Holistic Integration of Hatchery, Harvest and Habitat Management

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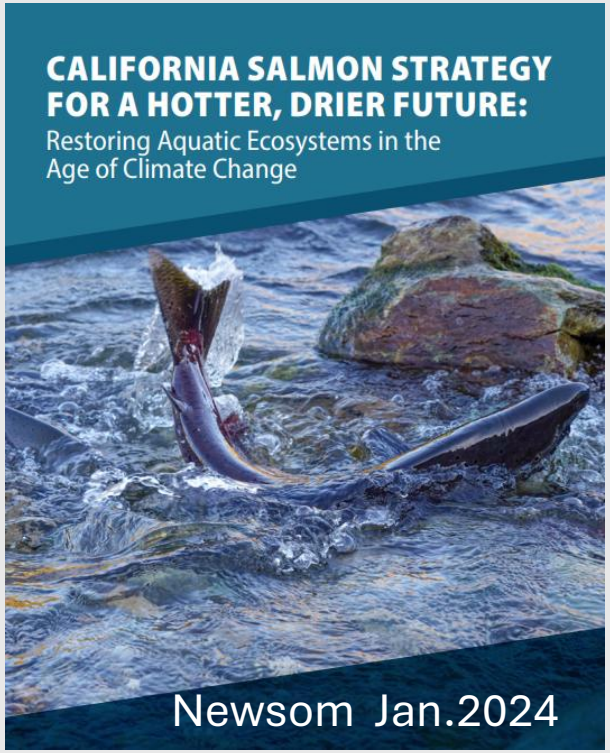
Reductionist approach to salmon management may lead to undesirable consequences.

- **Hatchery Management**
  - masks habitat decline
  - influences population genetic structure
  - leverages fisheries and/or misinforms restoration metrics
- **Harvest Management**
  - Klamath Basin wide
  - hatchery + natural origin returns
  - influenced by ESA constraints in mixed stock fisheries
- **Habitat Management**
  - focuses on survival/productivity of natural fish
  - extends to rivers, riparian, estuaries and floodplains
  - tied to reservoir operations

Principles for Integrated Salmon Management

- Central Valley Salmon, new directions
- Water-Shed Scale
- Shared Biological Metrics Across Domains
  - Natural-origin spawner abundance
  - Juvenile survival
  - Genetic Diversity
  - Habitat productivity
  - Spatial complexity
    - *Distribution of spawners*
    - *Distribution of rearing habitats*
  - Climate resilience
  - Population stability
- Climate-Informed Planning
- Adaptive Management
- Co-Management across tribal and non-tribal leadership

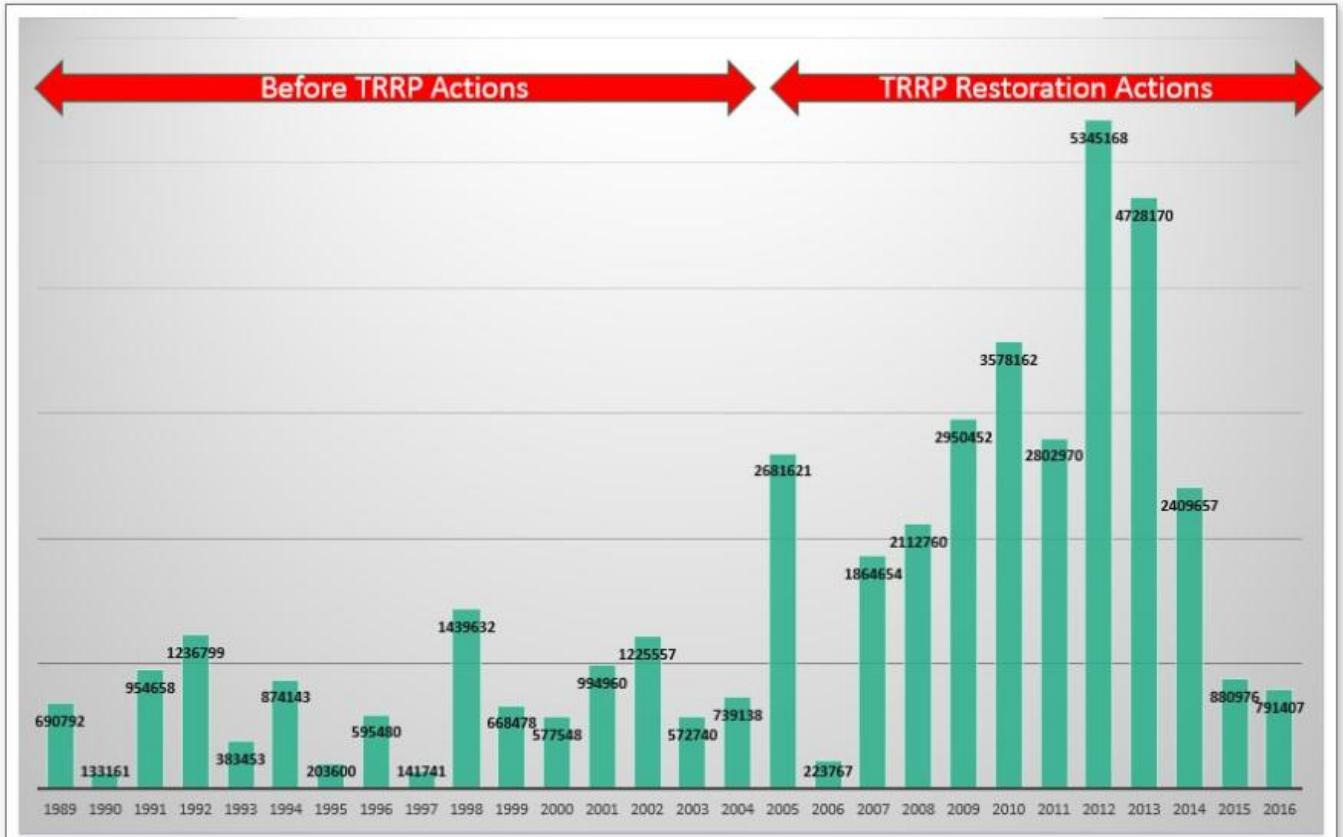


NCWA 2024

TRRP has documented positive cline in Chinook juvenile production, yet adult returns have trended downward in recent years…

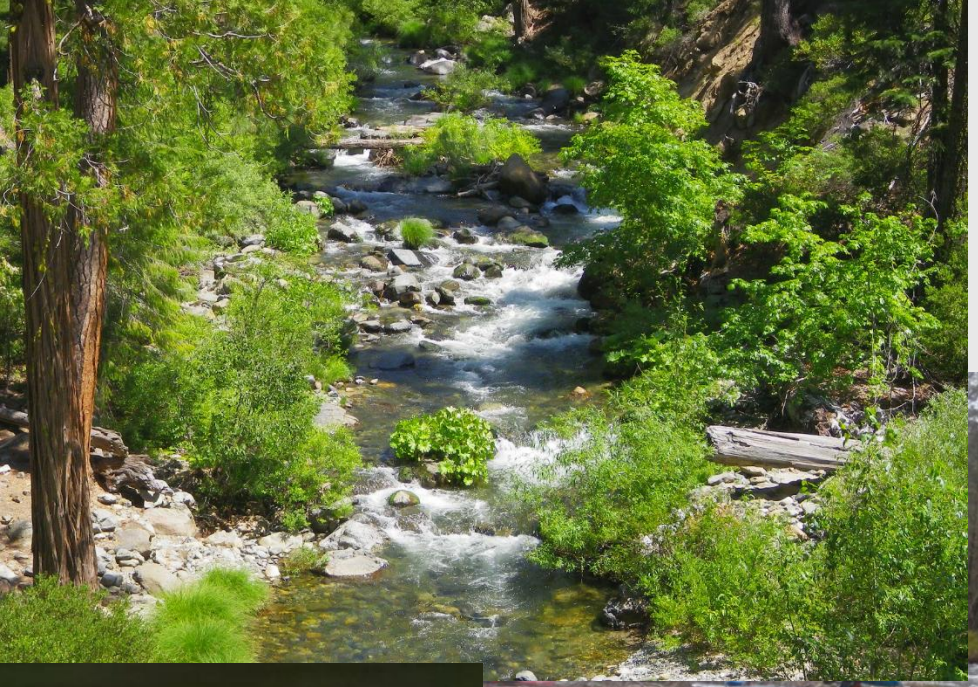
Juvenile salmonid population increasing

Although we have yet to see a clear change in the numbers of salmon that survive conditions and harvest in the Klamath River and Pacific Ocean, it is now clear that the number of young fish leaving the Trinity River has increased since establishment of the ROD.



Population estimates of naturally produced Chinook smolt outmigrants at Willow Creek screw trap site. Data show increase in the number of juveniles since restoration efforts began in 2005. From Pinnix (USFWS) unpublished data.

Fish productivity is not disconnected from a healthy river corridor and its associate riparian community. Anticipating environmental shift informs climate informed planning.



Other systems face similar challenges in restoring the past...

Vanishing whitefish, an integral part of Odawa, Ojibwe, Anishinaabe culture in Michigan, tied to invasive species, change in water clarity, parasitic lamprey, habitat degradation, aging fish...

How resilient are systems to environmental change?

the manchester mirror
reflecting the community of Manchester since 2013

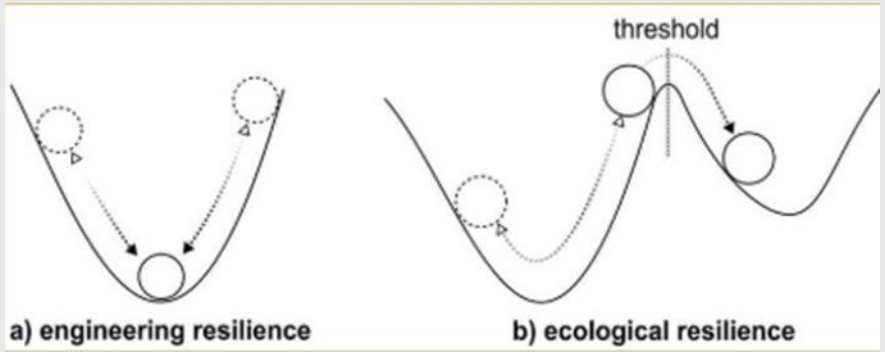
Added on May 15, 2023 — Sara Swanson

Anishinaabe tribes work to save Michigan whitefish

Lake whitefish on ice. The popular fish's reproduction rates declined to the point there's concern about whether commercial fishing will be viable in the future. (Courtesy of Michigan Sea Grant)

by Lester Graham, Michigan Radio (Bridge Michigan)

Commercial fishers are catching fewer whitefish in parts of the Great Lakes — and the Anishinaabe people are trying to figure out why. The Little Traverse Bay Bands of Odawa Indians is looking into low reproduction rates for the fish.



Resilience

- Engineering resilience (C.S. Holling 1996) like a bridge, maintain status quo

- Social-Ecological System trajectories determined by resilience, adaptation and transformation, (Walker et al 2004)

Fig. 1a. Three-dimensional stability landscape with two basins of attraction showing, in one basin, the current position of the system and three aspects of resilience, L = latitude, R = resistance, Pr = precariousness.

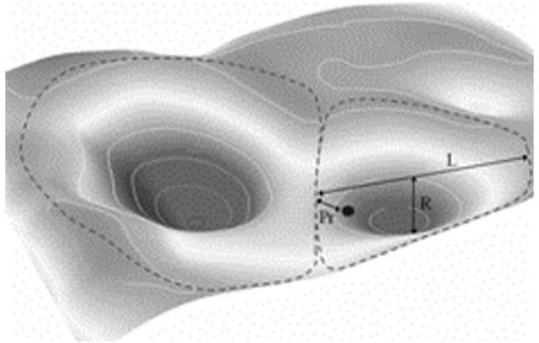
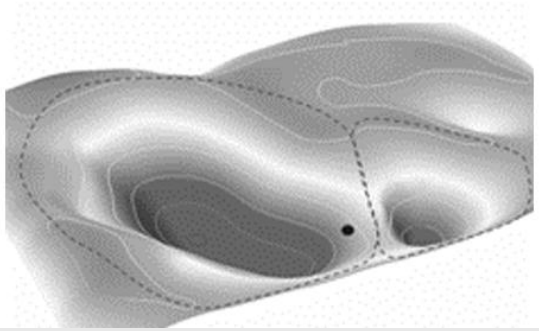
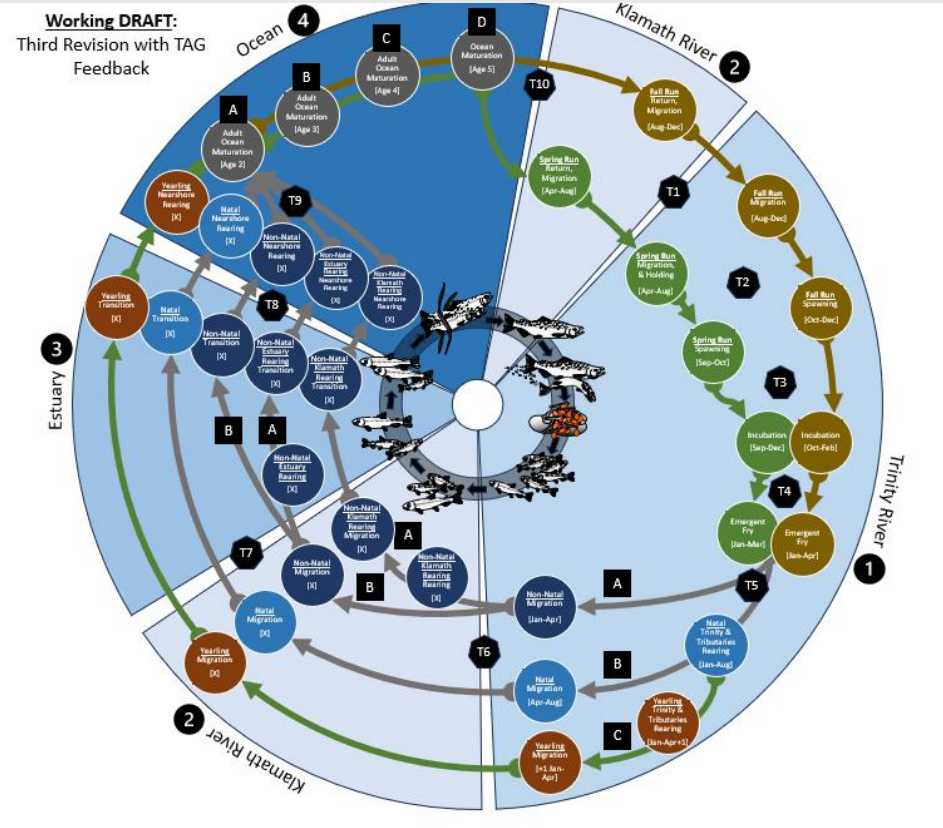
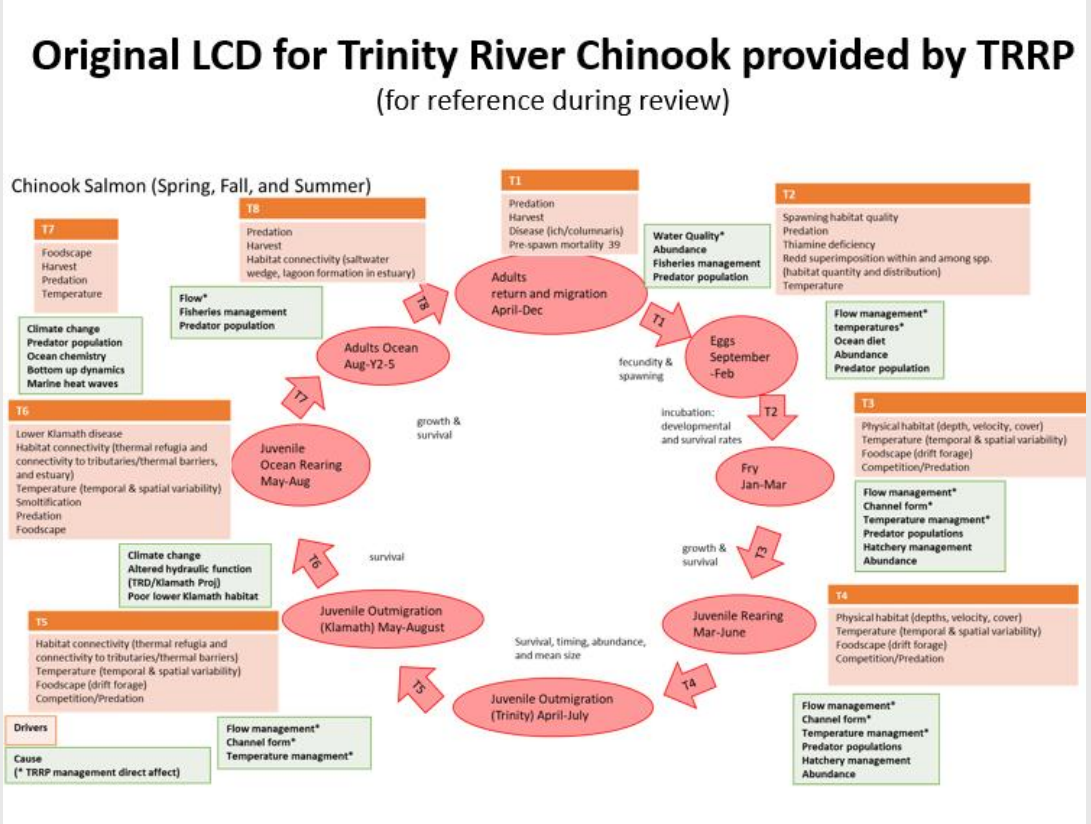


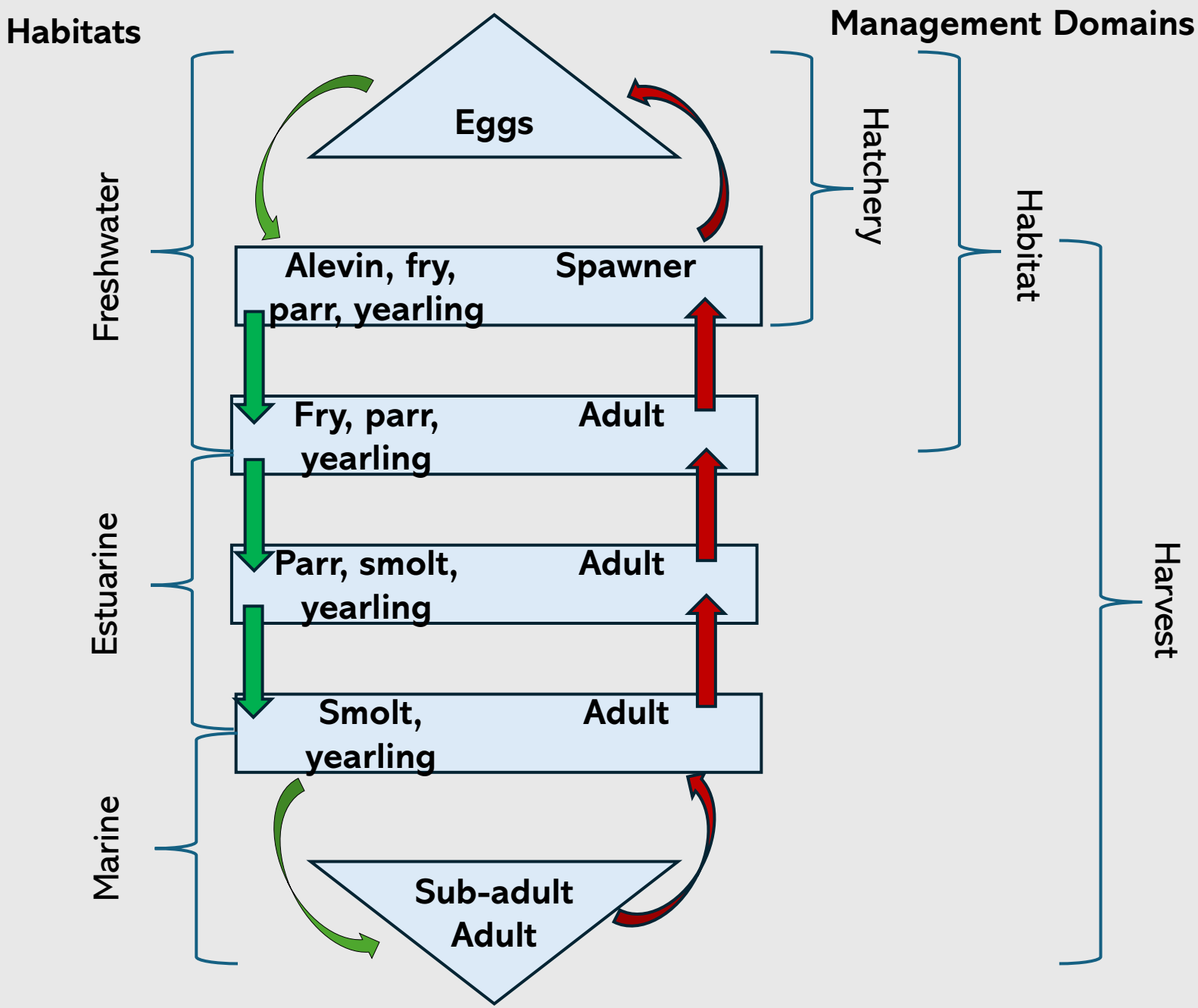
Fig. 1b. Changes in the stability landscape have resulted in a contraction of the basin the system was in and an expansion of the alternate basin. Without itself changing, the system has changed basins.







- **TRRP's Limiting Factors Analysis**
  - **Outward looking**
  - **A candidate platform for evaluating management interactions (habitat, hatchery and harvest)**



Salmon life stages are transitory, affected by multiple management domains and respond to cumulative conditions and cannot be managed in isolation

Toward Integration

- Goal Statement
  - *"Collaborate across hatchery, harvest, and habitat management domains to promote complementary actions for improving Trinity River salmon and steelhead abundance, diversity, and eco-system resilience for the benefit of dependent fisheries."*
- White paper, in progress (emphasis on co-manager participation)
- Governance structure
- Formalize interaction of TRRP and TRH through Hatchery Technical Team
  - Consistent participation, in both directions, pairing appropriate skill sets to the task
  - TRH release coordination with TRRP flow planning
  - Other examples of where TMC has authority and TRH could assist?
    - E.g., mixed hatchery-/natural-origin spawning in natural areas adjacent TRH
- Familiarity with Harvest Management and how it potentially affects TRRP goals

Fisheries Harvest Management

- Focus on Klamath Basin Fall Chinook and Coho Salmon
- Monitoring marine and freshwater areas
  - Marine recreational and commercial harvest
  - Freshwater
    - *Harvest tribal/non-tribal*
    - *Natural area spawning*
    - *Hatchery spawning*
- Ocean abundance forecast (fall Chinook)
- Conservation
- Harvest

- Discussion?