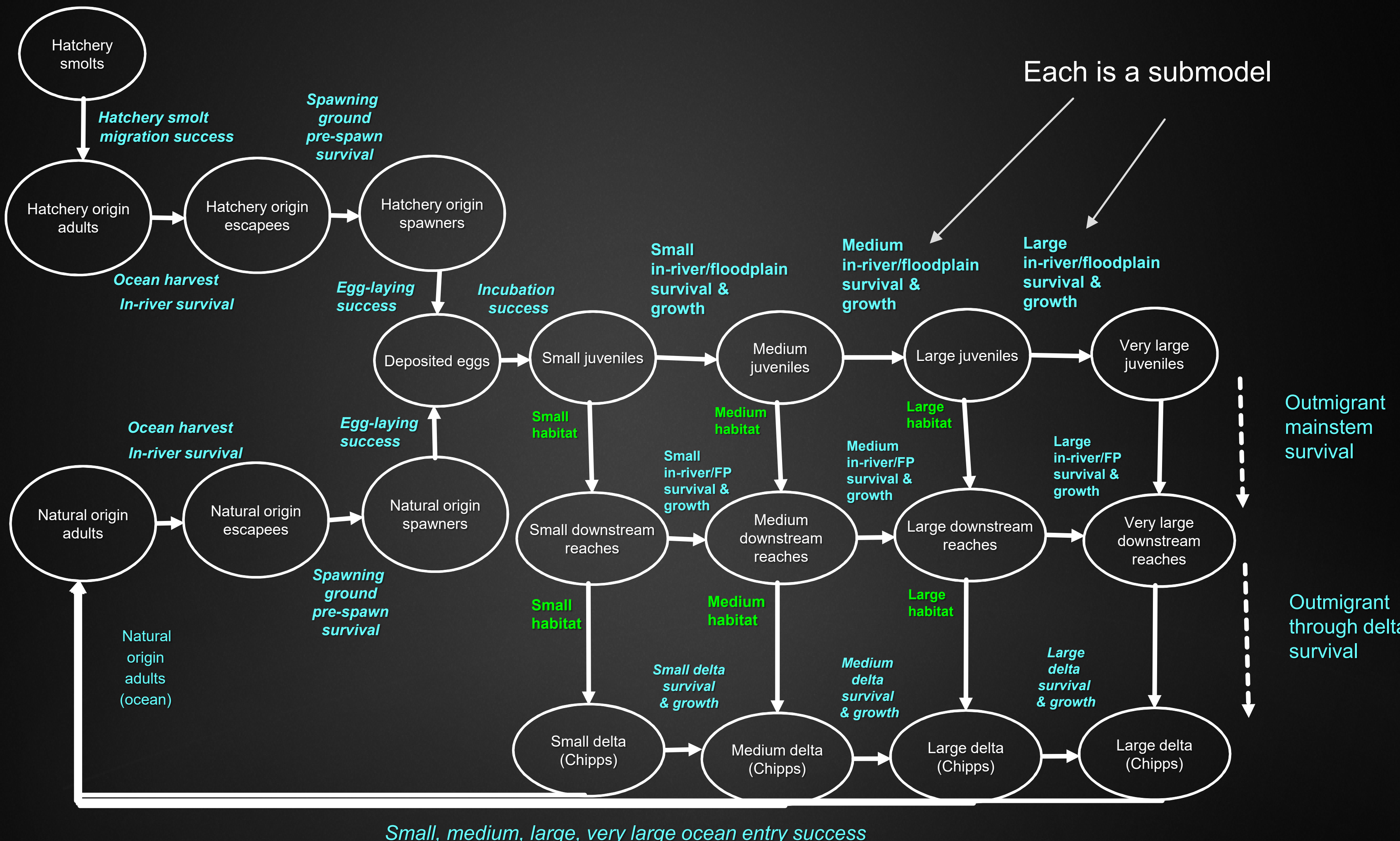
10 valley wide objectives
8 tributary objectives

Spatial grain and extent





Fall Chinook Salmon Base Model



87 total parameters

Model Parameterization

Where did we get the information?

Analyses of empirical data

Published reports

Expert elicitation (very, very little)

Lots of help

Model Implementation

Calibrated model with estimated escapement and juvenile catch data

Climate type (wet/dry)

Output at year 5 and 20

- Tributary and valley-wide metrics

Management alternatives (26 total scenarios)

- Eliminate predator contact points
- Reduce water diversions
- Increase spawning, floodplain, or in-channel habitat
- Manipulate flows
- Reduce hatchery origin spawners

Experts had to process…

26 scenarios x 2 climates x 2 time periods x 18 metrics = 1872!

Sensitivity analysis

FY 18 Fall Chinook Priorities

Actions
Sacramento Mainstem below Bend Bridge, Improve/increase juvenile Chinook rearing habitat
Yuba River, Improve/increase spawning and juvenile rearing habitat
Stanislaus River, Improve/increase juvenile rearing habitat (floodplain)
American River, Improve/increase juvenile rearing habitat (floodplain)
Adaptively manage reduction/improvement predator contact points

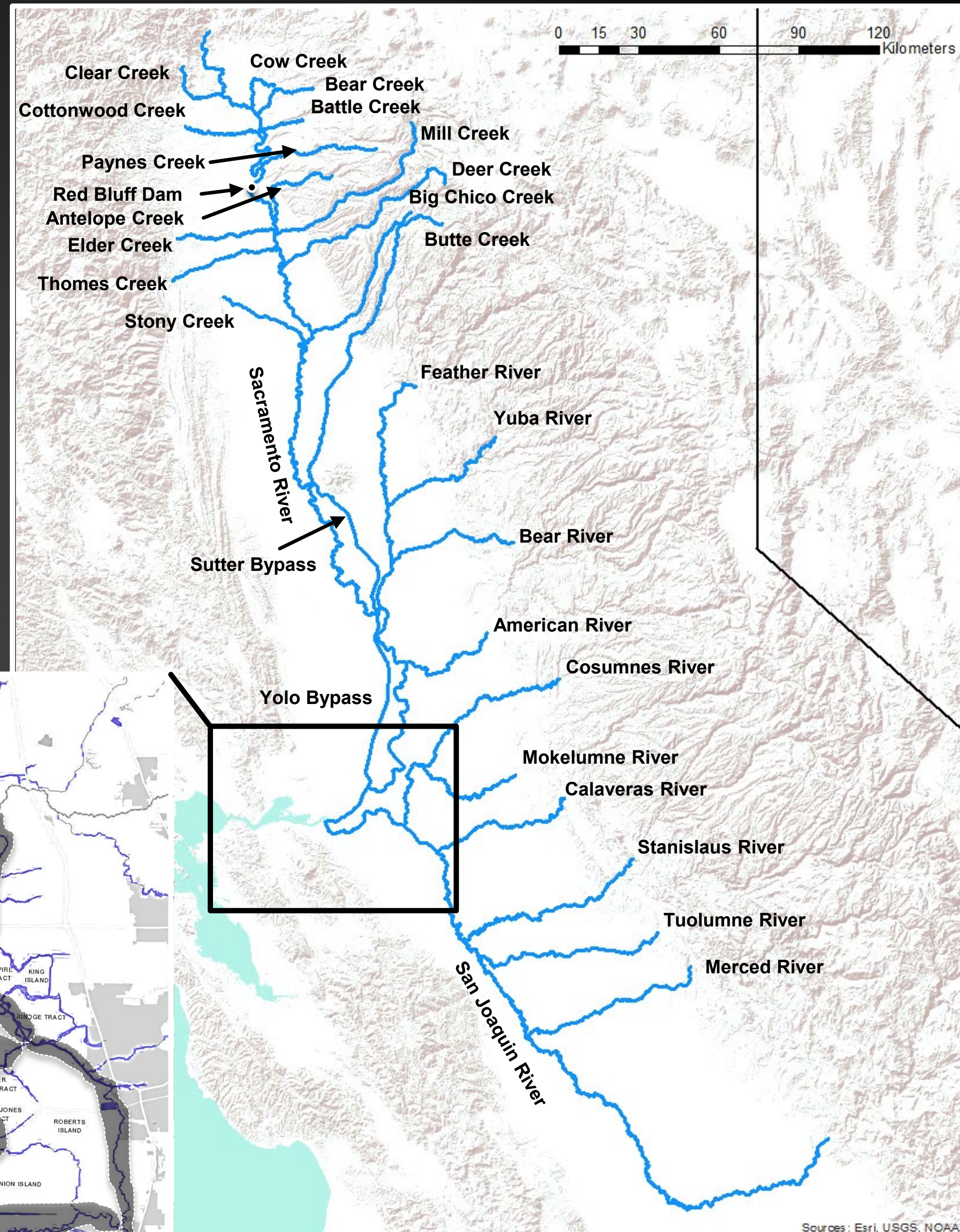
Sensitivity Analysis Summary
THE Key Uncertainties

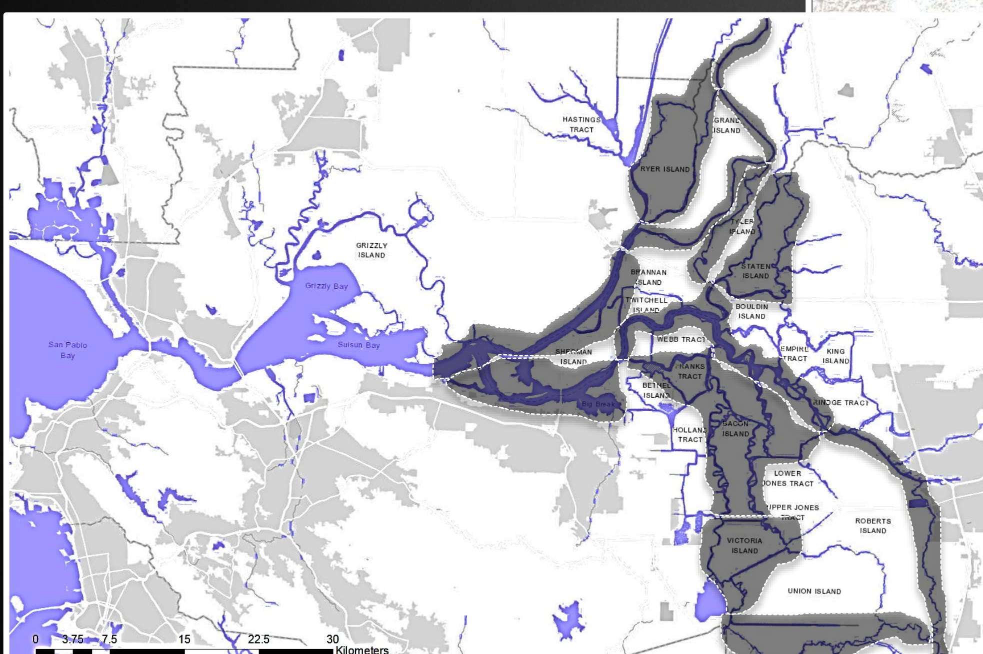
- Juvenile delta outmigrant survival
- Juvenile delta rearing survival
- Juvenile growth
- Juvenile ocean entry survival
- Juvenile Sacramento outmigrant survival
- Sex ratio
- Fecundity

Out of 87 parameters!

Phase III
2018 to Present
More Expansions

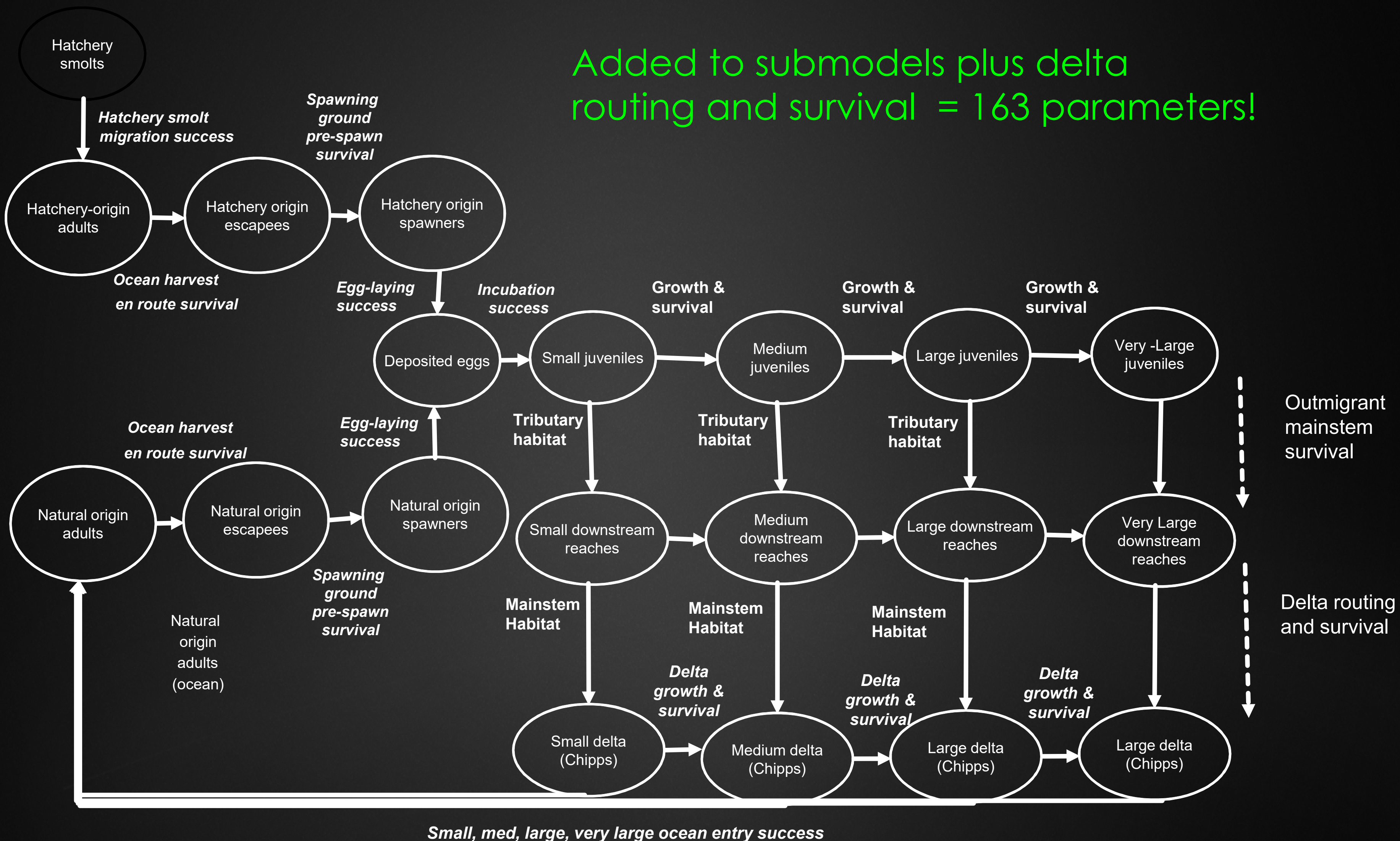
Separated Delta into 13 zones





More Expansions

Added to submodels plus delta routing and survival = 163 parameters!



Sensitivity analysis

Juvenile survival
Juvenile growth and territory size
Adult prespawn survival
Fecundity
Redd size
Sex ratio
In channel fry habitat
Initial abundance
Floodplain habitat
Spawning habitat

Out of 163 parameters

Near-Term Restoration Strategy

http://cvpia.scienceintegrationteam.com

Recommended Restoration Actions for Chinook Salmon	Runs benefitting
1: Juvenile habitat restoration in mainstem Sac River above the American River confluence	All
2: Reconnect ephemeral non-natal tributaries to the mainstem Sac River	Winter
3: Juvenile habitat restoration in Battle Creek in winter run juvenile rearing locations	Winter
4: Juvenile habitat restoration in American River	Fall
5: Juvenile habitat restoration in the Stanislaus River downstream through the San Joaquin River at Vernalis	Fall
6: Juvenile habitat restoration in Clear Creek	Spring, Fall
7: Improve survival in Butte Creek in downstream areas	Spring, Fall
8: Juvenile habitat restoration in the lower Feather River below the confluence of the Yuba River	Fall (Spring)
9: Maintain existing spawning habitats in Upper Sac, American, and Stanislaus Rivers; Clear and Butte Creeks	All

Lessons Learned…So Far

- Structured Decision Making is hard – but doable
  - You don't need all the information up front
  - You do need courage to make educated estimates and the willingness to be flexible and revisit debated values & methods
- After 7 years we are just now getting to Adaptive Management – SDM & AM are not the same
- Teamwork is key
- Data Management is a must – from the beginning
- SDM is not terribly expensive – may be less than the alternatives
- Helps to read up on Systems Analysis
- The Rule of 'Six' – no matter how complex the system, no more than six inputs will govern the output

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Contact the CVPIA Science Coordinator, Megan Cook, for more information: megan_cook@fws.gov

State-Dependent Policy Development

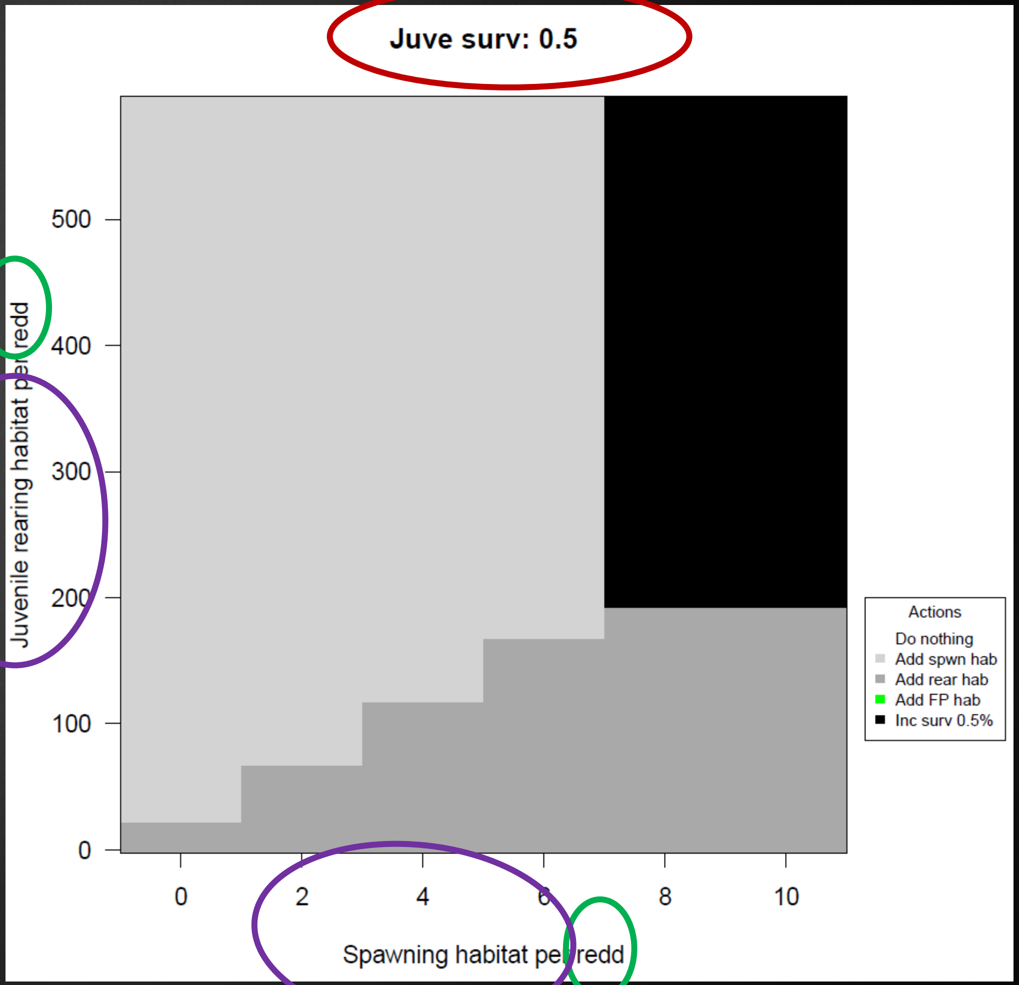
Use stochastic dynamic programming to derive a set of optimal policies

- Finds actions that maximize the cumulative utility value through time

How much habitat is available?

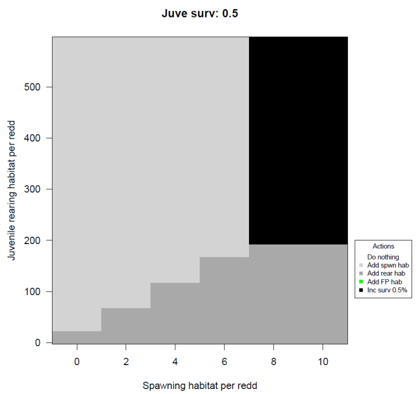
How many redds/females on average?

What is juvenile < 45 mm survival on average?



State-Dependent Policy Development

Group 1



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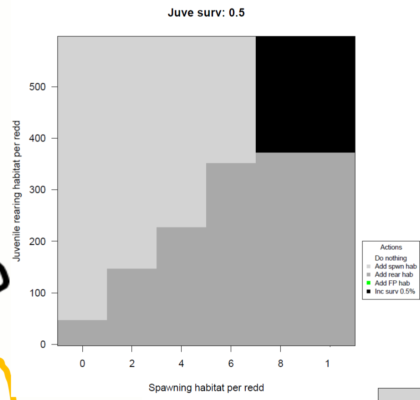

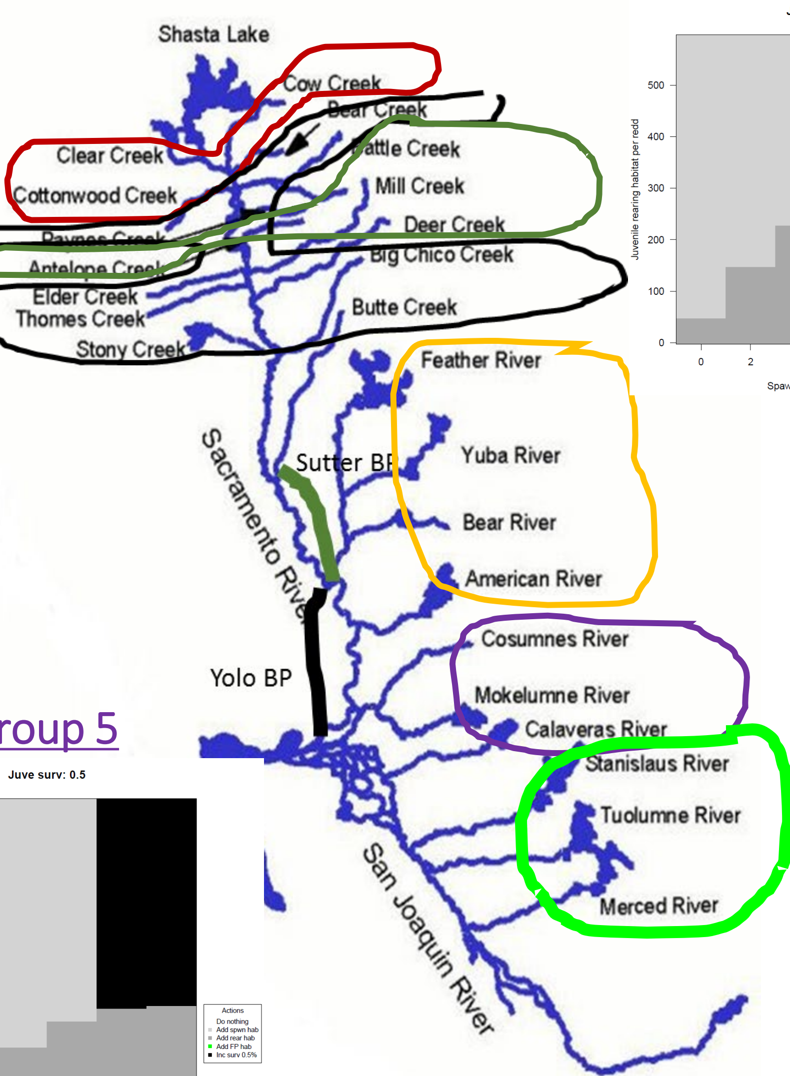

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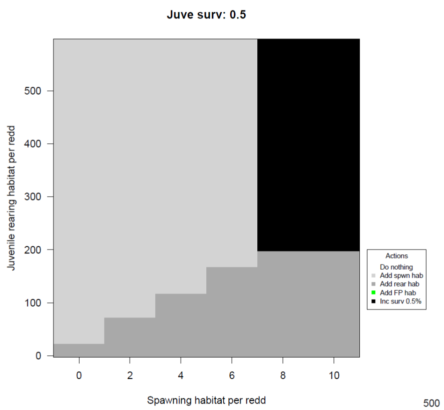

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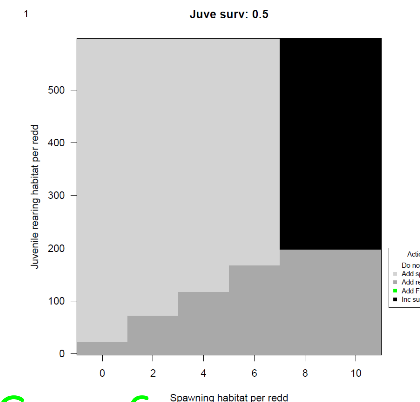

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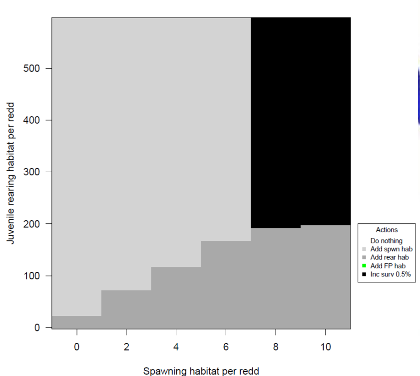

Group 6