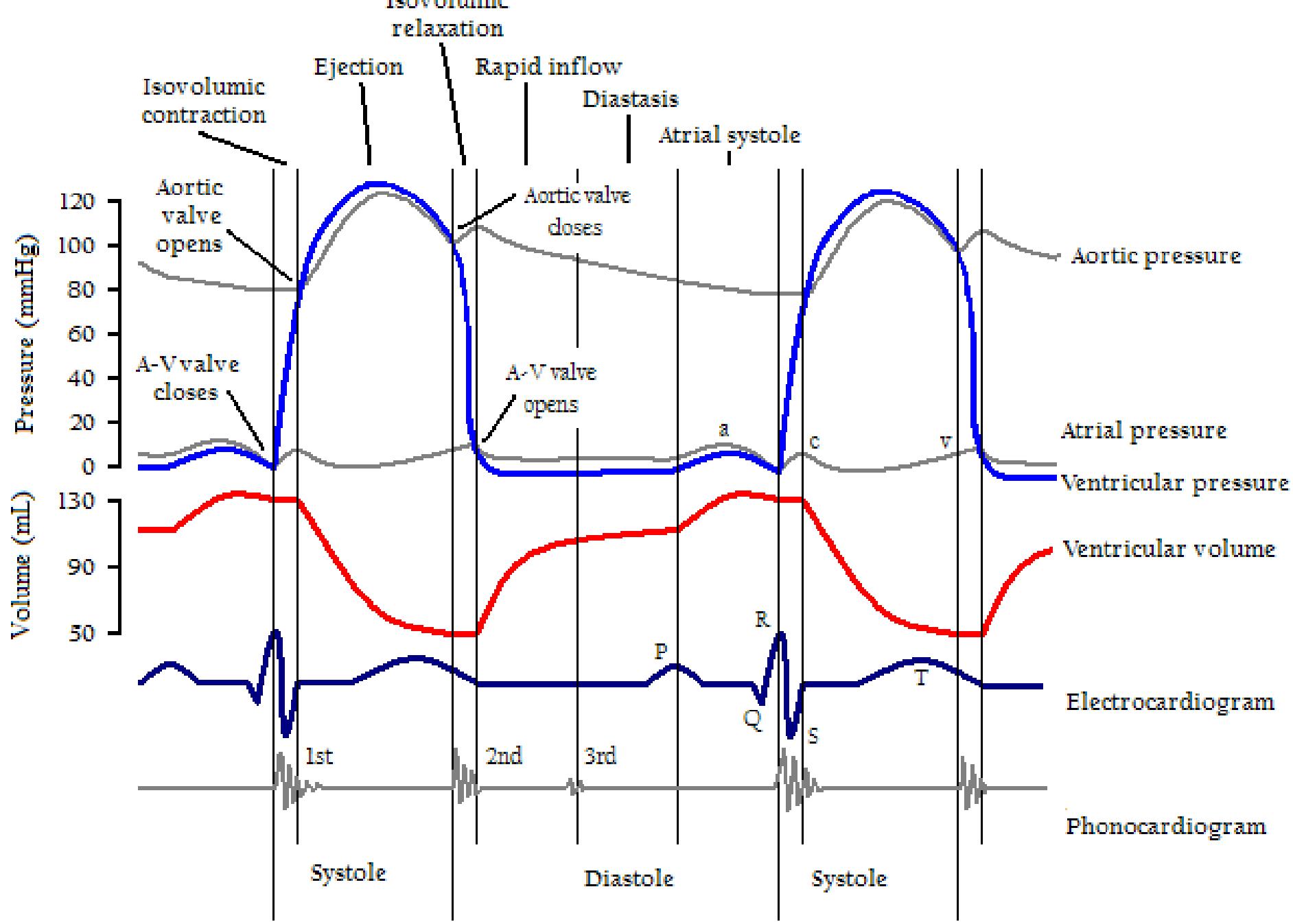
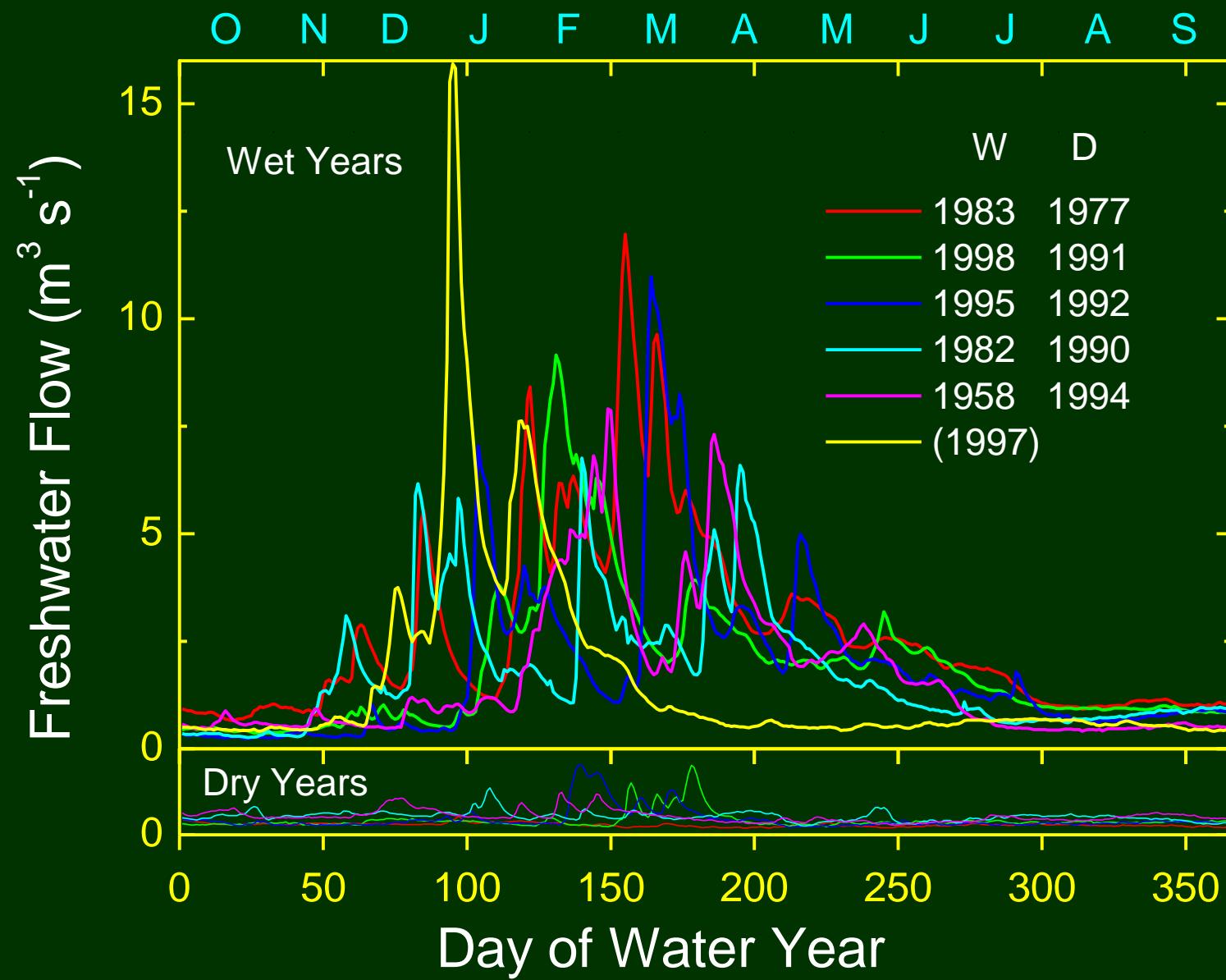
A satellite-style aerial photograph of a coastal region. In the lower-left foreground, a large body of water is visible. A river or coastal inlet flows from the center-left towards the bottom of the frame, creating a wide, light-colored delta. The surrounding land is a mix of dark green forests and brown agricultural fields. A winding white line, likely a road or a path, runs diagonally across the upper portion of the image. The overall scene is a blend of natural and human-made environments.

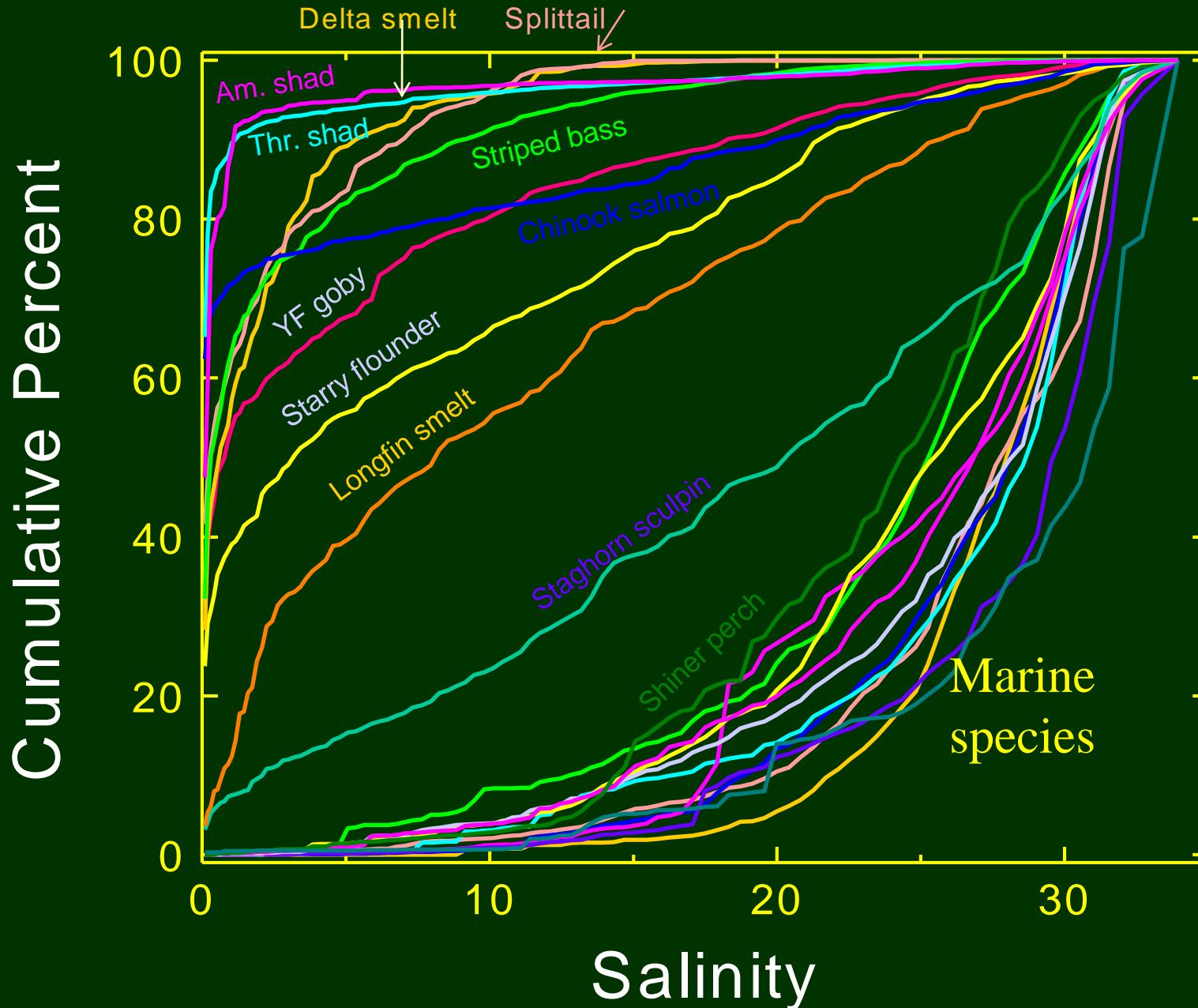
What is the Estuary's Pulse?

Bruce Herbold USEPA

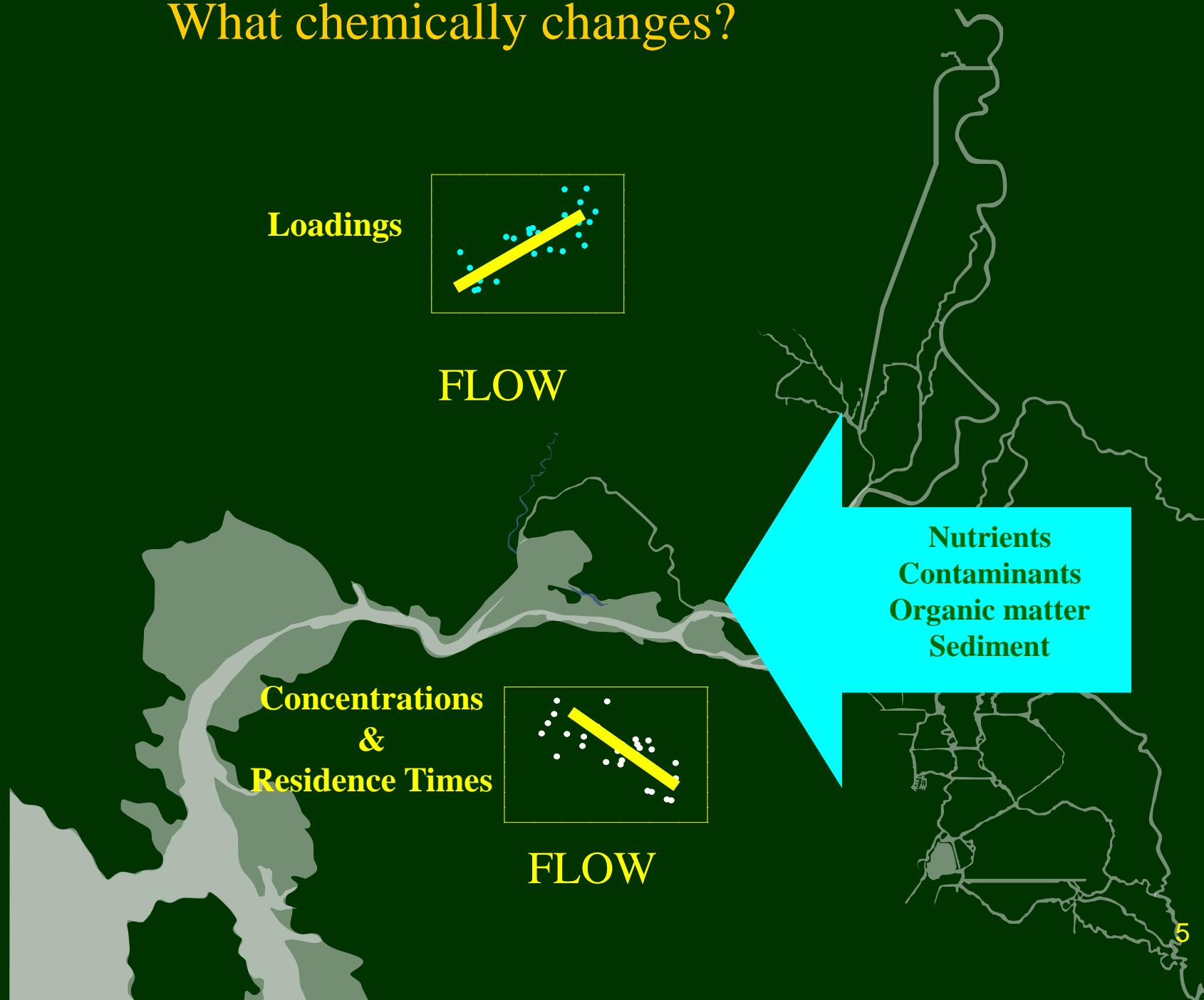




Most fishes follow salinities

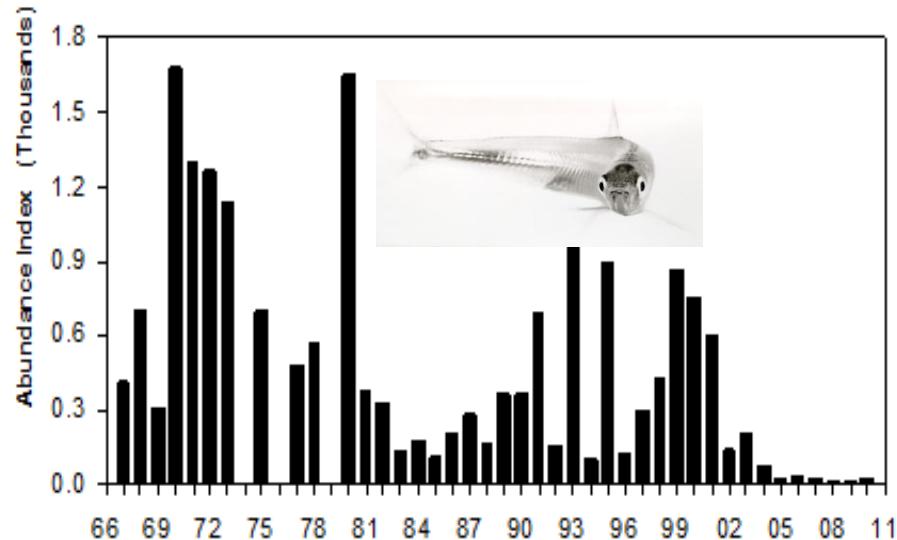


What chemically changes?

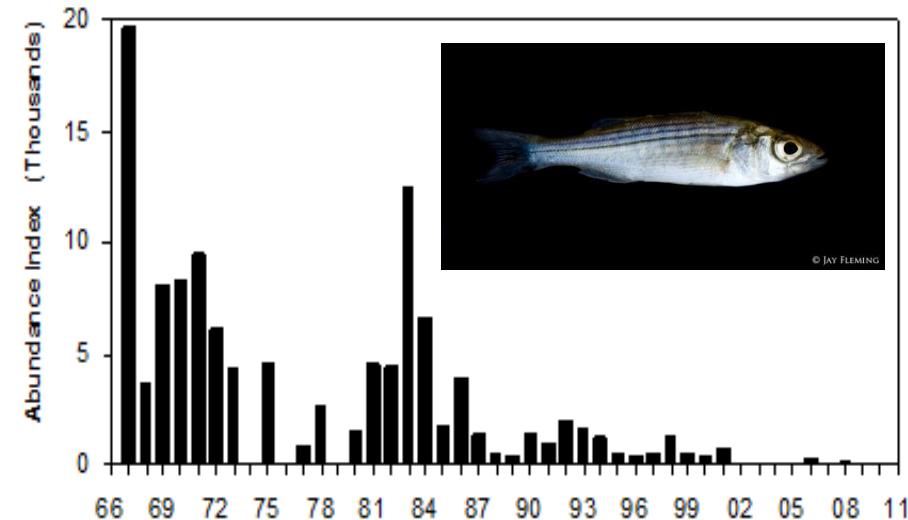


POD

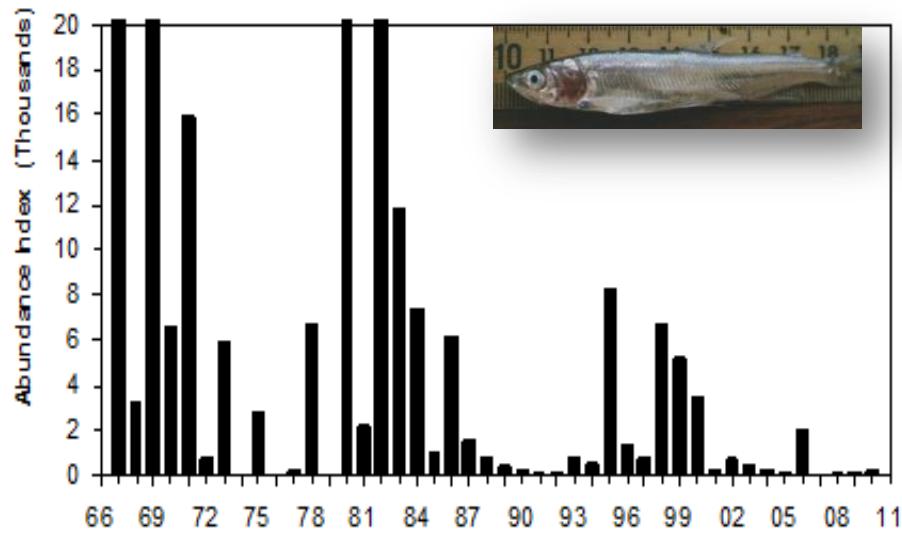
Delta Smelt



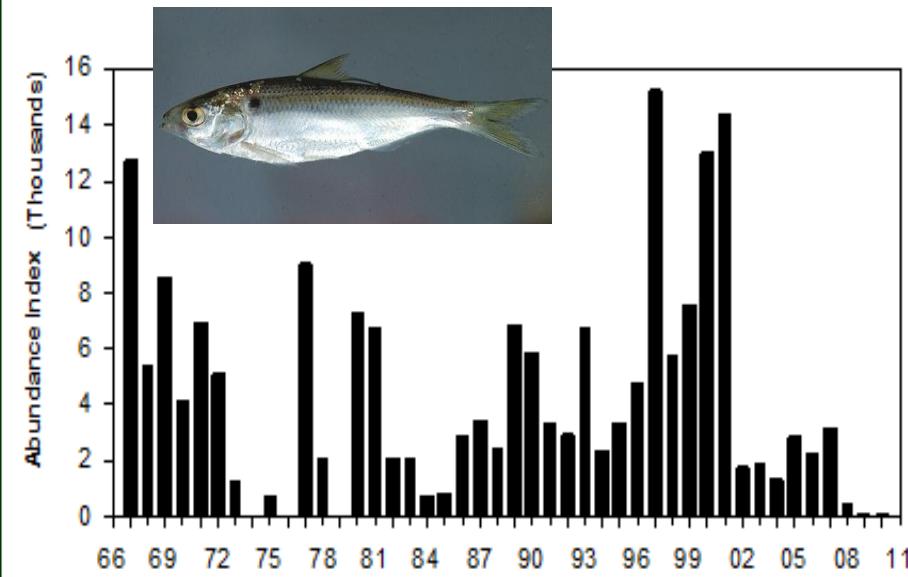
Striped Bass

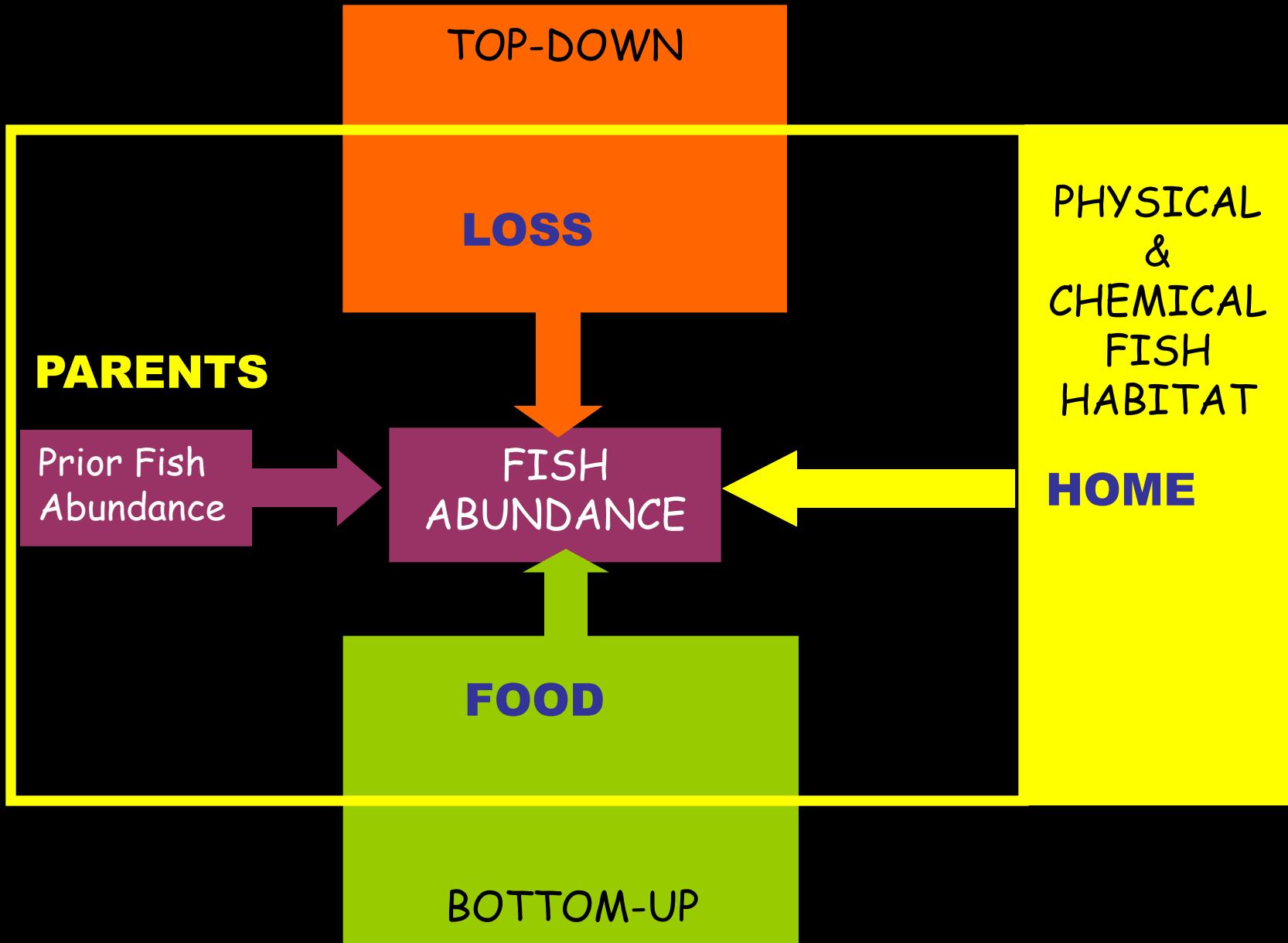


Longfin Smelt



Threadfin Shad





PHYSICAL
&
CHEMICAL
FISH
HABITAT

FISH
ABUNDANCE



FISH
ABUNDANCE



PHYSICAL & CHEMICAL FISH HABITAT

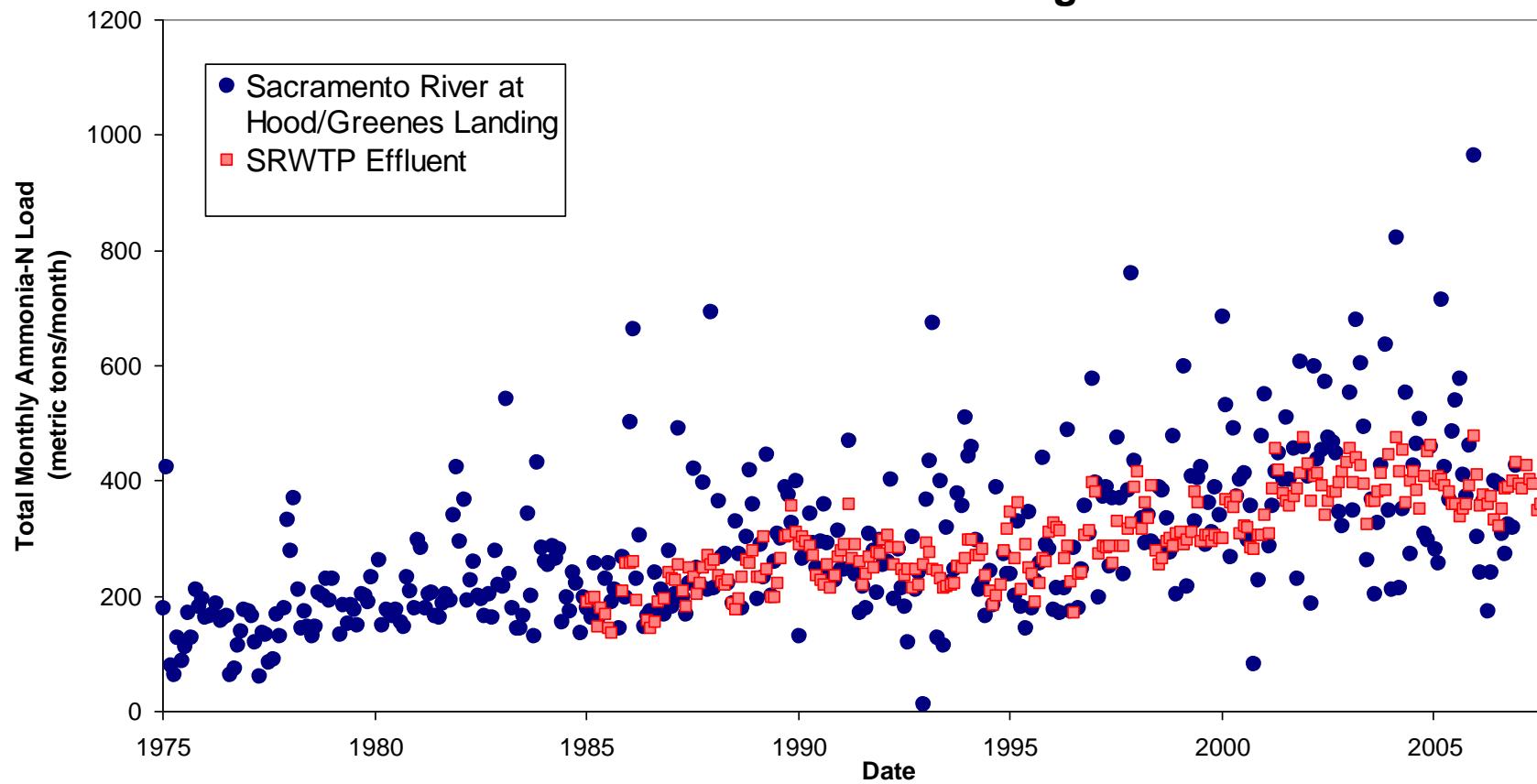
*Temperature
Turbidity
Salinity
Nutrients*

Contaminants

Disease

Toxic algae

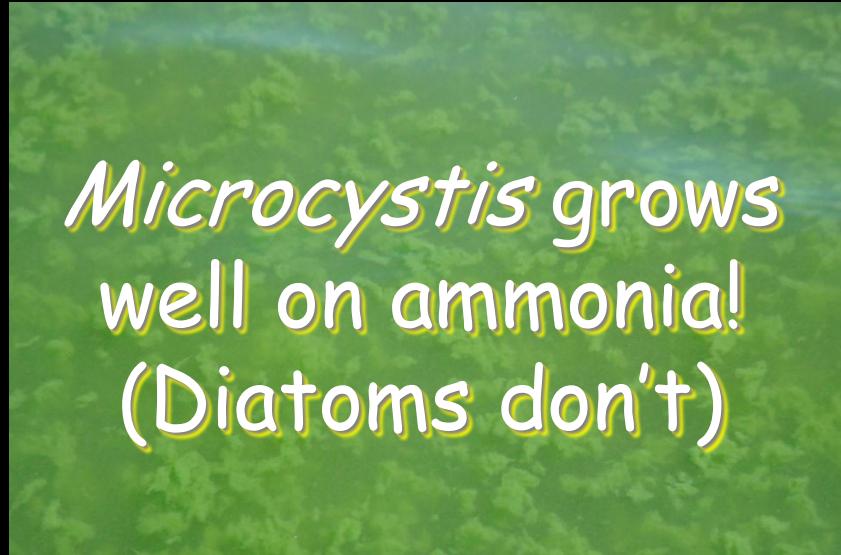
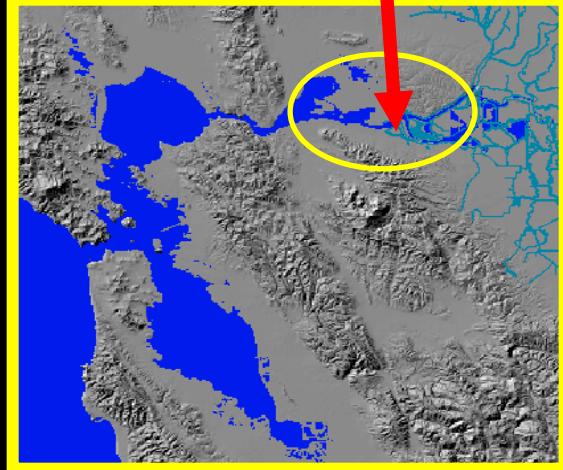
Monthly Ammonia Loads in the Sacramento River at Hood and in Effluent from the Sacramento Regional WWTP



Sources: A. Mueller-Solger, DWR; A. Jassby, in press SFEWS

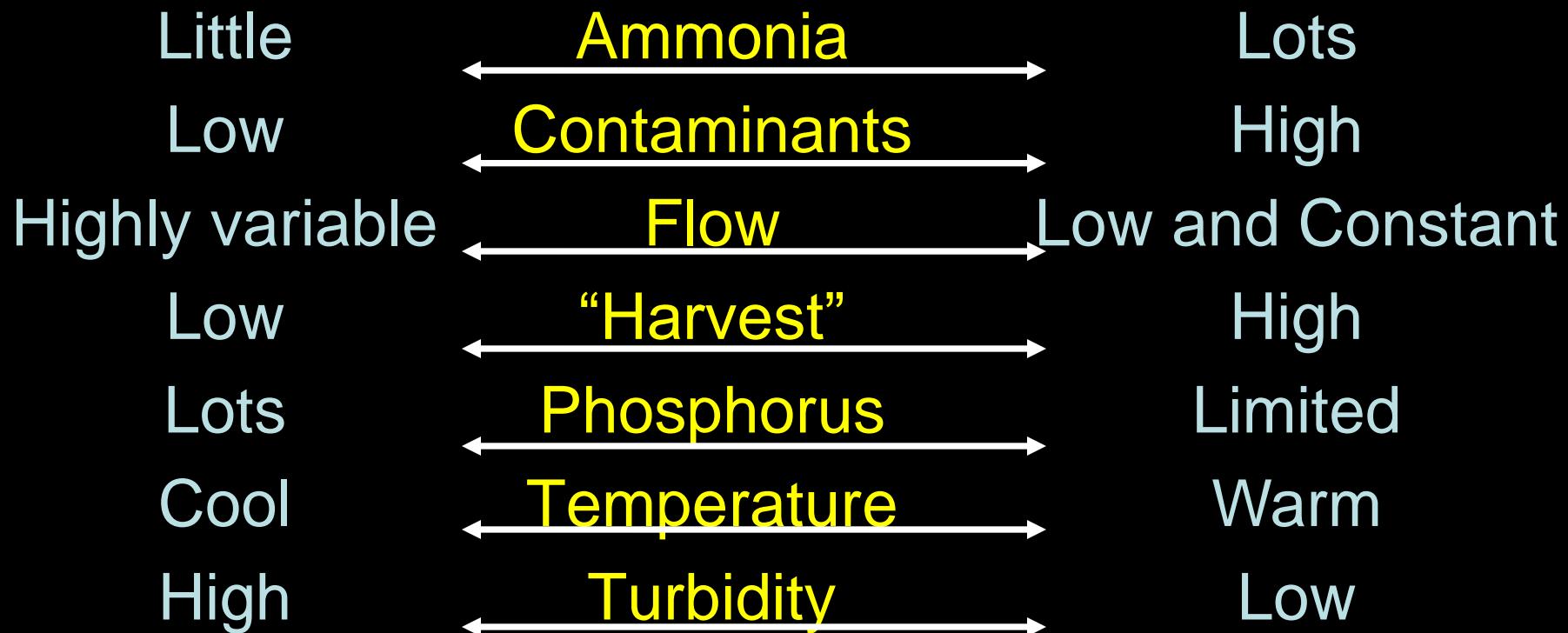
Widespread, sporadic blooms of *Microcystis*

August 2007 Levels: 1.3 million cells/mL



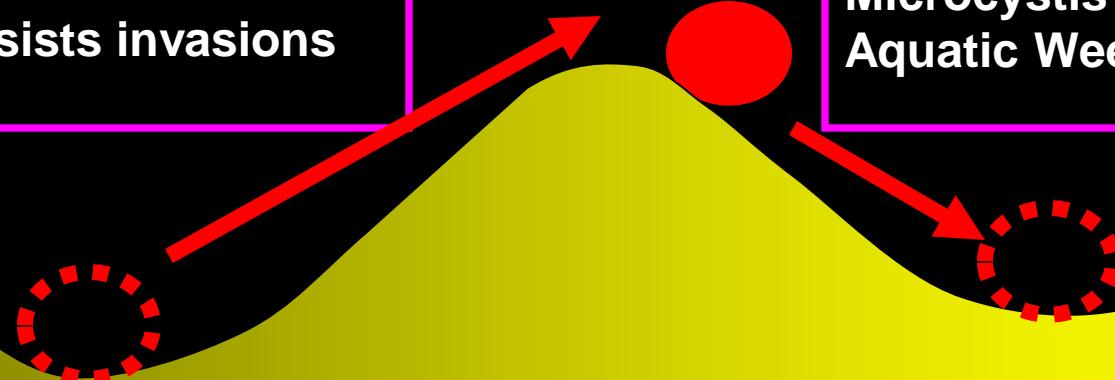
Core Habitat of Delta Smelt

Source: Peggy Lehman (DWR)

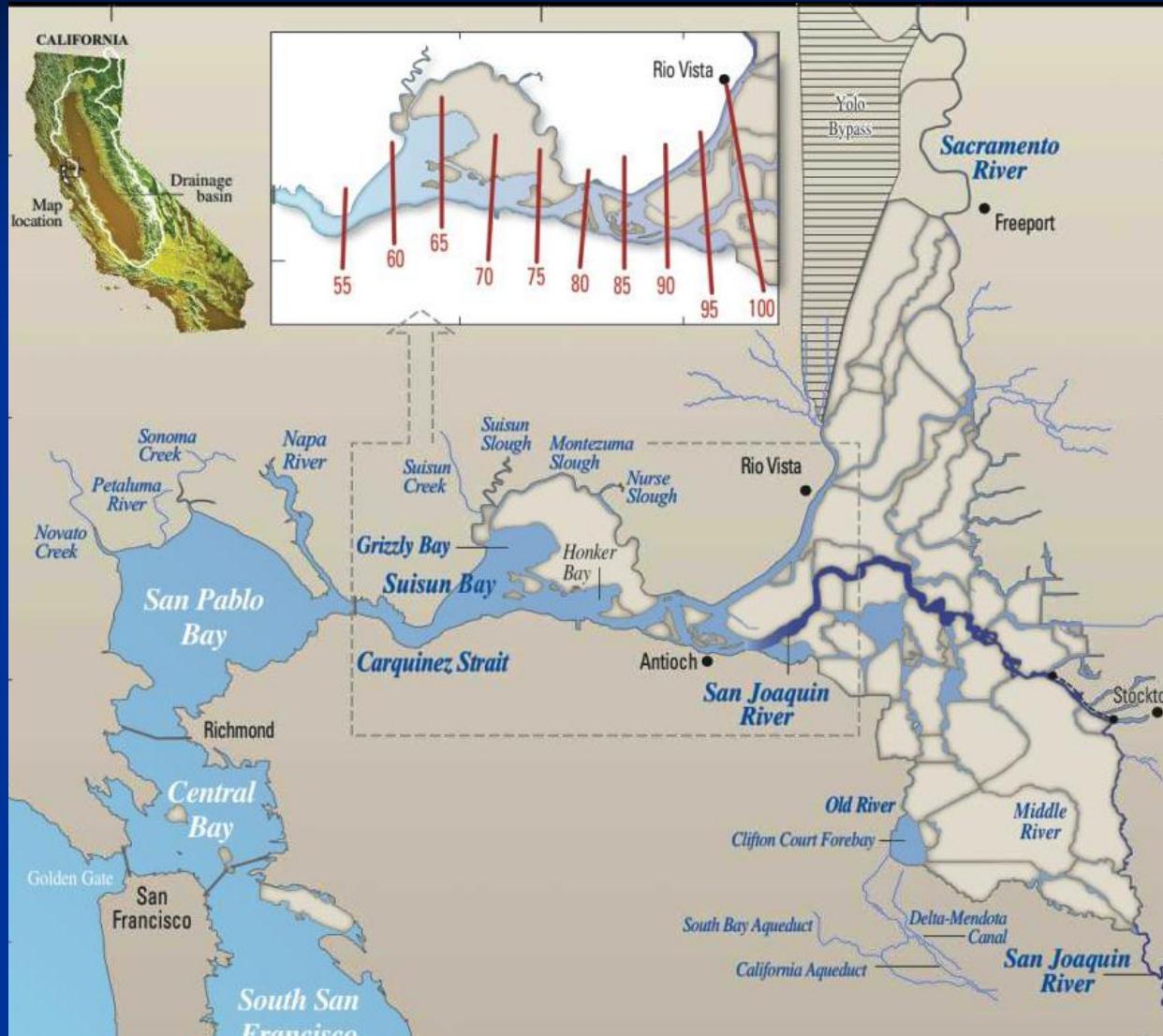


Diatoms
Pelagic fish
Natives thrive
Resists invasions

Clams
Jellyfish
Edge & benthic fish
Microcystis
Aquatic Weeds



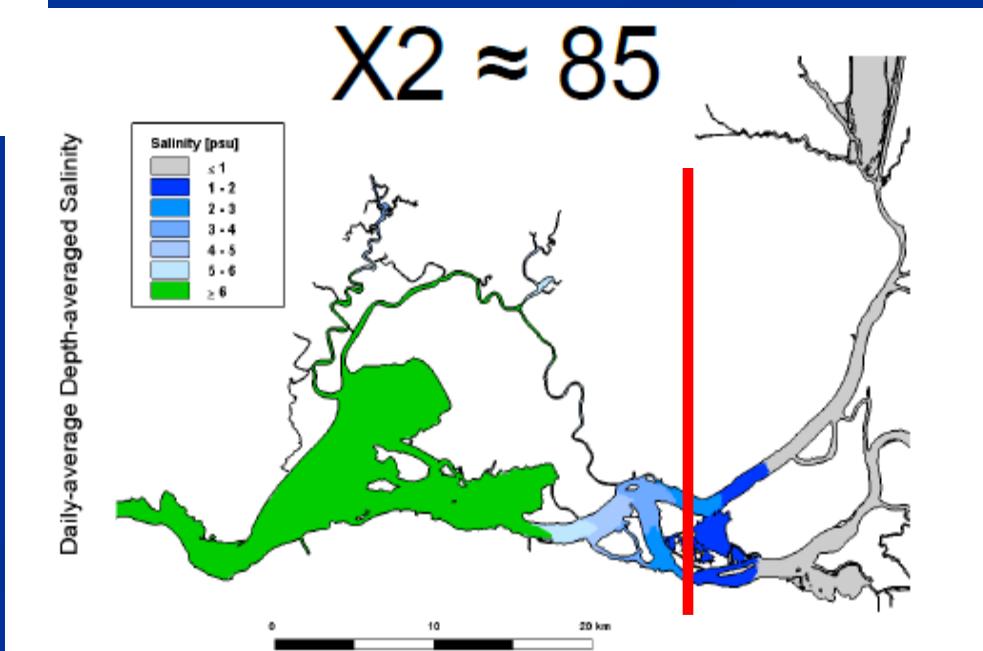
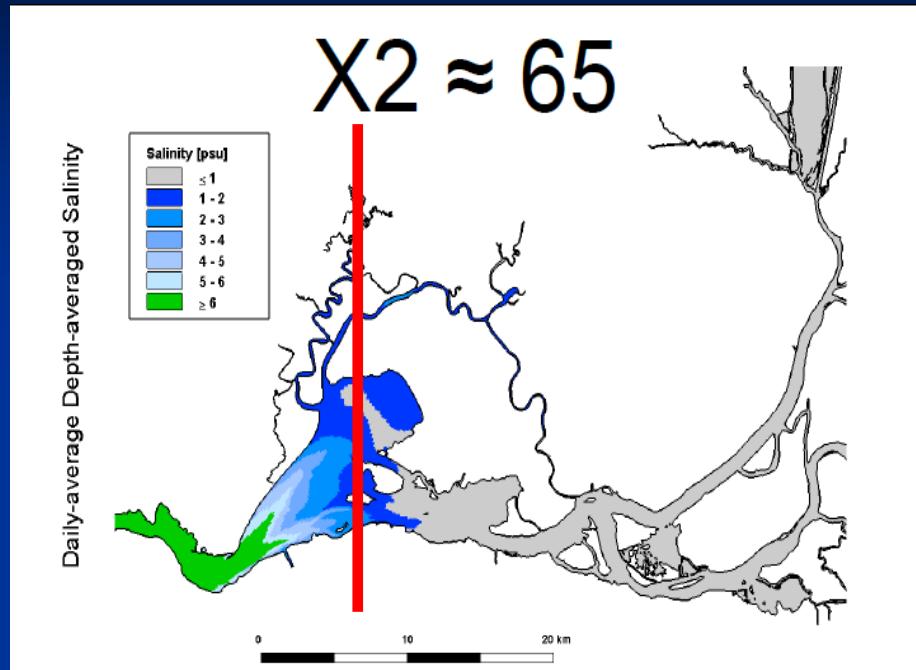
X2 and the SF Bay Delta Estuary



DeLio (2011) adapted from Jassby et al. (1995)



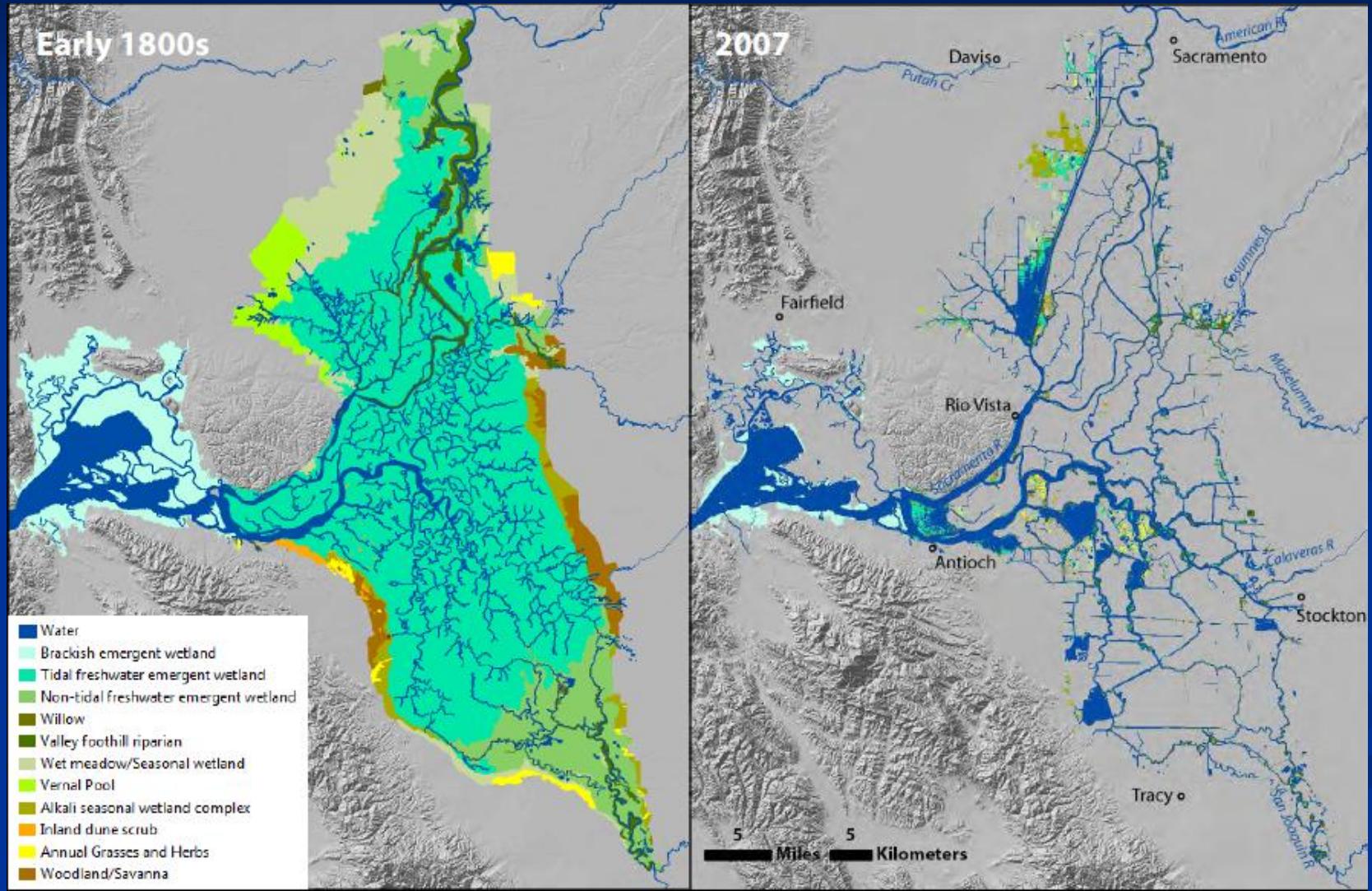
X2 and the Low Salinity Zone



Source of X2 maps is Delta Modeling Associates
Low Salinity Flip Book. June 15, 2012. Version 0.9.



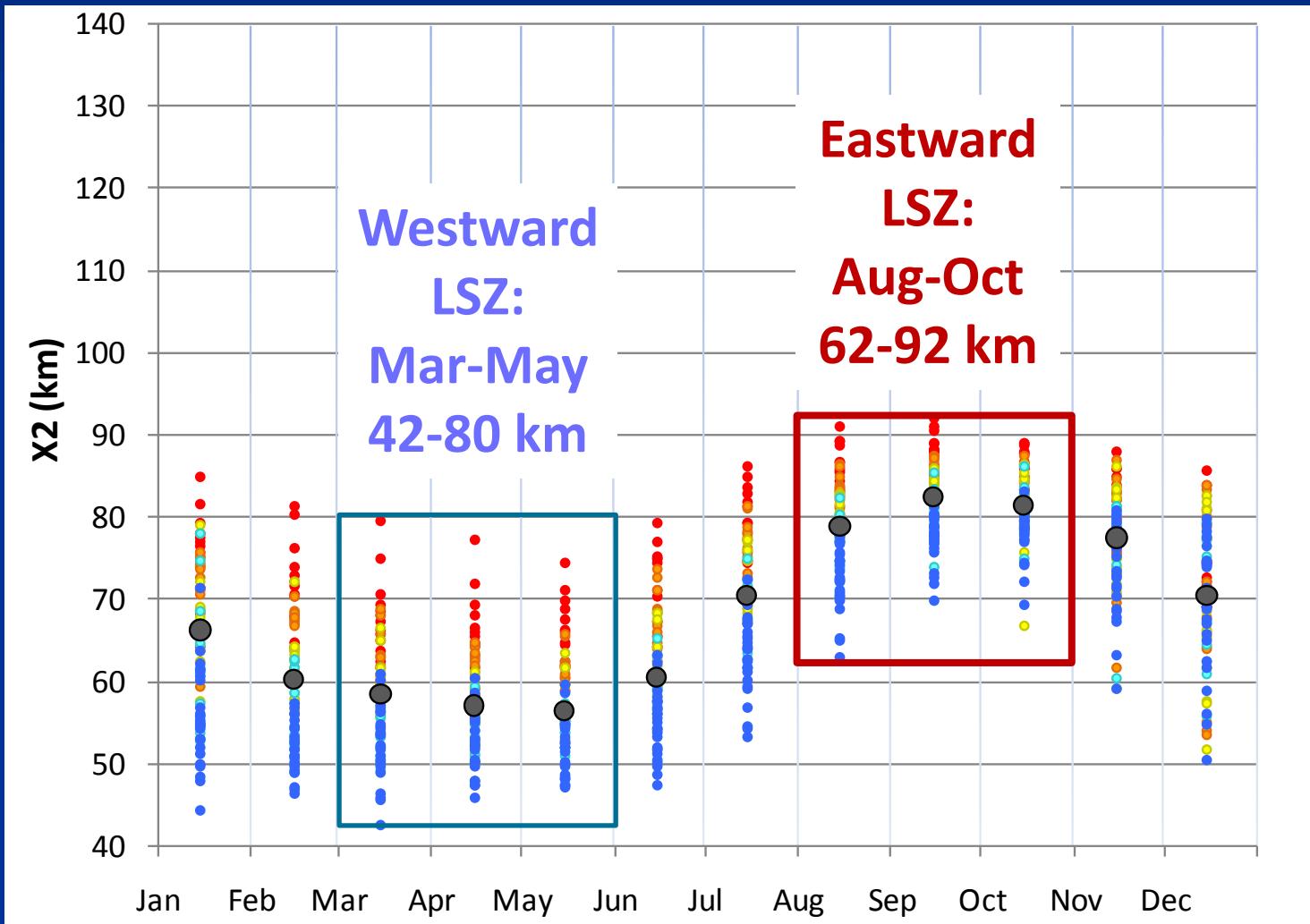
Geometry , habitat, and flows have changed



Monthly Unimpaired X2 (km)

Courtesy of Dr. Anke Mueller-Solger, Using Jassby et al. 1995 Monthly Equation)

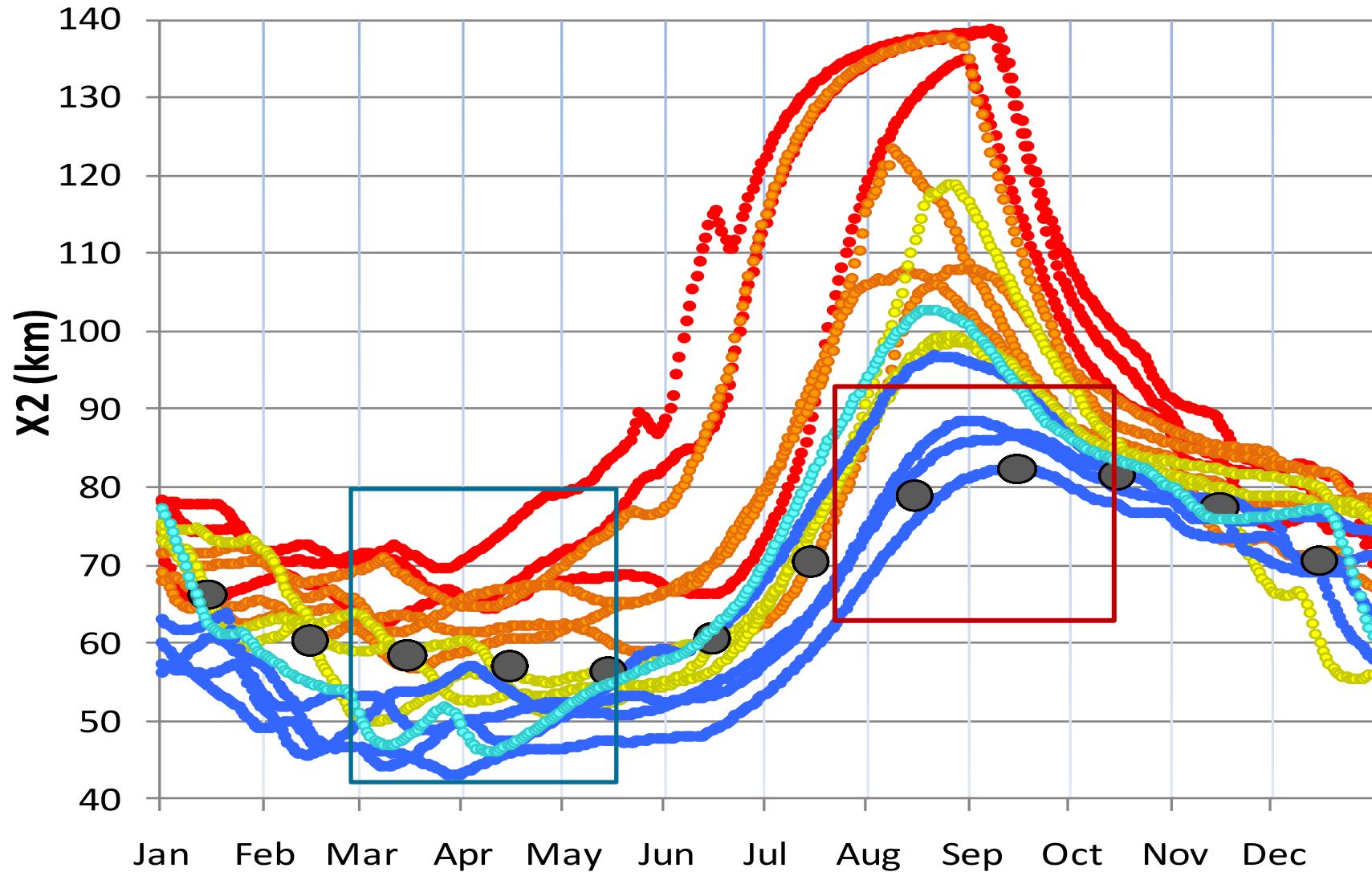
- C
- D
- BN
- AN
- W
- Unimpaired (Monthly Median 1921-2003)





Daily X2 (km) After Channelization 1930-1944

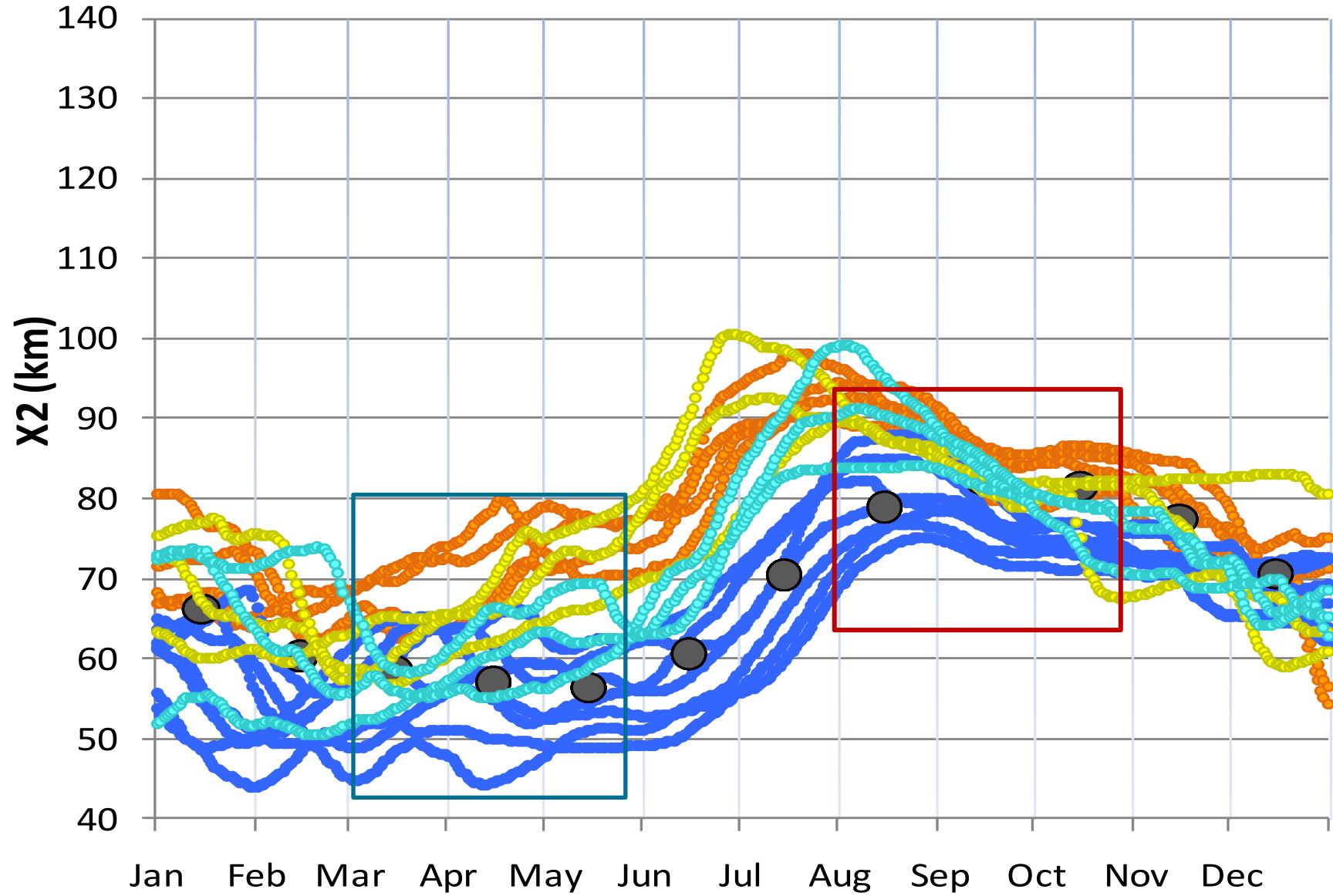
- C
- D
- BN
- AN
- W
- Unimpaired (Monthly Median 1921-2003)





Daily X2 (km) After Dams 1951-1967

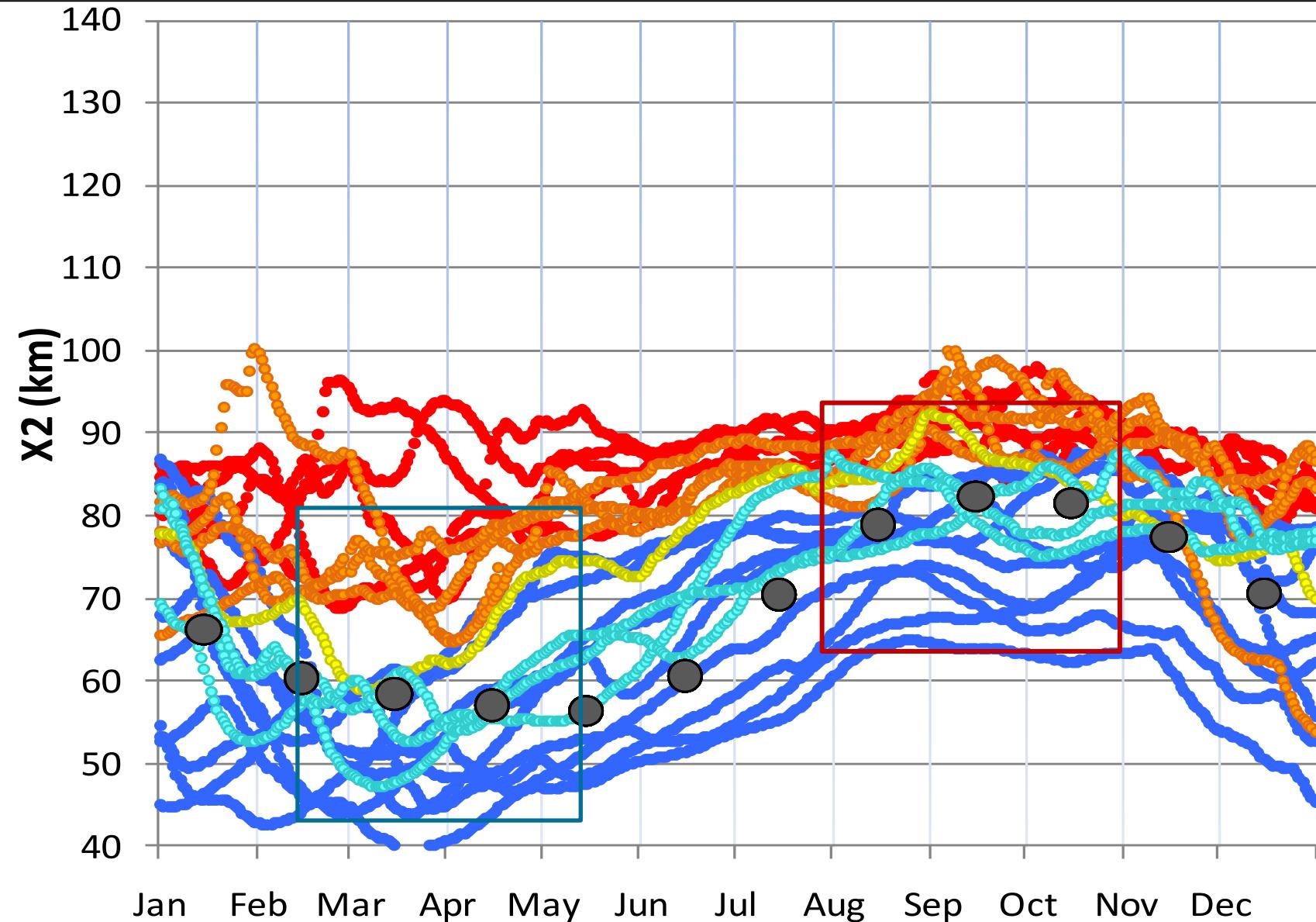
• C • D • BN • AN • W • Unimpaired (Monthly Median 1921-2003)





Daily X2 (km) Substantial Delta Diversions 1978-1999

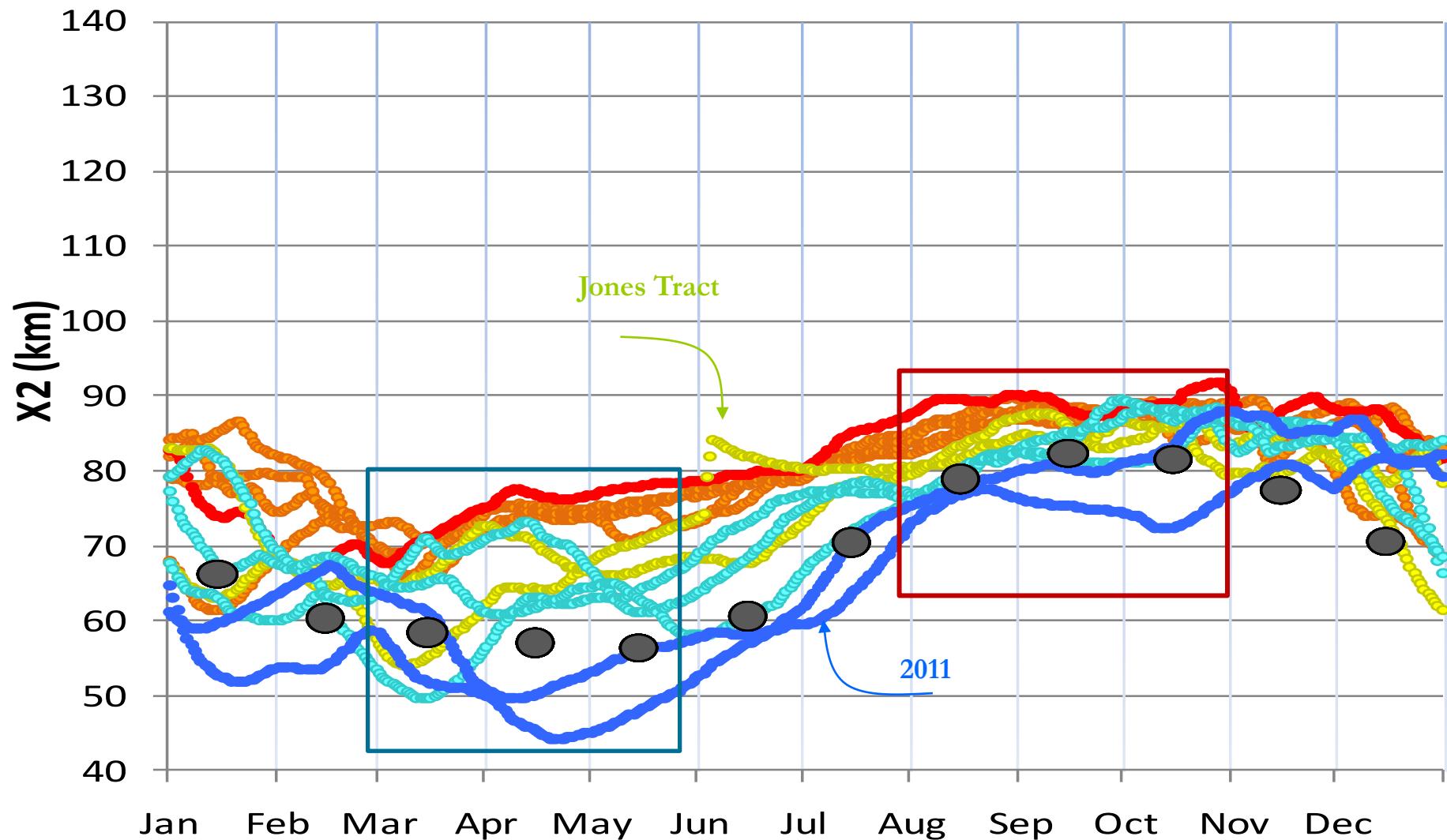
• C • D • BN • AN • W • Unimpaired (Monthly Median 1921-2003)



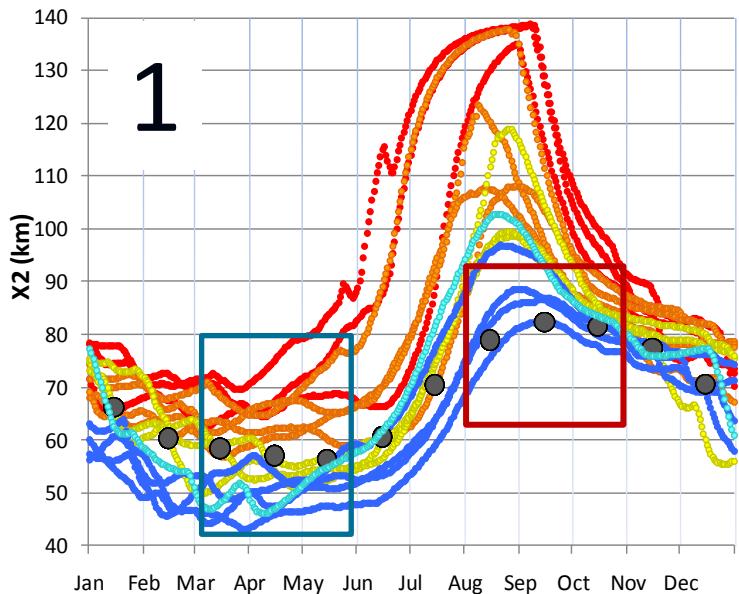


Daily X2 (km) After D-1641, 2000 and POD

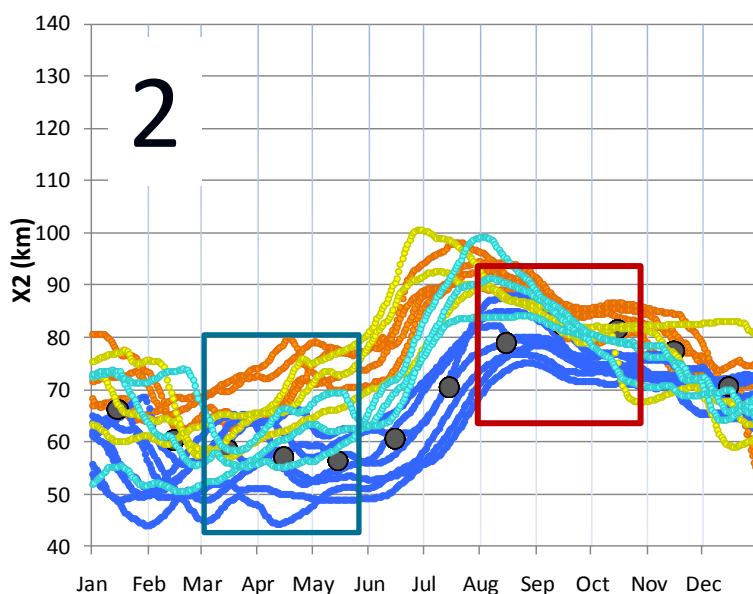
- C
- D
- BN
- AN
- W
- Unimpaired (Monthly Median 1921-2003)



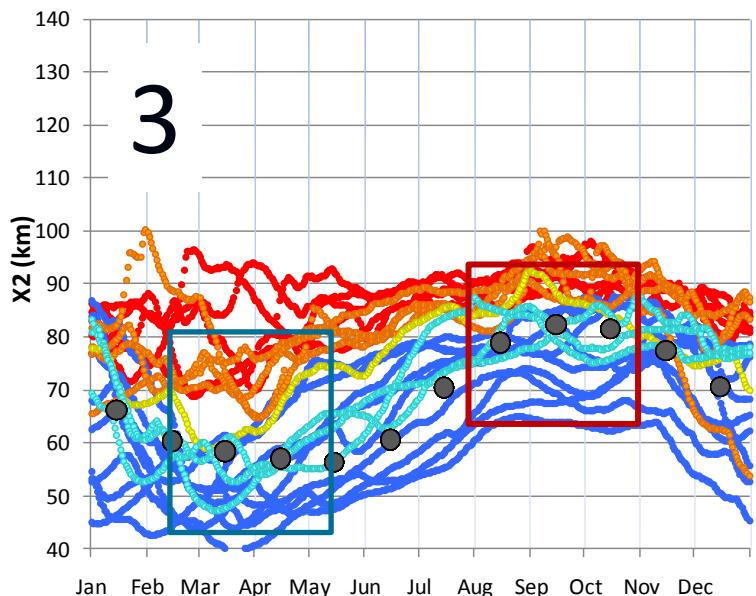
Before Shasta Dam (1930-1944)



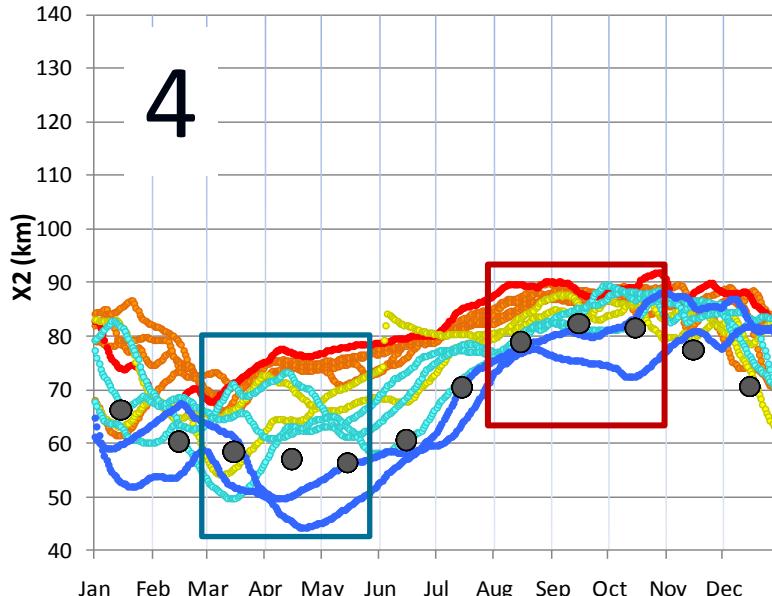
Before SWP Exports (1951-1967)



Substantial Delta Diversions (1978-1999)



After D-1641, 2000, & POD

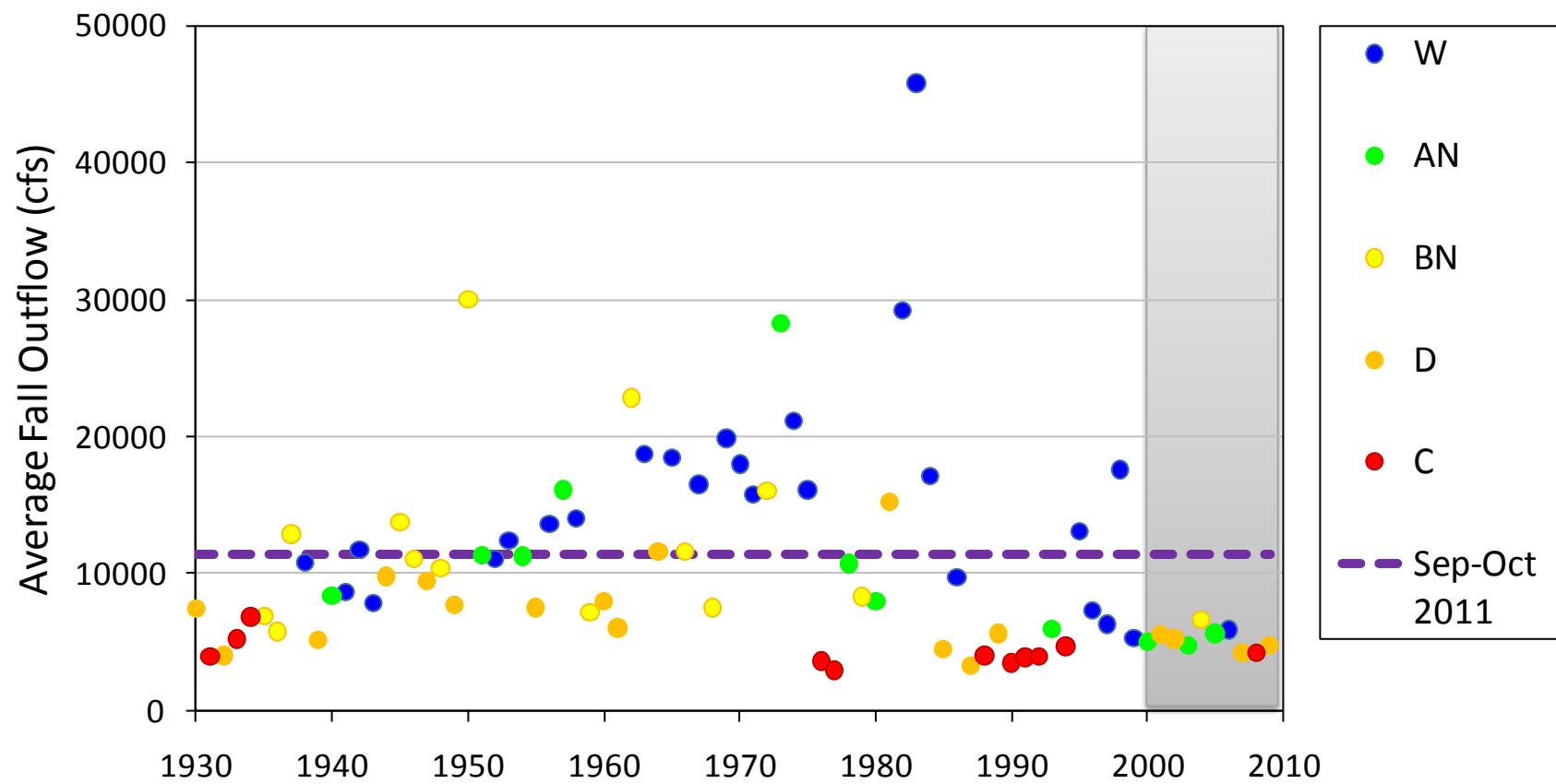


FLaSH

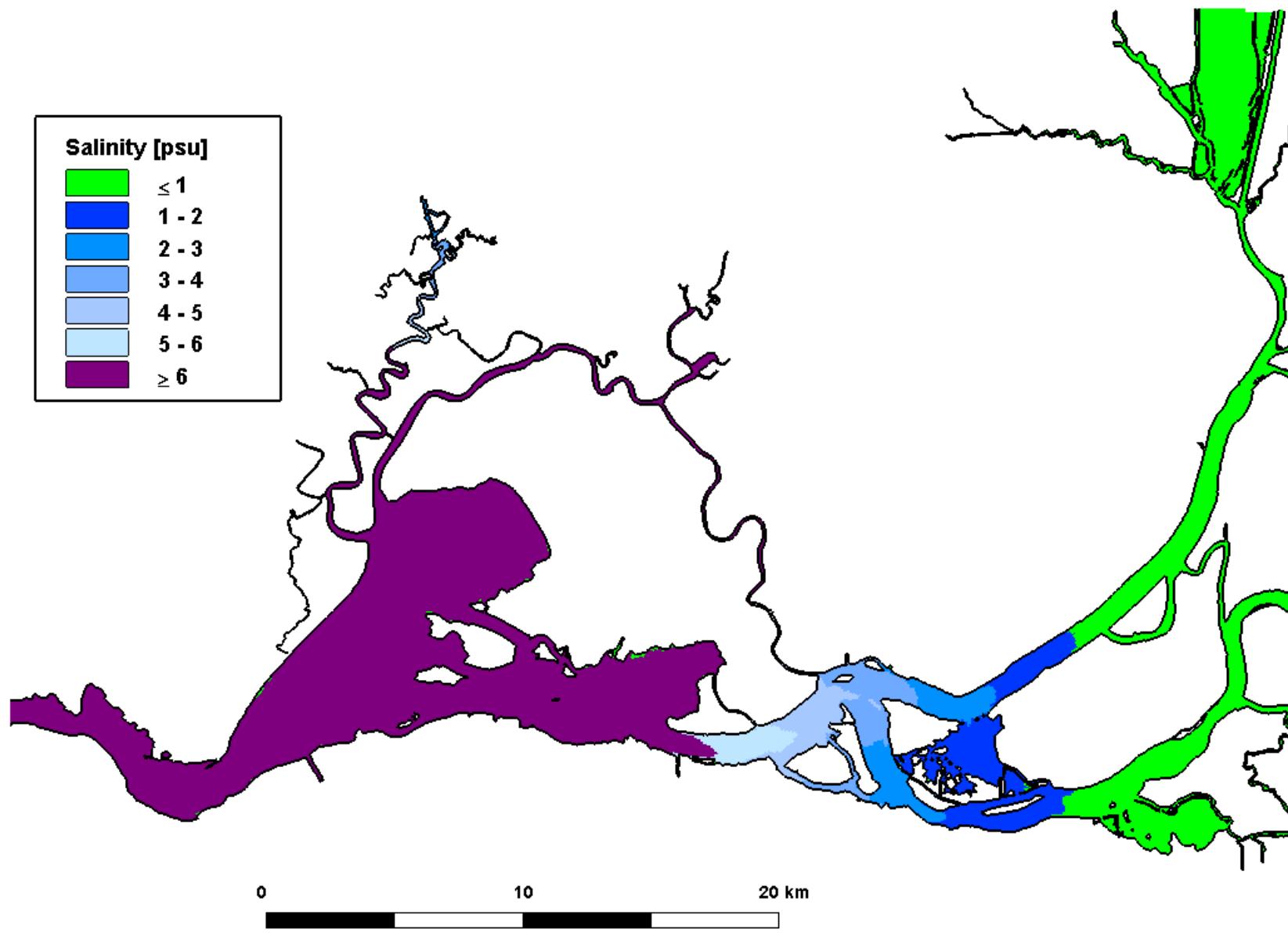
BIG Disclaimer:

Many graphs and data and their interpretation
in this presentation are PRELIMINARY and
subject to change!!!

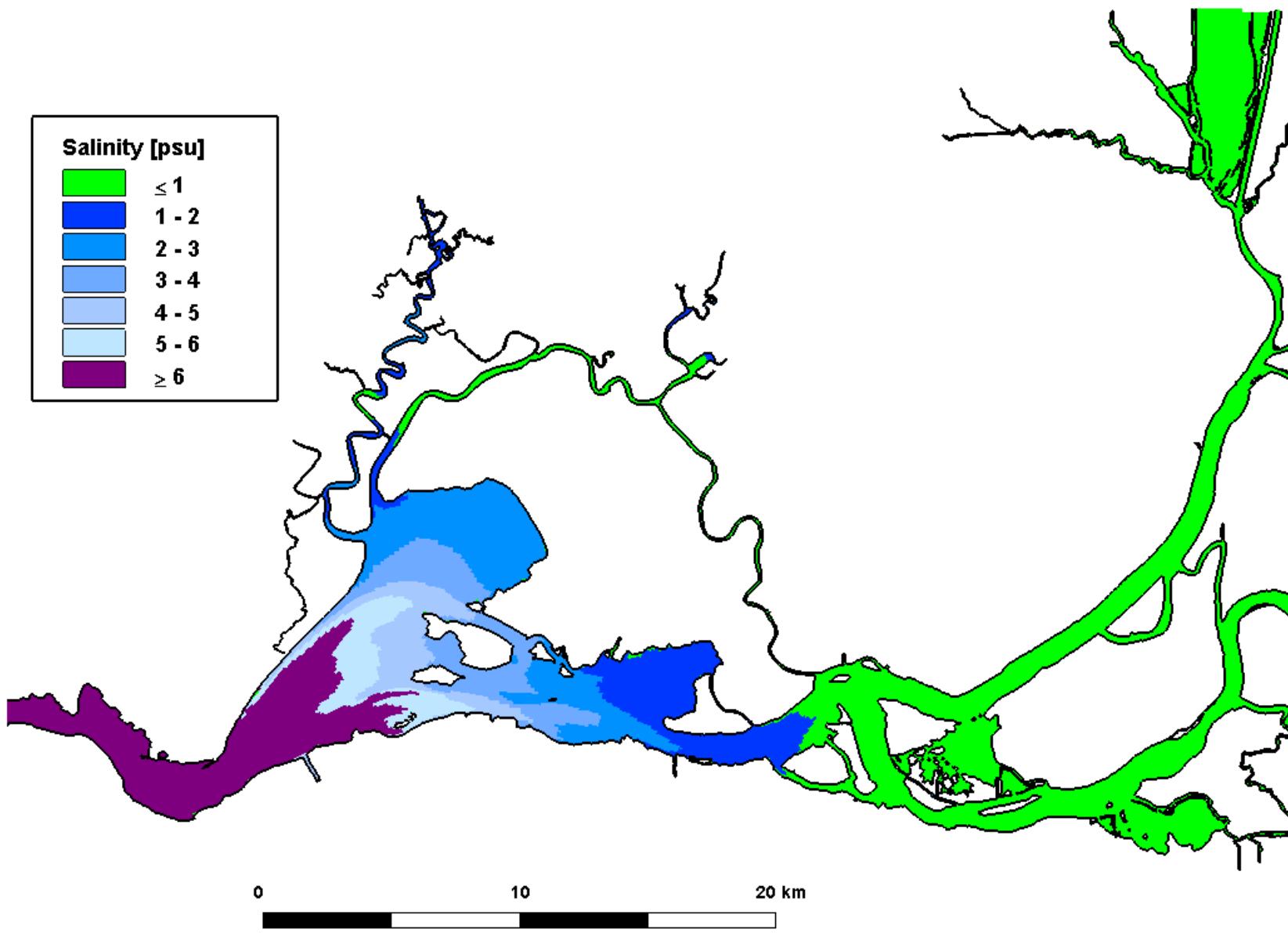
Many thanks to everyone who provided data
and graphs – all errors in display and
interpretation are mine, not theirs.



Daily-Average Depth-Averaged Salinity



Daily-Average Depth-Averaged Salinity

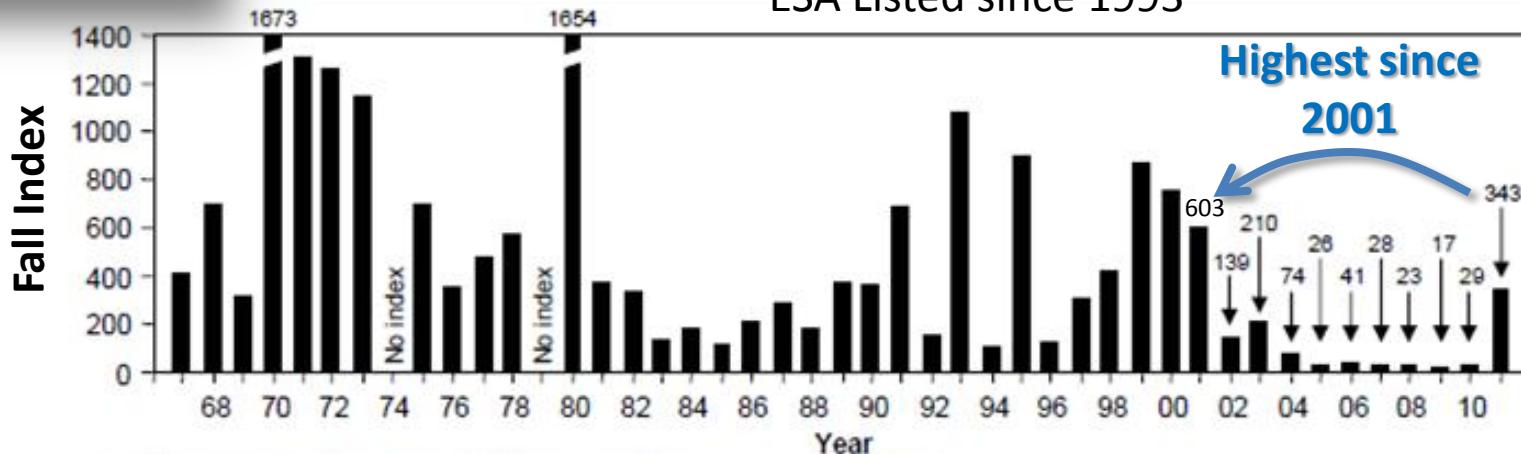


Some Fish Abundance Indices Improved in 2011



Delta Smelt

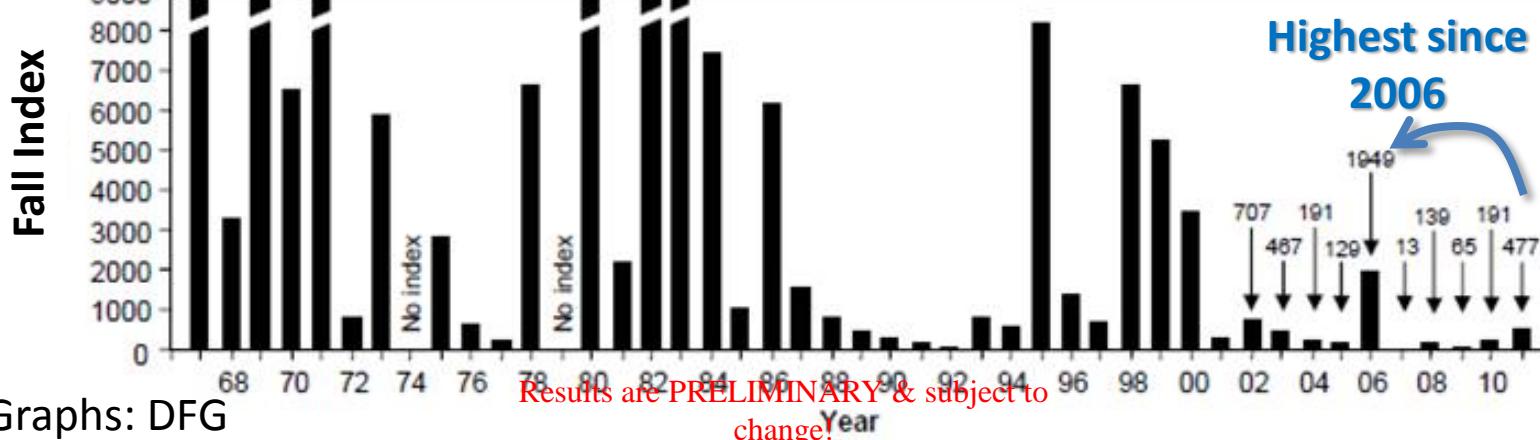
ESA Listed since 1993



Longfin Smelt

CESA Listed since 2009

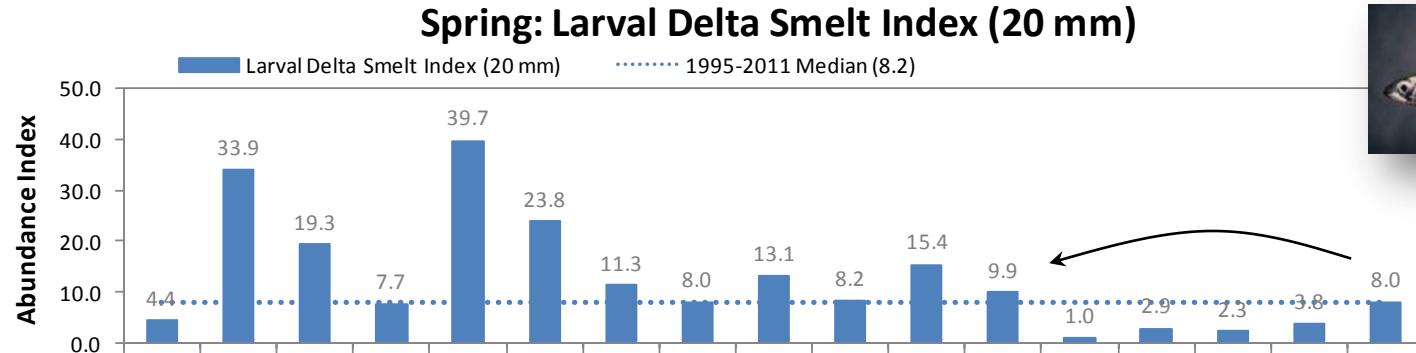
2012: ESA Candidate Species



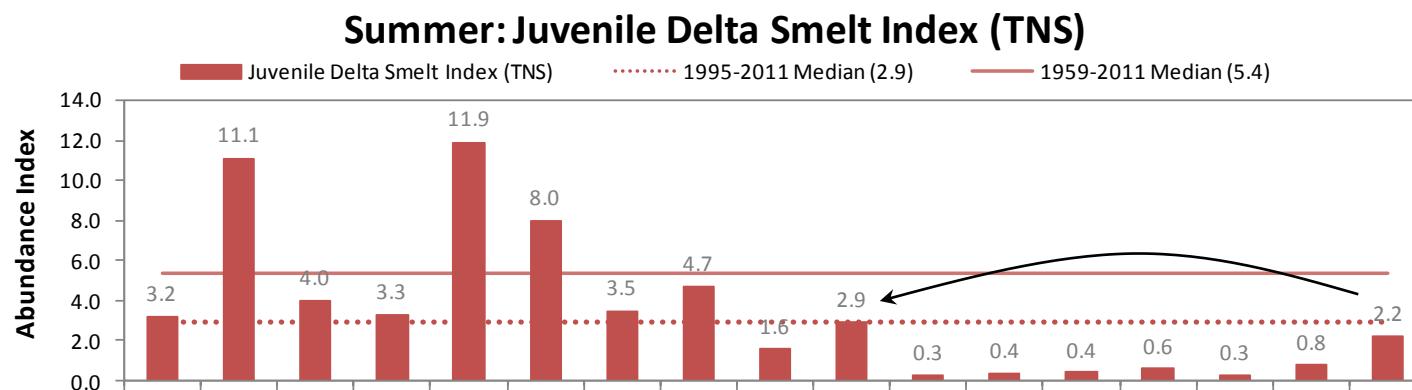
Graphs: DFG

Results are PRELIMINARY & subject to change!

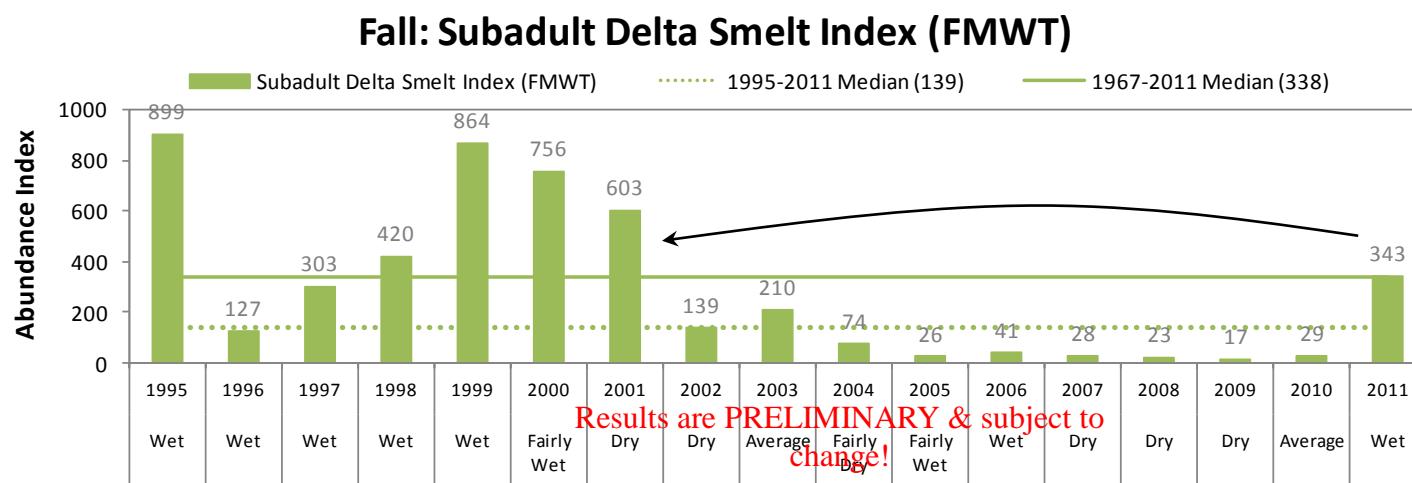
Delta smelt indices increased throughout 2011



Spring:
Highest
since 2006



Summer:
Highest
since 2004



Fall:
Highest
since 2001

Results are PRELIMINARY & subject to change!

Was the fall 2011 phytoplankton bloom unusual?

Golden Gate

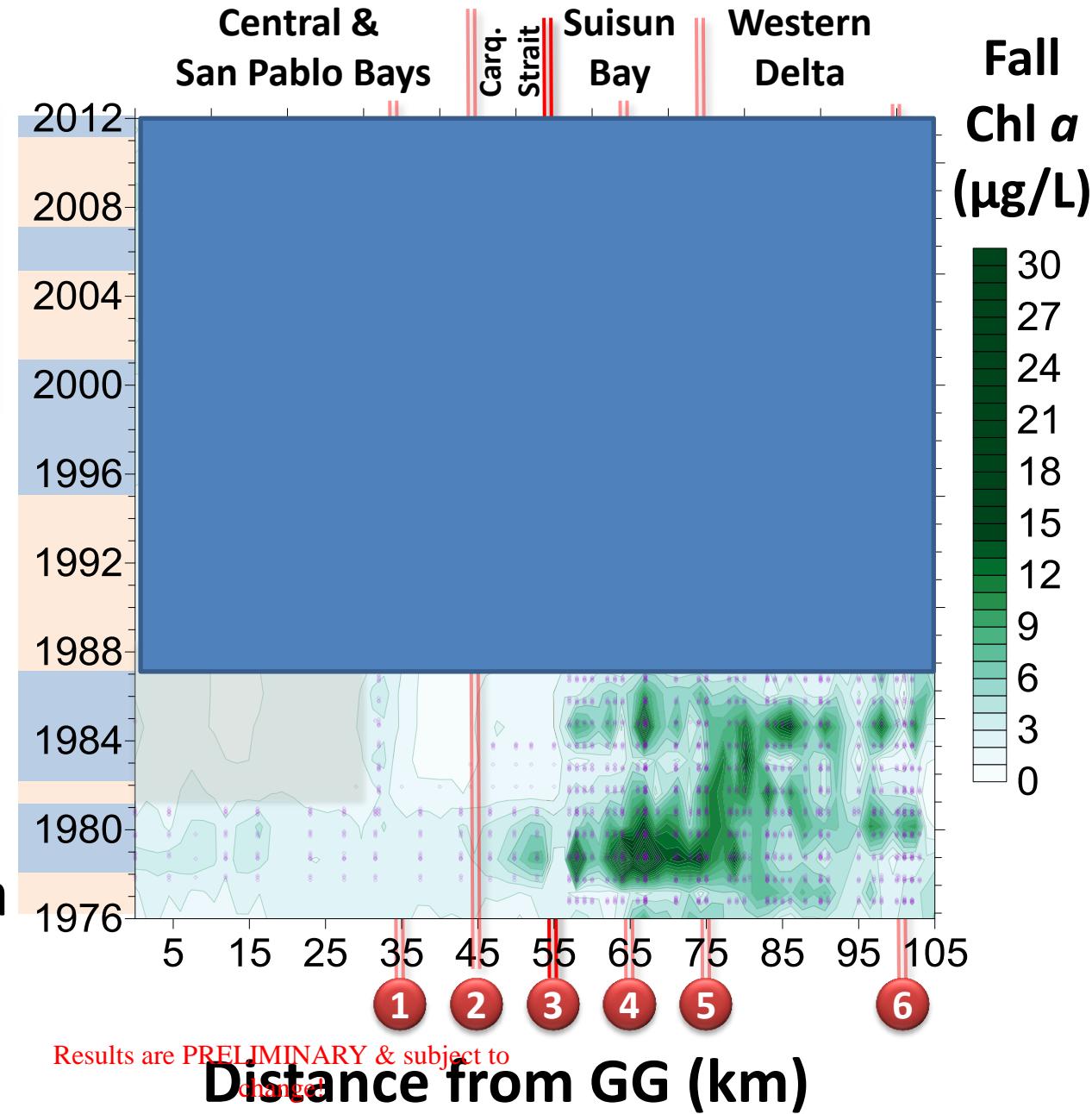
Rio Vista



Data: EMP, USGS-Polaris, DFG "NZ",
Graph: A. Mueller-Solger, DSC

Fall Blooms
common in
Suisun/West Delta
before 1987

Date

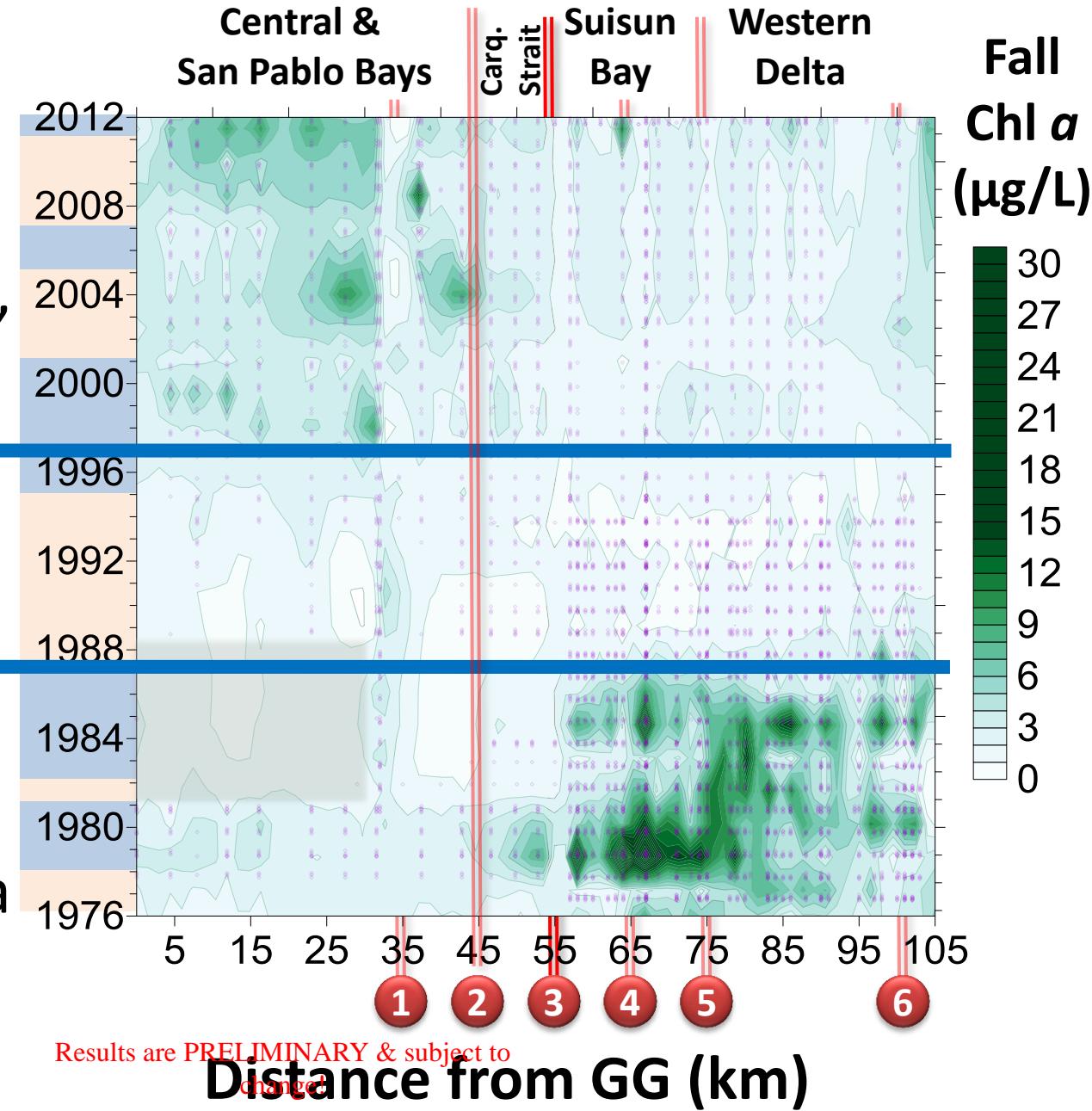


Was the fall 2011 phytoplankton bloom unusual?

Fall blooms only
west of Carquinez,
except 2011

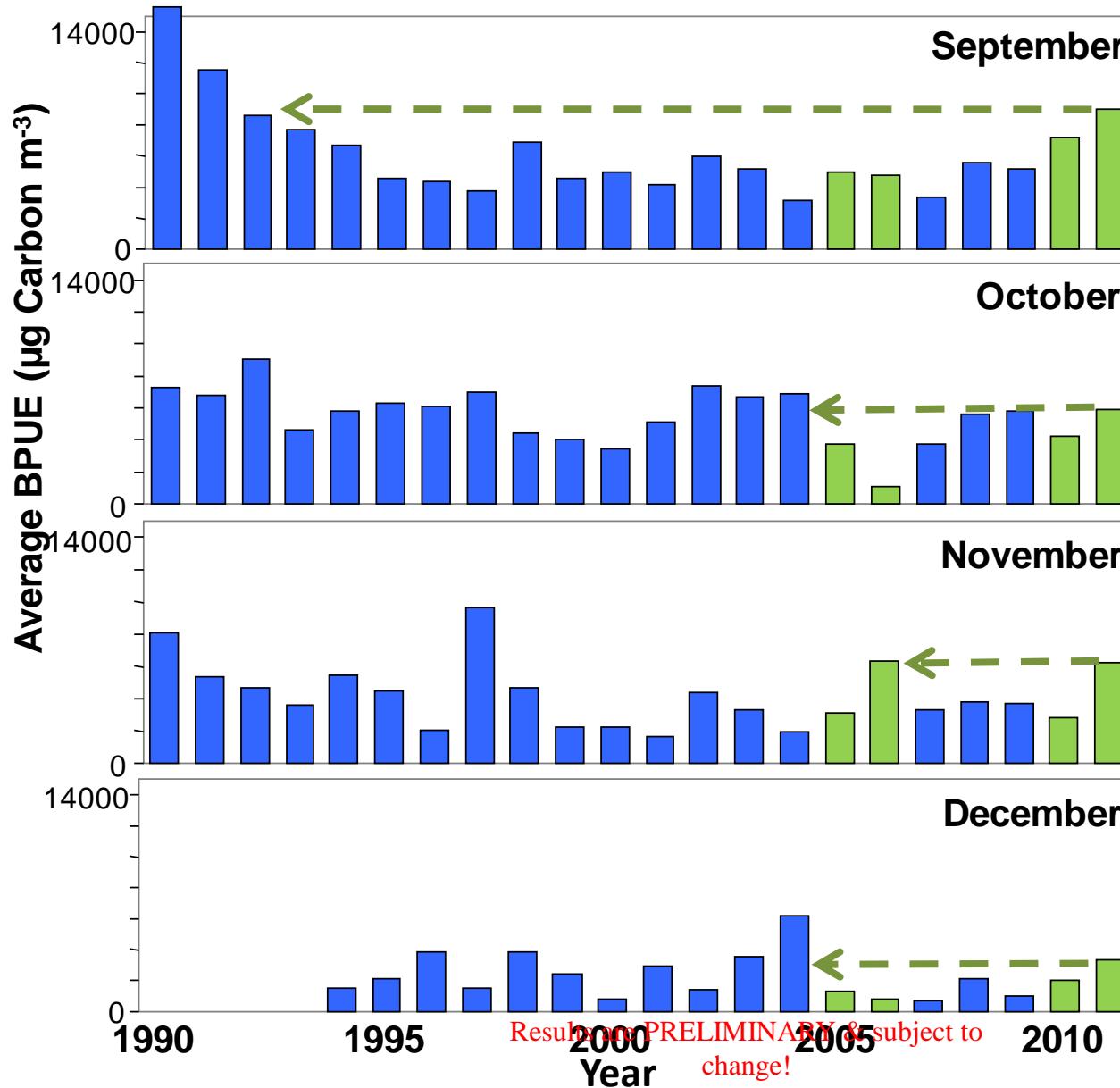
“Depression”

Fall Blooms
common in
Suisun/West Delta
before 1987



Zooplankton Biomass (2)

High total zooplankton biomass in LSZ in fall 2011



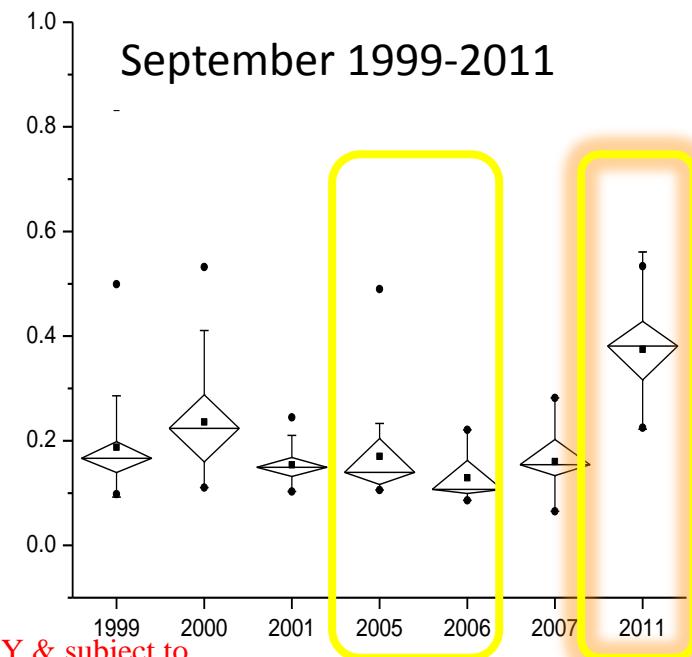
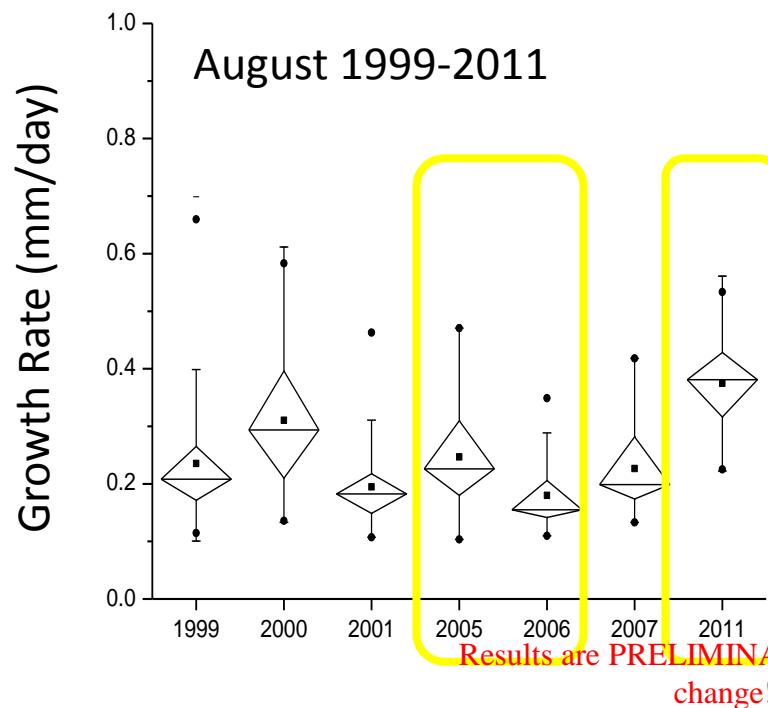
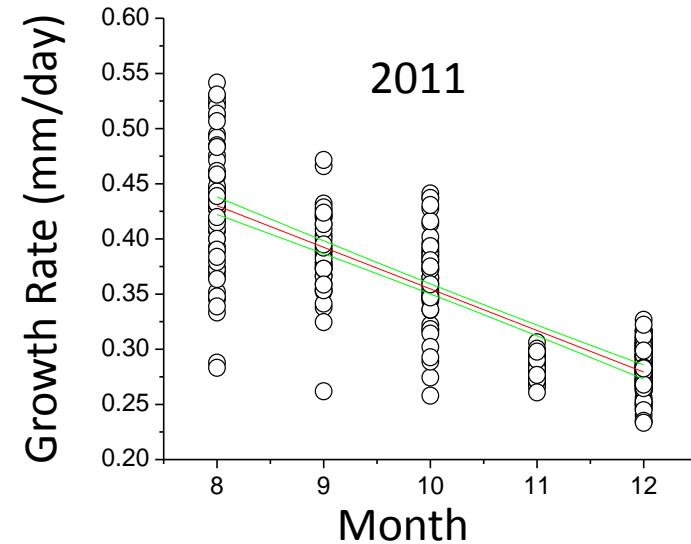
Data: IEP EMP

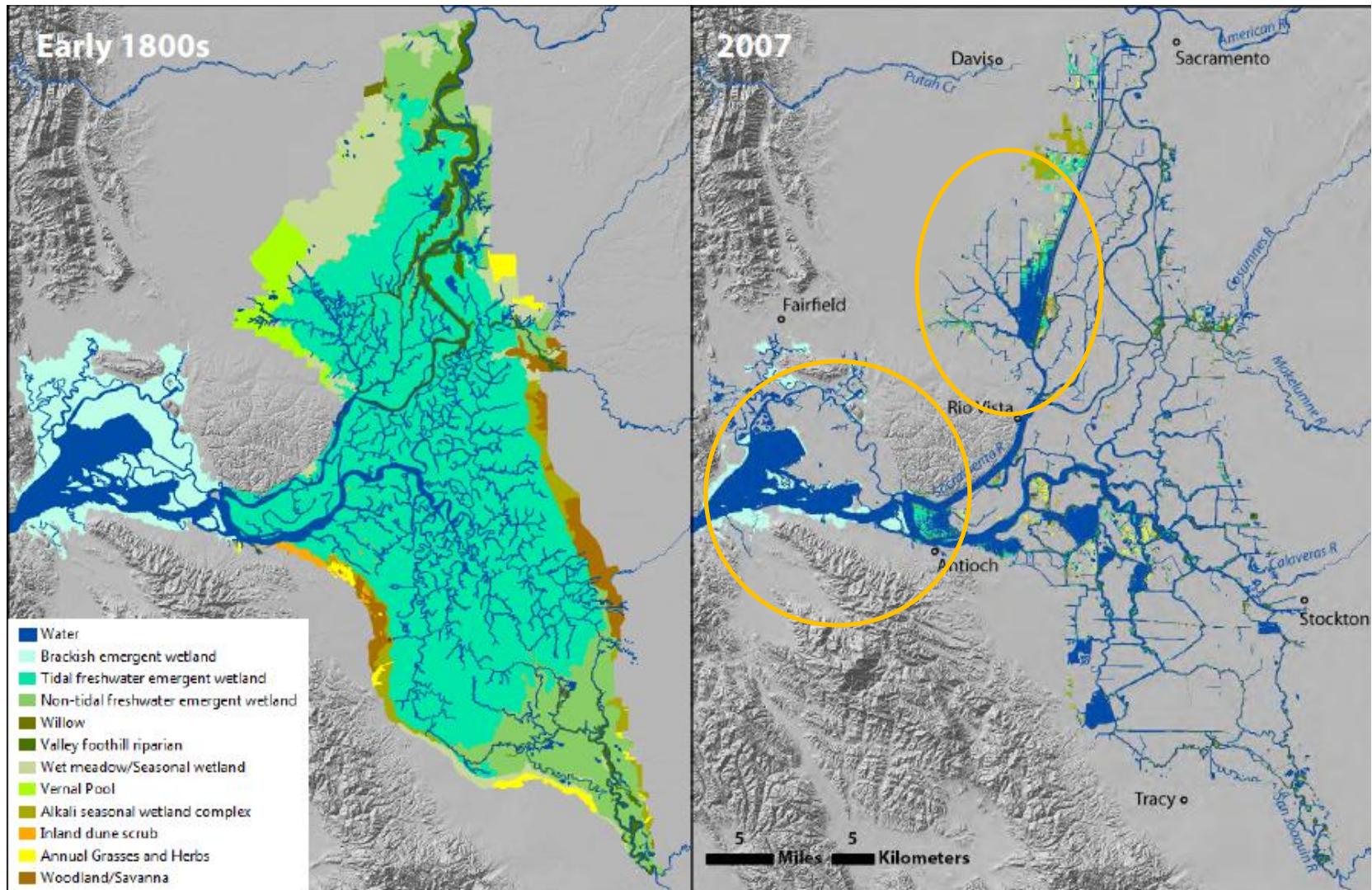
Graph: A. Hennessy,
DFG

Delta smelt grew well in 2011



Data and Graphs:
J. Hobbs, UC Davis





Results are PRELIMINARY & subject to change!

How much water do fish need?



