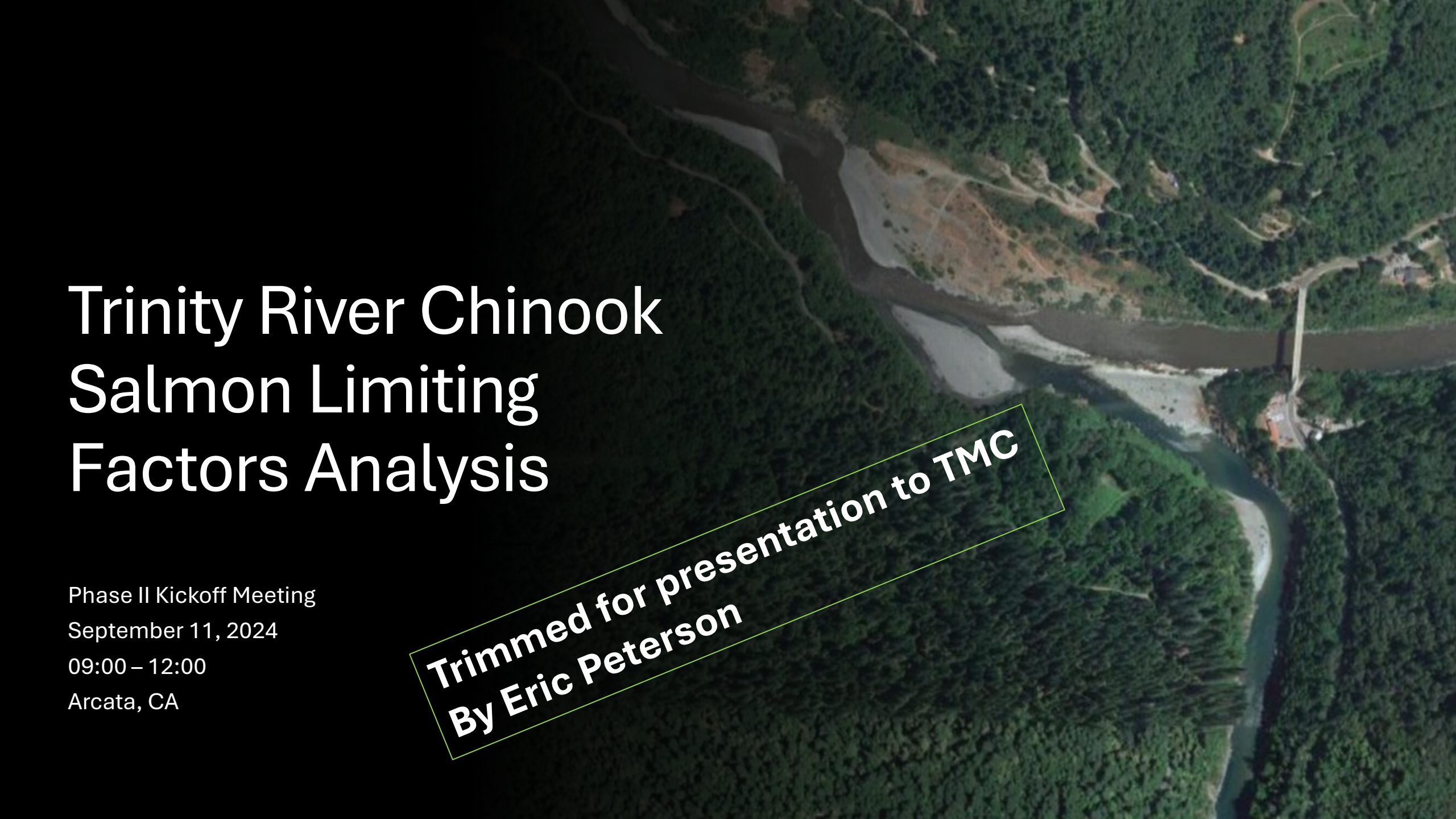
Trinity River Chinook Salmon Limiting Factors Analysis

Phase II Kickoff Meeting
September 11, 2024
09:00 – 12:00
Arcata, CA

Trimmed for presentation to TMC
By Eric Peterson



Background
Purpose and Need

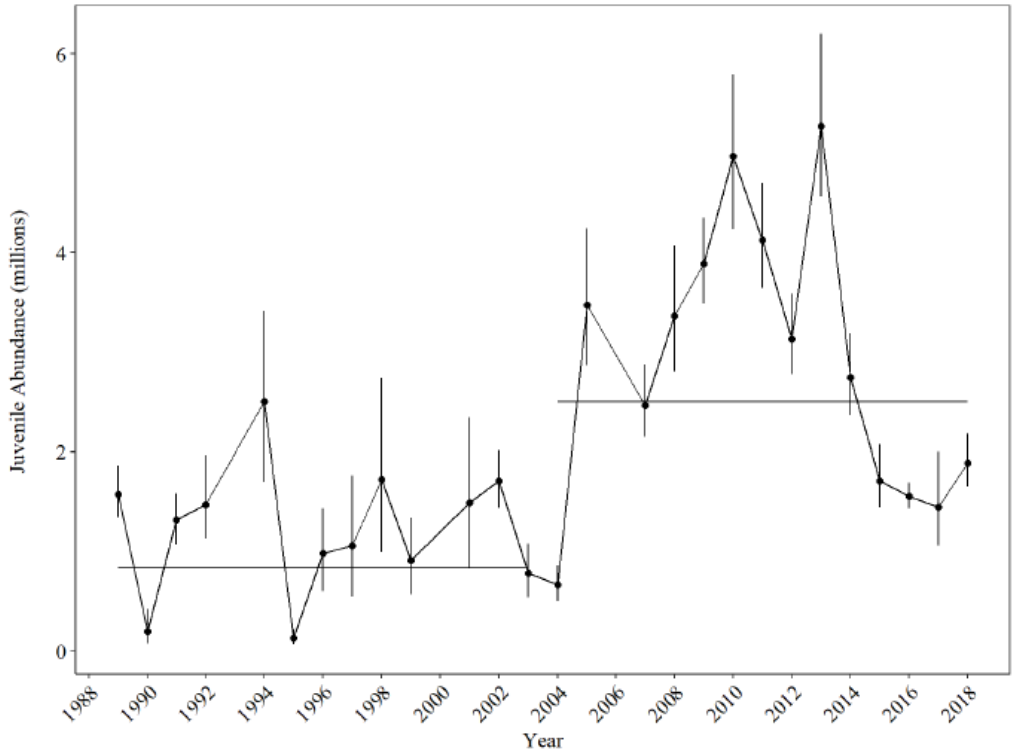


Figure 4. Juvenile Chinook Salmon abundance (in millions) at the Willow Creek trap site from 1989-2018. Horizontal lines indicate mean juvenile abundance (in millions) prior to and following the identified change point of 2004. Error bars indicate 95% credible intervals around juvenile abundance estimates.

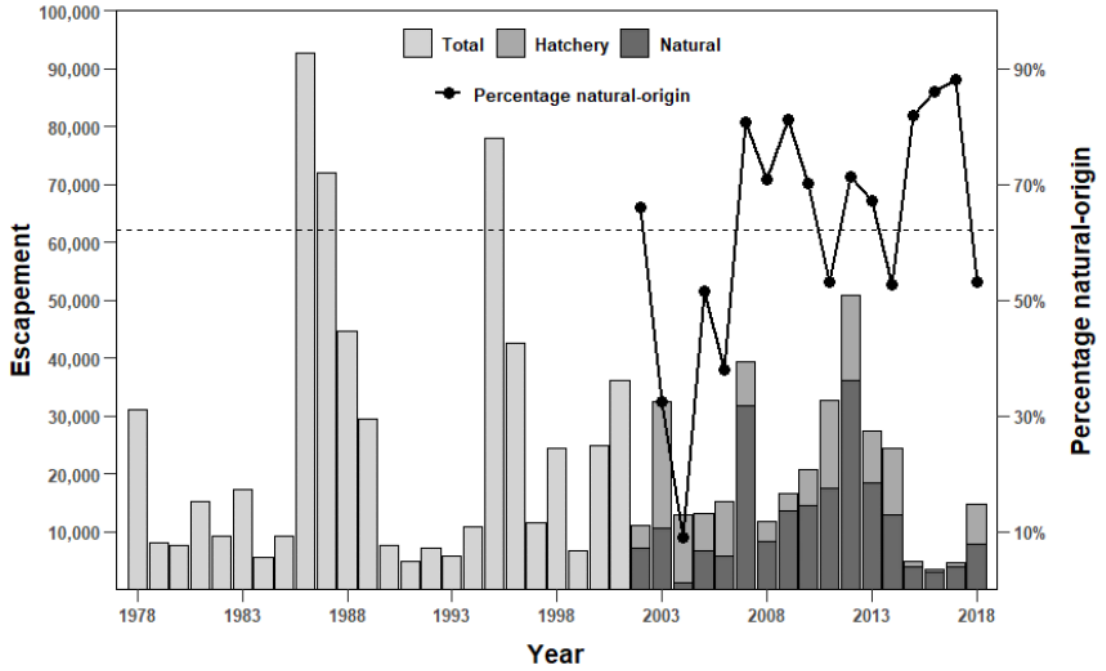


Figure 6. Time series of fall-run Chinook Salmon spawning escapement to natural spawning areas of the Trinity River from 1978 to 2018. Natural- and hatchery-origin fish were not estimated separately before 2002, so only total escapement is provided for those years. The dashed line denotes the TRRP escapement target of 62,000 natural-origin fall-run Chinook Salmon to natural spawning areas.

Pinnix et al. (2022)

Gough et al. (pending)

Background
Limiting Factors Analysis
Phase 1

- Analysis need scoped by the IDT
  - Focus on Chinook, but both runs
  - Span full life cycle
- Multi-phase plan envisioned by the IDT
  - Phase 1 = Develop Study Plan
  - Phase 2 = Implement Study Plan
- Contract externally for
  independent expertise
- Separate contracts for flexibility
- Phase 1 completed March 2024
- Phase 2 contracted in August 2024
  - 2 year time frame

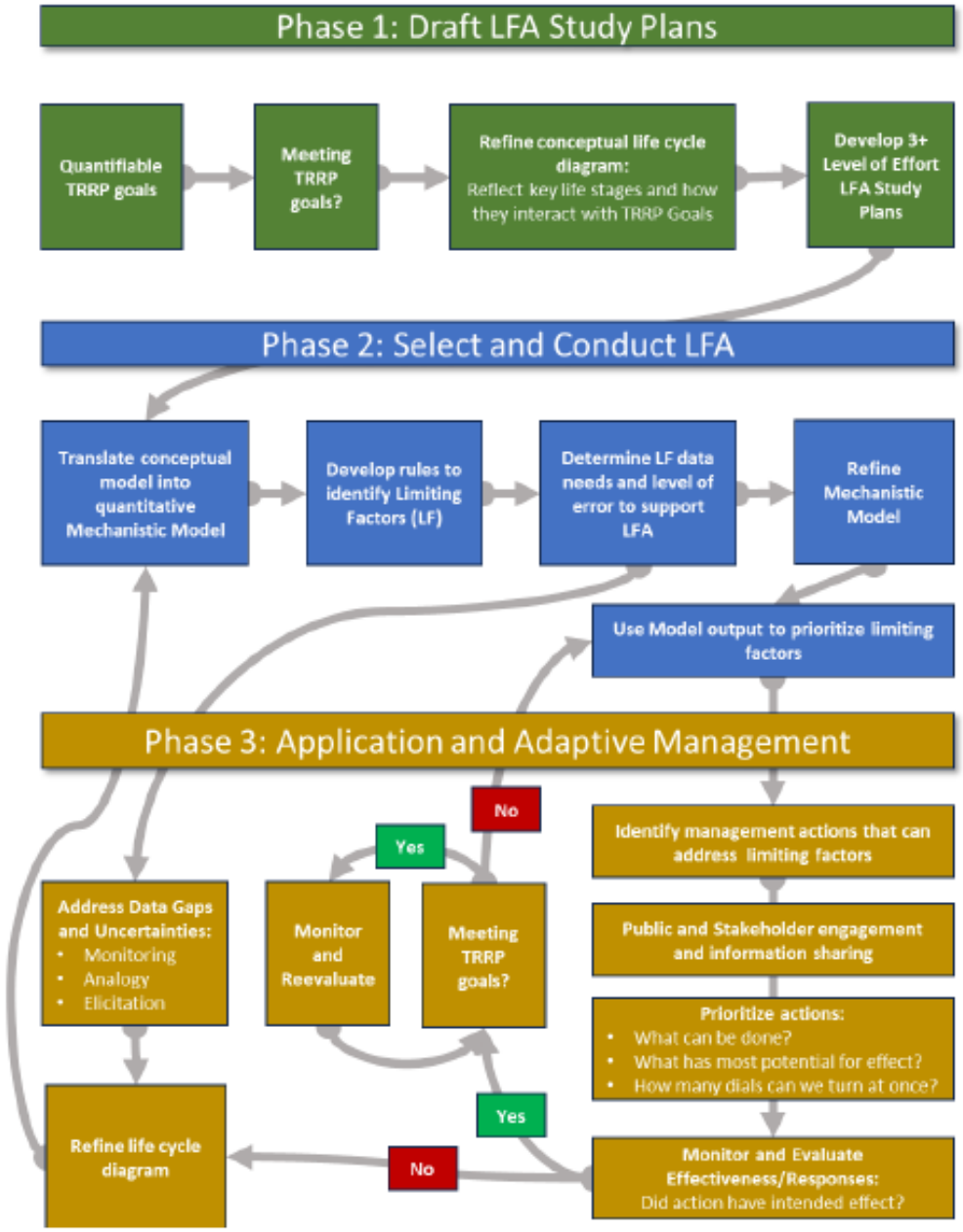
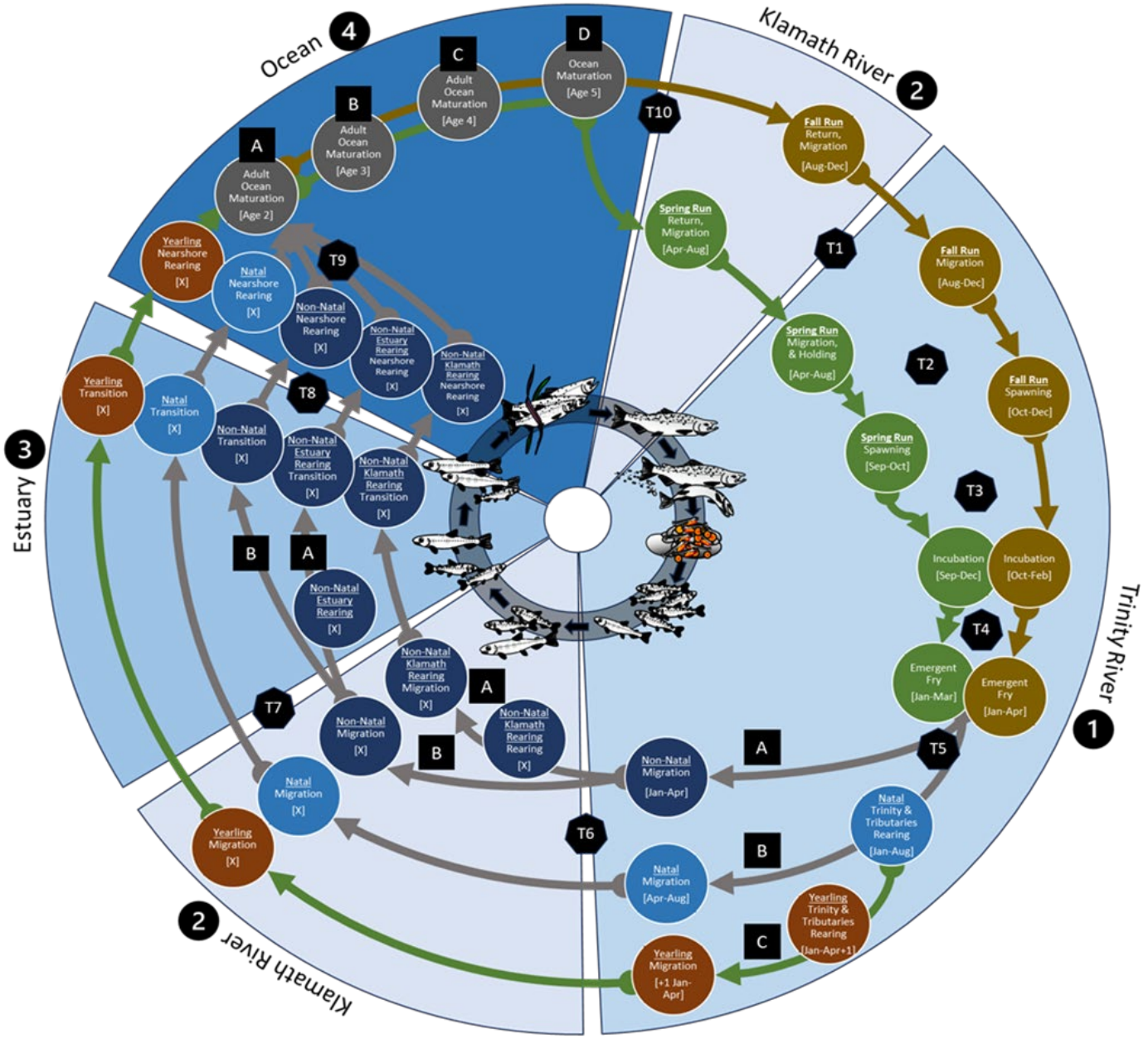


Figure 1. Conceptual Ecological Model for the Trinity River Chinook Salmon Limiting Factors Analysis (LFA) that describes Phase 1 (green) and development of the draft LFA study plans, Phase 2 (blue) and selection and completion of the LFA, and Phase 3 (orange) and application and adaptive management of the LFA and its outcomes.

Project Background and Overview

- Phase I completed March 2024
- Updated conceptual life cycle diagram, drivers/causes
- Developed 3 study plan levels of effort for Limiting Factors Analysis (LFA)
- Highest effort level option selected for Phase II

Updated Conceptual Life Cycle Diagram From Phase I



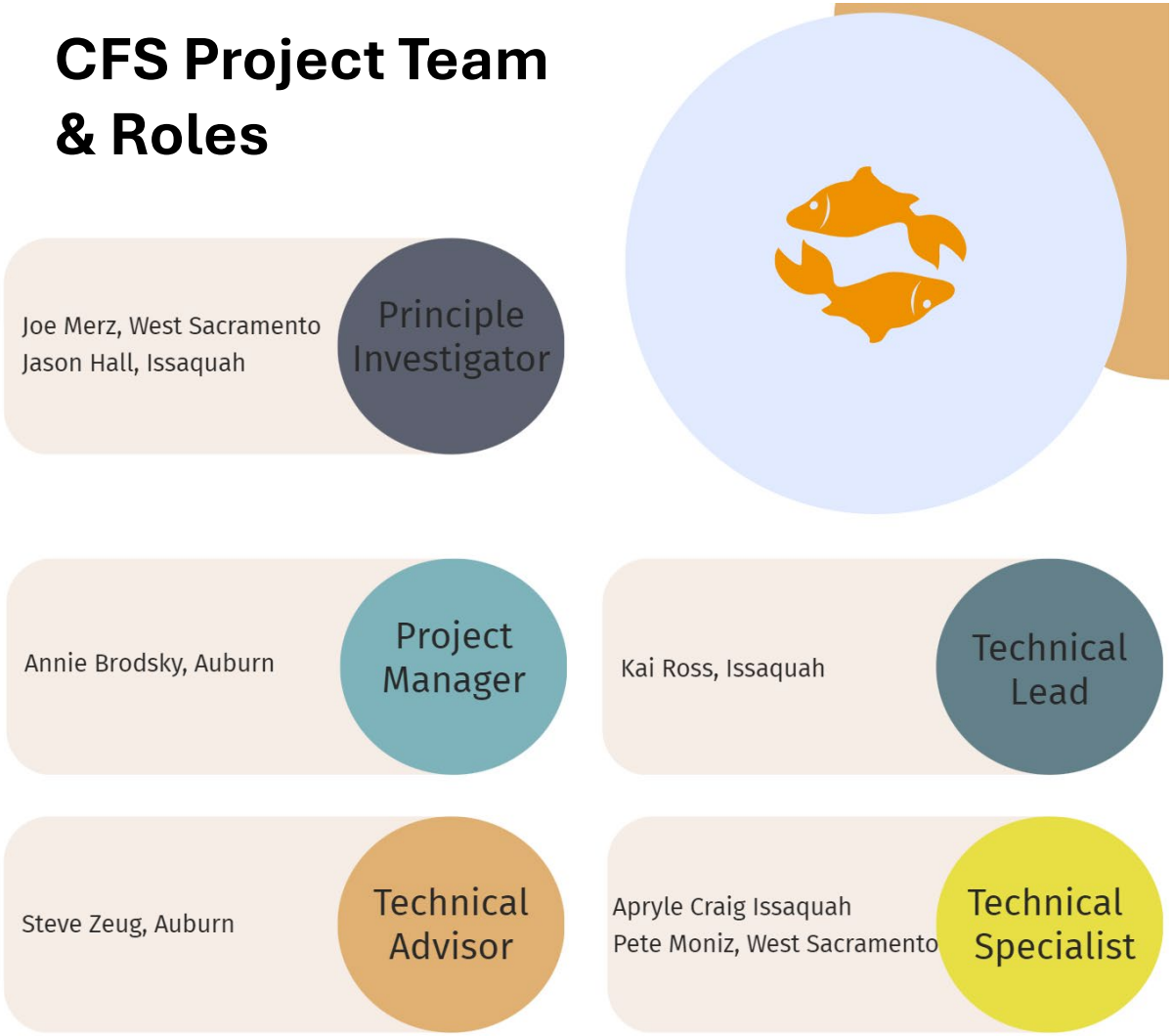
Key Goals and Objectives

- Develop a life cycle modeling tool with Graphic User Interface (GUI)
  - *Usable, open source, and transparent*
  - *Adaptable and maintainable*
- Identify and prioritize limiting factors
- Identify and prioritize data gaps
- Evaluate actions, strategies, scenarios

Key Personnel and Points of Contact

- CFS Project Team (CFS)
- Technical Advisory Group (TAG)
- Science Advisory Board (SAB)
- Inter-Disciplinary Team (IDT)

CFS Project Team & Roles



We will use our technical expertise to develop the analytical tools to analyze and identity limiting factors

Scope and Deliverables

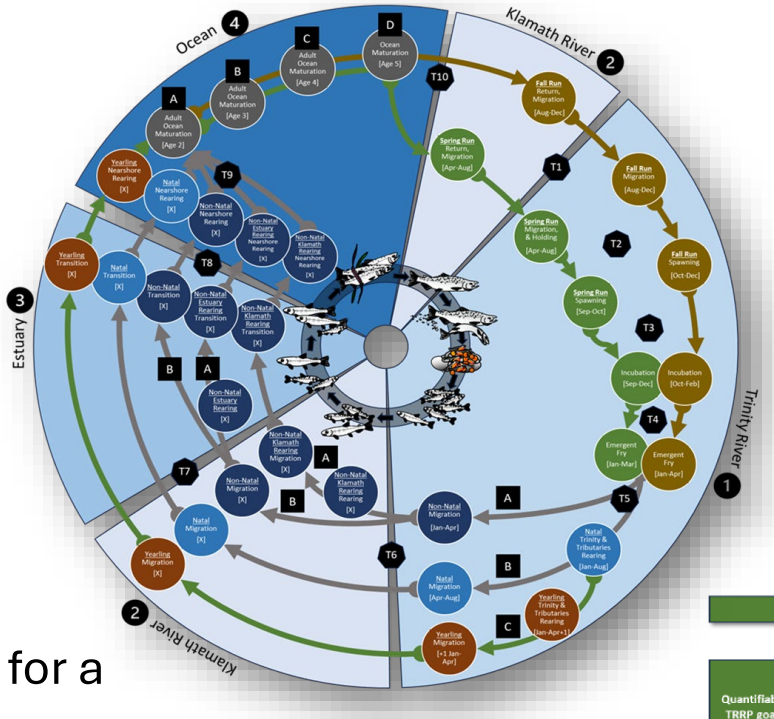
LFA Phase II Tasks

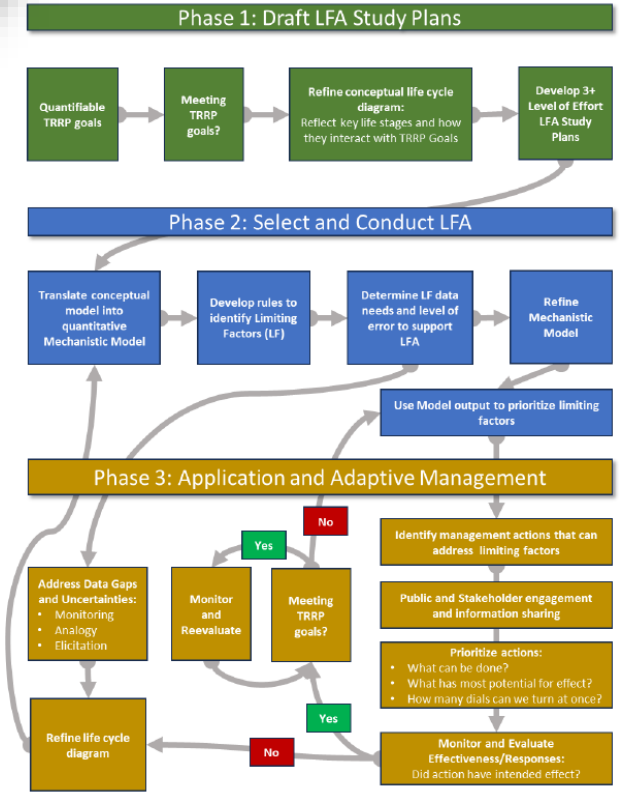
- **Task 1:** Regular interaction with the TRRP
- **Task 2:** Gather and review background information, address data gaps, and conduct literature review
- **Task 3:** Develop draft and final parameterized quantitative LCM with a GUI that supports analysis of scenarios
- **Task 4:** Analyze current limiting factors
- **Task 5:** Prepare draft and final technical report

Task	Subtasks	Deliverables
Task 1	• Kick off meeting • Quarter (8x) TAG/SAB meetings • LCM GUI Workshop • Draft Tech Report Presentation • Final Tech Report Presentation	• Meeting agendas • Meeting notes • Presentation materials
Task 2	• Review project plan • Determine data/quality needs • Work with TAG/SAB on data requests • Evaluate data • Develop hypotheses with TAG/SAB	• Project Plan Summary • Summary of compiled data • Evaluation results of compiled data
Task 3	• Develop open-source LCM with GUI • Parameterize model • Refine model	• Draft model code (R) • Draft model GUI (RShiny) • Final model code and GUI
Task 4	• Hypothesis testing • Identify and prioritize limiting factors and data gaps • Evaluate model sensitivity • Develop management scenarios and evaluate actions	• Identified and prioritized limiting factors and data gaps • Refined LCM and GUI with scenarios
Task 5	• Prepare draft report with user guide • Prepare final report from review comments	• Draft Tech Report • Response to reviewer comments • Final Tech Report

Rational for LCM-based Approach

- LCD developed in Phase I provides a framework for a quantitative LCM
- LCM integrates full life cycle
- Framework for hypothesis testing / gaming
- Supports identification of limiting factors
- Evaluate and inform management actions and scenarios
- Adaptable with new and emerging issues
- Can be developed in open-source platforms





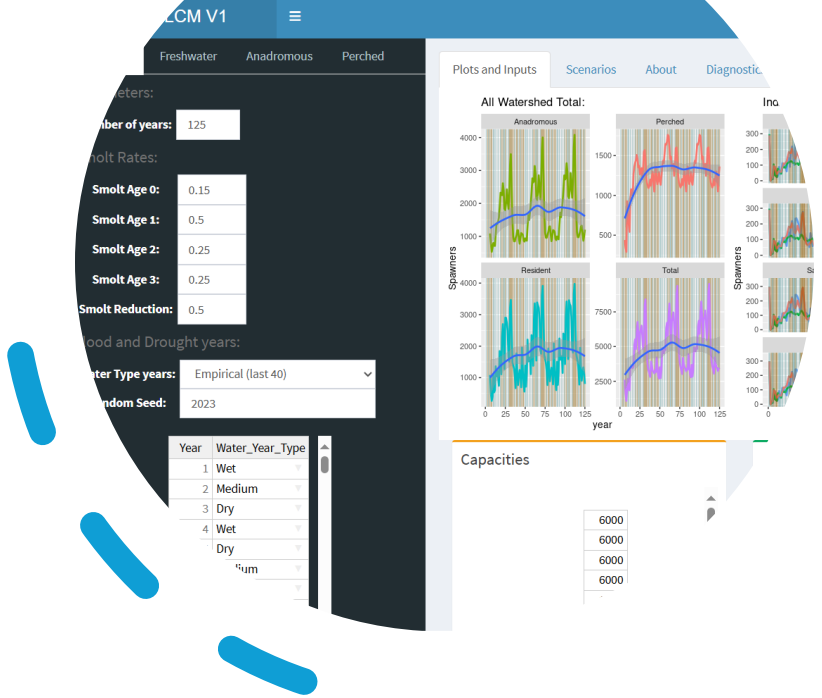
LCM and GUI Approach

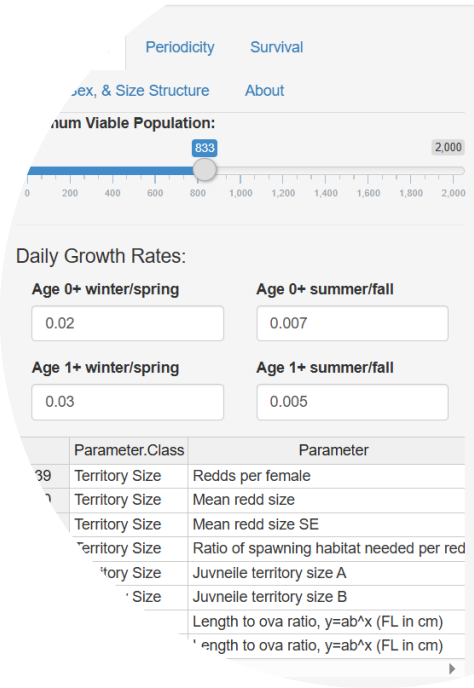
Overview

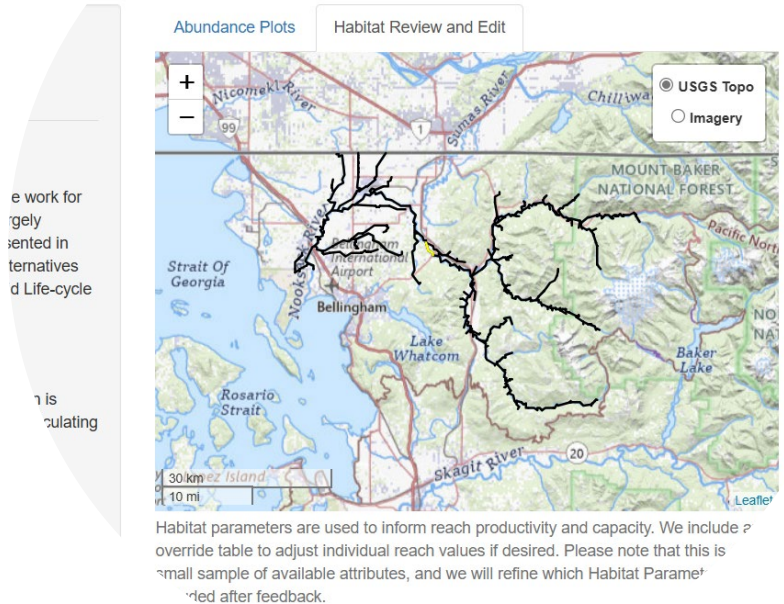
- Convert LCD to LCM framework
- Code LCM in R and GUI in RShiny
- Parametrize with empirical data where possible
- Develop limiting factors and scenario tools in GUI

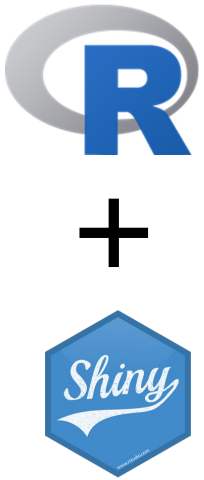
Live demos of a few LCM GUIS…

- Suisun Creek Steelhead LCM
- Nooksack River Chinook LCM
- Southern California Steelhead LCM



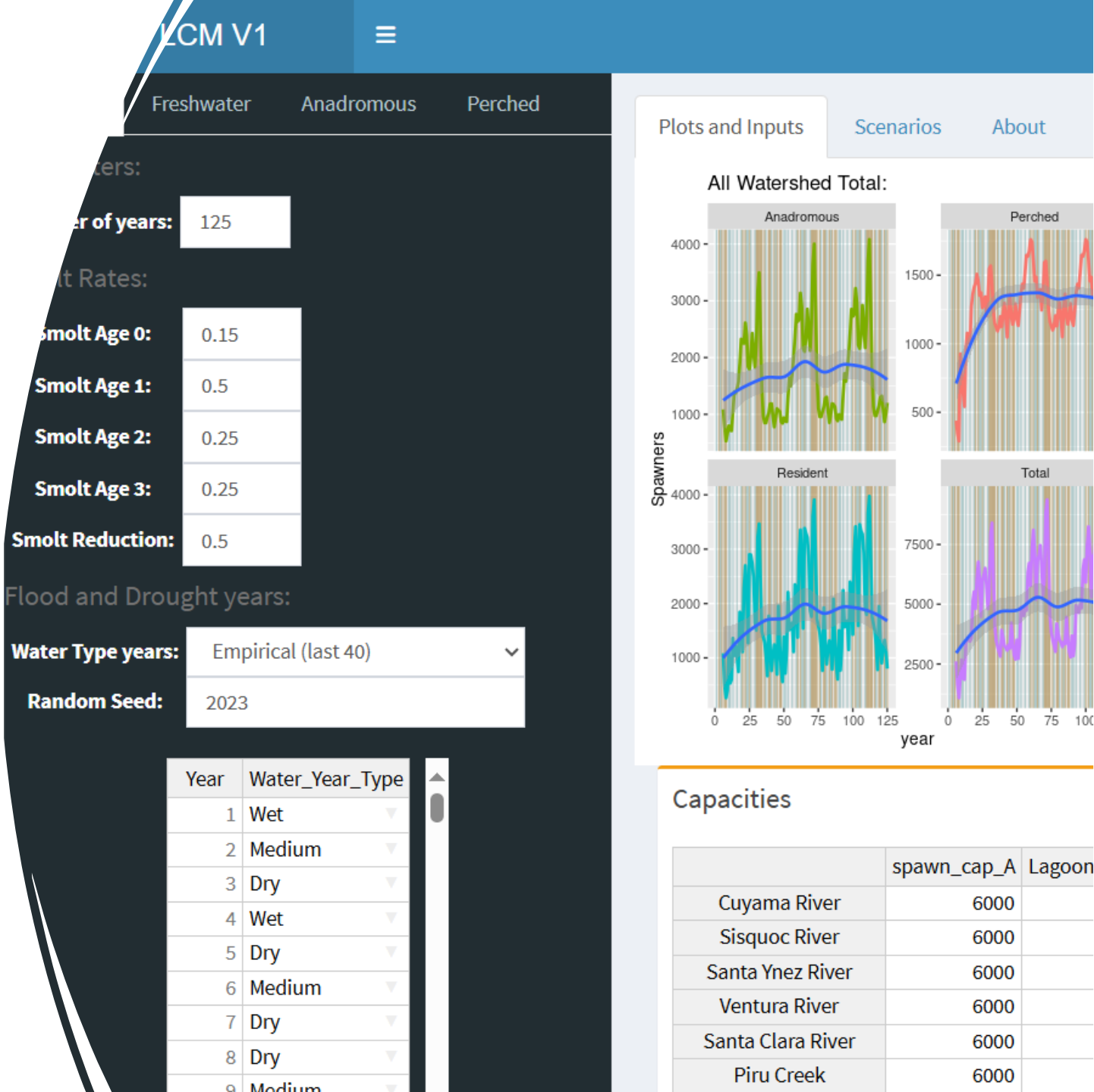






LFA Phase II Success Criteria

- Open source and transparent
- Identify and prioritize current limiting factors…
- Adaptable with new and emerging issues AND as management actions are implemented
- Identify and prioritize data gaps/monitoring needs
- Evaluate and inform management actions and adaptive management



Klamath River and the Trinity LFA

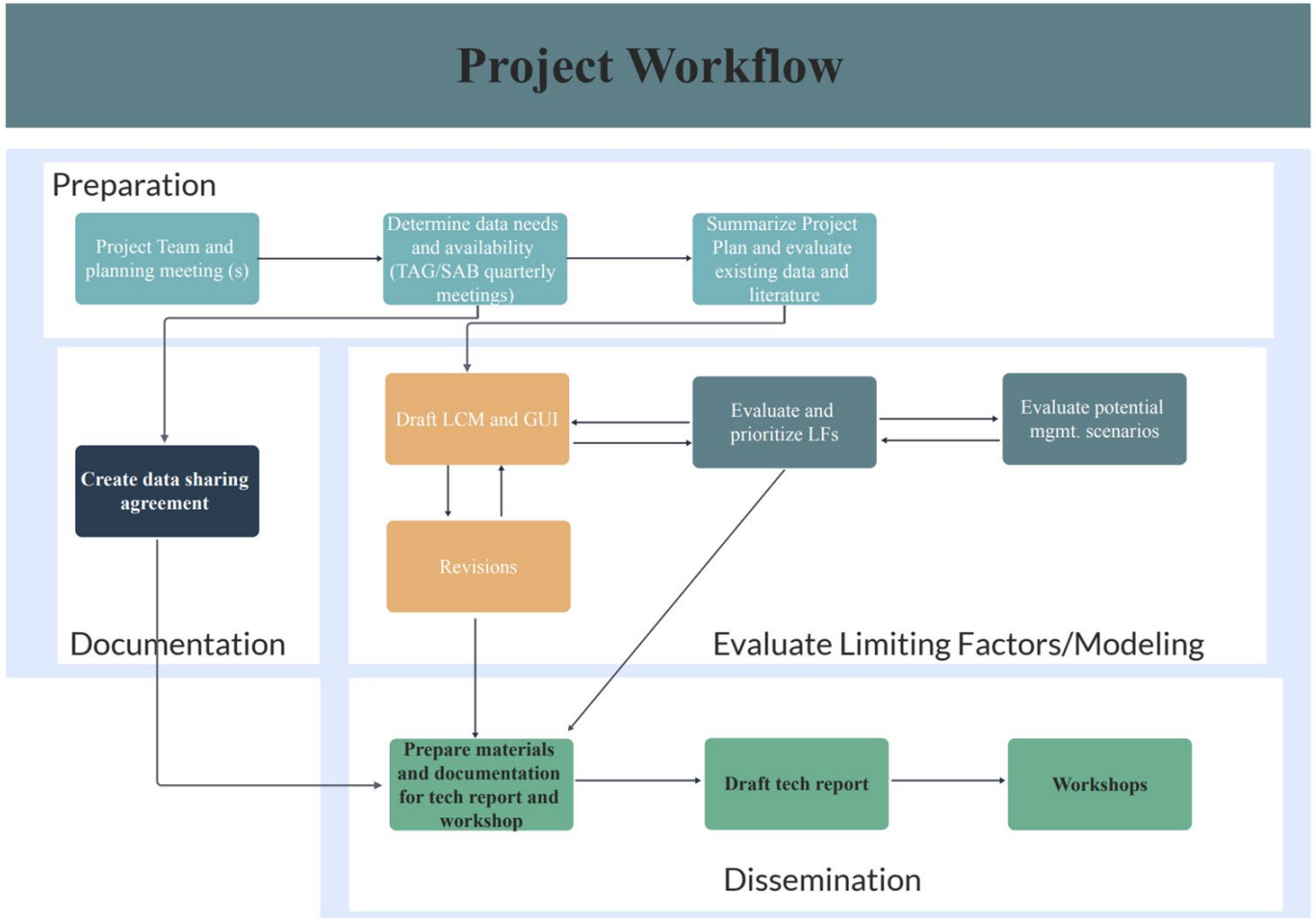
- Klamath River will be an important spatial strata for the LCM
- Numerous potential drivers and causes affecting Trinity River Chinook during Klamath River life stages
- The Klamath River dam removals are changing the system
- Acknowledge potential limitations on model applications
- Limit scope of discussions and evaluation to Trinity River Chinook

Image by Yurok Tribe

Roles and Responsibilities

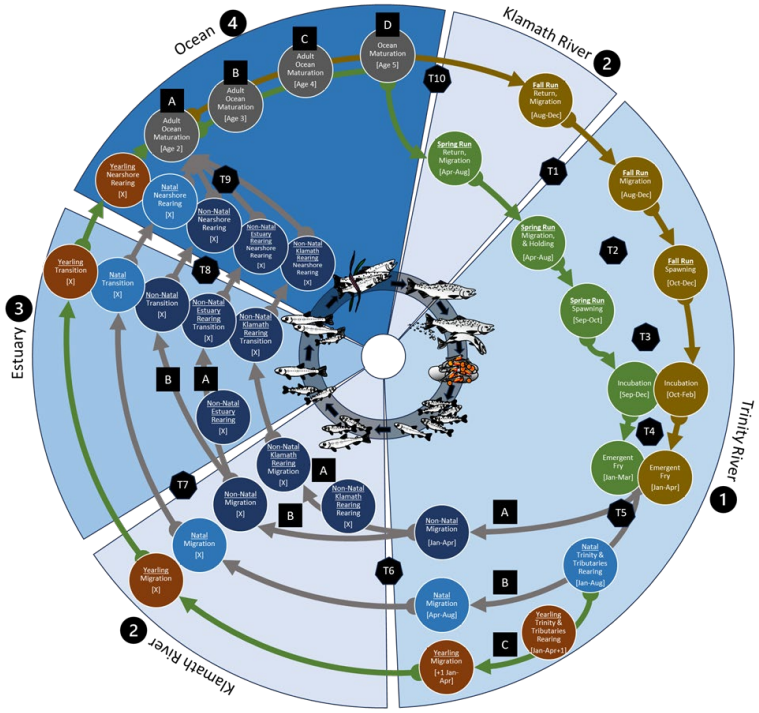
Partnership, workflow, and data requirements

- **Data requirements/resource limitations**
  - *Option 3 has highest data requirements*
  - *Task 2 is budget limited*
  - *Limited iteration built into Task 3 and 4*
- **Support from TAG, SAB, and IDT on data request will be key to success**
  - *CFS will clearly define data requests*
  - *TAG, SAB, and IDT provide data in usable format*
  - *Maximize efficiency and increase project success*



Summary of Key Data Requirements

- Phase I produced initial list of the data we should consider…
- Abundance estimates at each life stage transition (transition rates)
- Data describing drivers and causes
- Specific to life stages, life histories, and spatial/temporal periods
- Error or variance < transition rates or effect of driver



Previous Life Stage(s) & Life History(s)	Spatial Extent	Transition to Next Life Stage	Drivers	Causes
Spring-Run & Fall-Run Chinook: Adult return, migration.	Klamath River	T1	• Predation • Harvest • Disease • Pre-spawn mortality • Water quality and quantity (temperature, flow) • Habitat connectivity (thermal refugia & tributaries)	• Water quality‡ • Abundance • Fisheries management* • Predator population • Climate (change, wet/dry water year) • Water withdrawal* • Wildfire
Spring-Run Chinook: Migration & holding.	Trinity River	T2	• Predation • Harvest • Disease • Pre-spawn mortality • Habitat quantity and quality (holding) • Water quality and quantity (temperature, flow) • Habitat connectivity (thermal refugia & tributaries)	• Flow management† • Water quality† • Temperature management† • Abundance (and Hatchery management*) • Fisheries management* • Predator population • Climate (change, wet/dry water year) • Water withdrawal* • Wildfire

Questions and Feedback