Mountain Counties Symposium – The Stressors and the Fix

Review of Central Valley Salmon Issues

Doug Demko

October 27, 2017

- Background
- Historical conditions
- Invasive aquatic species
- Salmon survival
- Hatcheries
- Moving forward

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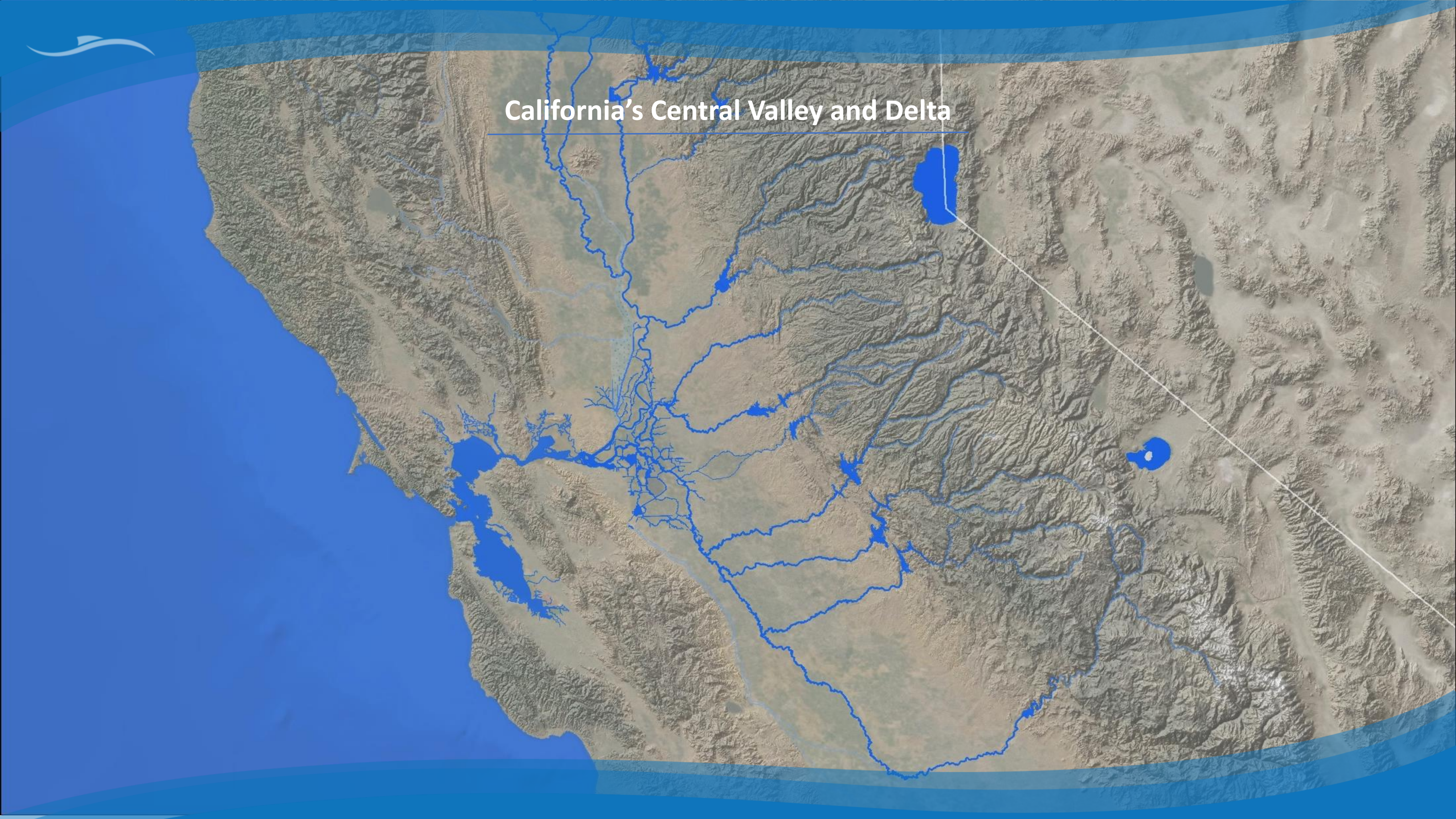
California's Central Valley and Delta



Which fish species influence resource management?

Protections under federal and state ESA

Life-history protected under federal ESA

Winter-run and Spring-run protected under state and federal ESA

Protections under federal ESA

Protections under state ESA

Chinook Salmon Life-history

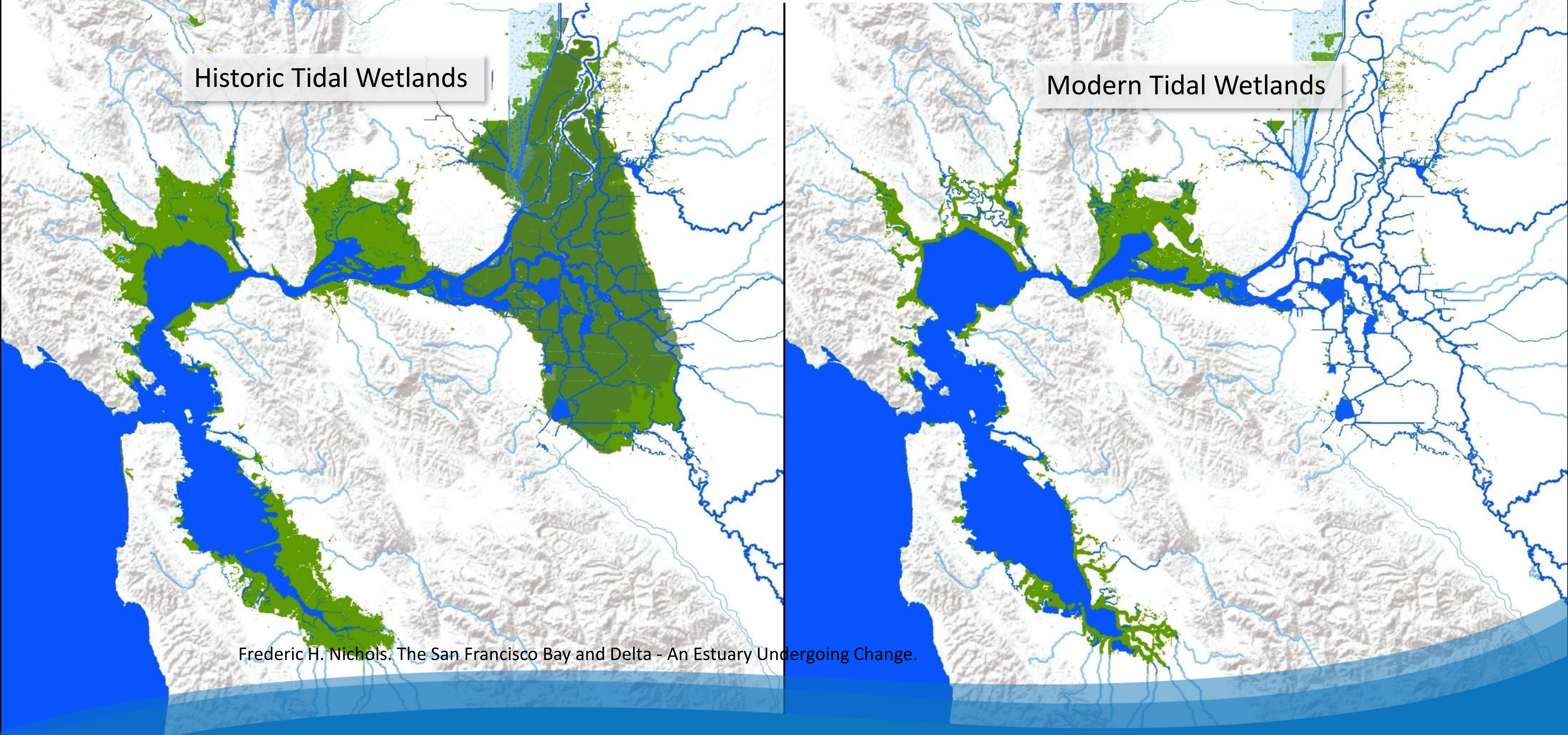
Habitat Alteration Began Early in California's History

University of Washington Digital Library

Natural Delta Landscape

Extensive Conversion of Shallow Water Habitat

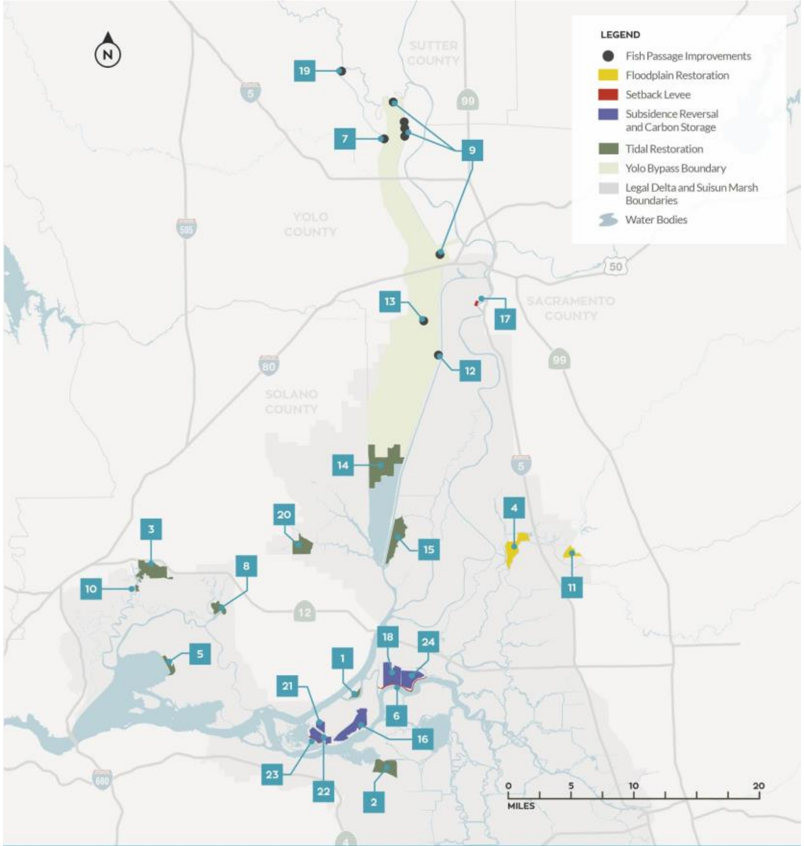
Delta Habitat for Native Fish is Gone…



Frederic H. Nichols. The San Francisco Bay and Delta - An Estuary Undergoing Change.

EcoRestore:
Habitat Restoration in the Delta

- Formerly part of the Bay-Delta Conservation Plan restoration
- 30,000+ acres of Delta restoration in the next 5 years
- Expected cost is at least $300 million in the first four years
- Lacking sites in the South Delta and lower San Joaquin River



2016 - 2017 (Target Construction Start Dates)

1	Decker Island
2	Dutch Slough
3	Hill Slough
4	McCormack Williamson Tract
5	Tule Red
6	Twitchell Island: Levee
7	Wallace Weir Fish Rescue Facility

2018+ (Target Construction Start Dates)

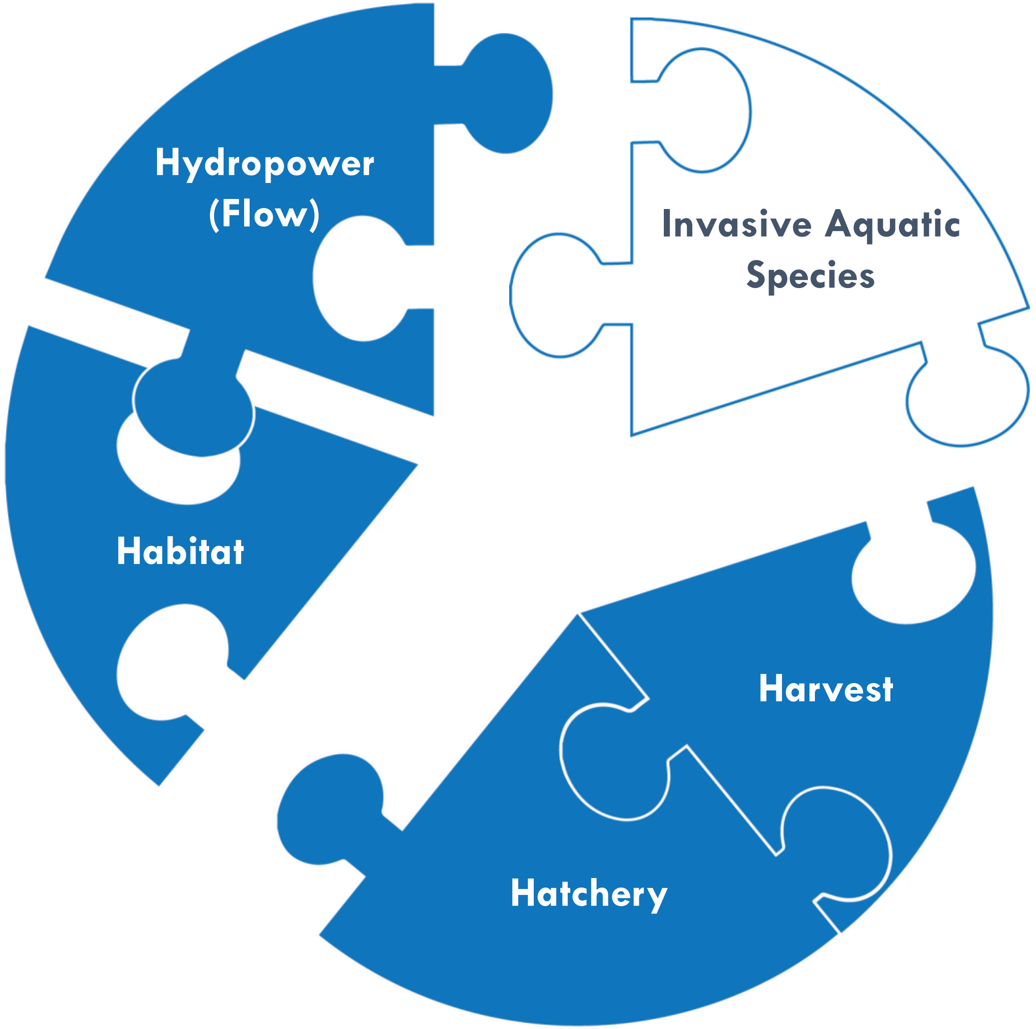
8	Bradmoor Island
9	Fremont Weir Adult Fish Passage Modification
10	Goat Island
11	Grizzly Slough
12	Lisbon Weir
13	Lower Putah Creek Realignment
14	Lower Yolo Ranch
15	Prospect Island
16	Sherman Island: Whale's Belly
17	Southport Levee
18	Twitchell Island: West End

COMPLETED (Construction Completed)

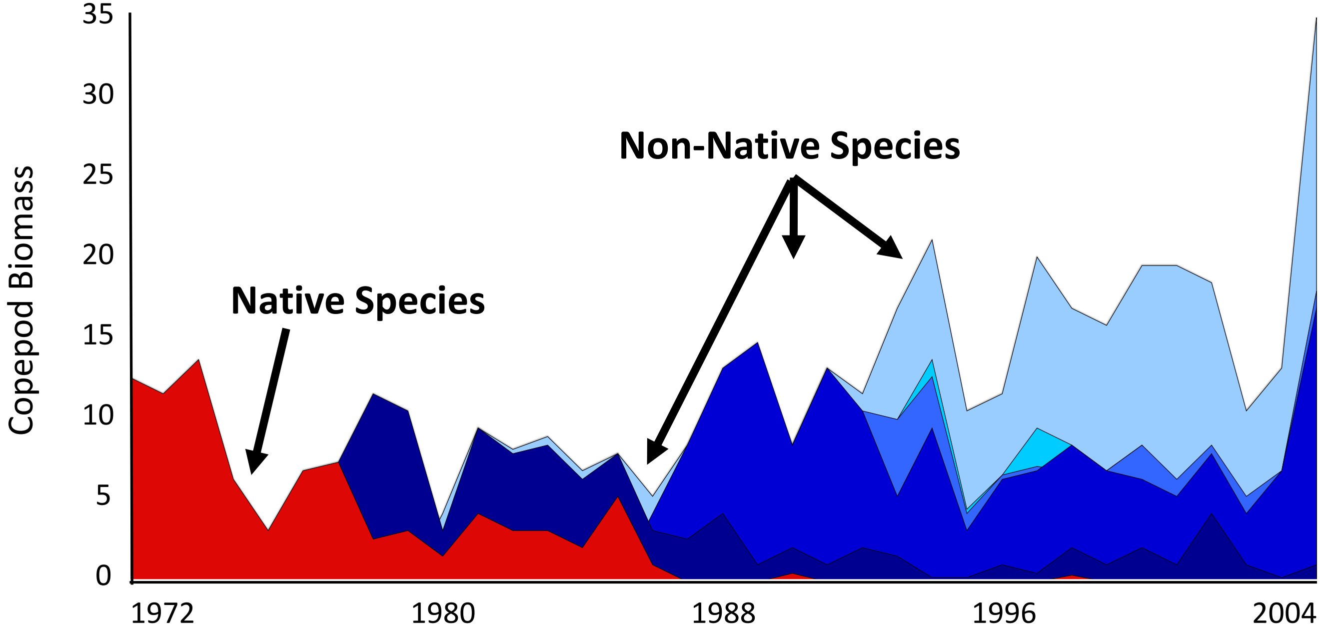
19	Knights Landing Outfall Gate
20	Lindsey Slough
21	Sherman Island: Mayberry Farms
22	Sherman Island: Whale's Mouth
23	Sherman Island: Mayberry Slough
24	Twitchell Island: East End

http://resources.ca.gov/ecorestore

Central Valley Salmon Management Puzzle



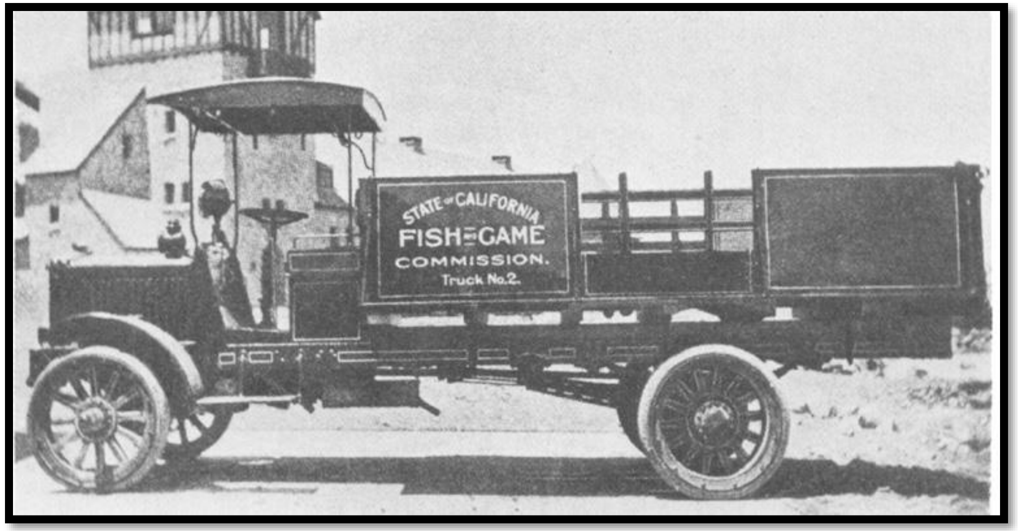
Delta Zooplankton Community Dominated by Non-natives



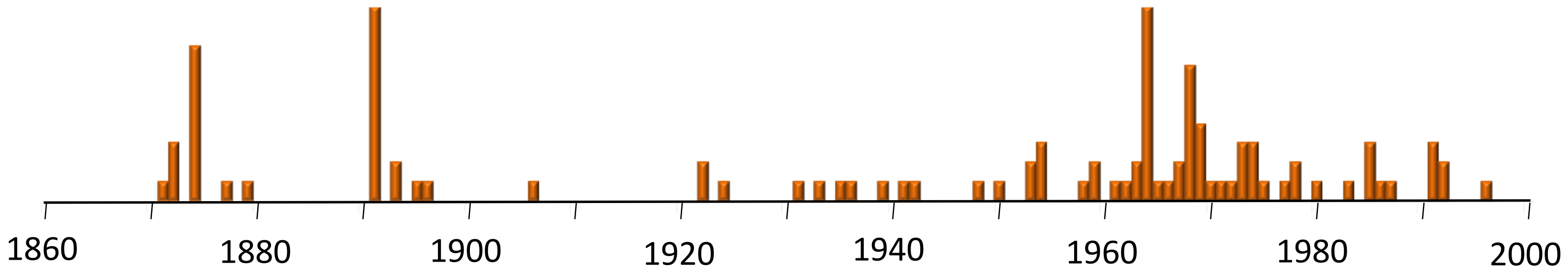
IEP POD Work Plan 2008

Non-native Fish Introductions Began Early in our History

- The majority (69%) of California fish introductions were deliberately introduced



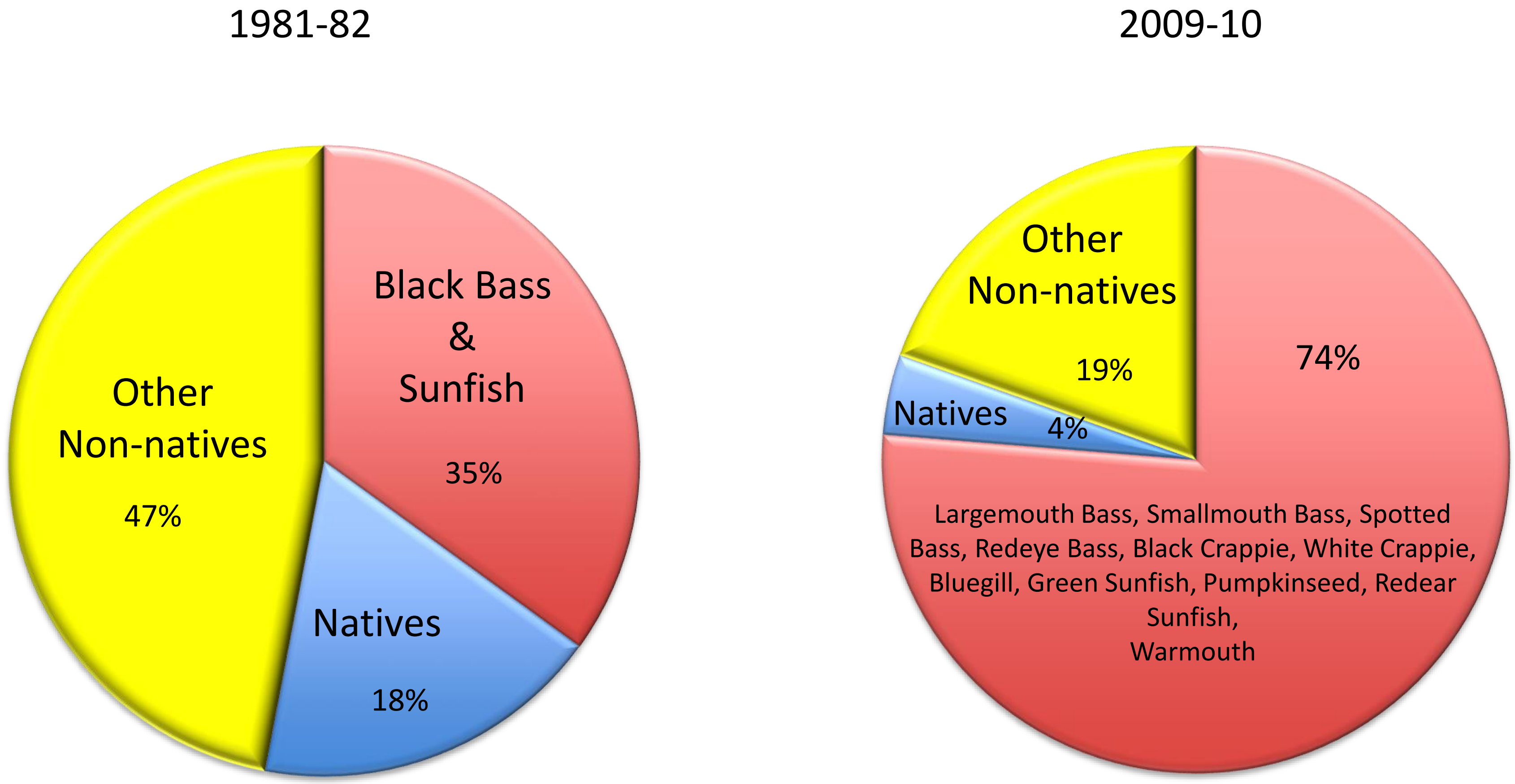
CA archive image



Non-native Fish Introduction Timeline

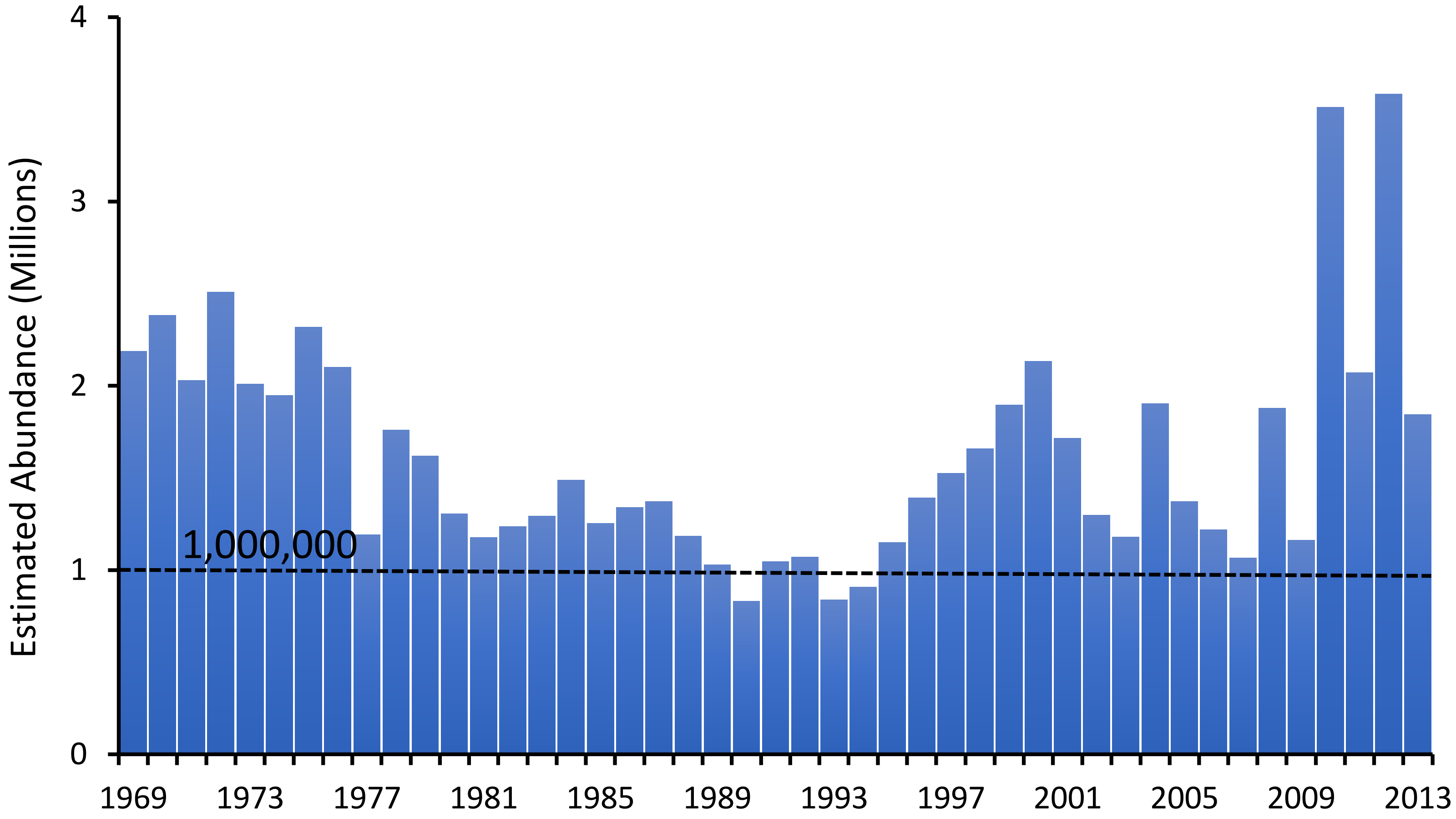
Data from Cohen and Moyle 2004

Proportion of Centrarchids Increasing in Delta



J. Louise Conrad, Kelly L. Weinersmith, Matthew J. Young, Denise de Carion, Erin Hestir, Maria Santos, Patrick Crain, Susan Ustin, Peter B. Moyle, Andrew Sih. 2010. More big bass: Understanding the role of largemouth bass as top predators in the littoral zone. Delta Science Council Conference Sacramento, California September 2010

Striped Bass Very Abundant in Delta



Data courtesy of Marty Gingras (CDFW). June 2016. Striped Bass Population estimates for legal size fish (≥18”) from creel survey and fyke trapping

NMFS 2009 Recovery Plan Conclusions

Restoring the ecosystem for anadromous salmonids will require, among other actions, "*significantly reducing the nonnative predatory fishes that inhabit the lower river reaches and Delta*"

Reducing abundance of striped bass and other non-native predators must be achieved to "*prevent extinction or to prevent the species from declining irreversibly*"

National Marine Fisheries Service. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. October 2009.

Juvenile Chinook Survival Rates by River or Region

- Sacramento River (Battle Creek to Golden Gate)
  - Average survival = 6.3%, Median survival = 3.8%
  - 2007 – 2011, late fall-run Chinook
  - Michel et al. (2015)
- Mill Creek, Sacramento River (Mill Creek to Golden Gate)
  - Average survival = 0.3%
  - 2013 – 2016, spring-run Chinook
  - Notch (2017)
- Lower Stanislaus River
  - 7 - 25% survival
  - 2012-2014, fall-run Chinook
  - Zeug et al. (2016)
- Delta
  - Since 2003, consistently <12% survival (VAMP studies)
  - 5% survival (Buchanan et al. 2013)
  - <12% survival during 2012 and 2013 (Brandes et al. 2016)

High Predation Mortality in Tuolumne by Non-Native Fish

2012 Tuolumne River Predation Study

- Only 4% Chinook estimated to survive 25 mile migration
- Predator abundance and predation rates showed potential for 100% loss due to predation

Juvenile salmon pumped from striped bass stomach

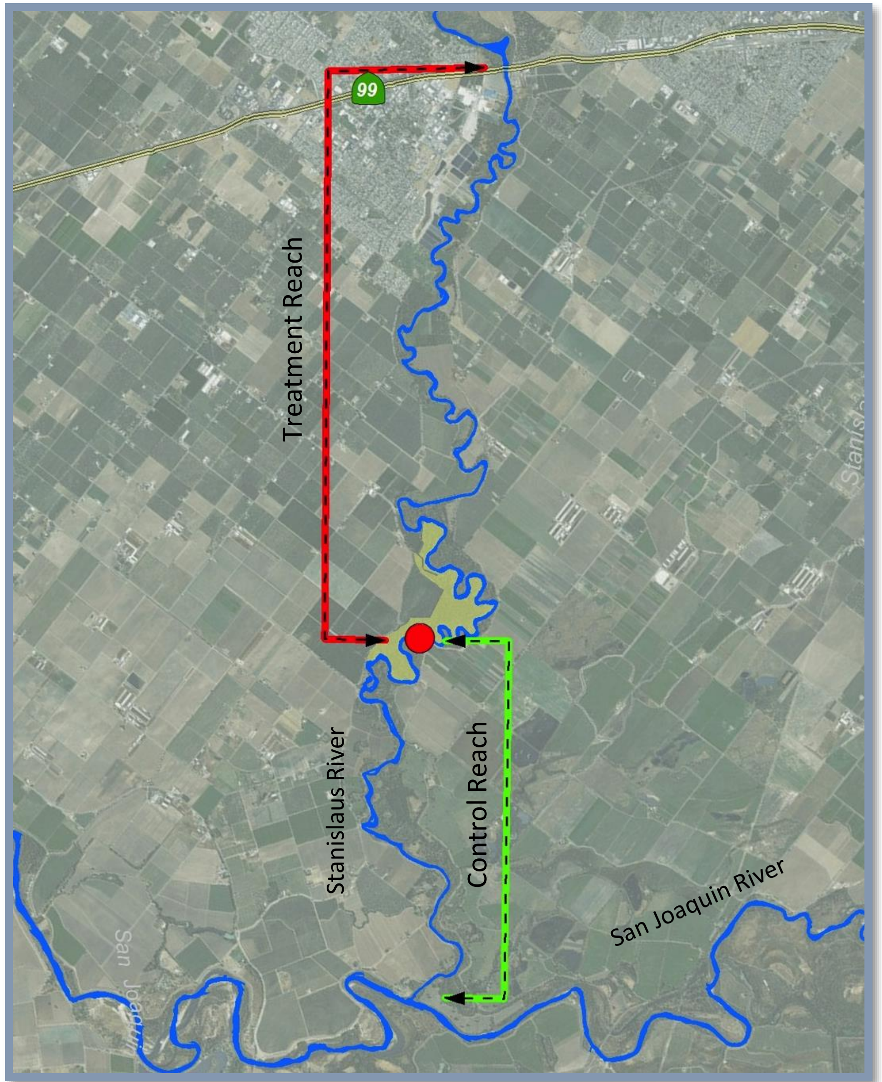
Water Infrastructure for Improvements to the Nation (WIIN) Act

- Stanislaus water users first proposed suppressing predators in 2009 to improve juvenile salmon survival

- Denied permits to sample or remove predators

- In 2016, Congress passed the WIIN Act which contained a provision allowing Stanislaus water users to remove predators and evaluate salmon survival

Stanislaus Native Fish Enhancement Research 2017 – 2027

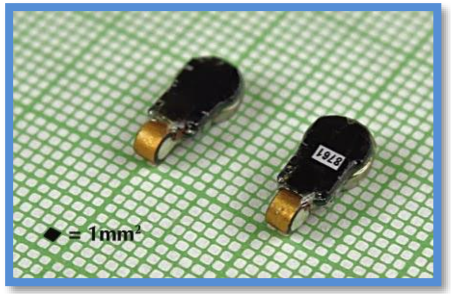


- Partnership between SSJID/OID and National Marine Fisheries Service

- Remove predators and evaluate salmon survival with telemetry

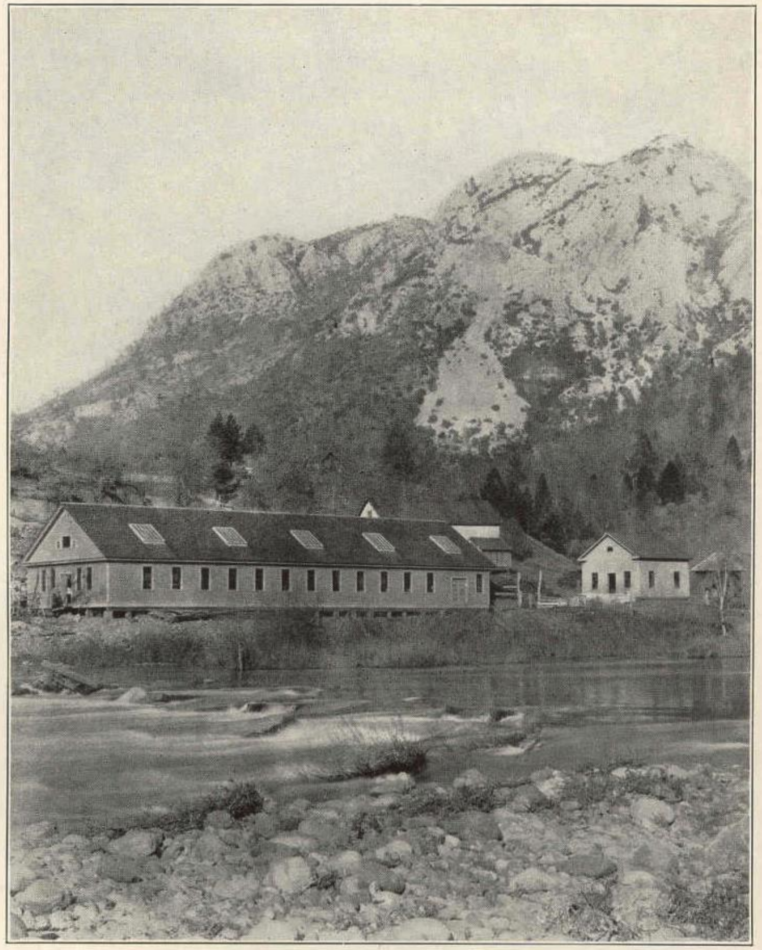
- Monitor response of native and non-native fish populations

JSATS Acoustic Tags



Raft Electrofishing

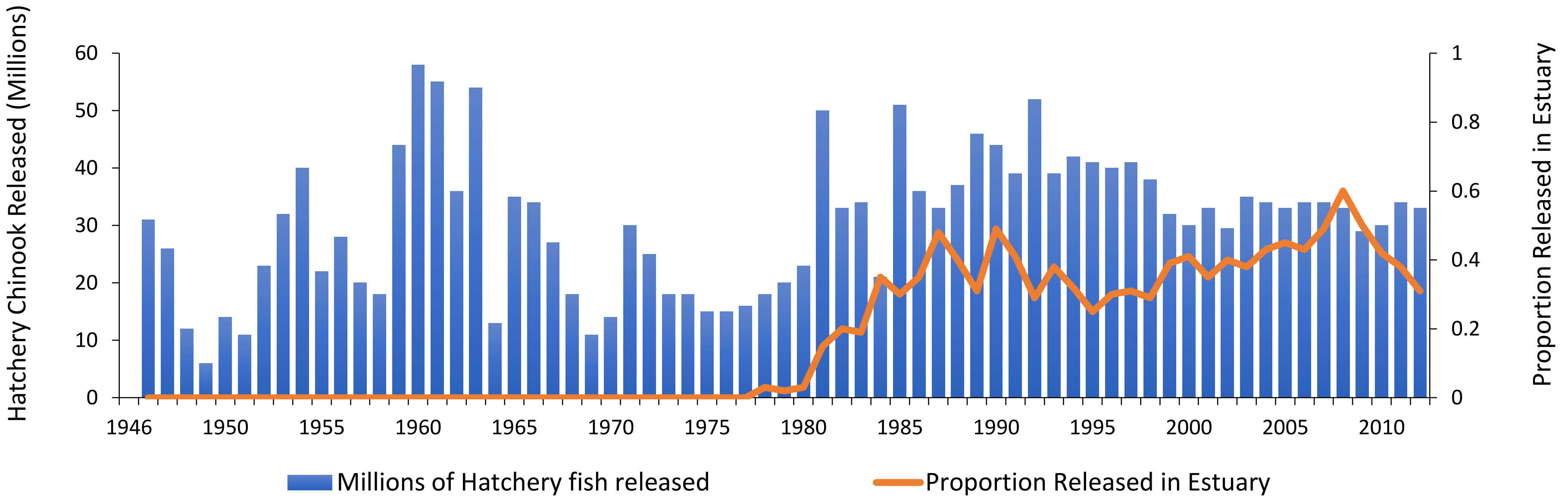
California's First Salmon Hatchery - 1872



Salmon hatchery at Baird, Cal., the pioneer salmon hatchery on the Pacific coast, located on the McCloud River, a swift stream formed by the melting snow on Mount Shasta. The station can accommodate 25 million eggs at one time, and in 1907–8 produced about 5 million young chinook or quinnat salmon and 10 million eyed eggs. Operations of this hatchery and its auxiliaries at Battle Creek and Mill Creek (73½ million eggs of the chinook salmon were taken in 1907–8) have been the prime factor in maintaining the salmon run in the Sacramento River. (See p. 1400.)

- More recently hatcheries intended as mitigation for lost habitat above dams
- Substantial negative impacts on wild fish well established

Number of Fall-run Hatchery Salmon Released

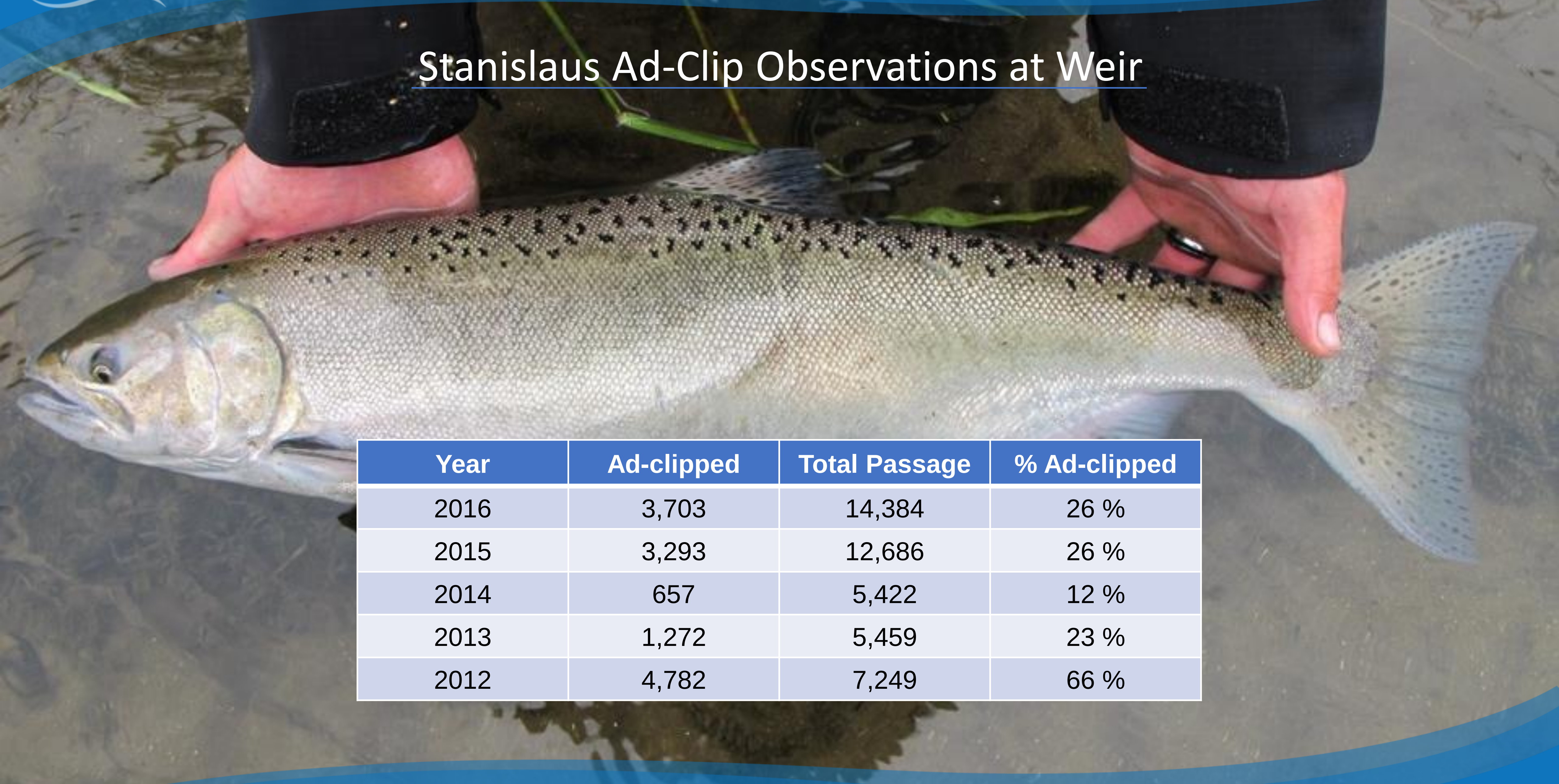


- From 2007 to 2013, 54 percent of all hatchery fish in California were released off-site (PSMFC 2013)

- In 2014 and 2015, poor river conditions due to the drought resulted in 79% and 91%, respectively, of all hatchery fish being transported and released off-site, mostly into the Delta or the San Francisco Bay (RMIS)

Huber and Carlson 2015

Stanislaus Ad-Clip Observations at Weir



Year	Ad-clipped	Total Passage	% Ad-clipped
2016	3,703	14,384	26 %
2015	3,293	12,686	26 %
2014	657	5,422	12 %
2013	1,272	5,459	23 %
2012	4,782	7,249	66 %

Impacts of Hatchery Fish

- 90% of Central Valley fall-run Chinook salmon are produced in hatcheries and this does not account for potentially large contribution of juveniles from hatchery origin adults spawning in-river (Barnett-Johnson et al. 2007)

- Loss of genetic diversity - little or no significant population structure present in the Central Valley fall-run due to hatchery practices (Williamson and May 2005; Garza et al. 2008)

- Overall reduced genetic fitness - hatchery-origin salmon can reduce the fitness of the entire population by essentially erasing generations of natural selection for traits adapted to the local environment (Araki et al. 2008, Christie et al. 2014)

Solutions/Summary

- **Less is more - focus on healthy populations of wild fish**
  - Abundance goals should correspond to habitat capacity
  - Hatcheries should be better integrated in overall management and recovery agendas, rather than focus solely on releasing large numbers of fish

- **Minimize the influence of hatchery fish on wild populations**
  - Employ hatchery release practices that minimize straying
  - Mass marking to permit selective harvest
  - Terminal fisheries in suitable coastal locations to provide commercial harvest

- **Move away from single species management**
  - Single species management actions often expensive and ineffective
  - Large scale habitat restoration benefits ecosystem

Solutions/Summary

- **Reducing non-native fishes has a role in management**
  - Explore management actions to reduce non-native fish abundance/distribution (using flow and non-flow actions)
  - Enhance understanding of how non-natives are limiting native fishes
- **Reduce redundant regulatory requirements for research and monitoring**
- **Funding is limited and privately funded research should be encouraged**

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