Fishing For a Complement:

Current and Historical Sampling for Fish and Invertebrates and in the San Francisco Estuary

Interagency Ecological Program

Cooperative Ecological Investigations Since 1970

Ted Sommer

California Department of Water Resources

Interagency Ecological Program

- Long-term monitoring program for Bay-Delta
- Nine agencies
  - Department of Water Resources (DWR)
  - Department of Fish & Wildlife (CDFW)
  - State Water Resources Control Board (SWRCB)
  - National Marine Fisheries Service (NMFS)
  - U.S. Army Corps of Engineers (USACE)
  - U.S. Bureau of Reclamation (USBR)
  - U.S. Environmental Protection Agency (USEPA)
  - U.S Fish and Wildlife Service (USFWS)
  - U. S. Geological Survey (USGS)

Interagency Ecological Program

Cooperative Ecological Investigations Since 1970

Why Do We Sample the SF Estuary?

- Legal Requirement
- Sport Fishes
- Economic Importance of Water System
- Ecological Insights
- Guidance for Restoration and Other Management Actions

Evolution of IEP's Fish Sampling Programs

Late 1950s-1960s

- Early pre-project surveys
- Start of important long-term sampling programs

1970s-1980s

- Focus on Salmon and Striped Bass
- Addition of SF Bay Study, Chipps Island & Beach Seine surveys

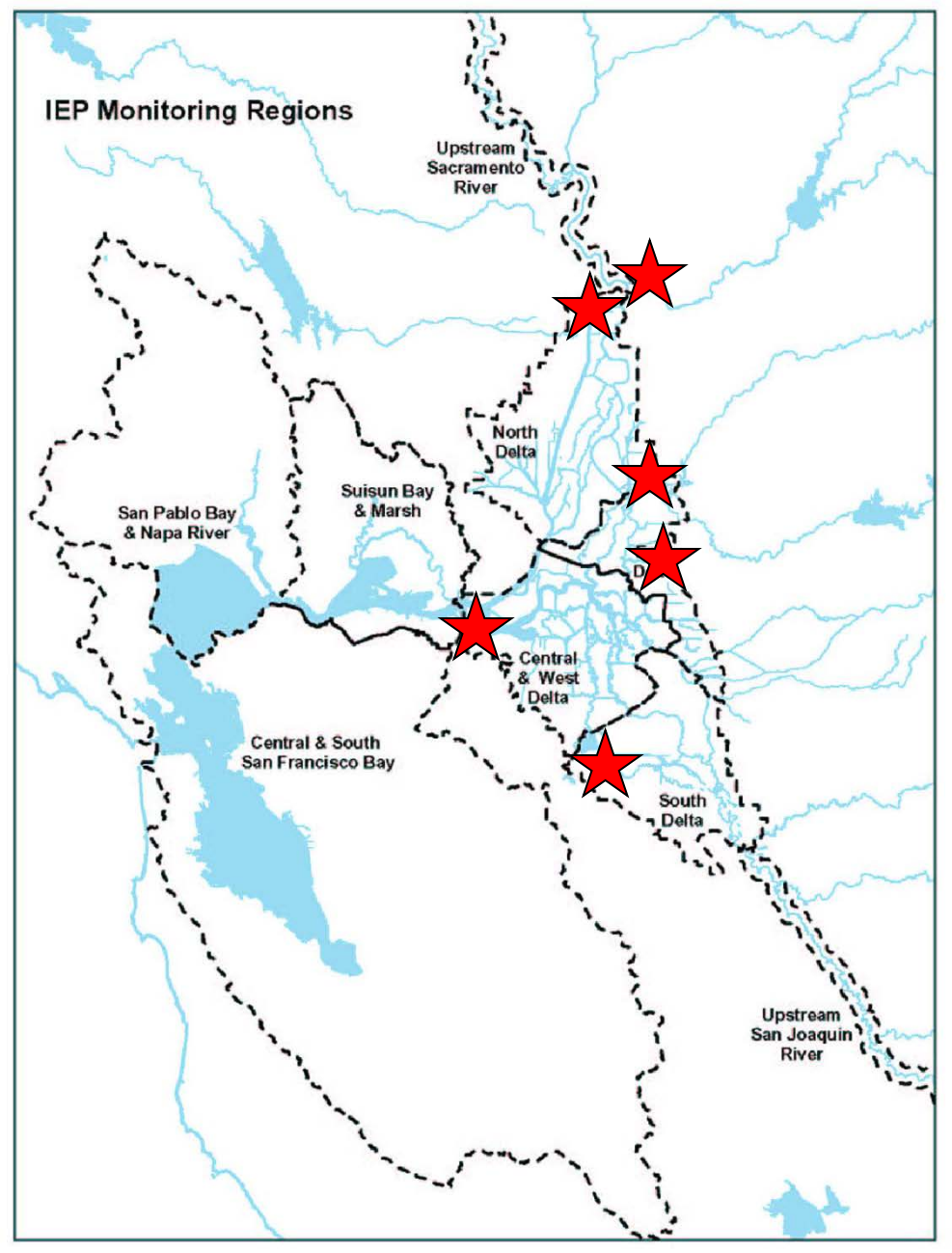
1990s

- Listing of Salmonids and Delta Smelt
- Addition of new Delta Smelt surveys

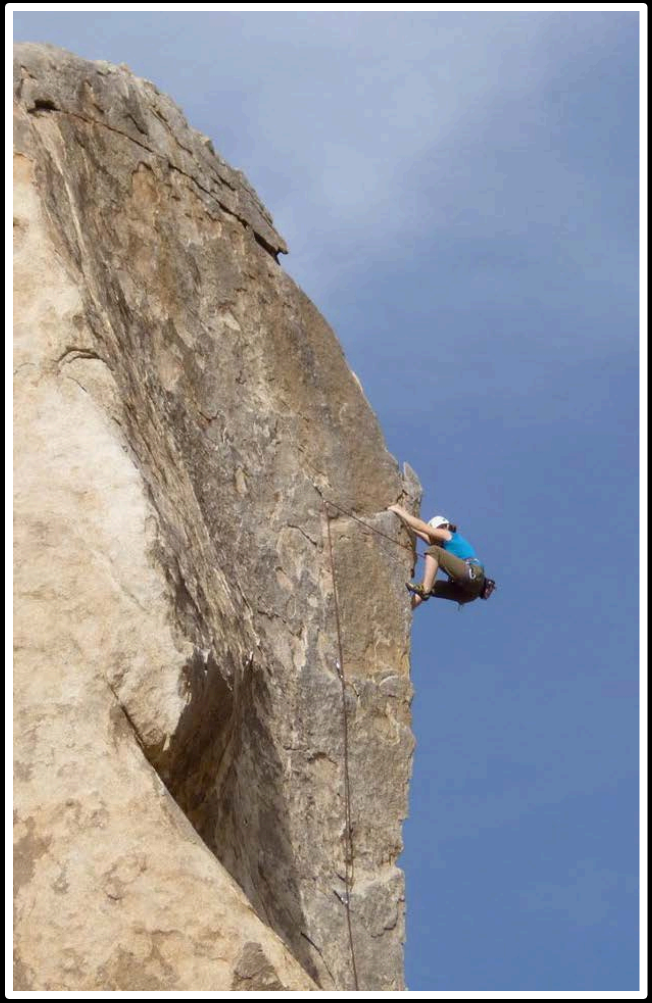
2000s - Present

- Pelagic Organism Decline = More ecological focus
- Addition of more Smelt surveys
- Listing of Longfin Smelt

Broad Geographic Scope!



Challenges



- Huge Geographical Area
- Multiple Habitat Types
- Hydrologic Variability
- High Turbidity
- Broad Salinity Range
- Rare & Patchy Fishes
- Regulatory Constraints
- Multiple Life Stages

Detailed Survey Information

IEP Long-term Fish Monitoring Program Element Review

by
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December 2004

Interagency Ecological Program
for the
San Francisco Bay/Delta Estuary

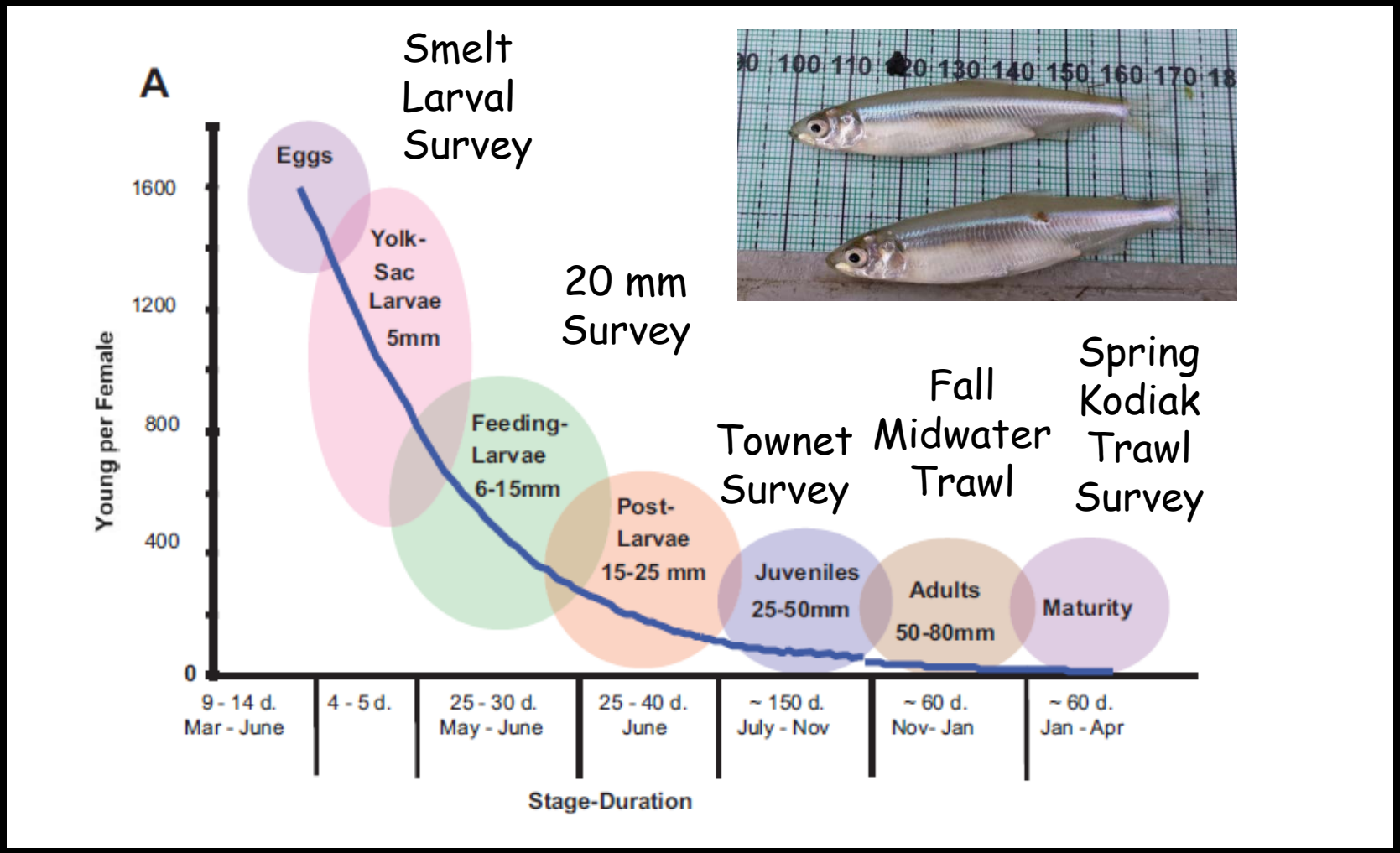
A Cooperative Program of
California Dept of Water Resources
State Water Resources Control Board
U.S. Bureau of Reclamation
U.S. Army Corps of Engineers
California Dept. of Fish and Game
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S. Environmental Protection Agency
National Marine Fisheries Service

http://www.water.ca.gov/iep/docs/IEP_FishMonitoring_final.pdf

Quick Overview: Fish Sampling

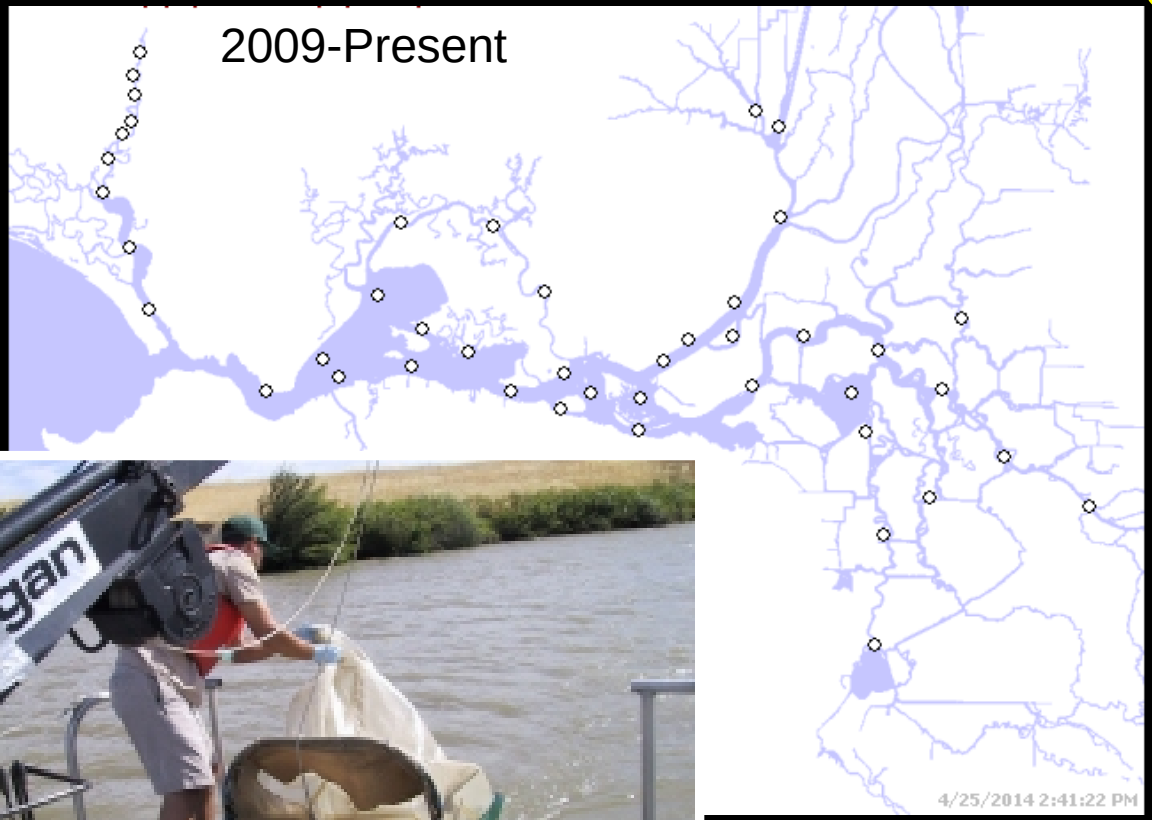
- Multiple fixed locations (9 surveys)
- Single fixed location (4 surveys)
- Flexible location (2 surveys)
- Fixed regional strata, random location (1 survey)

Sampling Multiple Life Stages



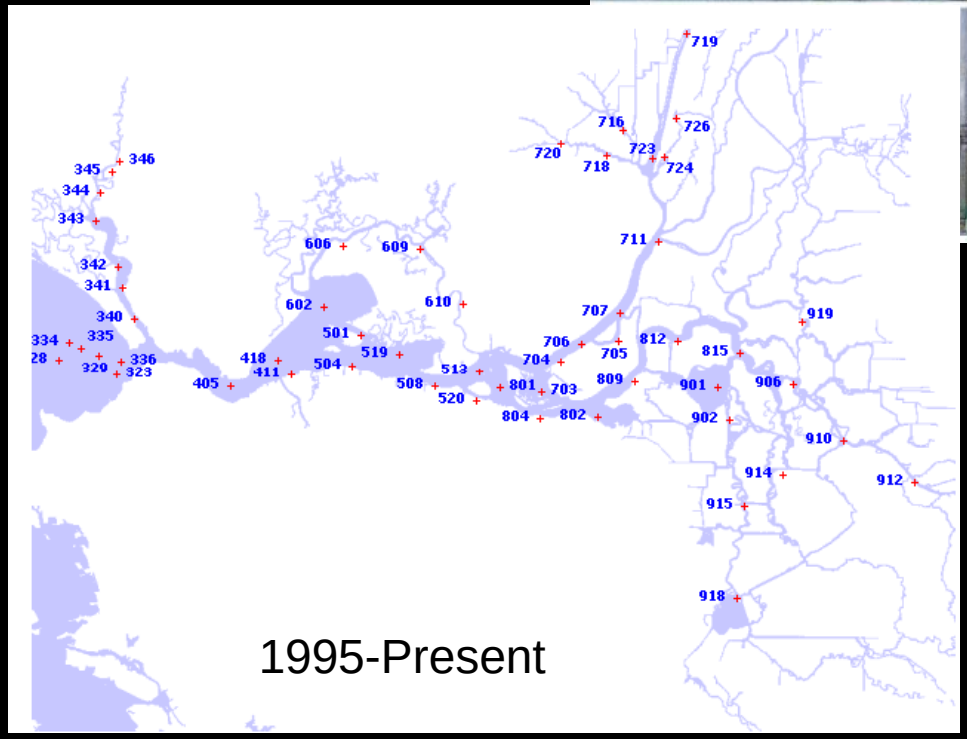
Adapted From Bennett (2005)

Smelt Larval Survey



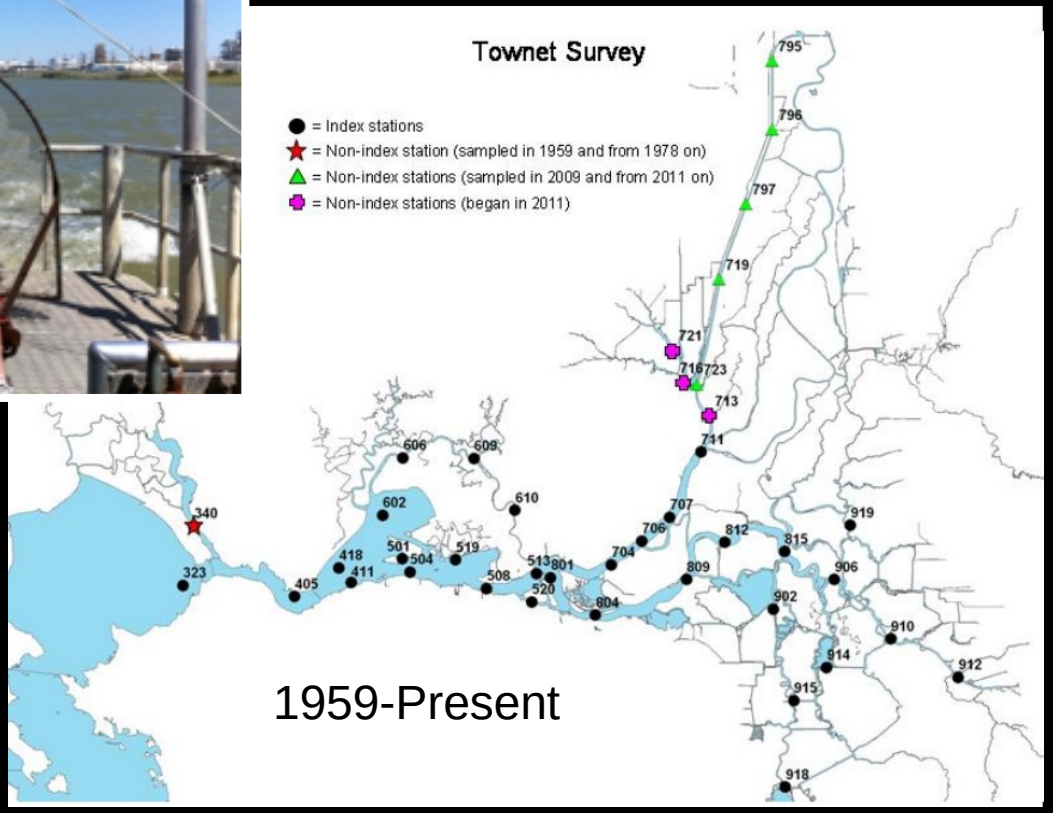
- 505 micron nets
- Every other week Jan-Mar
- Oblique Tows
- 35 Stations
- Focus is entrainment

20 mm Survey



- 1600 micron nets
- Every 2 weeks Mar-July
- Oblique Tows
- 40 Stations
- 50+ species captured

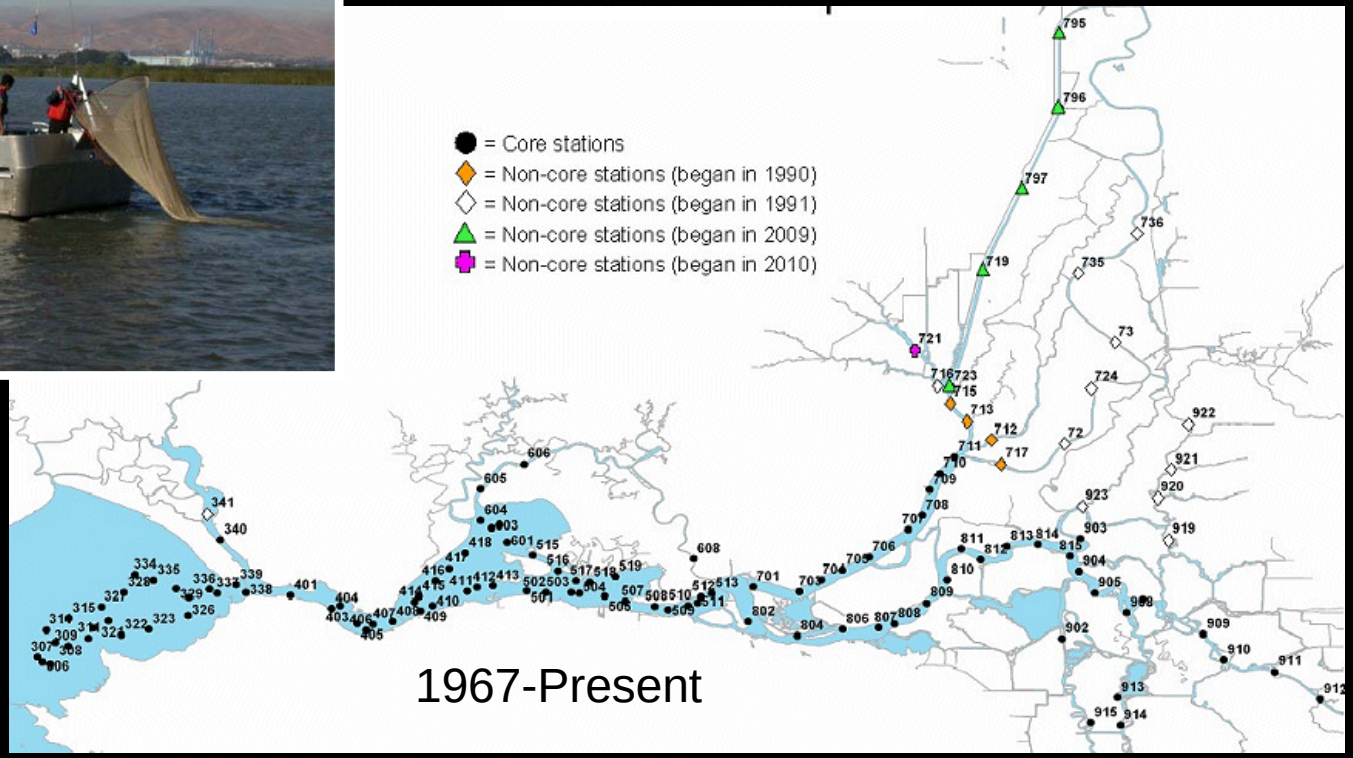
Summer Townet Survey

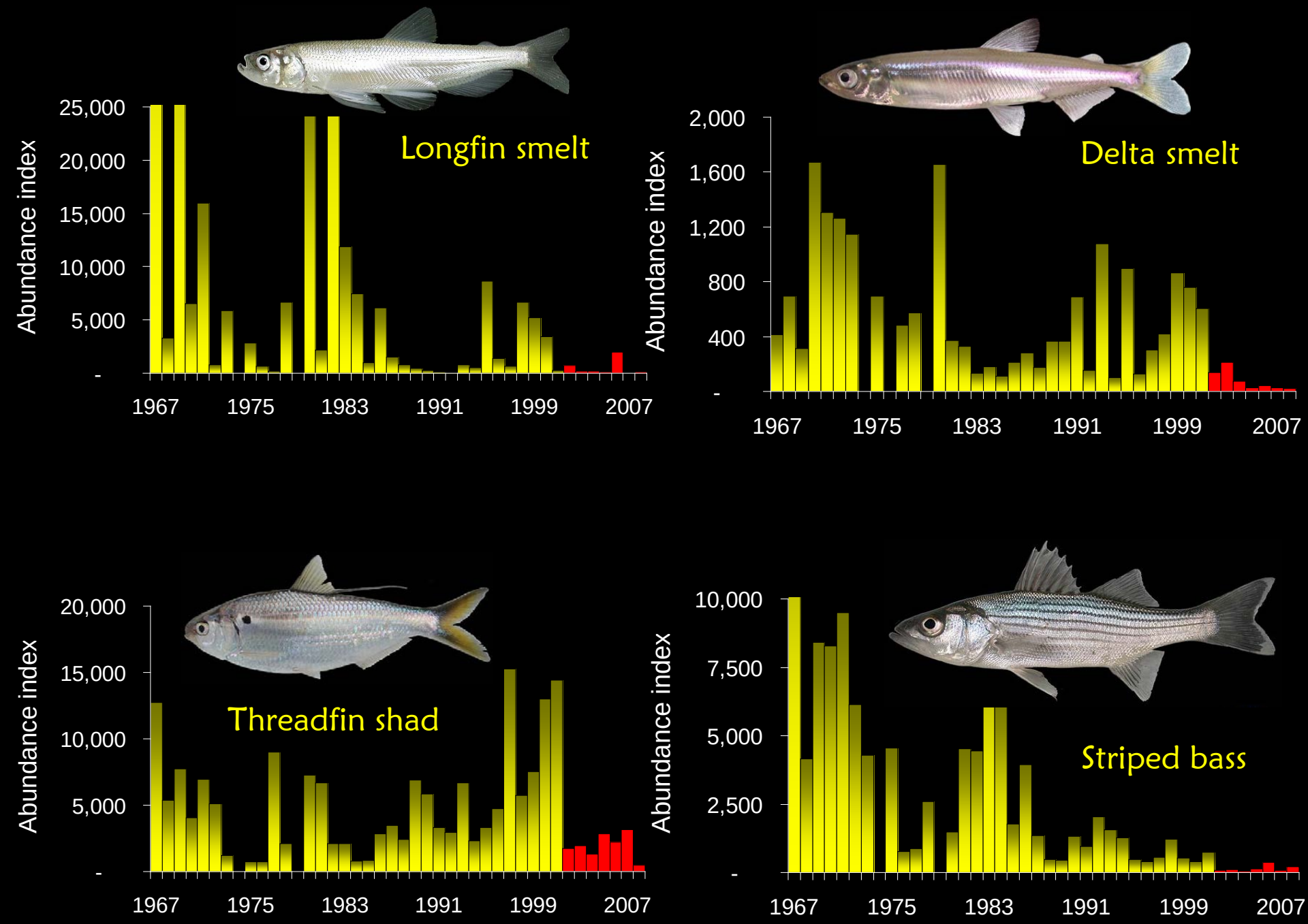


- 1.49m^2 net--variable mesh
- 6 surveys Jun-Aug
- Oblique tows
- 32 core + 8 additional stations
- Fish, inverts, WQ data

Fall Midwater Trawl

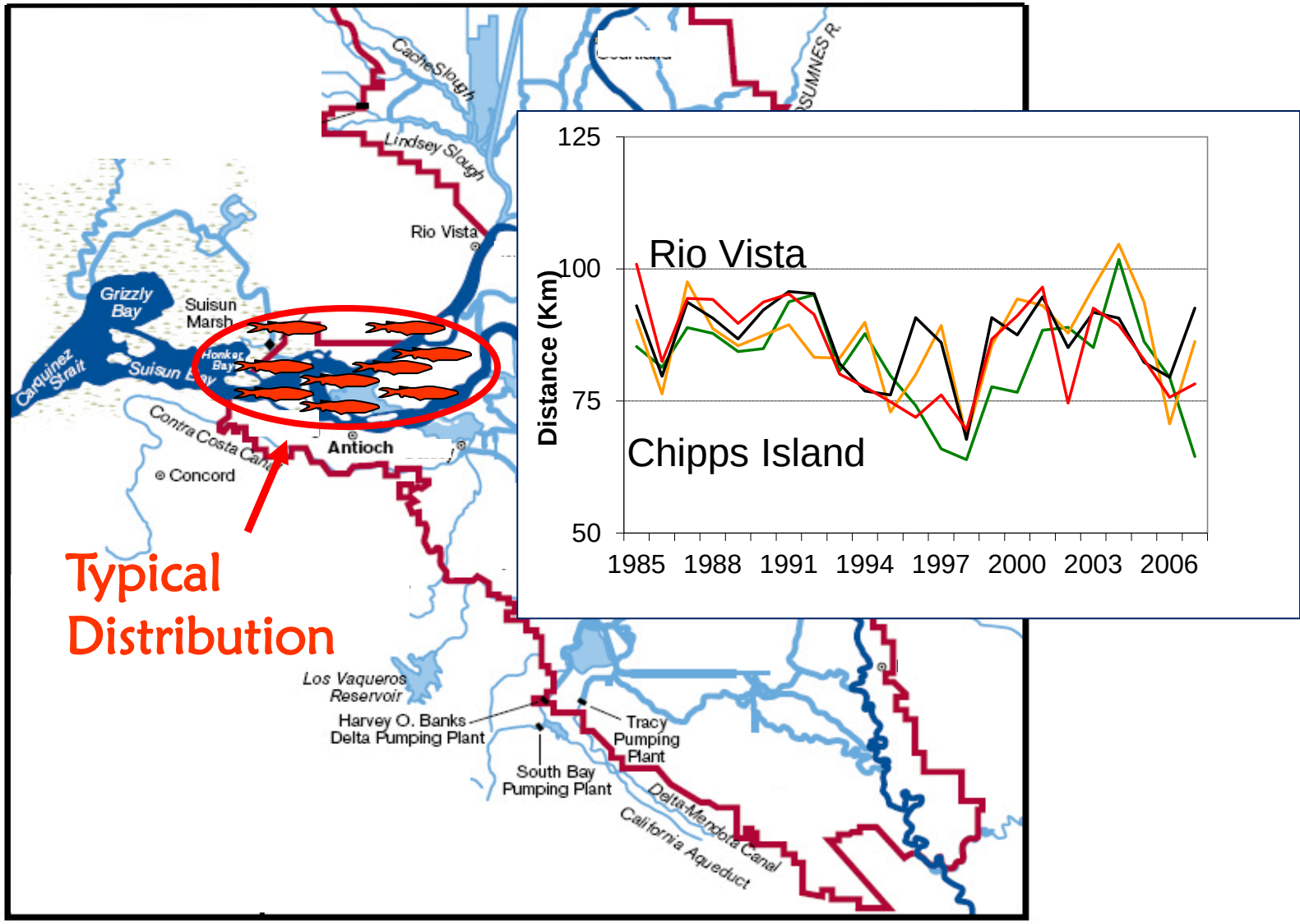
- 12'x12' nets, variable mesh
- Monthly Sept-Dec
- Oblique tows
- 100 core stations (122 total)
- Annual fish indices





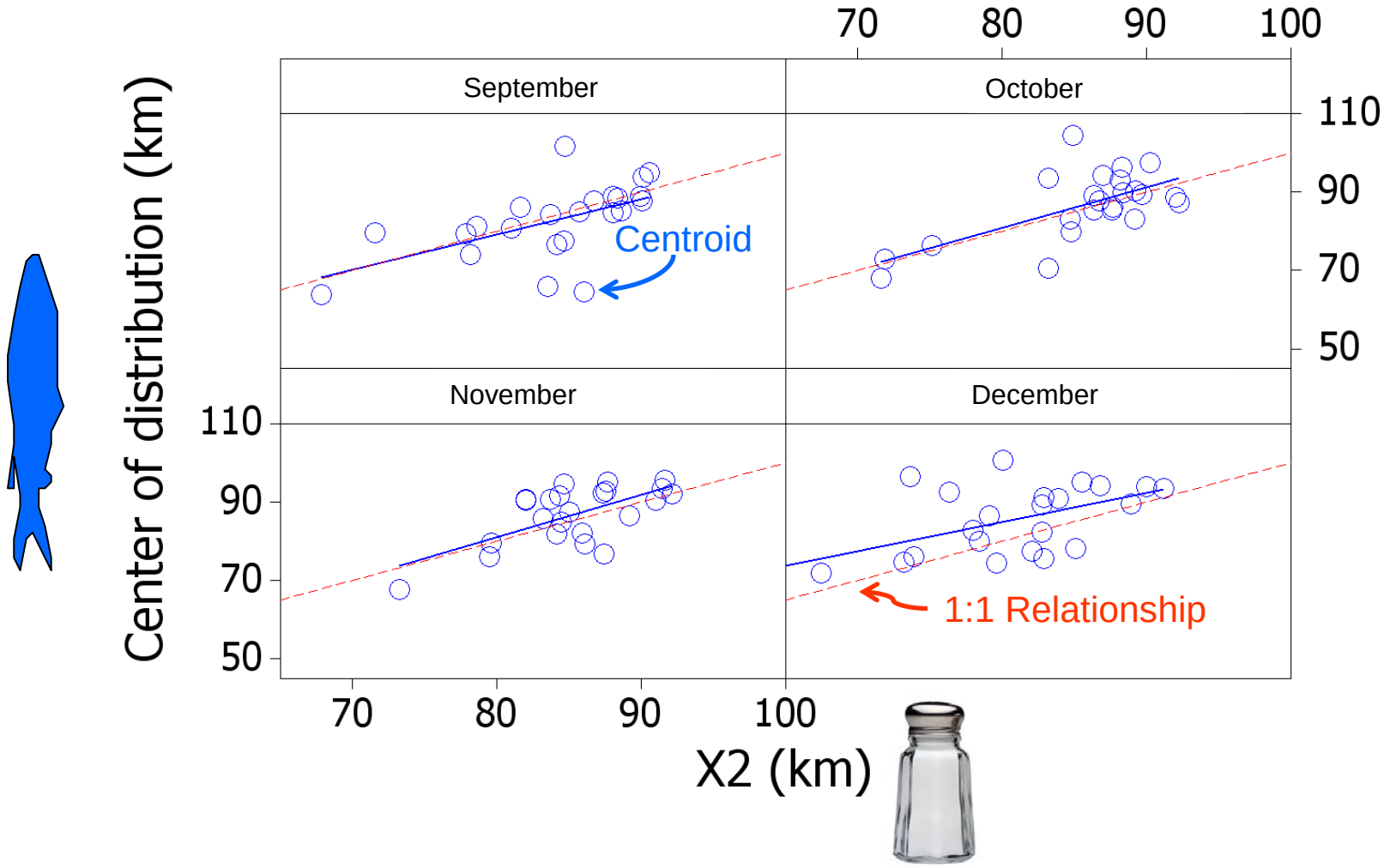
Slide From Fred Feyrer, USGS

Fall Distribution = West Delta



Source: Sommer et al. (2011); Merz et al. (2012)

Distribution Strongly Linked to Salt Field

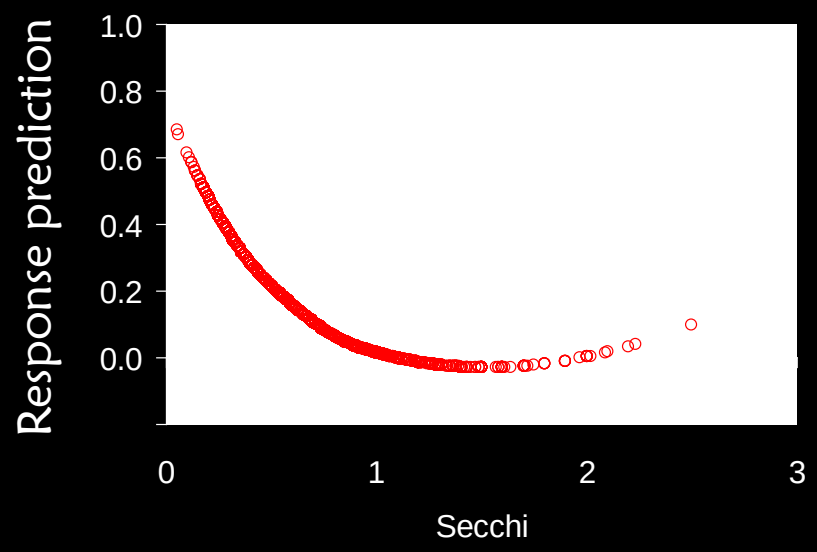


Source: Sommer et al. 2011

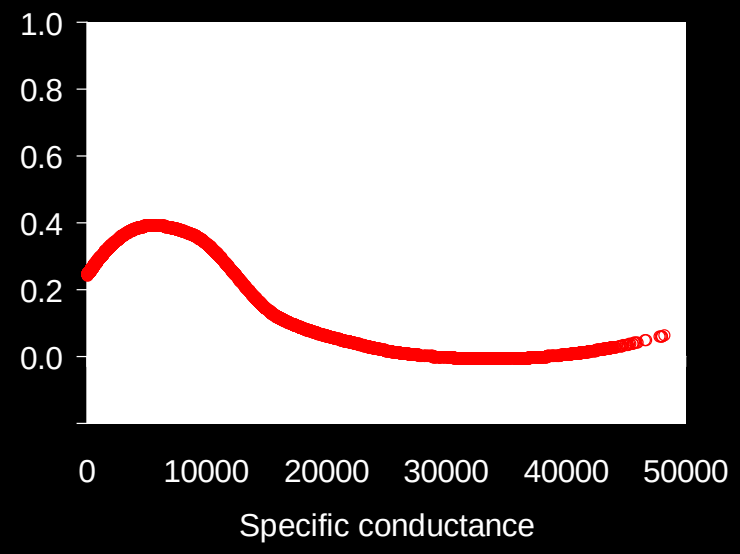
Results of Generalized Additive Modeling

Smelt Are Found Primarily In:

High Turbidity

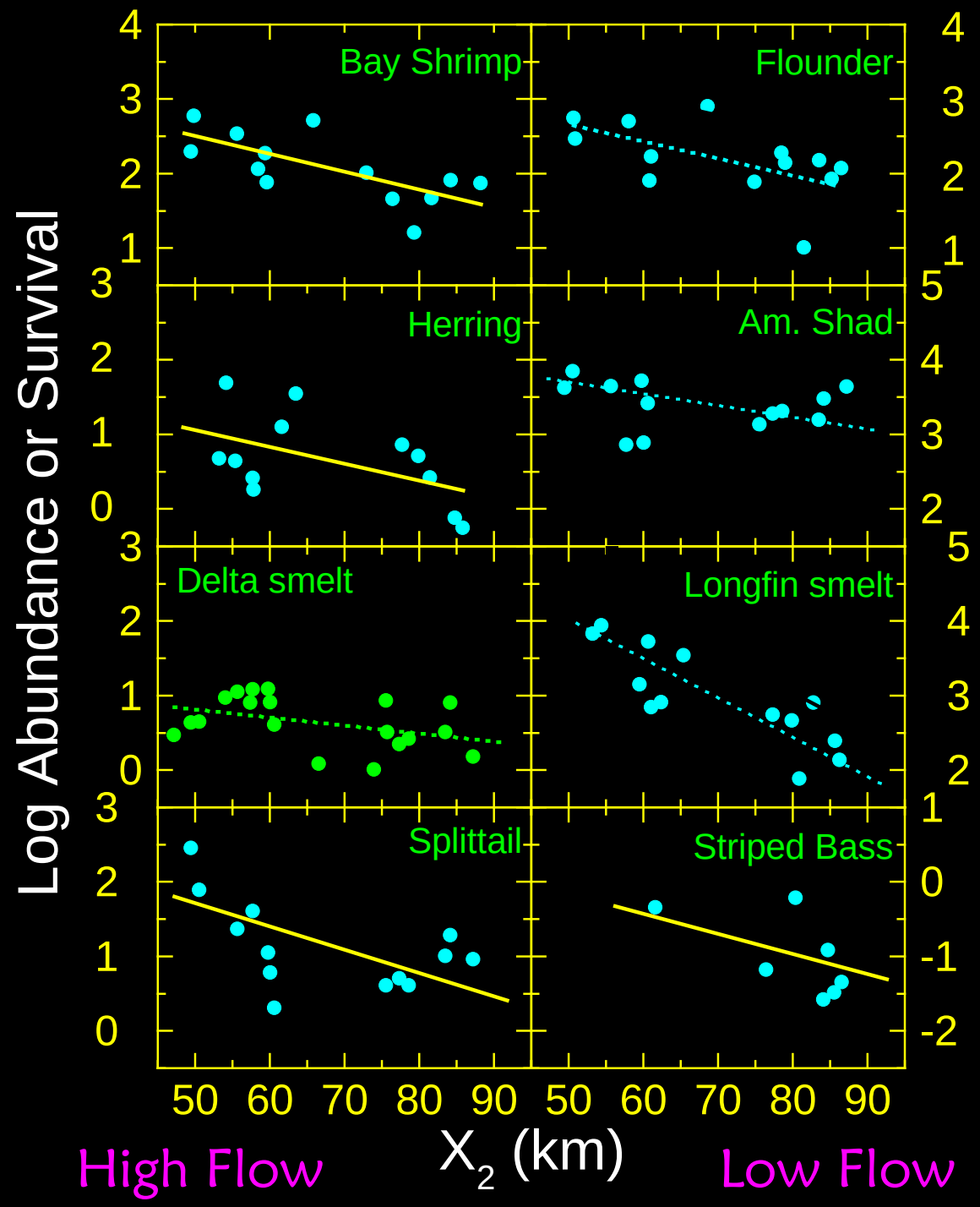


Relatively Low Salinities



Source: Feyrer et al. (CJFAS 2007)

Relationships Between Freshwater Flow and Biological Populations

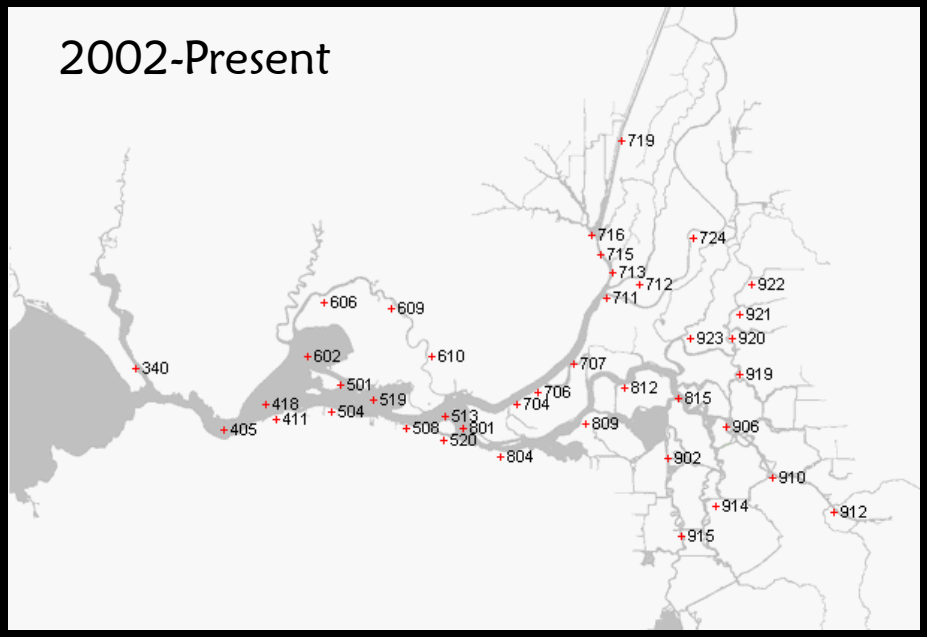


1988-2000

1982-2000 (DS)

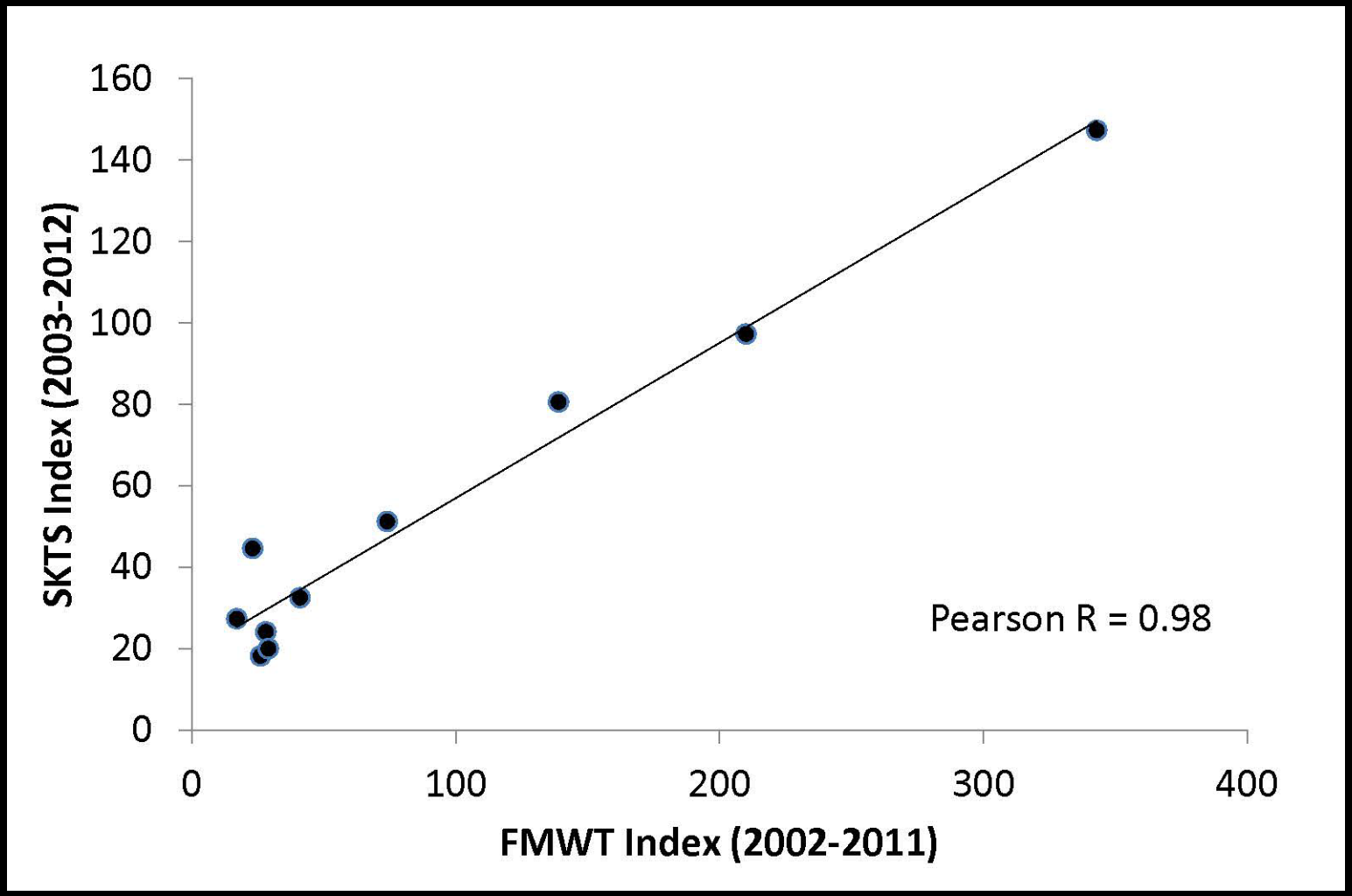
Source:
Kimmerer 2002 MEPS

Spring Kodiak Trawl Survey



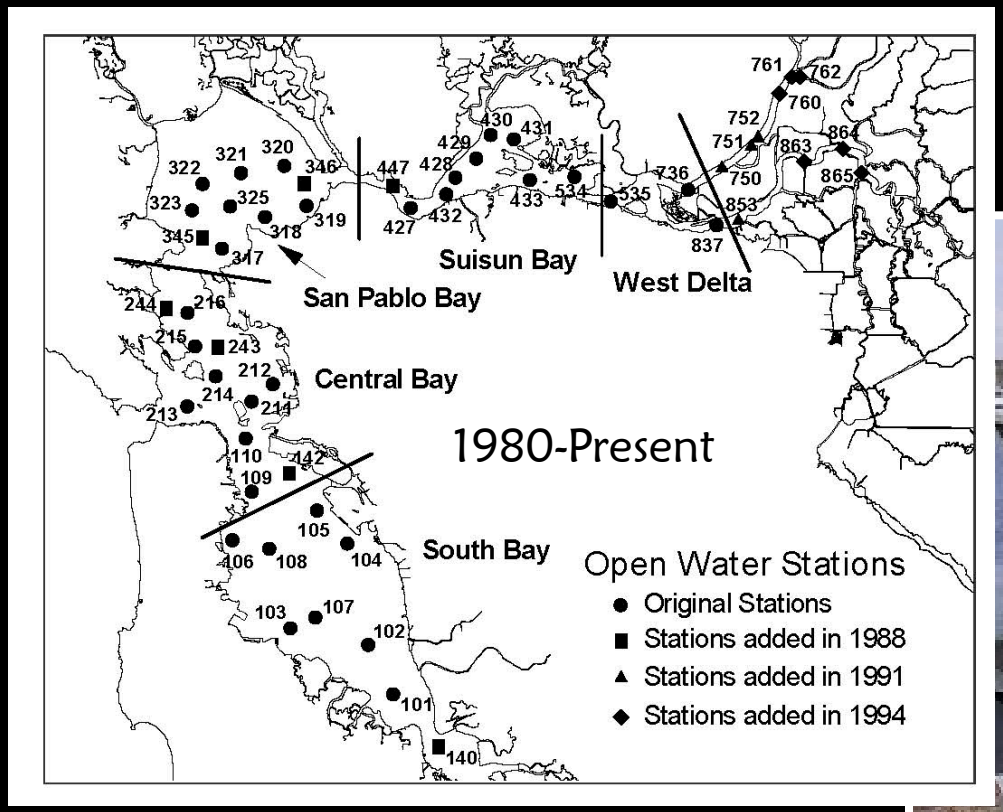
- Monthly Jan-May
- Surface tows with 25’ x 6’ net
- 40 Stations
- Supplemental surveys to assess entrainment risk

Evidence That Surveys Capture Relative Trends



Source: Adib-Samii, DFW; Brown et al. (2013)

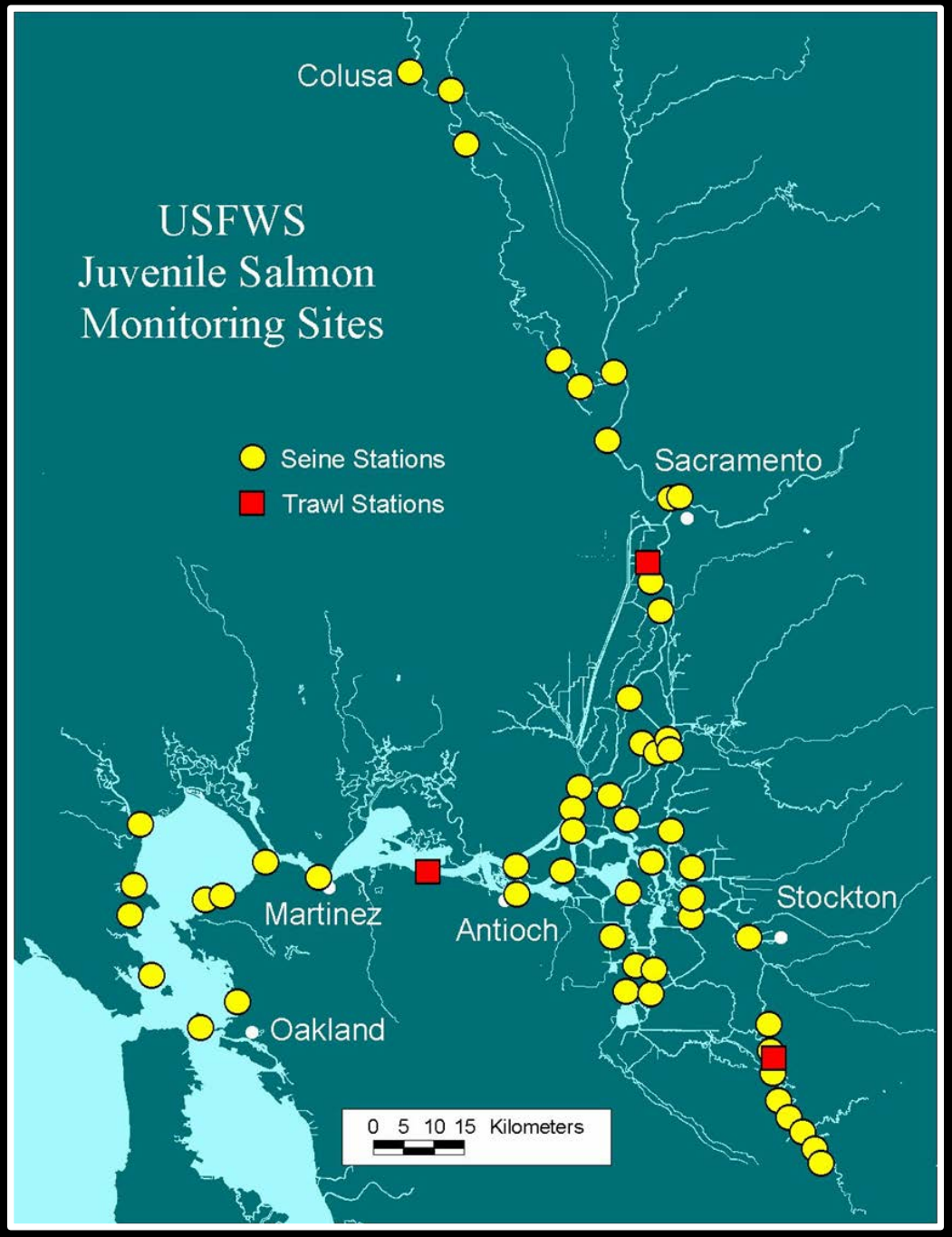
San Francisco Bay Study



- 52 stations
- Otter and midwater trawls
- Abundance indices: fish and invertebrates

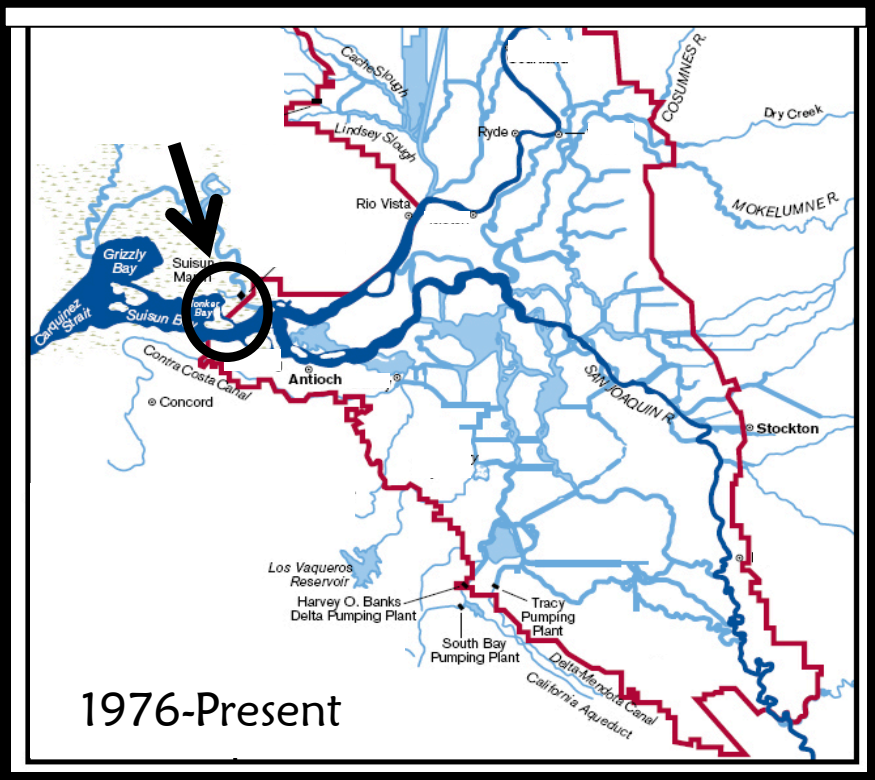
Beach Seine Survey

- 15 x 1.2 m nets
- Weekly year-round
- 57 stations
  - Ramps & beaches
- Samples fish & inverts
  - >25 mm FL

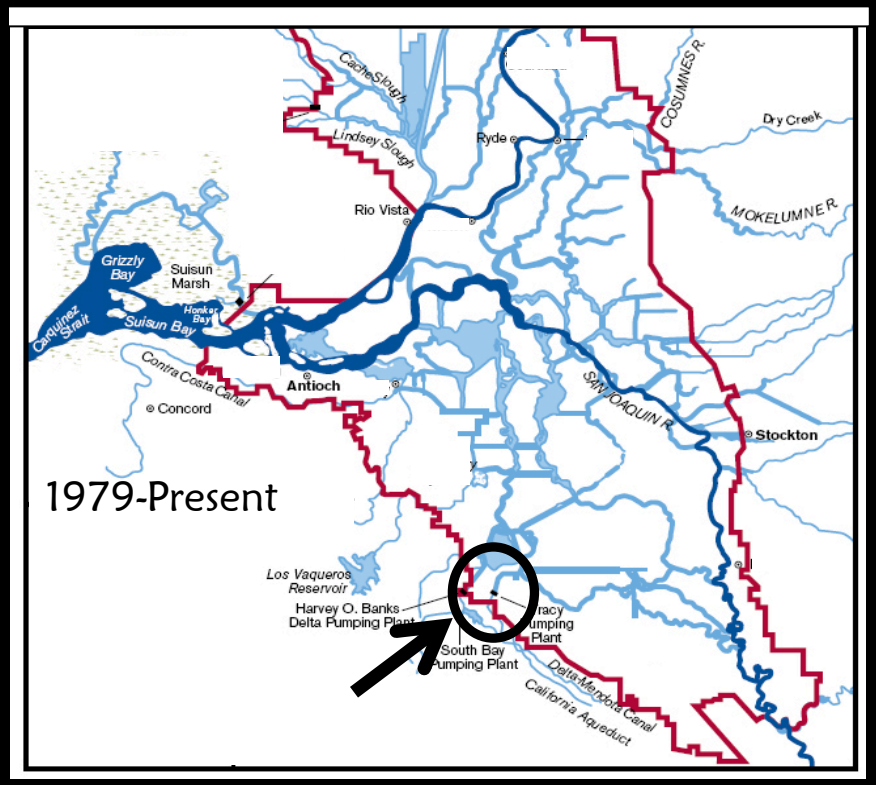


Chipps Island Trawl

- Focus on emigrating salmonids
- 4.6 m x 9.1 m net
- Ten 20 minute trawls/day
- 3-7 days/week
- Now year-round



Fish Salvage Facilities

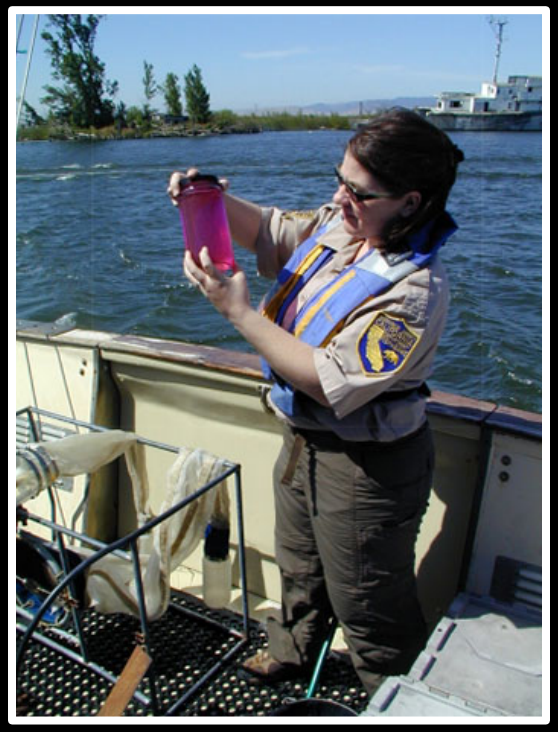


- Louvered screens
- Collect fish >20mm FL
- Subsamples throughout day
- Year-round sampling

Adult Striped Bass Survey

Sturgeon Survey

Other Surveys



- Suisun Marsh Survey (UCD)
- Sacramento and Mossdale Trawl Surveys (USFWS)
- Zooplankton Tows (DFW; EMP)

Sampling Summary

Strengths

- Long, consistent data sets.
- Useful for relative trends.
- Distribution, habitat use, drivers.
- Good data availability.
- Broad geographical coverage.
- Multiple species & life stages.
- Collaboration, resource sharing.
- Adaptability.

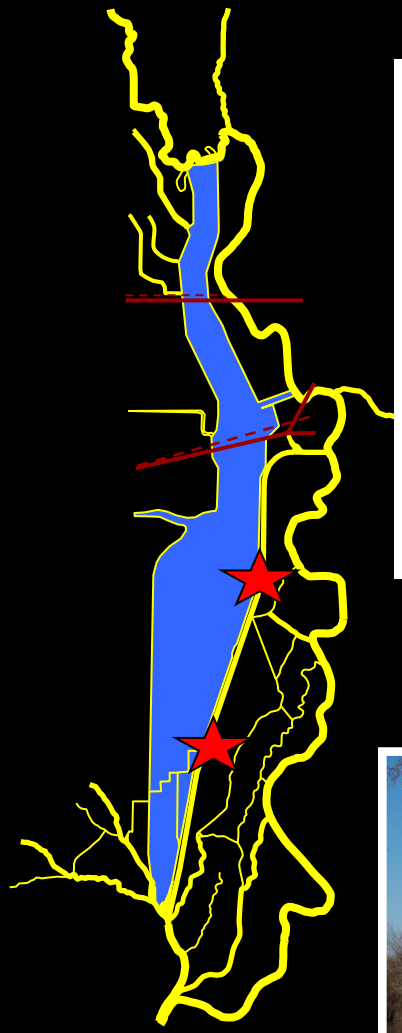
Weaknesses

- Some surveys very geographically limited.
- Not enough larval or adult surveys.
- Population size, vital rates, health?
- Little off-channel habitat.
- Mortality ("Take").
- Difficult, expensive.

Yolo Bypass Sampling

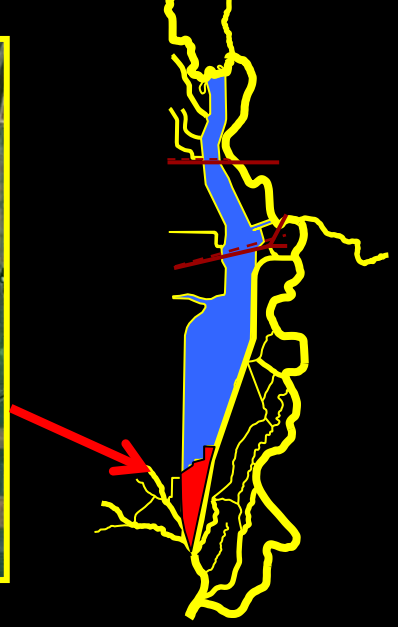
Fyke Trap

- Focus on adult fish
- 10’ x 16’ passive trap
- 3-7 days week, Jan-Jun
- Since 1999

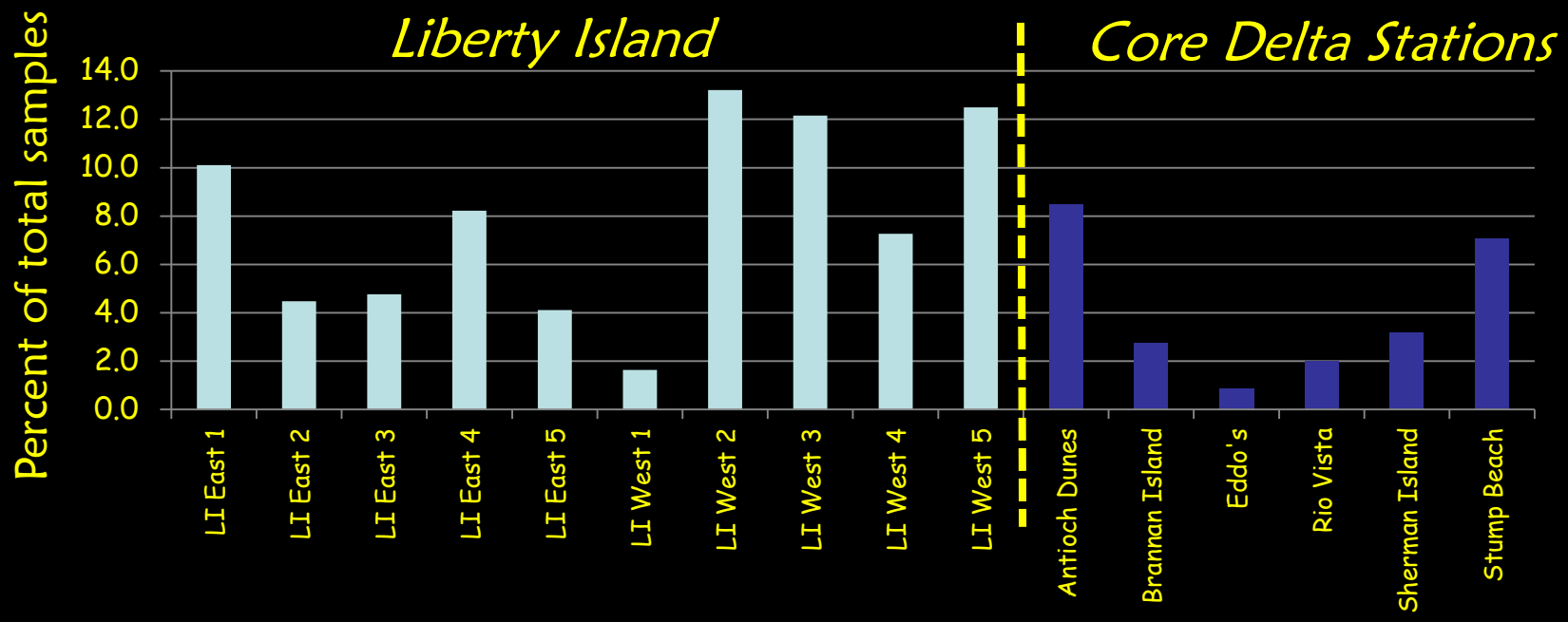


Rotary Screw Trap

- Focus on outmigrating juvenile fish
- 3-7 days/week, Jan-Jun
- Since 1998



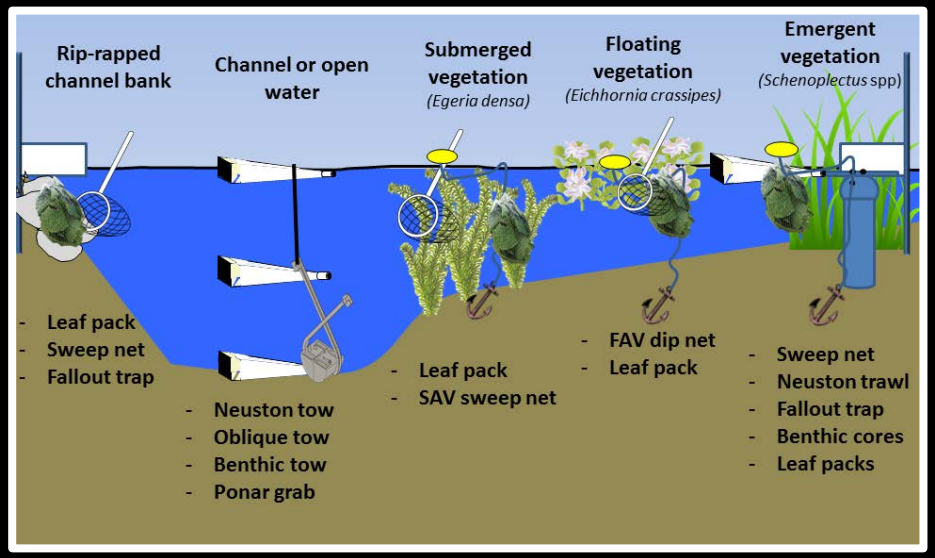
Expansion of Beach Seine Survey into Liberty Island



Sommer and Mejia 2013

Tidal Wetlands Gear Testing

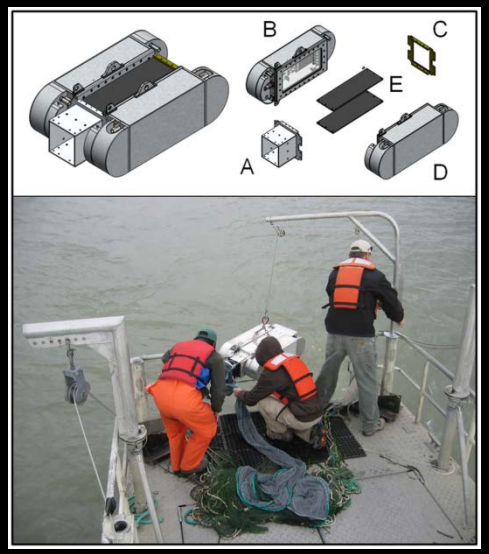
Fish



Food Web

Additional R&D for New Monitoring Approaches

- SmeltCAM (*USGS*).
- "Early Warning" trawling in channels leading to water diversions (*USFWS*).
- Genetic estimation of effective population size. (*UC Davis*)
- Environmental DNA sampling (*UC Davis*).
- Gear efficiency (DFW)



Questions?