Life Cycle Monitoring for Central Valley Salmonids: What do we need to know and how will we know it?

Bradley Cavallo
Cramer Fish Sciences
• Knights Landing Rotary Screw Trap
• Sacramento Trawl
• Mossdale Trawl
• Chipps Island Trawl
Delta Juvenile Monitoring

- Knights Landing Rotary Screw Trap
- Sacramento Trawl
- Mossdale Trawl
- **Chipps Island Trawl**
Analysis of trawl efficiency at Chipps Island using coded-wire-tagged releases of juvenile Chinook salmon

Absolute abundance estimates of juvenile spring-run and winter-run Chinook salmon at Chipps Island

by

Brian Pyper, Tommy Garrison, and Steve Cramer
Cramer Fish Sciences

Pat Brandes
United States Fish and Wildlife Service

David P. Jacobson and Michael A. Banks
Coastal Oregon Marine Experiment Station
Department of Fisheries & Wildlife, OSU

http://deltacouncil.ca.gov/scienceprogram/projects/estimating-juvenile-chinook-salmon-spring-and-winter-run-abundance-chipps-is
Efficiency Estimate

0.000 0.004 0.008 0.012


Jersey Point
Figure 8. Abundance estimates of winter-run juvenile Chinook salmon at Chipps Island by sample year for four different estimates of trawl efficiency (abundance estimates based on corrected DNA assignments).
• Delta juvenile salmonid abundance estimates are problematic
• Should such estimates be a priority?
Winship et al. 2014. Fishery and hatchery effects on an endangered salmon population with low productivity. Transactions of the American Fishery Society.


Sacramento winter-run Chinook

Stanislaus fall-run Chinook
• Possible to estimate juvenile abundance in rivers
• Reliable trap efficiency data needed
Spawning Escapement
Majority of salmon spawn in natural areas

![Graph showing number of fall-run salmon spawners over the years, with two categories: Hatchery spawners (cyan) and In-river spawners (yellow). The graph highlights the significant numbers of salmon that spawn in natural areas, with peaks indicating high spawner numbers in certain years.](image-url)
Hatchery origin salmon spawning in-river?

2010

Clear Creek: 60% Hatchery origin, 40% Natural origin

Butte Creek

Upper Sacramento

Feather River

Yuba River

American River

Mokelumne River

Stanislaus River

Tuolumne River

2011

Clear Creek

Upper Sacramento

Yuba River

American River

Mokelumne River

Stanislaus River

Tuolumne River

Cottonwood Creek: 70% Hatchery origin, 30% Natural origin

Butte Creek

Feather River
Ocean Harvest Monitoring
California Ocean Chinook Harvest
Central Valley Hatcheries
2010-13, n=54,972

- Fall: 90.0%
- Late Fall: 3.3%
- Spring: 6.4%
- Winter: 0.2%

49,475 hatchery fall Chinook!
Spawning Escapement
Juvenile Emigration
Ocean Harvest Monitoring
Delta Juvenile Monitoring
What can we know?

For each tributary monitored, for hatchery and natural origin components within each tributary:

- Juvenile Chinook salmon production
- Reproductive success (recruits per spawner)
- Smolt-to-adult (SAR) returns
- Survival to Delta
- Survival to ocean fishery recruitment
- Ocean distribution and harvest exploitation rate
How will we know it?

**Spawning Escapement Surveys:**

- With 100% marking (or tagging) of hatchery produced fall Chinook
- Collect tissues samples from known hatchery or natural origin salmon
- Genetics for Parental Based Tagging
How will we know it?

Juvenile Emigration:

- Modify rotary screw traps to improve efficiency to >10%
- Utilize increased catch for more trap efficiency experiments
- Utilize increased catch for telemetric studies
- Collect tissues samples from subsample of fish encountered in rotary screw traps
  - Use genetics (parental based tagging) to estimate population metrics
How will we know it?

Delta Juvenile Monitoring:

• Estimate tributary to Delta survival by tagging *natural origin* fish captured in rotary screw traps
• Collect tissues samples from subsample of fish encountered in Delta trawls, seines or export salvage
  • Use genetics (parental based tagging) to identify tributary of origin (and race)
How will we know it?

Ocean Harvest Monitoring:

- Continue to sample 20% of all Chinook salmon harvested
- Reallocate effort from collecting hatchery fall Chinook coded wire tags, to collecting tissue samples from natural origin Chinook
- Use genetics (parental based tagging) to identify tributary of origin and race for harvested Chinook
  - And to estimate population parameters of interest
What’s stopping us?

- Silos
- Hard to see the big picture
- Scientific Collection and Take Permits
- Inertia from existing programs
Deep Thought

We tend to view all our monitoring challenges as statistical problems.

But, improved biological sampling will often yield better results than the application of more advanced statistical techniques.
Control access to spawning grounds (pHOS), collect wild origin fish for hatchery broodstock (pHOB), collect tissue samples for genetics.
Help develop and implement new harvest management strategies

- Expanded genetic monitoring
- Mark-selective: harvest only hatchery fish, release others
What do we need to do?

• Need more and better outreach to decision makers so that they will support solutions
• Need Central Valley demonstration projects
• Need to develop ways to “process” fish at weirs that minimize potential for stress and delay
• Need CFS staff to help with all the above, pursue leads, and provide great deliverables to existing hatchery projects!
Figure 4. Boxplots of survival-rate estimates (A) and efficiency estimates (B) for upstream releases across the 40 candidate control groups (Table 2).
Hatchery-origin fish return to hatcheries

2010

Fall run Chinook salmon escapement to hatcheries

Data source: Kormos et al. 2013, Palmer-Zwahlen & Kormos. 2013
Cohort replacement rates of natural populations

![Graph showing cohort replacement rates over time with categories for growth, replacement, and decline.](image)