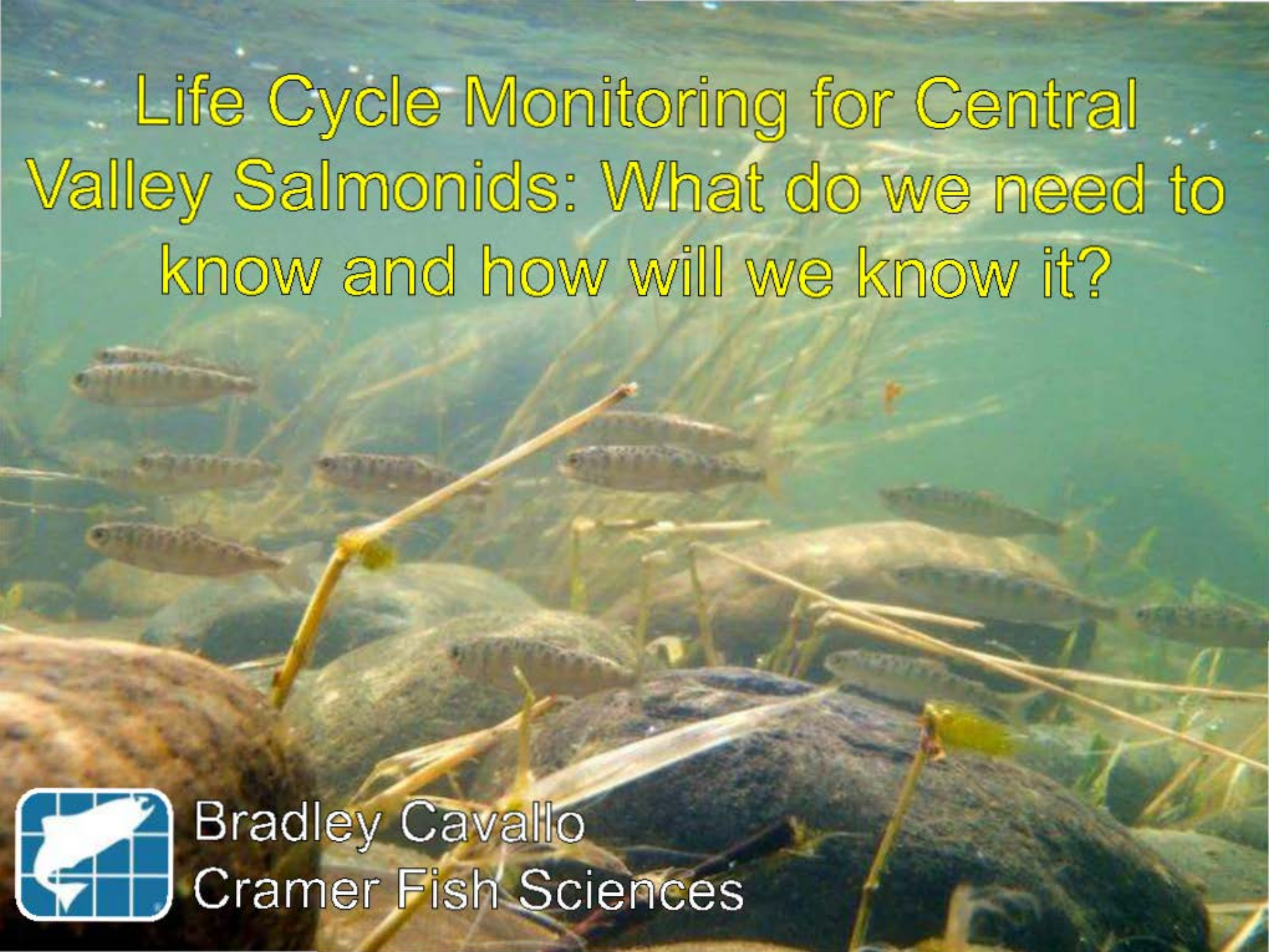
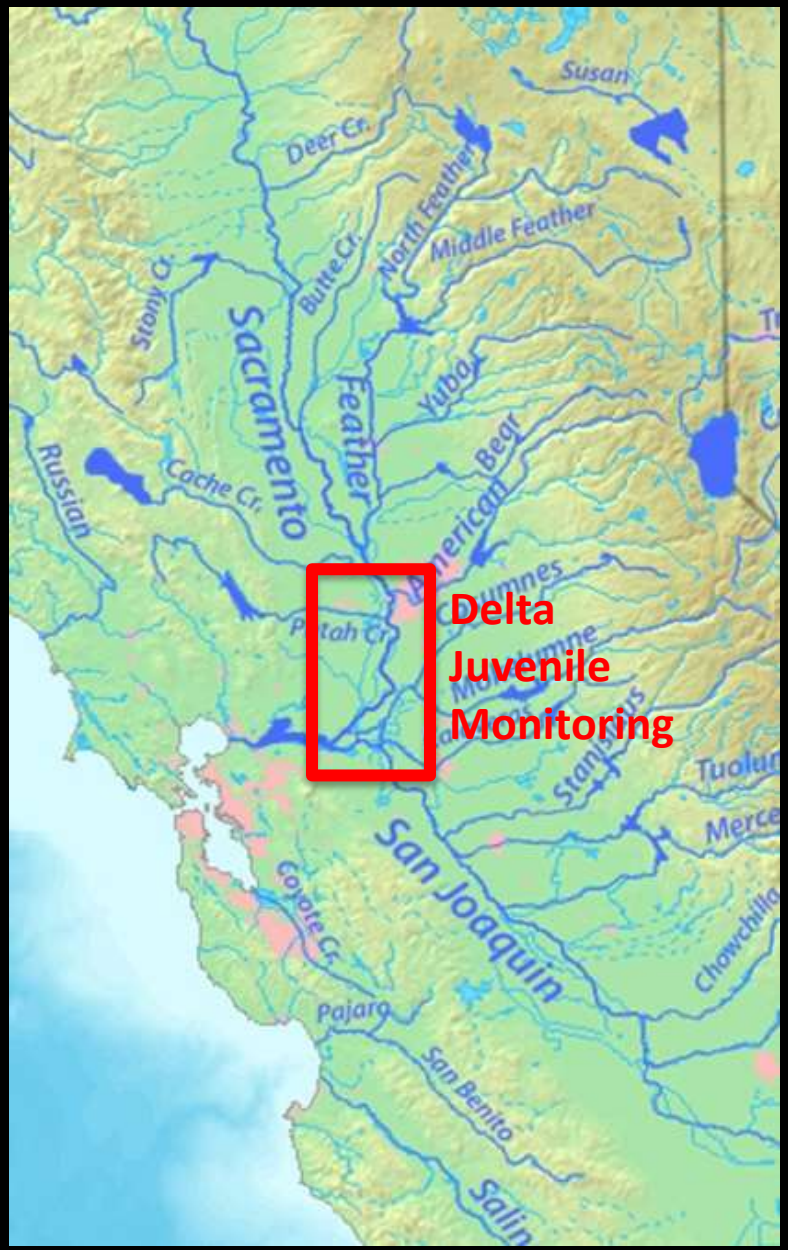
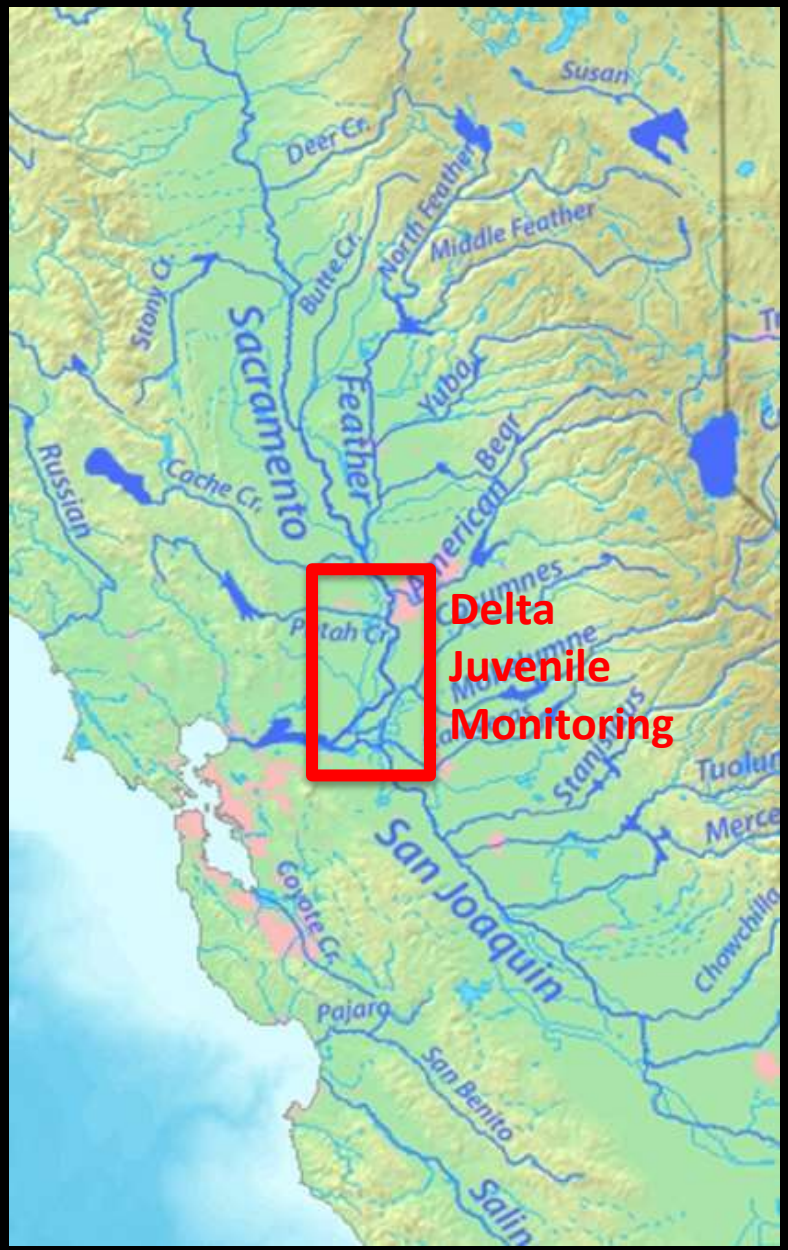


Life Cycle Monitoring for Central Valley Salmonids: What do we need to know and how will we know it?

Bradley Cavallo
Cramer Fish Sciences



- Knights Landing Rotary Screw Trap
- Sacramento Trawl
- Mossdale Trawl
- Chipps Island Trawl



- 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

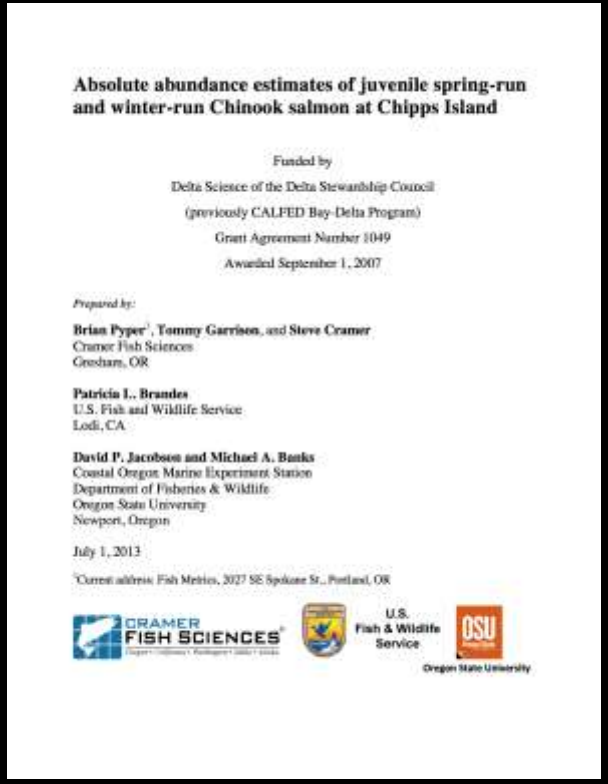
Absolute abundance estimates of juvenile spring-run and winter-run Chinook salmon at Chipps Island

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



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

Funded by

Delta Science of the Delta Stewardship Council

(previously CALFED Bay-Delta Program)

Grant Agreement Number 1049

Awarded September 1, 2007

Prepared by:

Brian Pyper[1], **Tommy Garrison**, and **Steve Cramer**
Cramer Fish Sciences
Gresham, OR

Patricia L. Brandes
U.S. Fish and Wildlife Service
Lodi, CA

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

July 1, 2013

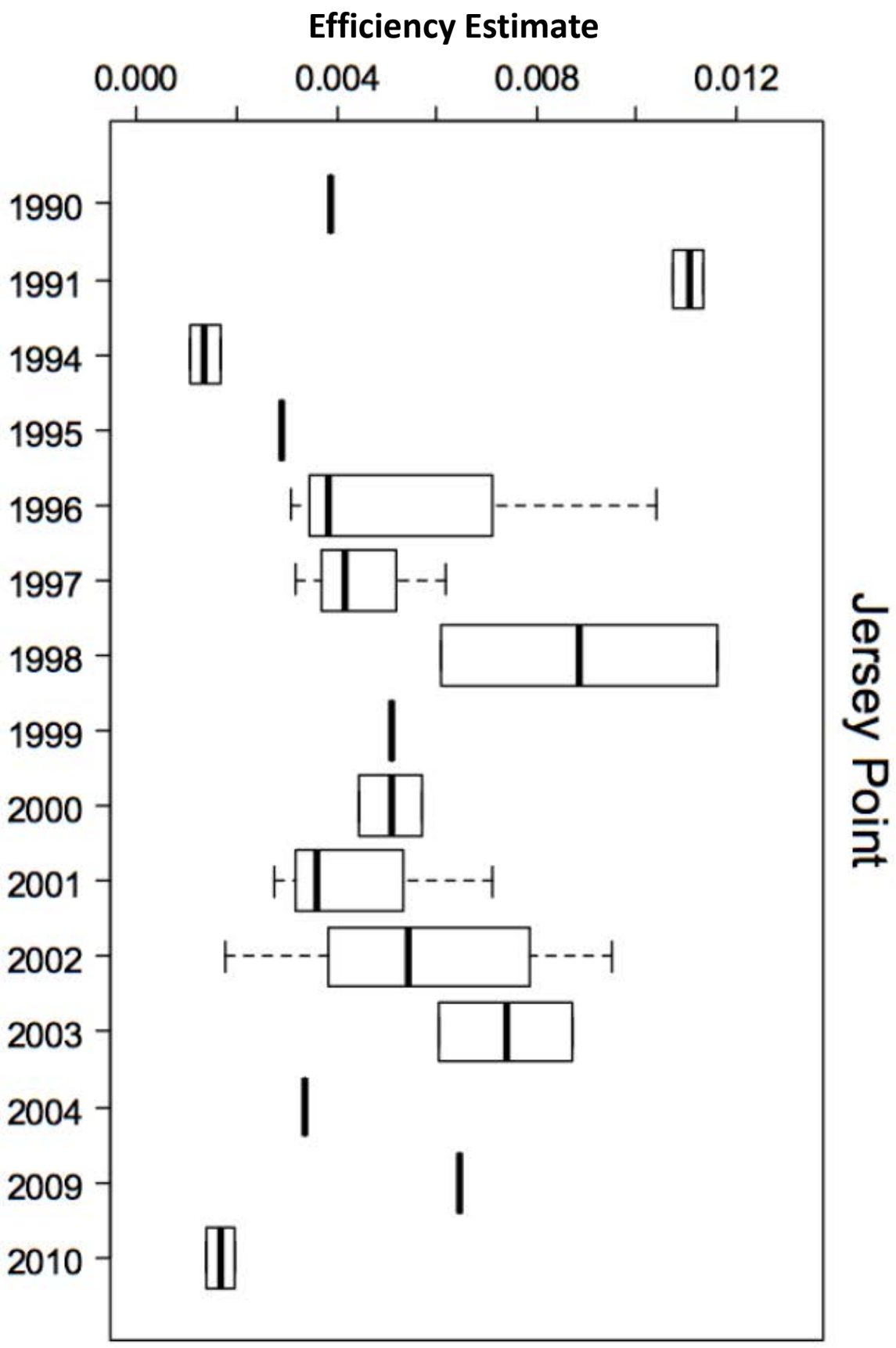
[1]Current address: Fish Metrics, 2027 SE Spokane St., Portland, OR

CRAMER FISH SCIENCES

U.S. Fish & Wildlife Service

OSU Oregon State University

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



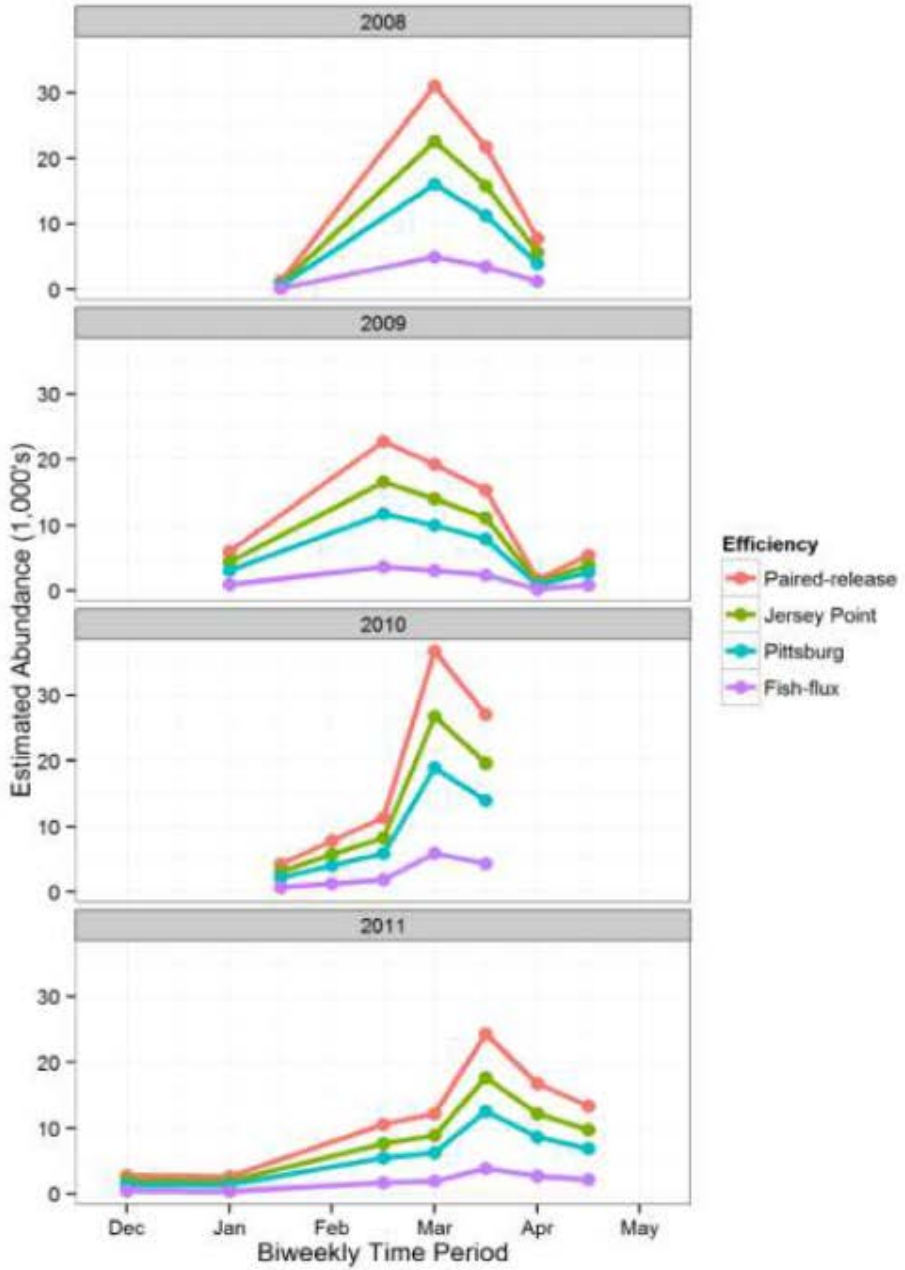
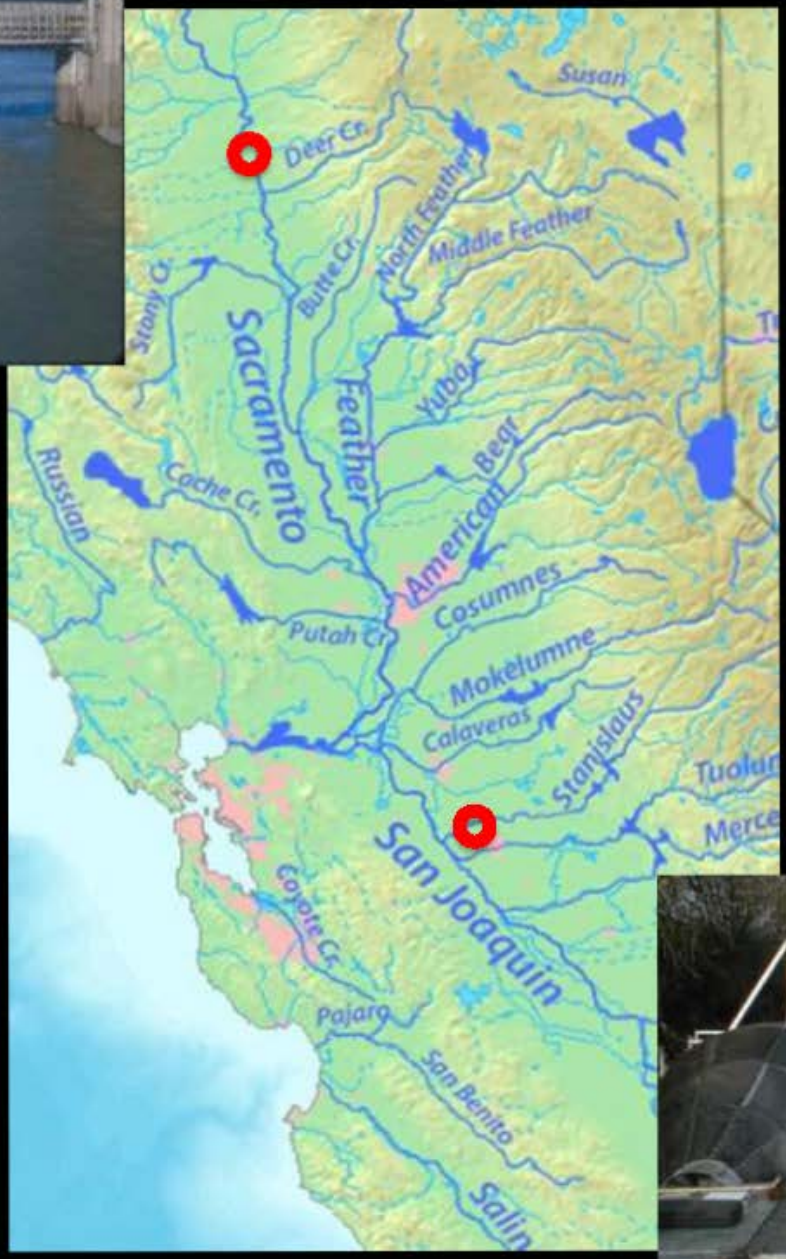


Figure 8. Abundance estimates of winter-run juvenile Chinook salmon at Chipps Island by sample year for four different estimates of trawl efficiency (abundance estimates based on corrected DNA assignments).

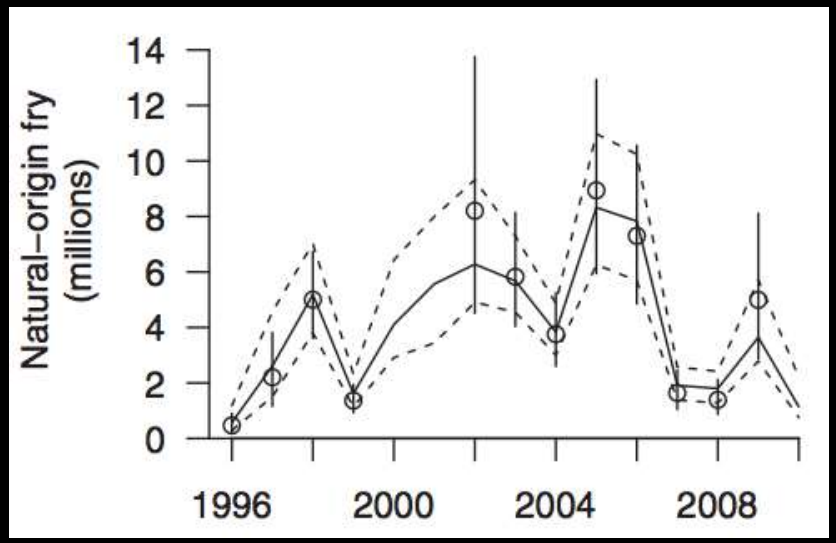
- **Delta juvenile salmonid abundance estimates are problematic**
- **Should such estimates be a priority?**


Susan
Deer Cr.
North Feather
Middle Feather
Butte Cr.
Stony Cr.
Sacramento
Feather
Yuba
Bear
American
Russian
Cache Cr.
Cosumnes
Putah Cr.
Mokelumne
Calaveras
Stanislaus
San Joaquin
Coyote Cr.
Pajaro
San Benito

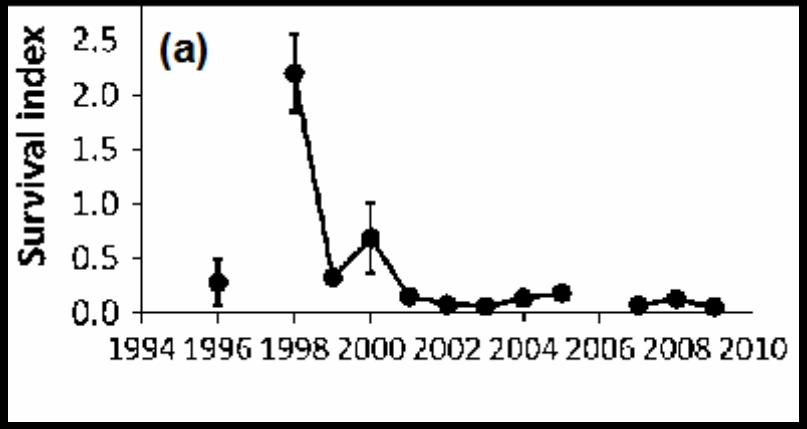

Caswell 1/8/00 10:34am

Winship et al. 2014. Fishery and hatchery effects on an endangered salmon population with low productivity. Transactions of the American Fishery Society.

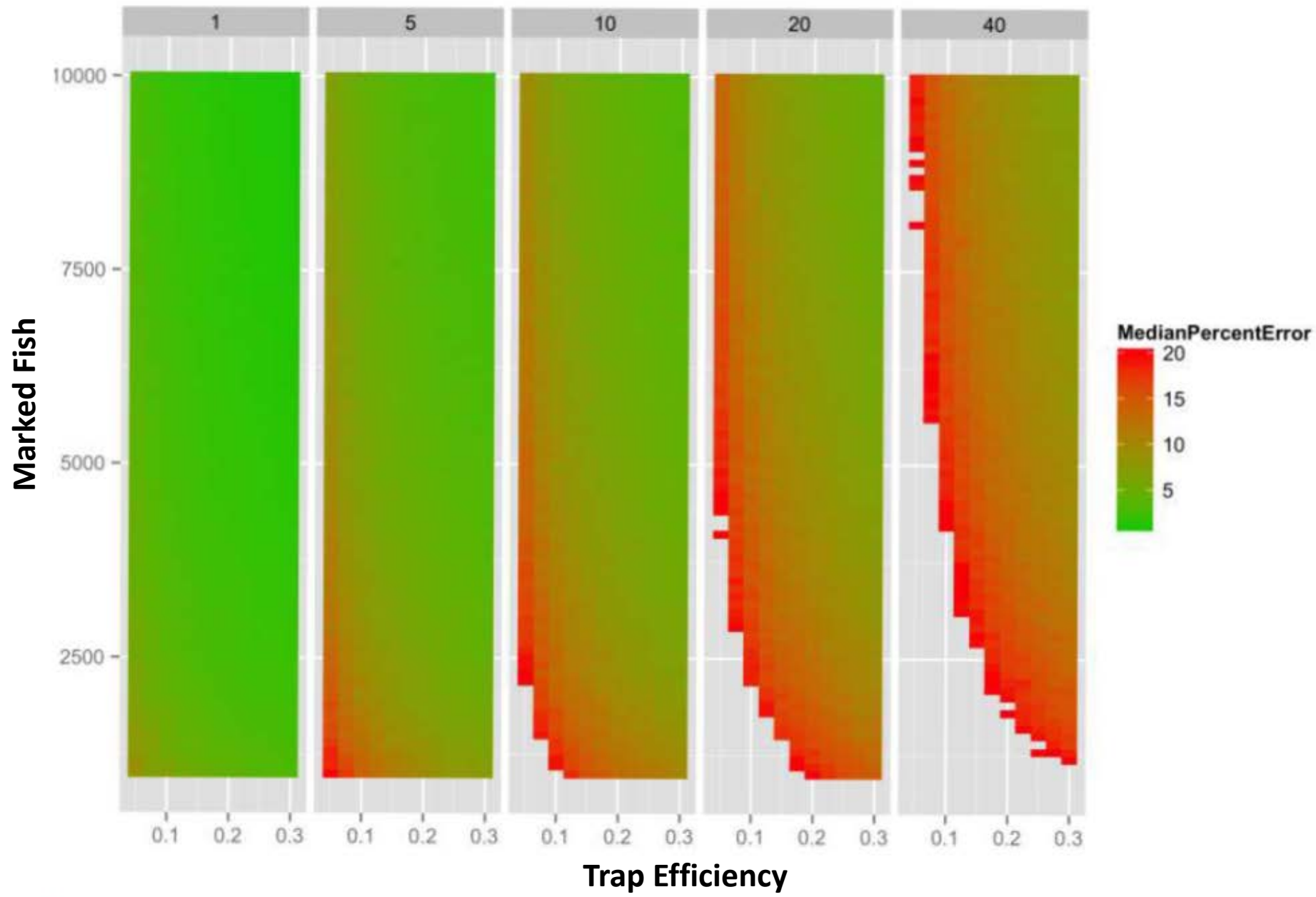
Sacramento winter-run Chinook



Stanislaus fall-run Chinook



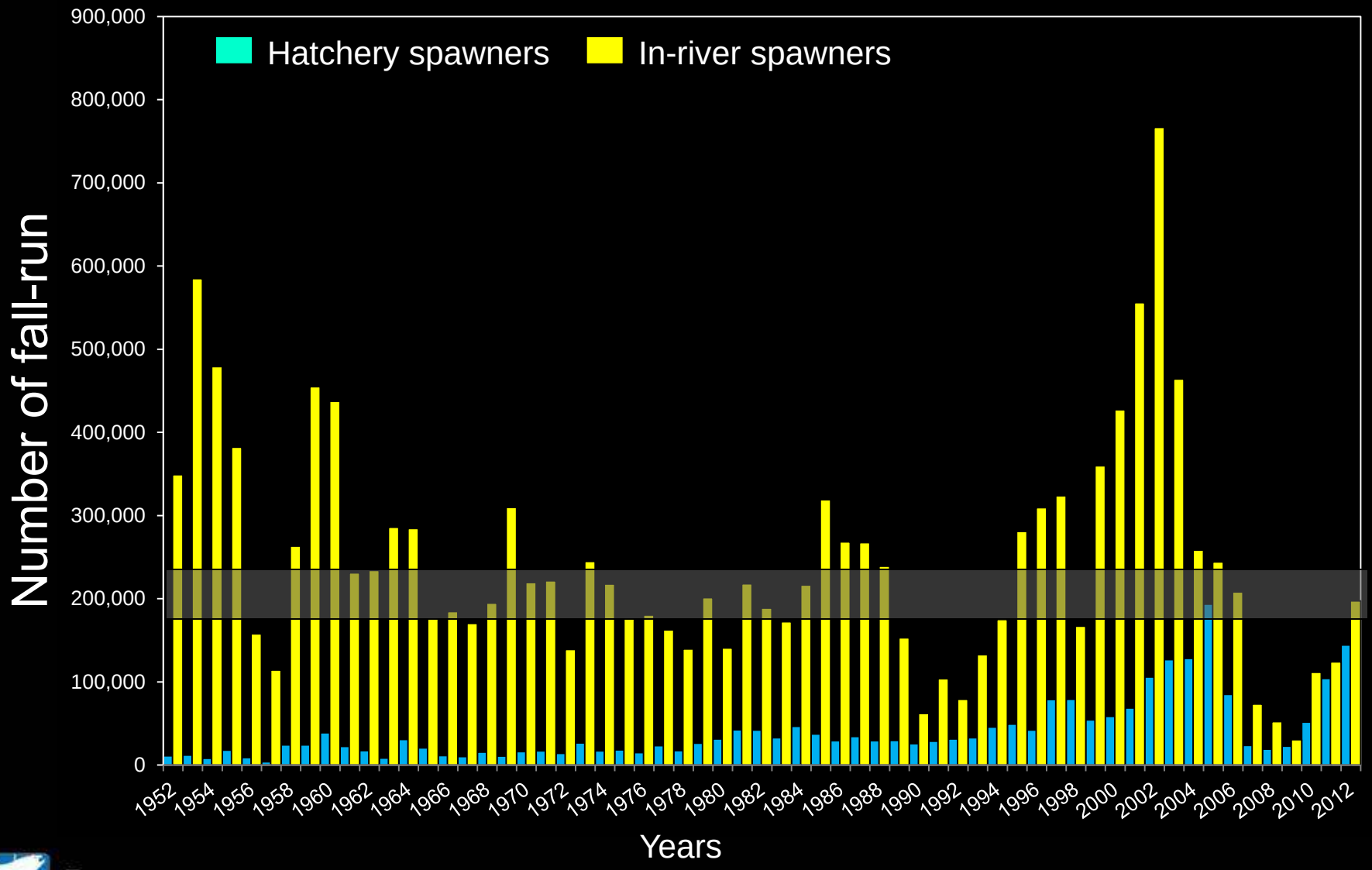
Zeug et al. (2013) Response of juvenile Chinook salmon to managed flow: lessons learned from a population at the southern extent of their range in North America . Fisheries Management and Ecology.


1
5
10
20
40
10000
7500
5000
2500
Marked Fish
0.1
0.2
0.3
Trap Efficiency
MedianPercentError
20
15
10
5

- **Possible to estimate juvenile abundance in rivers**
- **Reliable trap efficiency data needed**

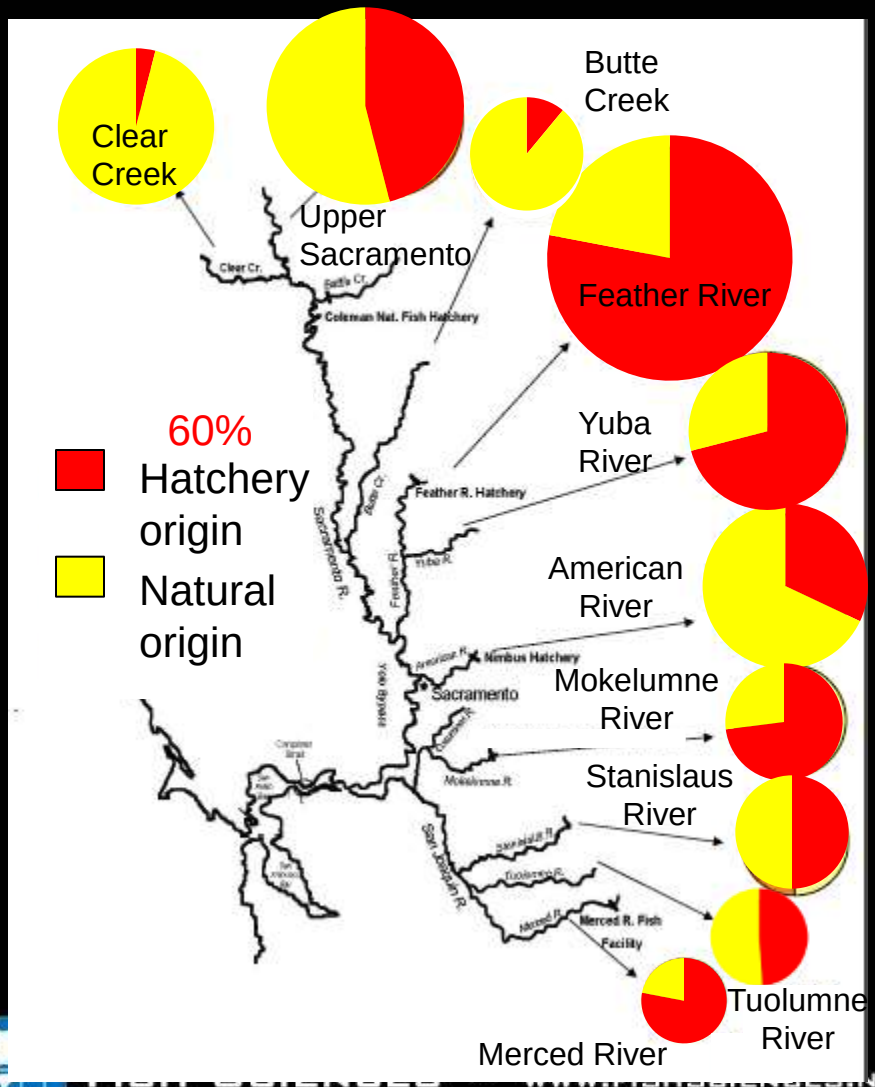

Spawning Escapement
Susan
Deer Cr.
North Feather
Middle Feather
Butte Cr.
Stony Cr.
Sacramento
Feather
Yuba
Bear
American
Russian
Cache Cr.
Cosumnes
Putah Cr.
Mokelumne
Calaveras
Stanislaus
San Joaquin
Coyote Cr.
Pajaro
San Benito

Majority of salmon spawn in natural areas

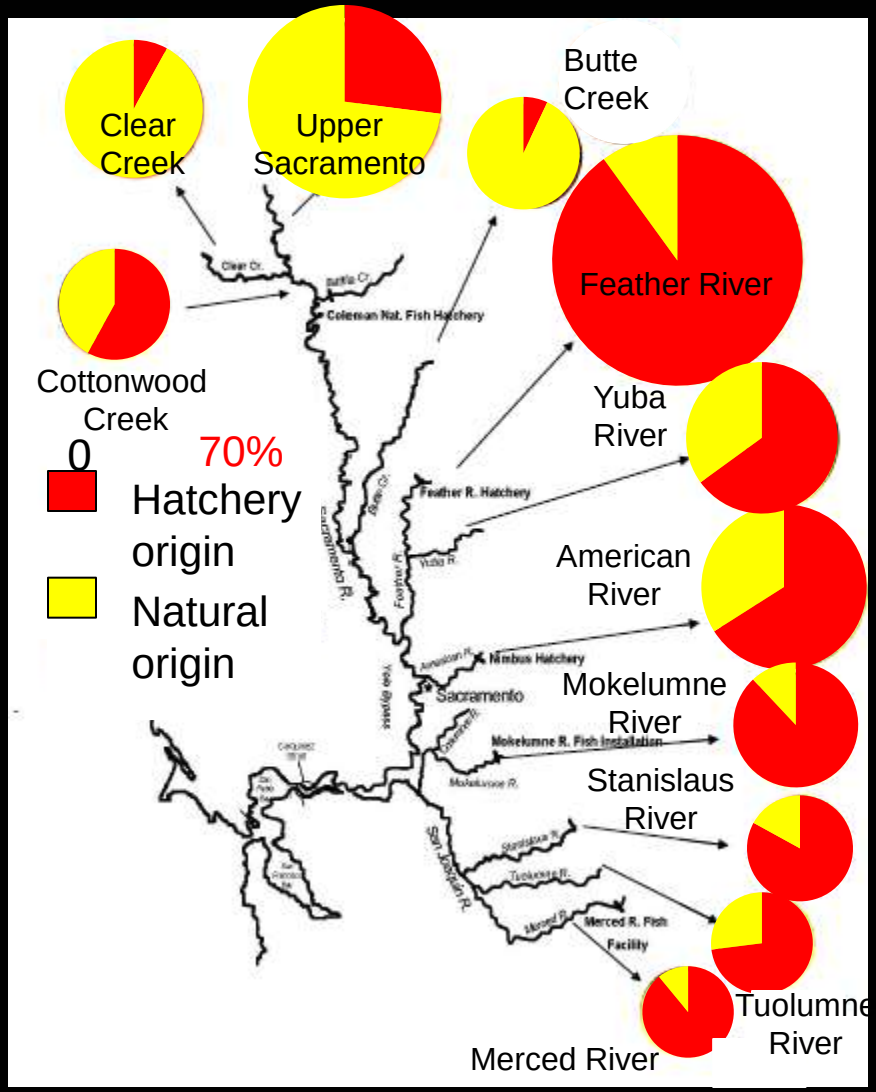


Hatchery origin salmon spawning in-river?

2010



2011

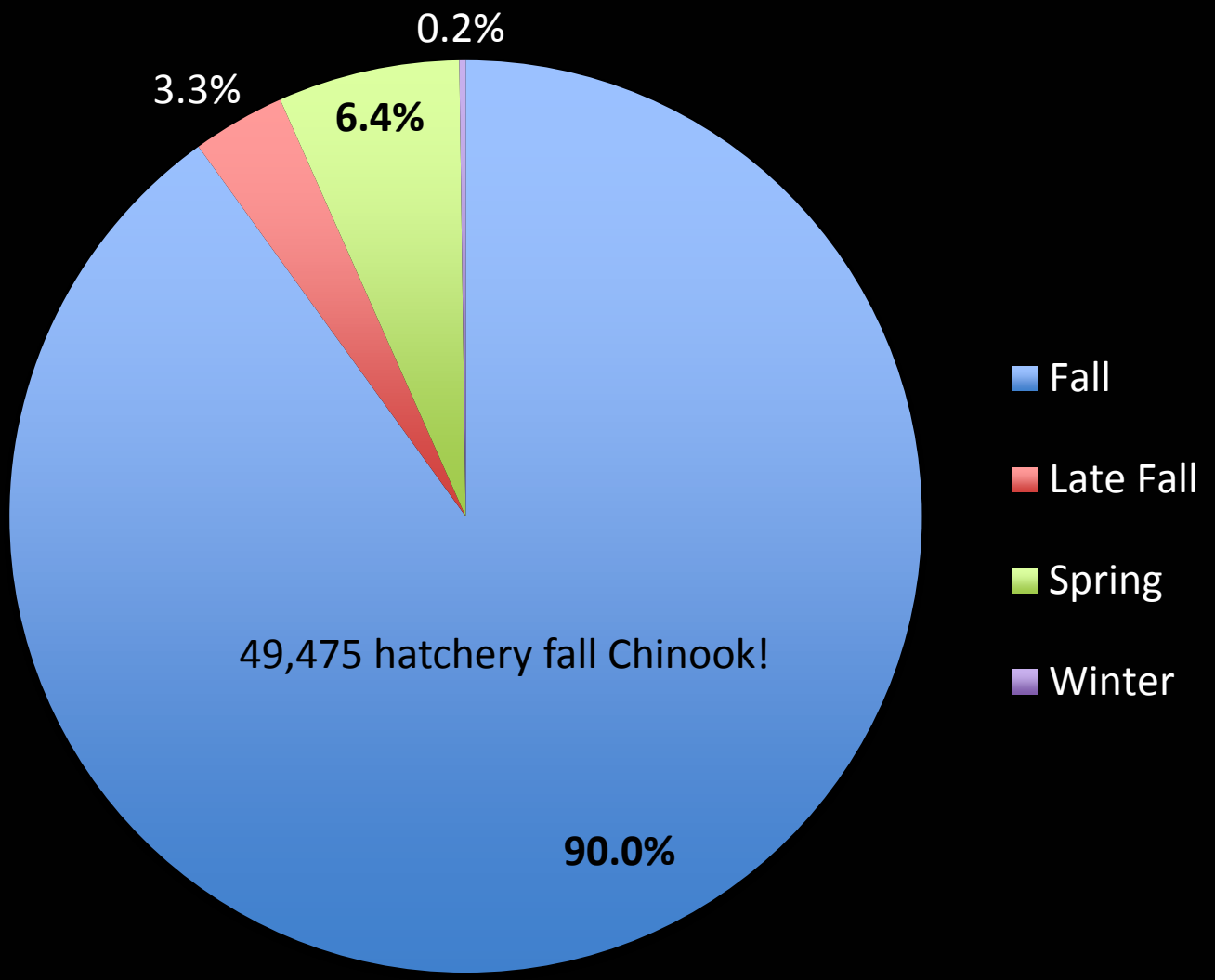


Ocean
Harvest
Monitoring

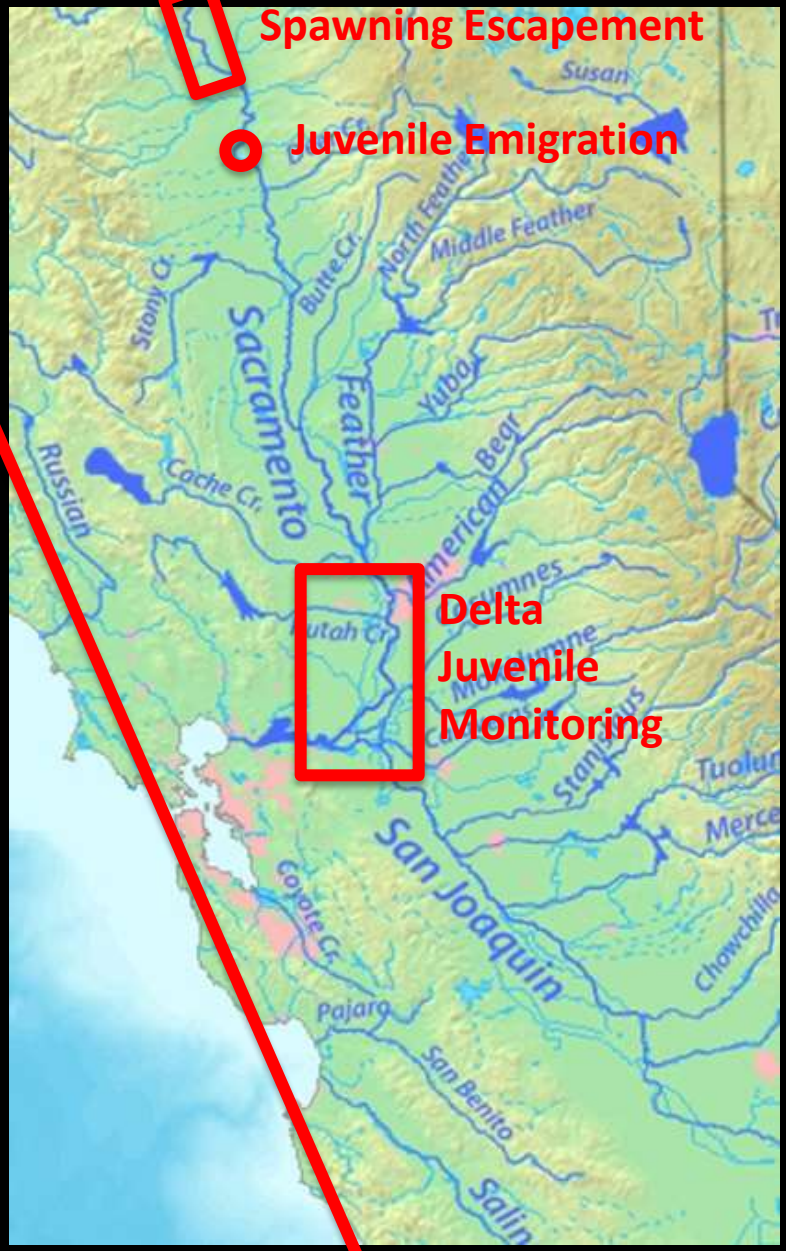
California Ocean Chinook Harvest

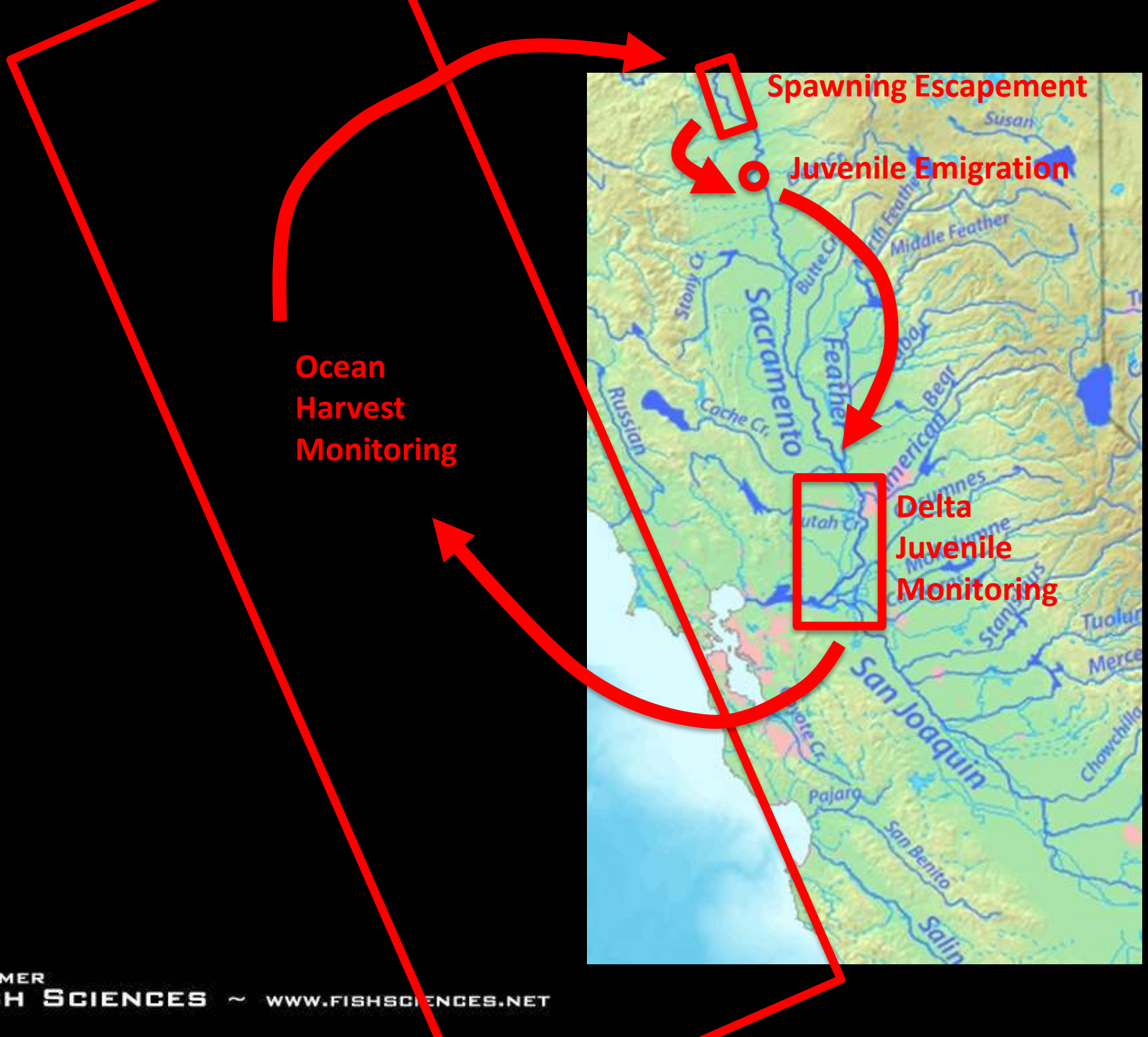
Central Valley Hatcheries

2010-13, n=54,972



Ocean
Harvest
Monitoring




Spawning Escapement
Juvenile Emigration
Ocean
Harvest
Monitoring
Delta
Juvenile
Monitoring
Sacramento
Feather
Middle Feather
Stony Cr.
Butte Cr.
Cache Cr.
Russian
Susan
Yuba
Bear
American
Mokelumne
Stanislaus
San Joaquin
Pajaro
San Benito

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 scew 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!

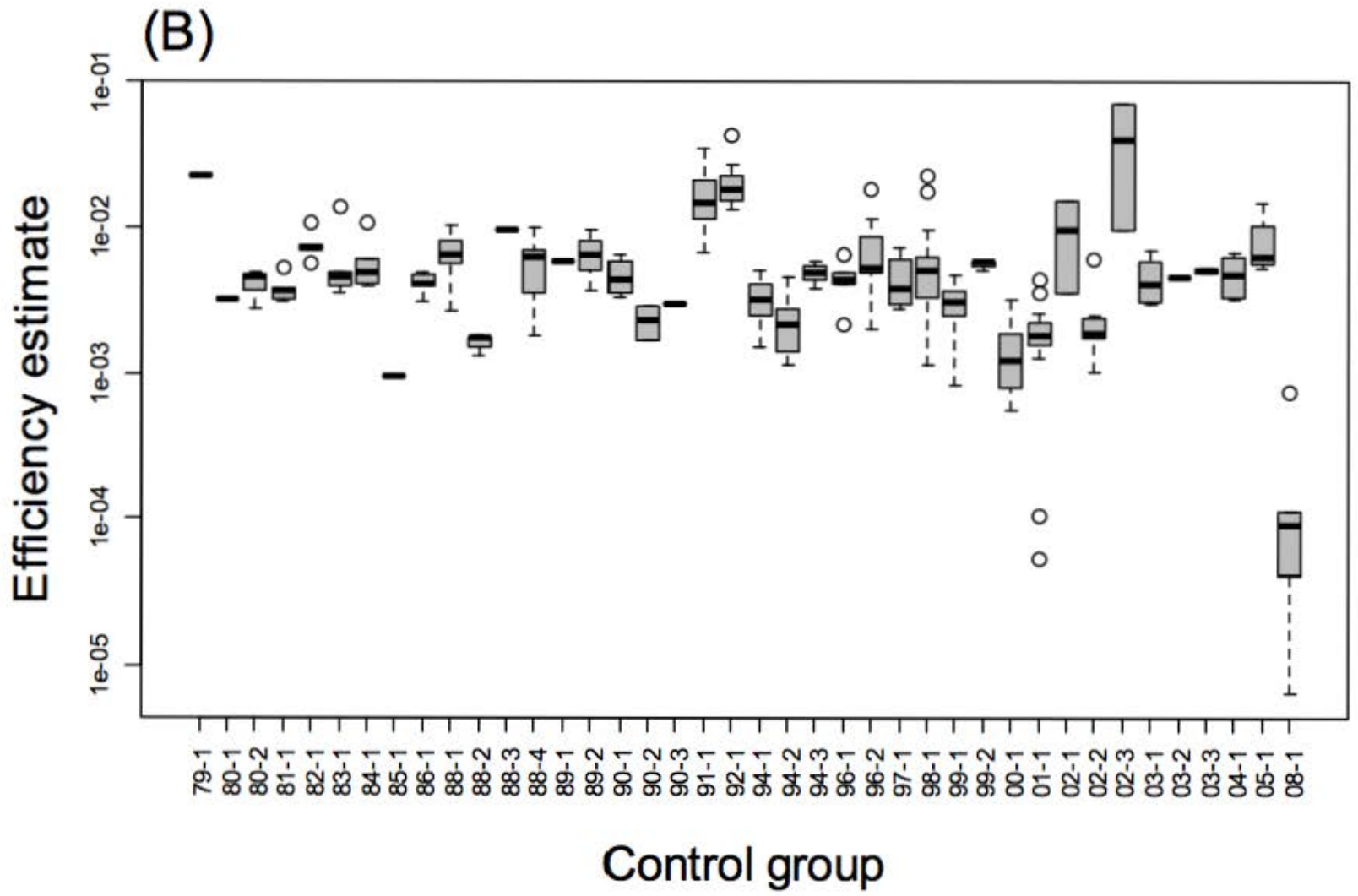
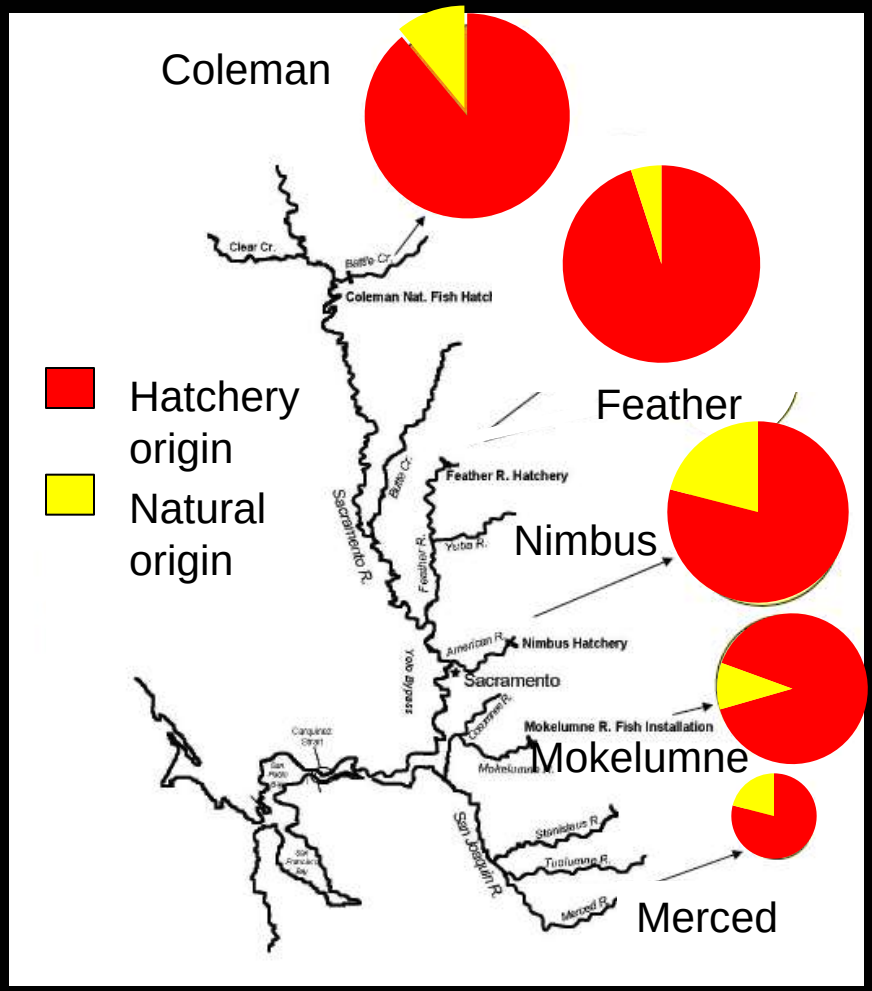


Figure 4. Boxplots of survival-rate estimates (A) and efficiency estimates (B) for upstream releases across the 40 candidate control groups (Table 2).

Hatchery-origin fish return to hatcheries

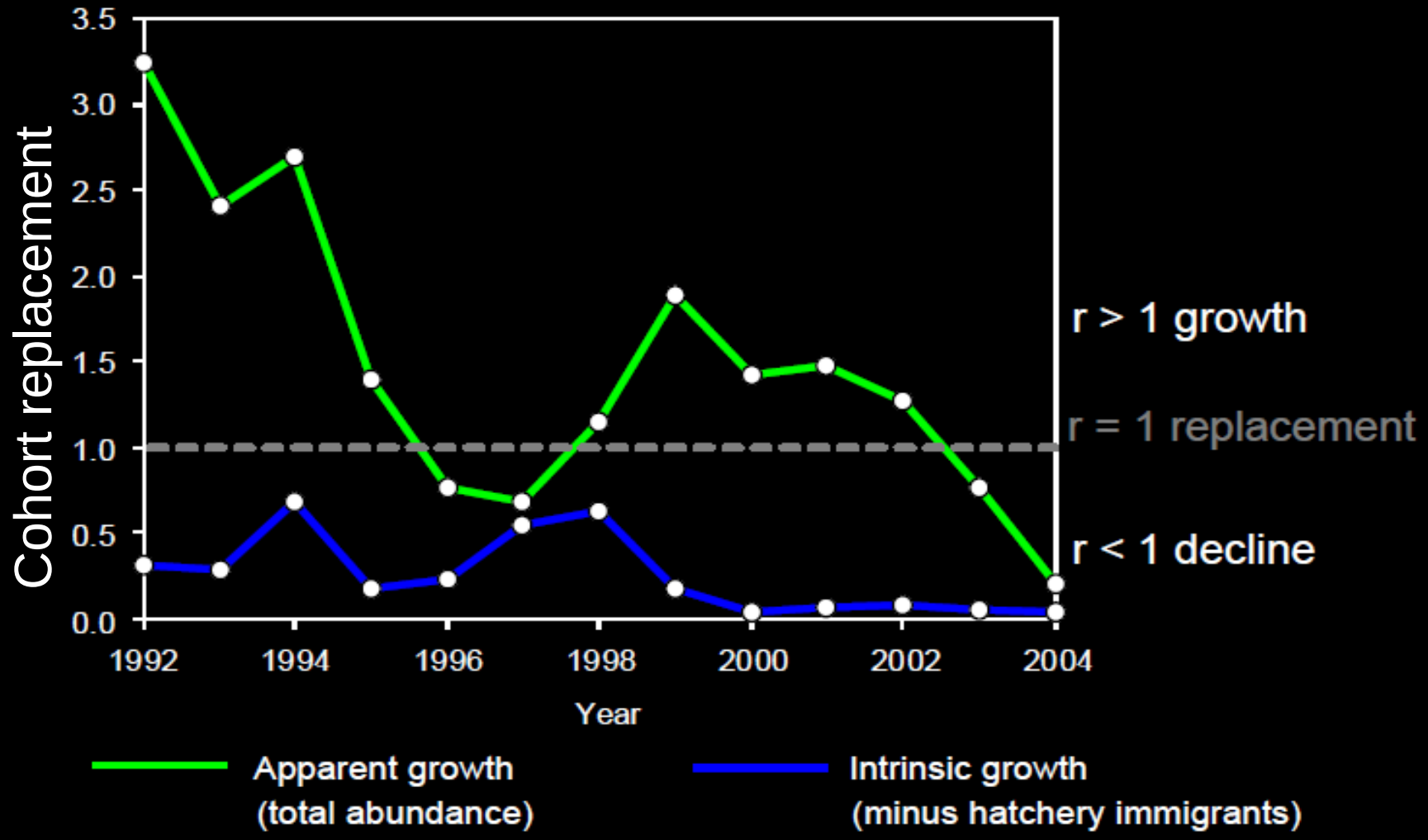
2010



Fall run Chinook salmon escapement to hatcheries

Data source: Kormos et al. 2013, Palmer-Zwahlen & Kormos. 2013

Cohort replacement rates of natural populations



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Managed Metapopulations: Do Salmon Hatchery 'Sources' Lead to In-River 'Sinks' in Conservation?

Rachel C. Johnson[1*¤a], Peter K. Weber[2], John D. Wikert[3], Michelle L. Workman[4¤b], R. Bruce MacFarlane[5], Marty J. Grove[6¤c], Axel K. Schmitt[7]

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