

Feather River Fish Hatchery spring run Chinook salmon Program: moving toward conservation



**Ryon Kurth, Jason Kindopp,
Anna Kastner, and A.J. Dill**



Spring Chinook
Historical/Current Distribution

Legend:

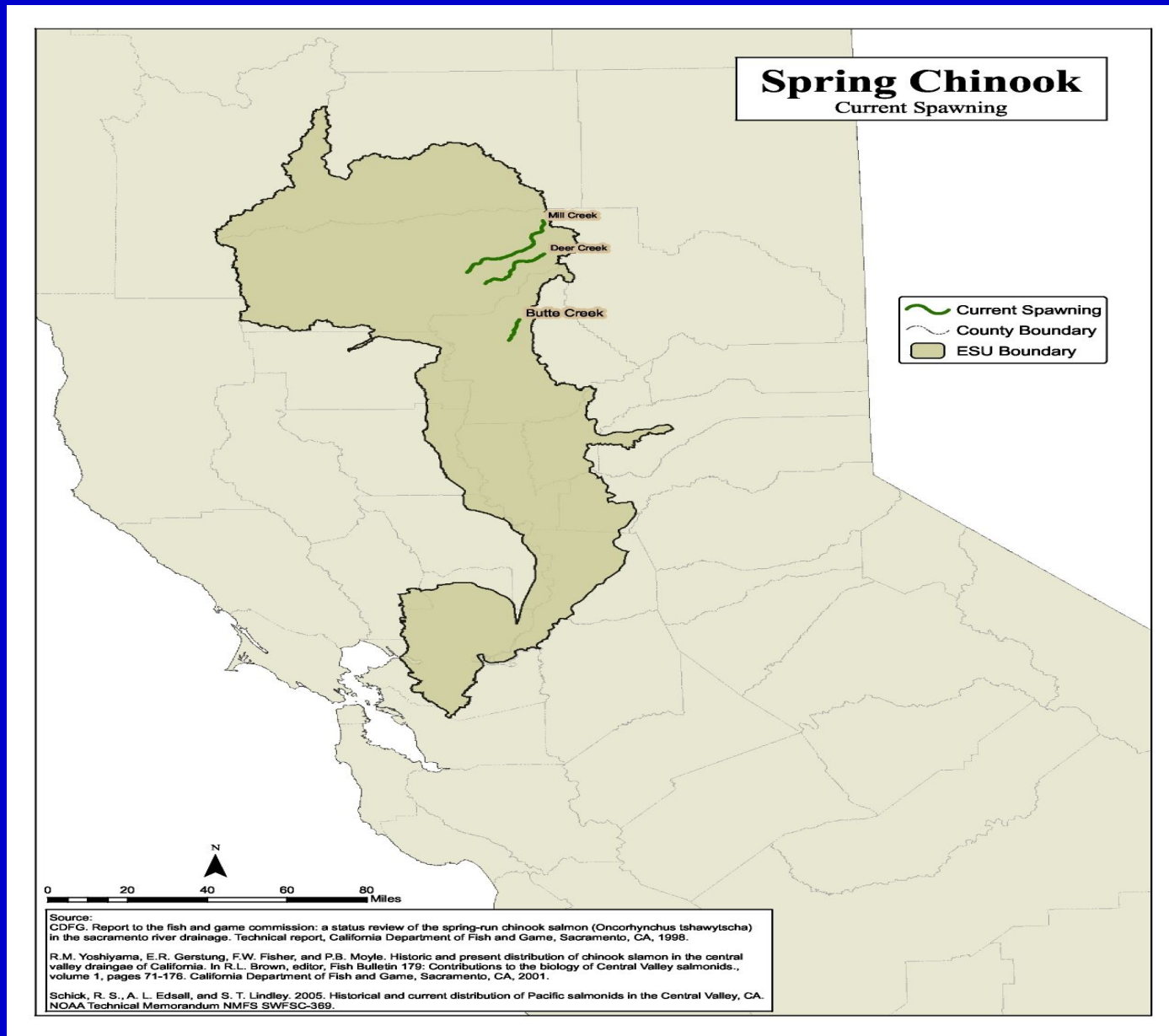
- Dam
- Weir
- City
- Current Spawning
- Current Distribution
- Current Distribution (Critical Habitat)
- Historic Distribution
- County Boundary
- ESU Boundary

Source:
CDFG. Report to the fish and game commission: a status review of the spring-run chinook salmon (*Oncorhynchus tshawytscha*) in the sacramento river drainage. Technical report, California Department of Fish and Game, Sacramento, CA, 1998.

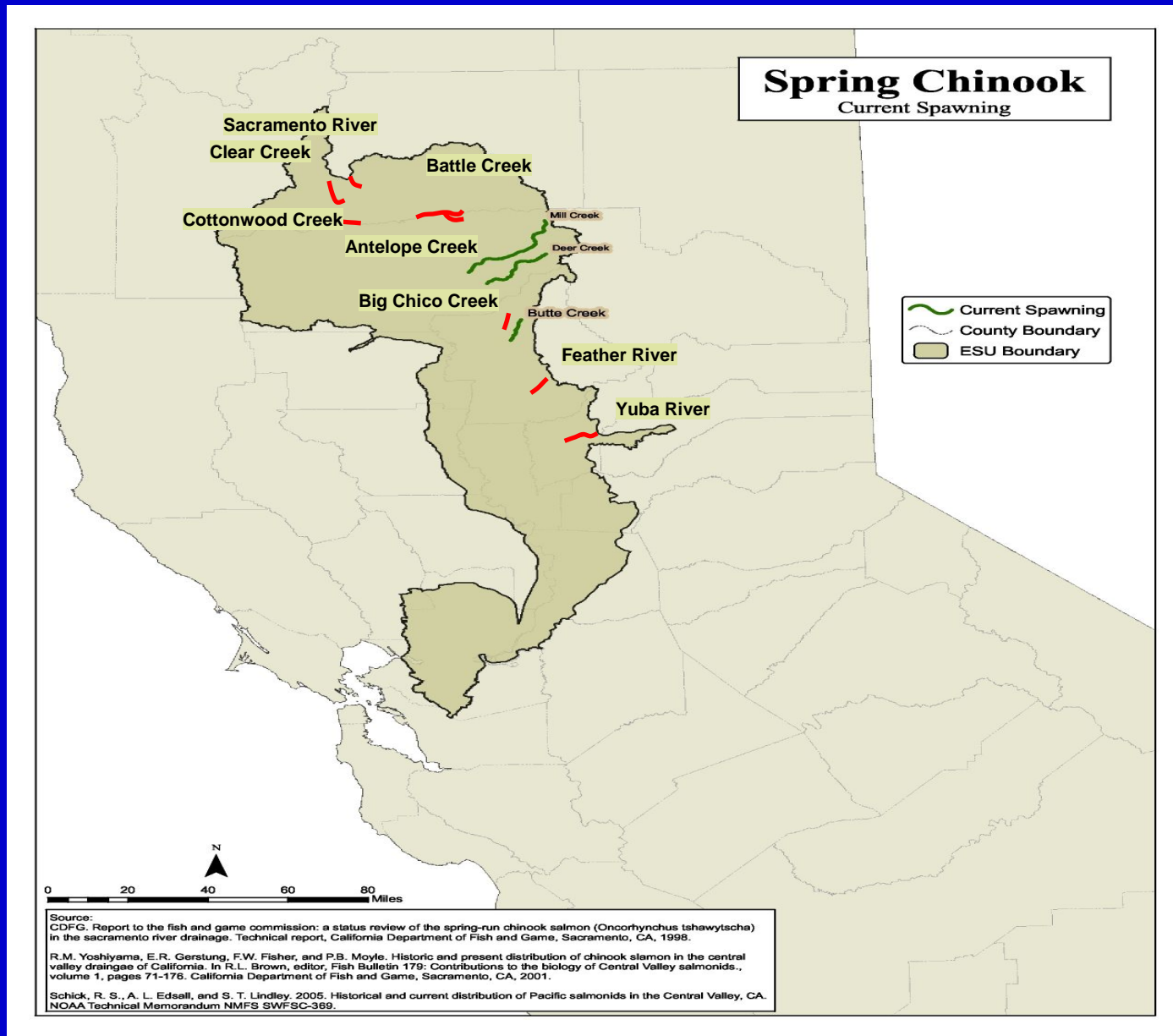
R.M. Yoehiyama, E.R. Gerstung, F.W. Fisher, and P.B. Moyle. Historic and present distribution of chinook salmon in the central valley drainages of California. In R.L. Brown, editor, Fish Bulletin 179: Contributions to the biology of Central Valley salmonids., volume 1, pages 71-176. California Department of Fish and Game, Sacramento, CA, 2001.

Schick, R. S., A. L. Edsall, and S. T. Lindley. 2005. Historical and current distribution of Pacific salmonids in the Central Valley, CA. NOAA Technical Memorandum NMFS SWFSC-369.

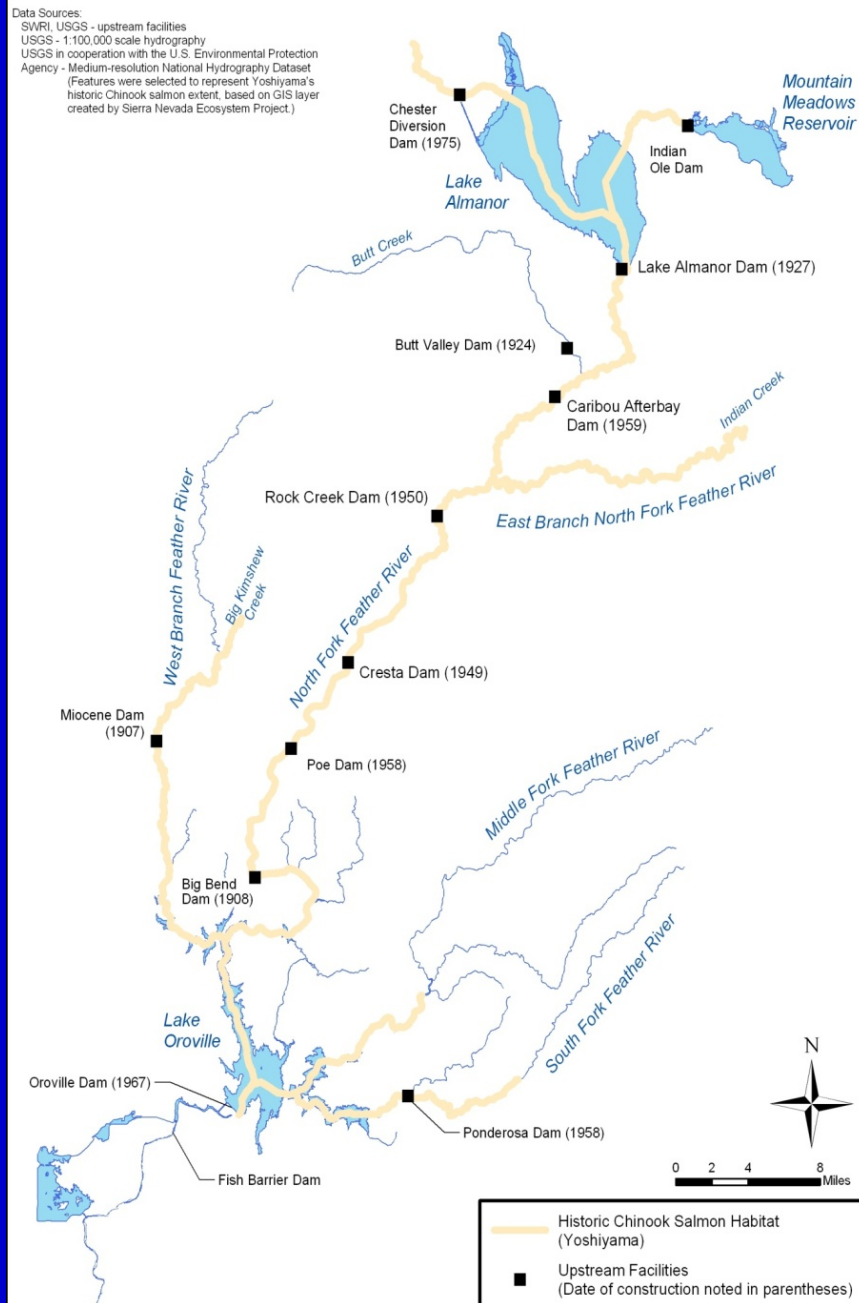
Central Valley Spring Run Chinook



Central Valley Spring Run Chinook



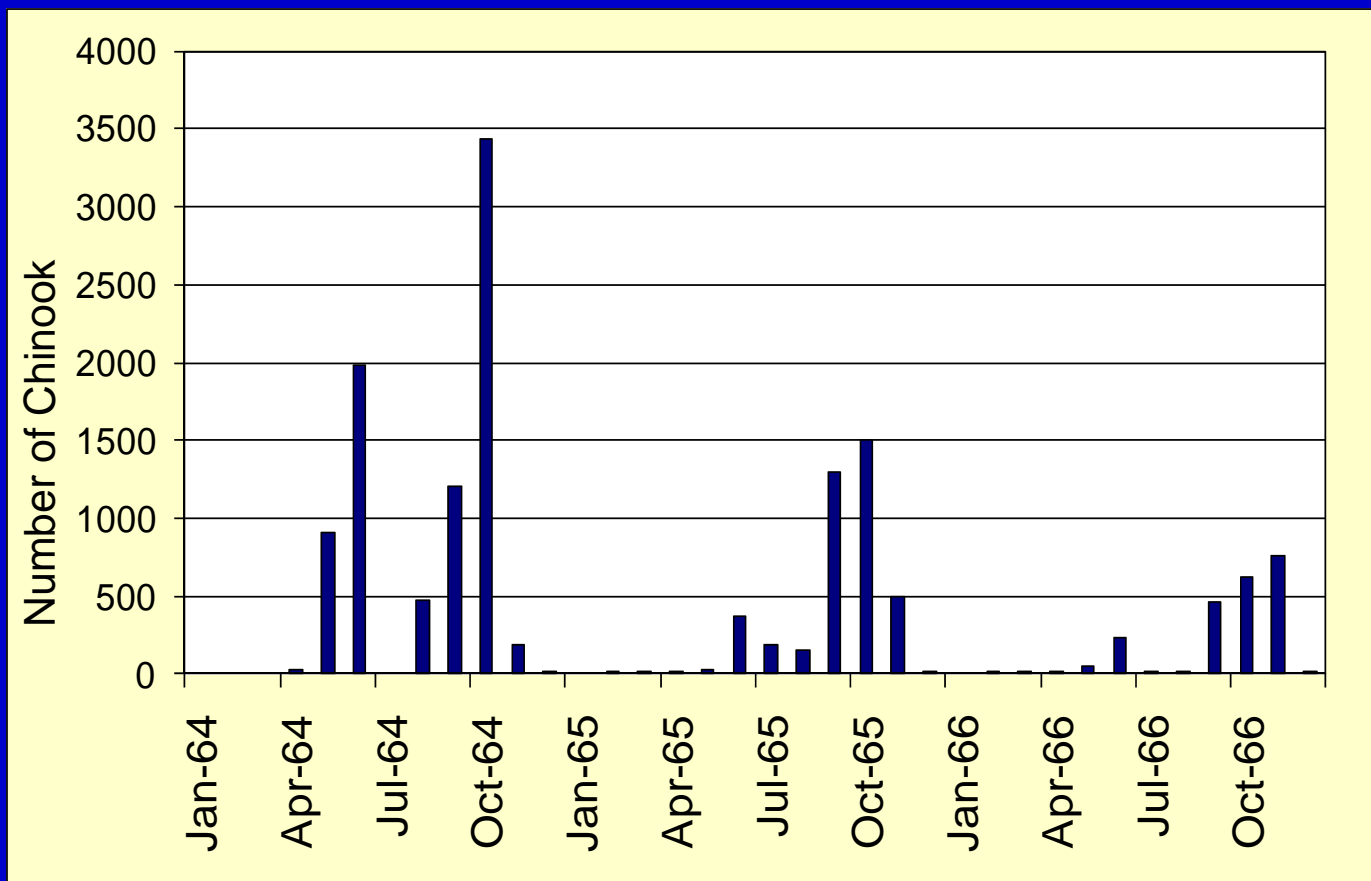
Feather River



- Highly altered
- Terminal mitigation hatchery
- spring and fall run Chinook

Feather River Chinook

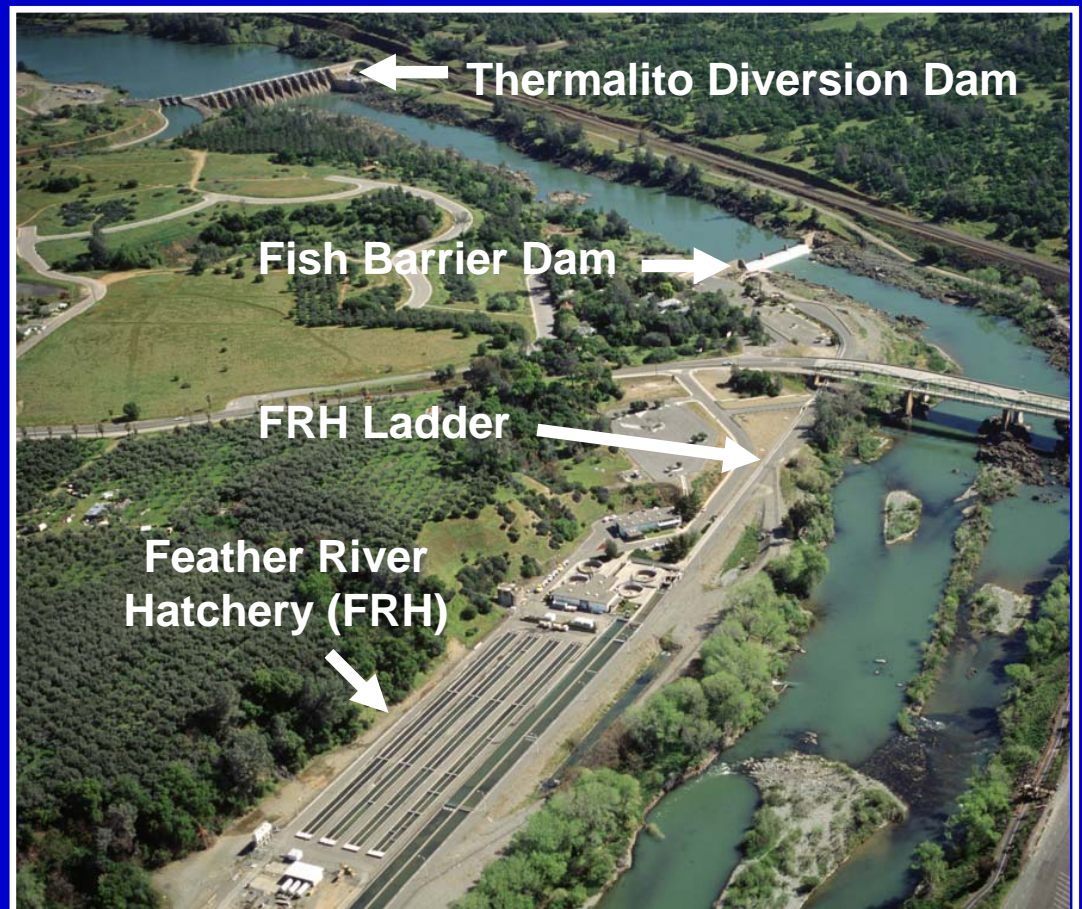
CDFG trap counts from Oroville Dam Site



**Pre-dam spring run abundance averaged
1,700 fish**

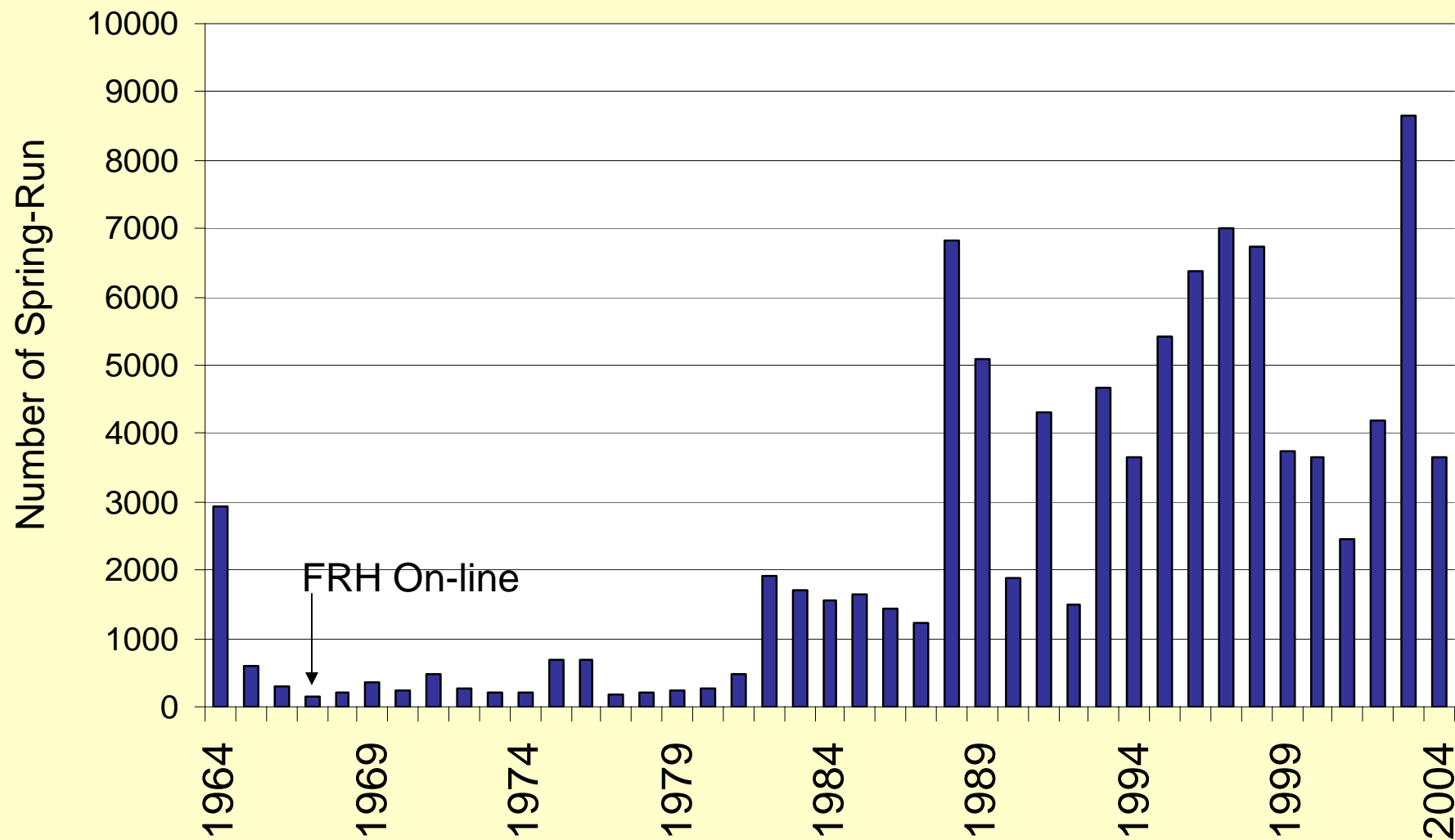
Feather River Hatchery (FRH)

- On-line in 1967
- *only* Central Valley hatchery which produces spring run
- currently 2 million smolts released annually



Feather River Spring Run Chinook

Spring-run into FRH 1964-2004



ESA status for Feather River spring run Chinook

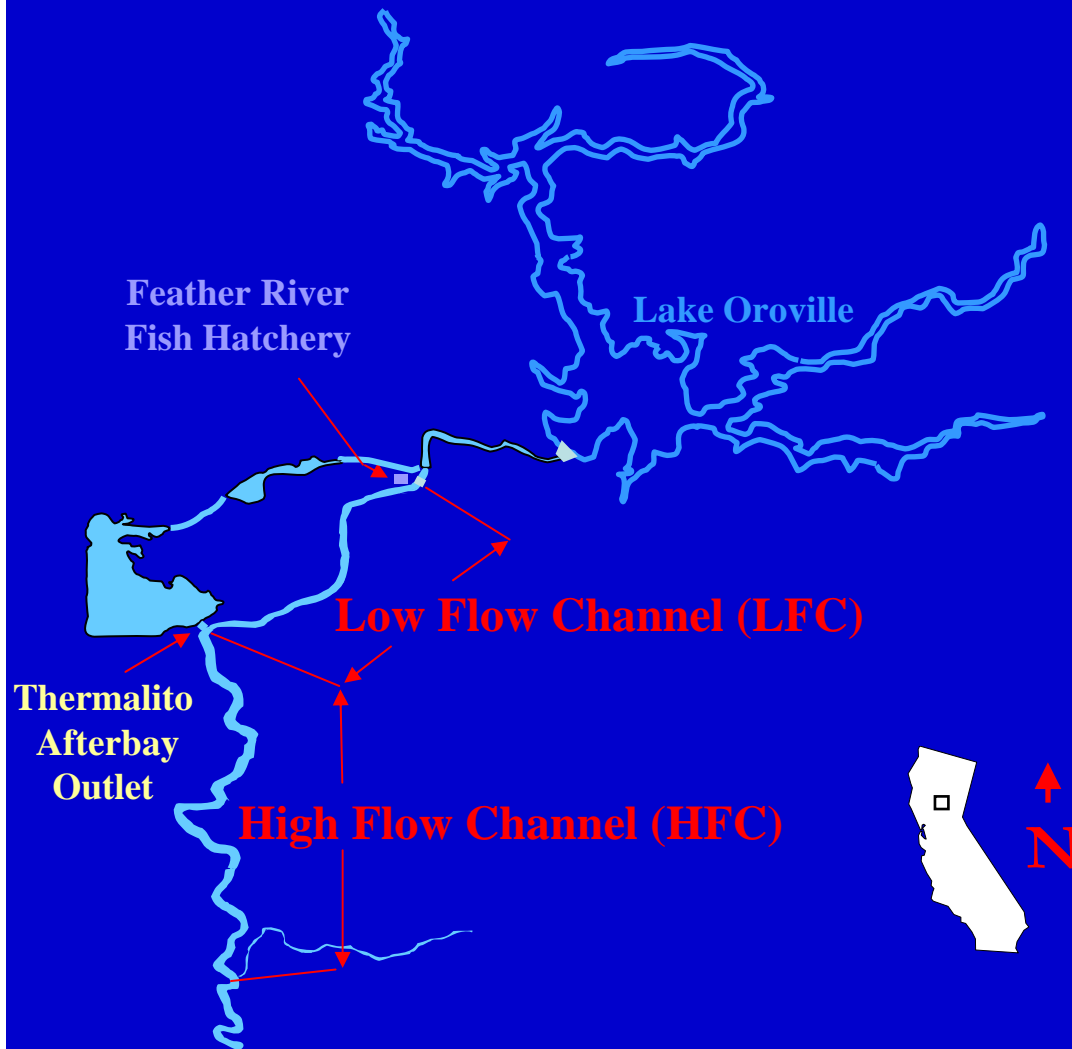
Natural *and* hatchery origin Feather River spring run Chinook are part of the ESU.

“TRT views the FRH as a major threat to the genetic integrity of the remaining wild spring-run comprising this ESU”

“...not included for discussions of ESU abundance.”

What's "wrong" with Feather River spring run?

No temporal and spatial segregation from fall run Chinook

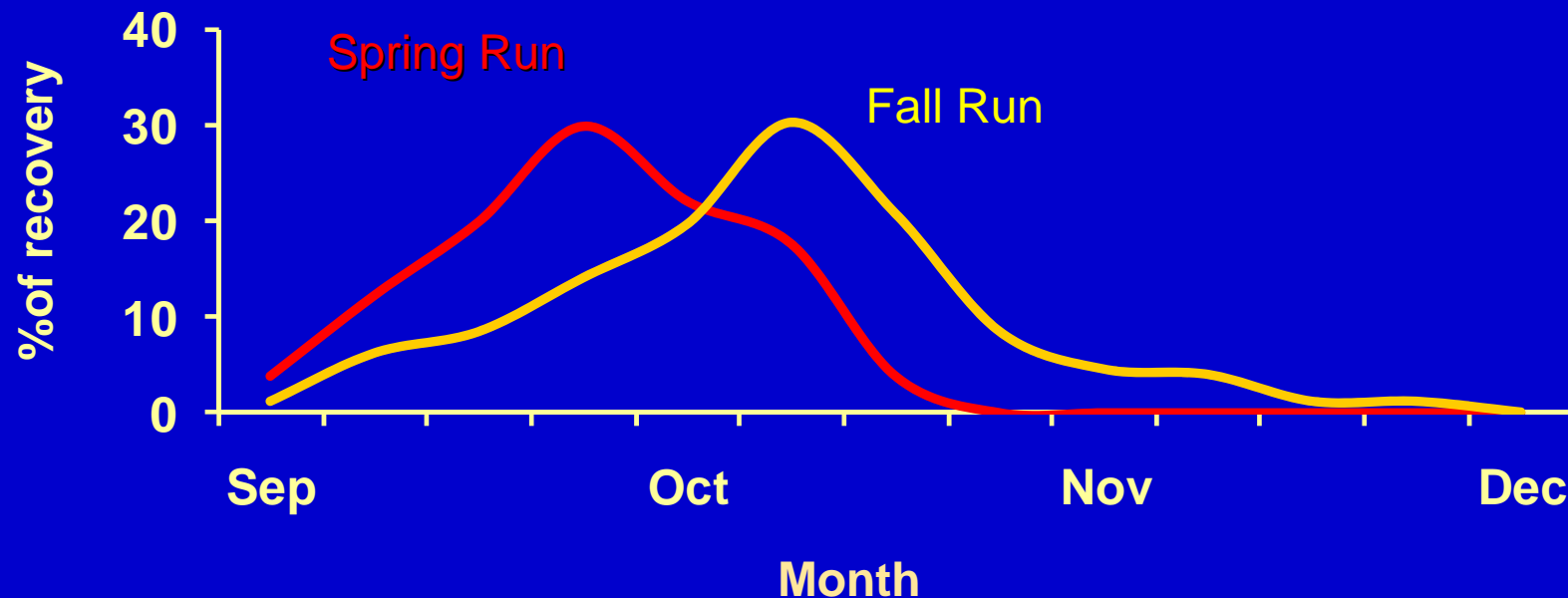


Classification of FRH spring run Chinook using CWTs 1997-2002

Run assigned at release (smolt) / Run assigned at spawning (adult)

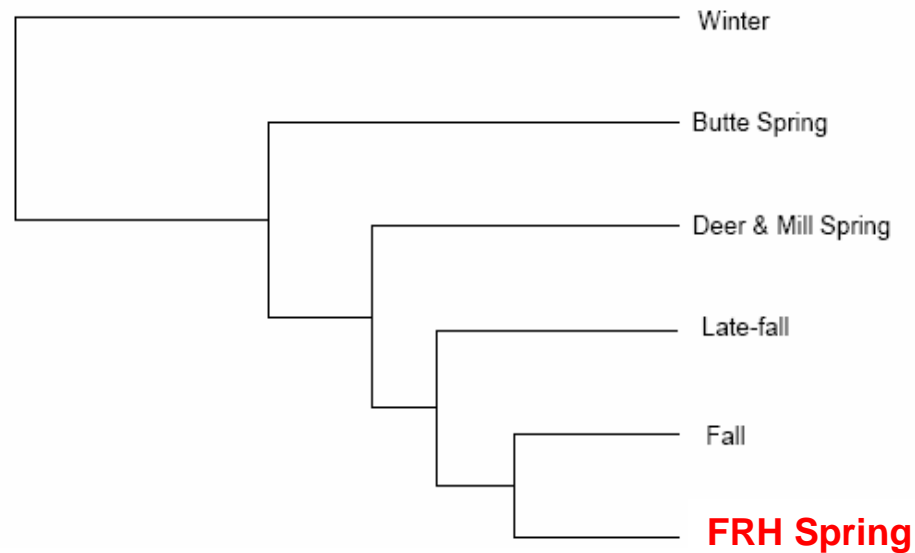
Spring / Spring : 54.1%

Natural spawning of Feather River Chinook



Feather River Spring Run Chinook Population Genetics

2003 Feather River Early returns



That's the bad news....is there any good news?

Still phenotypic spring run present

Some new evidence of genetic differences

“clock gene” found in nominal Feather river spring run, but not fall run (O'Malley et al. 2007)

Opportunities for restoration, conservation

FERC Relicensing, HGMP

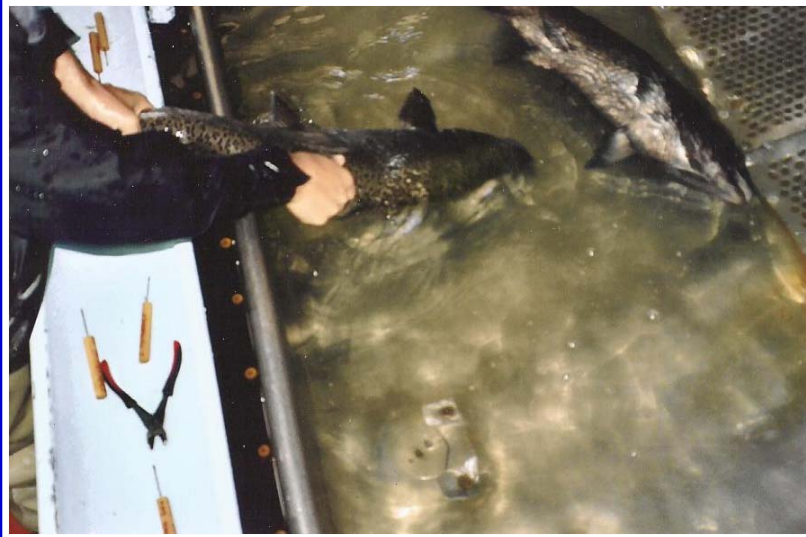


Feather River Spring Run Program

- Spring Run Broodstock Selection
 - Identifying and separating nominal spring run
 - a.k.a. “early returners”
- Study stray rates
 - Paired CWT releases



FRH spring run broodstock selection

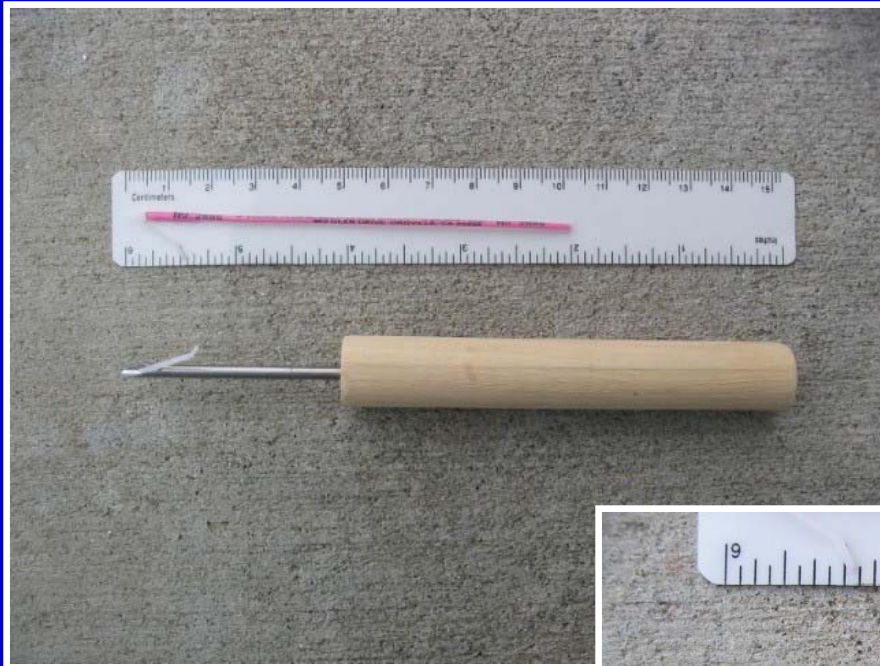


- Fish voluntarily ascend ladder between April – June.
- Fish are anesthetized, tagged and released back to the river

up to 20, 000 fish



FRH spring run broodstock selection



- Hallprint Dart Tags
 - Individually numbered
 - 10 cm long

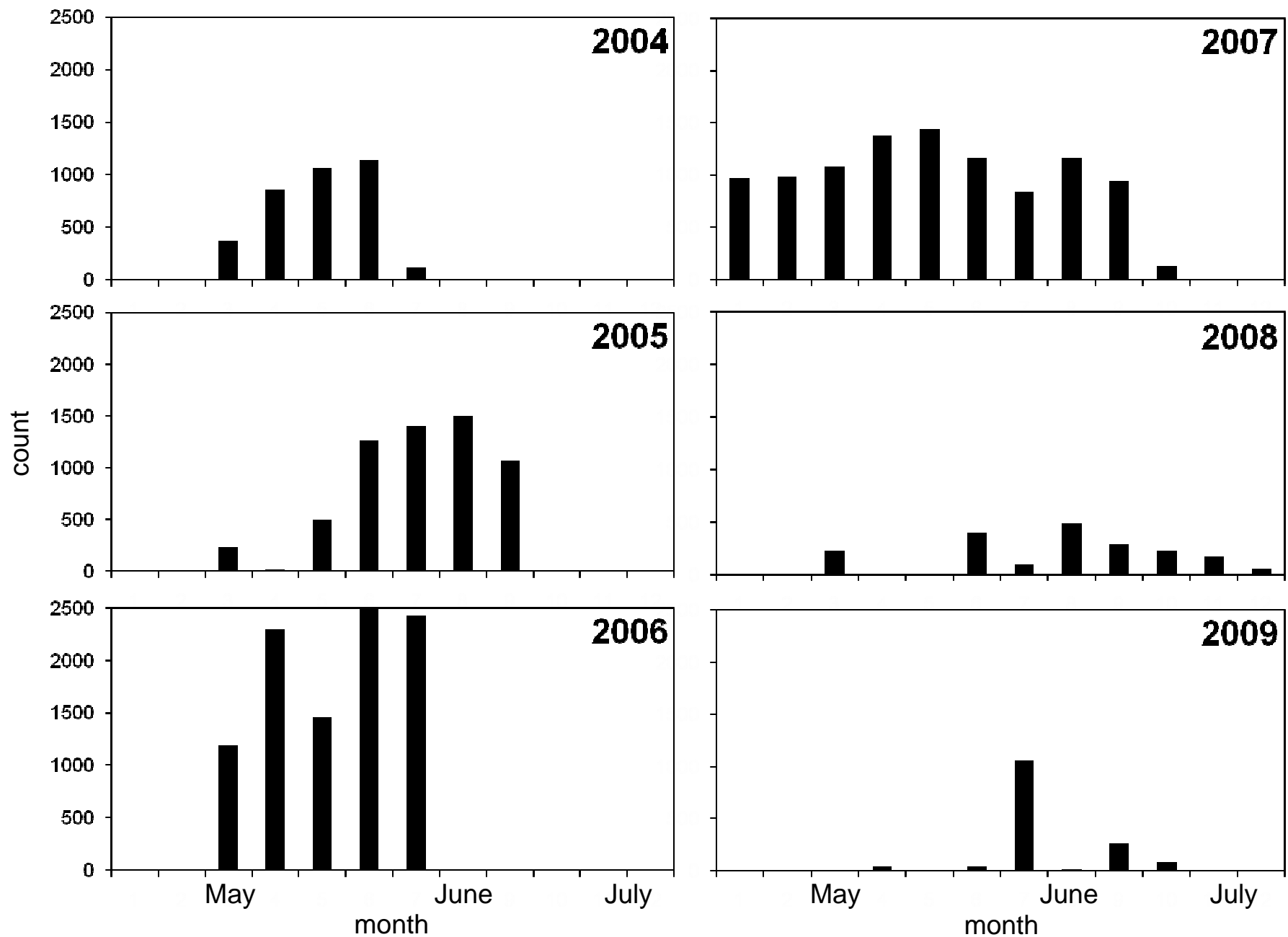


FRH spring run broodstock selection

Spring run broodstock consist of only hallprint tagged fish returning to FRH



Hatchery Spring run Weekly Tagging Counts

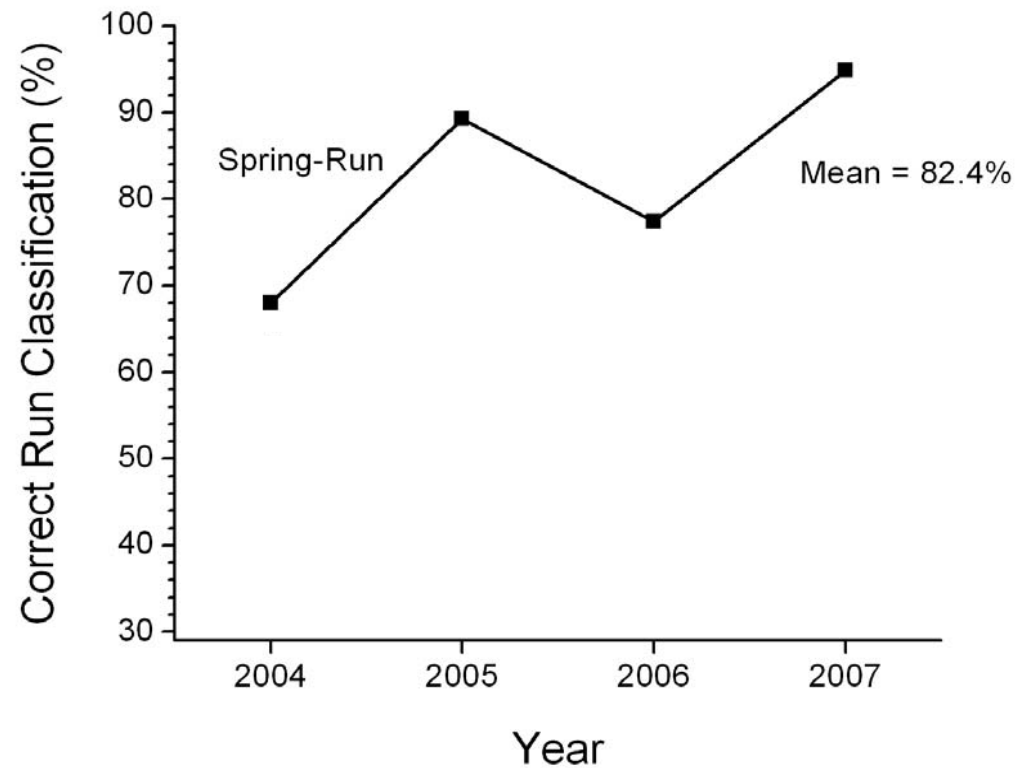


FRH spring run Chinook Broodstock

<i>Year</i>	<i>Total Tagged</i>	<i>Hatchery Recaptures (%)</i>	
<i>2004</i>	<i>3650</i>	<i>834</i>	<i>(22.8)</i>
<i>2005</i>	<i>5960</i>	<i>1835</i>	<i>(30.7)</i>
<i>2006</i>	<i>10179</i>	<i>1768</i>	<i>(17.4)</i>
<i>2007</i>	<i>9756</i>	<i>1849</i>	<i>(18.9)</i>
<i>2008</i>	<i>1915</i>	<i>1058</i>	<i>(55.2)</i>
<i>2009</i>	<i>1462</i>	<i>989</i>	<i>(67.6)</i>

**Average spawning success:
86%**

Classification of FRH spring run Chinook

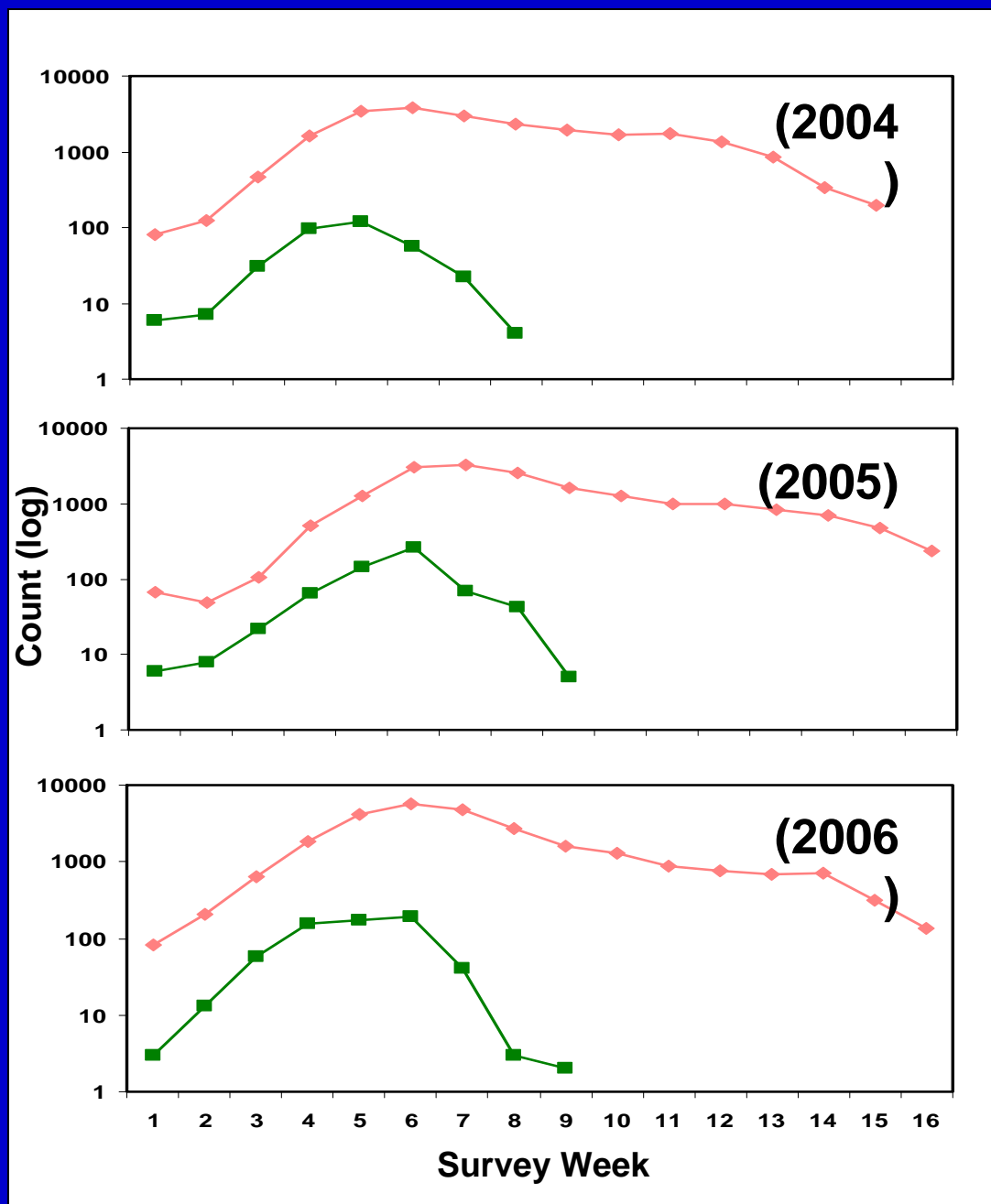


In River Temporal Distribution of FRH spring run

Log transformed carcass count of :

HALL (■) and NTS (◆) fish by survey week.

The survey period is September to December.



FRH Spring run Chinook Broodstock selection

Provides sufficient number of spring run to meet current production goals.

We're better at correctly identifying nominal spring run, but spring and fall run still mix.

Nominal spring run appear to spawn earlier as a group, but not all early arriving fish enter the hatchery

Feather River Spring Run Program

- Spring Broodstock Selection
 - Identifying and separating nominal spring run
 - a.k.a. “early returners”
- **Study stray rates**
 - **Paired CWT releases**



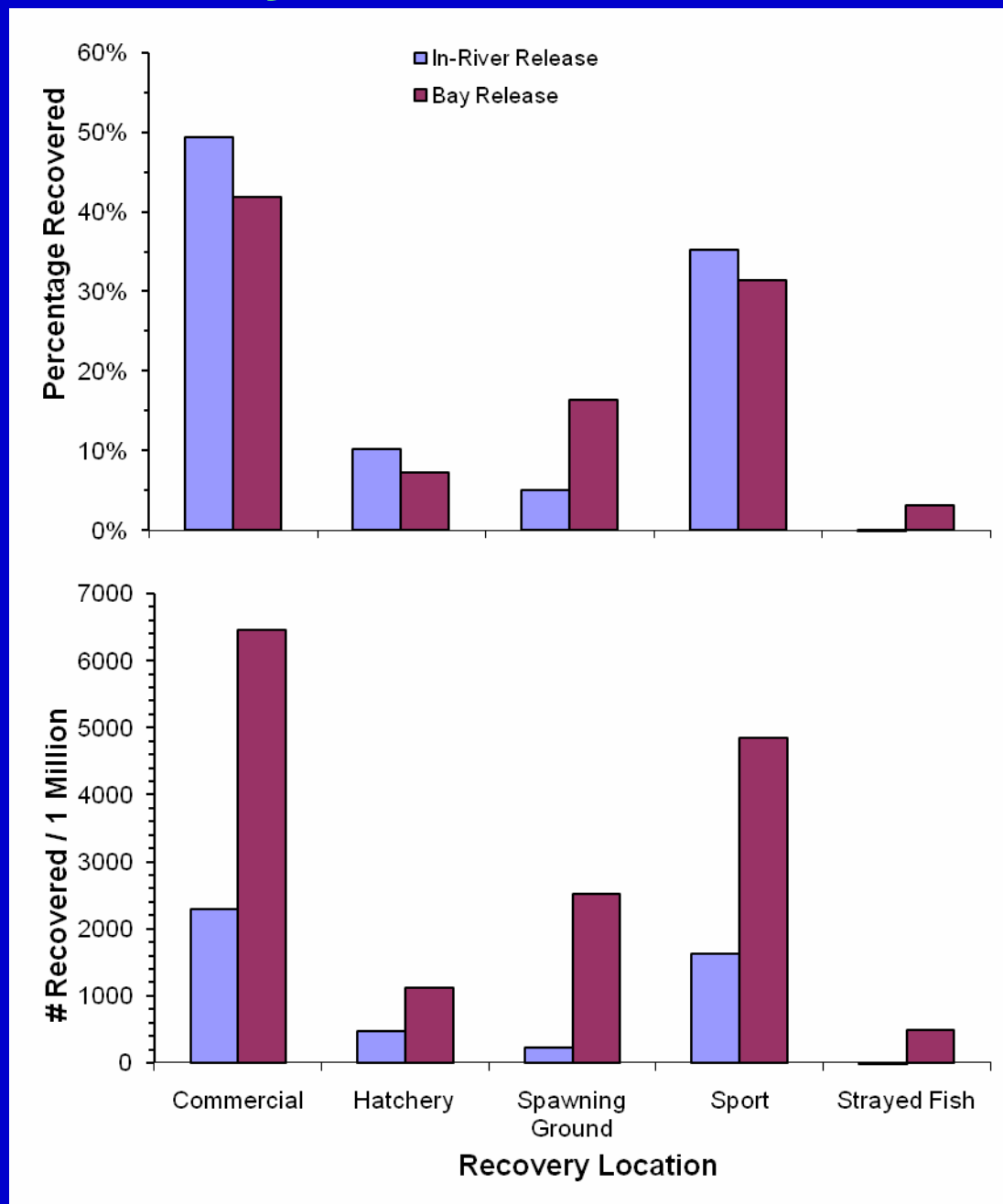
Paired release of FRH spring run

Determine fate of Bay vs. In-river release (stray rate)

- 100% CWT of spring run smolts.
- Release half in the Bay and half In-river.
- Recoveries expressed as expanded catch of CWTs
- Grouped by type: Commercial, Sport, Spawning ground, Hatchery, and stray



SF Bay vs. In-river releases



SF Bay vs. In-river releases

- Straying rates for Bay releases were substantially higher than stray rates for in-river releases, but overall low
 - 3.13% and 0.02%, respectively
- Survival of in-river releases is roughly 1/3 that of fish released directly into the Bay

SF Bay vs. In-river releases

Recovery Location	% of All reported strays
Sacramento River Spawning Ground	46.6
Yuba River Spawning Ground	32.0
Battle Creek Spawning Ground	9.0
American River Spawning Ground	5.5
Coleman Hatchery	2.6
Clear Creek Spawning Ground	2.2
Mokelumne River Spawning Ground	0.8
Nimbus Hatchery	0.9
Butte Creek Spawning Ground	0.2
Merced River Spawning Ground	0.1
Merced River Hatchery	0.1

Summary

Broodstock selection

Isolating “early arrivals” as spring run broodstock is a step in the right direction, but need more complete separation and identification of runs.

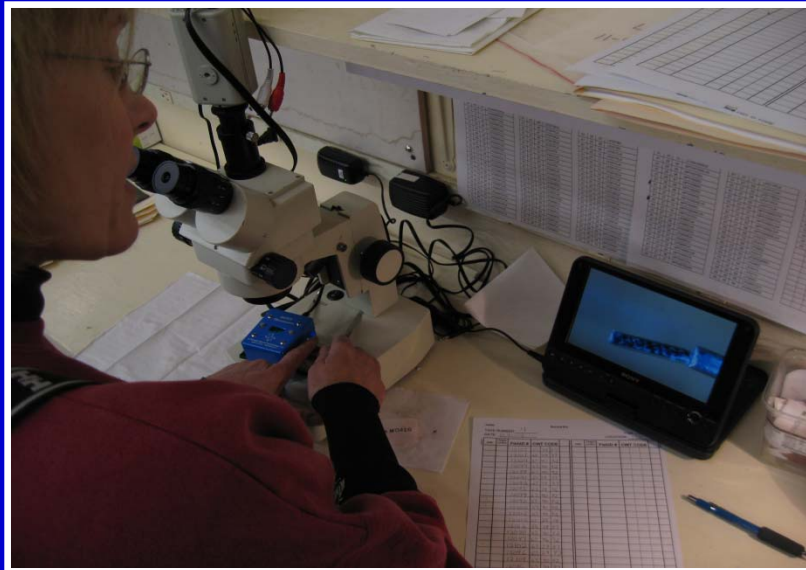
- segregation weir
- pair matching using real-time reading of CWTs

Summary

Broodstock selection

Segregation Weir to be implemented in 5-7 years
trap and haul
additional facility

100% mark (CWT or FPG?) to identify and separate
hatchery spring and fall run fish at FRH
real-time pair matching



Summary

Smolt release strategy

Straying not too bad...maybe

In river release of production would reduce straying, but survival substantially reduced.

- increase survival
- increase production

Summary

Smolt release strategy

Survival studies using CWT, PIT and or acoustic tags.

Coordinated flow pulses

Volitional release from temporary in river enclosures



Acknowledgements



DFG: Feather River Fish Hatchery, Fisheries Branch, Region 2
DWR: DES Feather River Program, License Coordination Branch
Cramer Fish Sciences
Feather River Technical Team