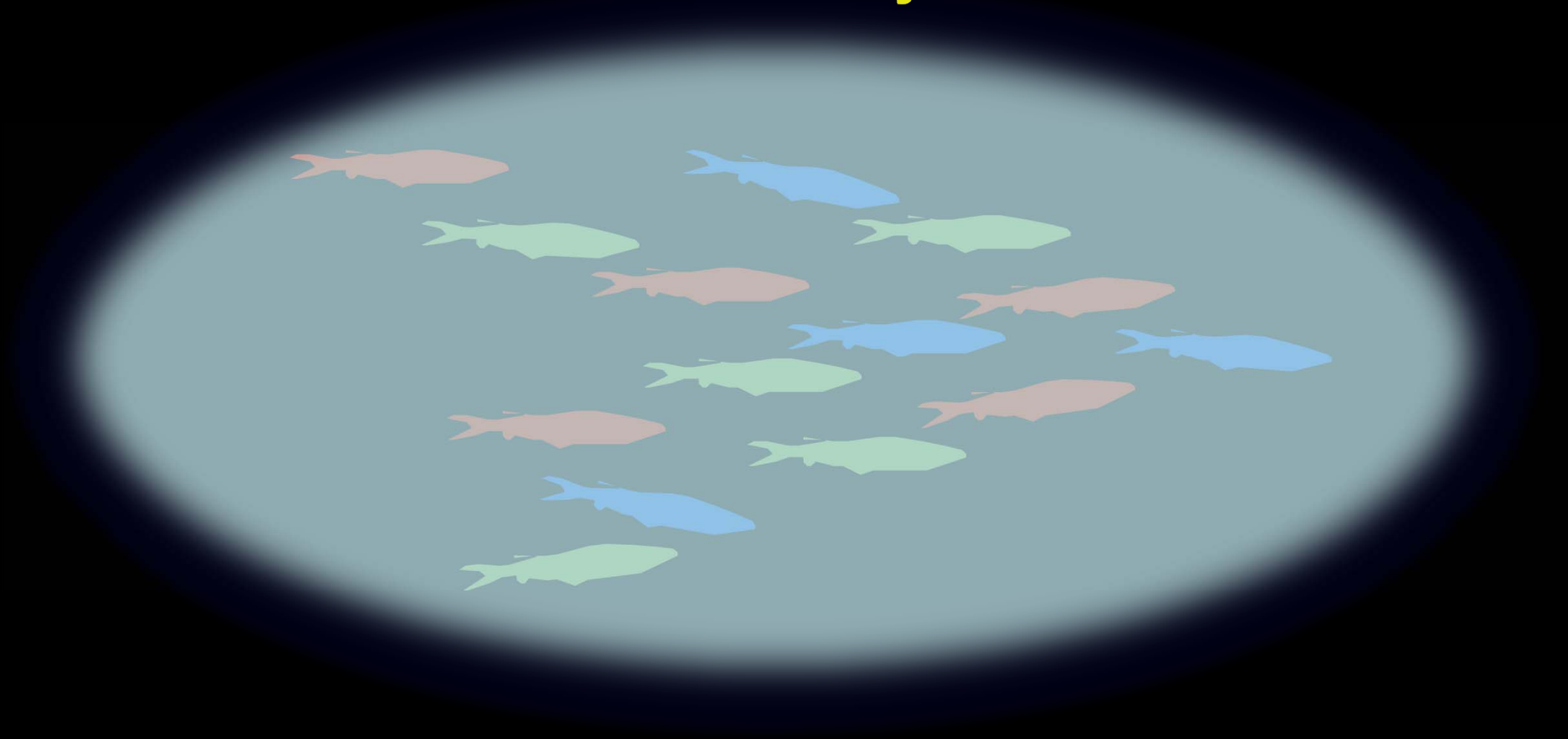
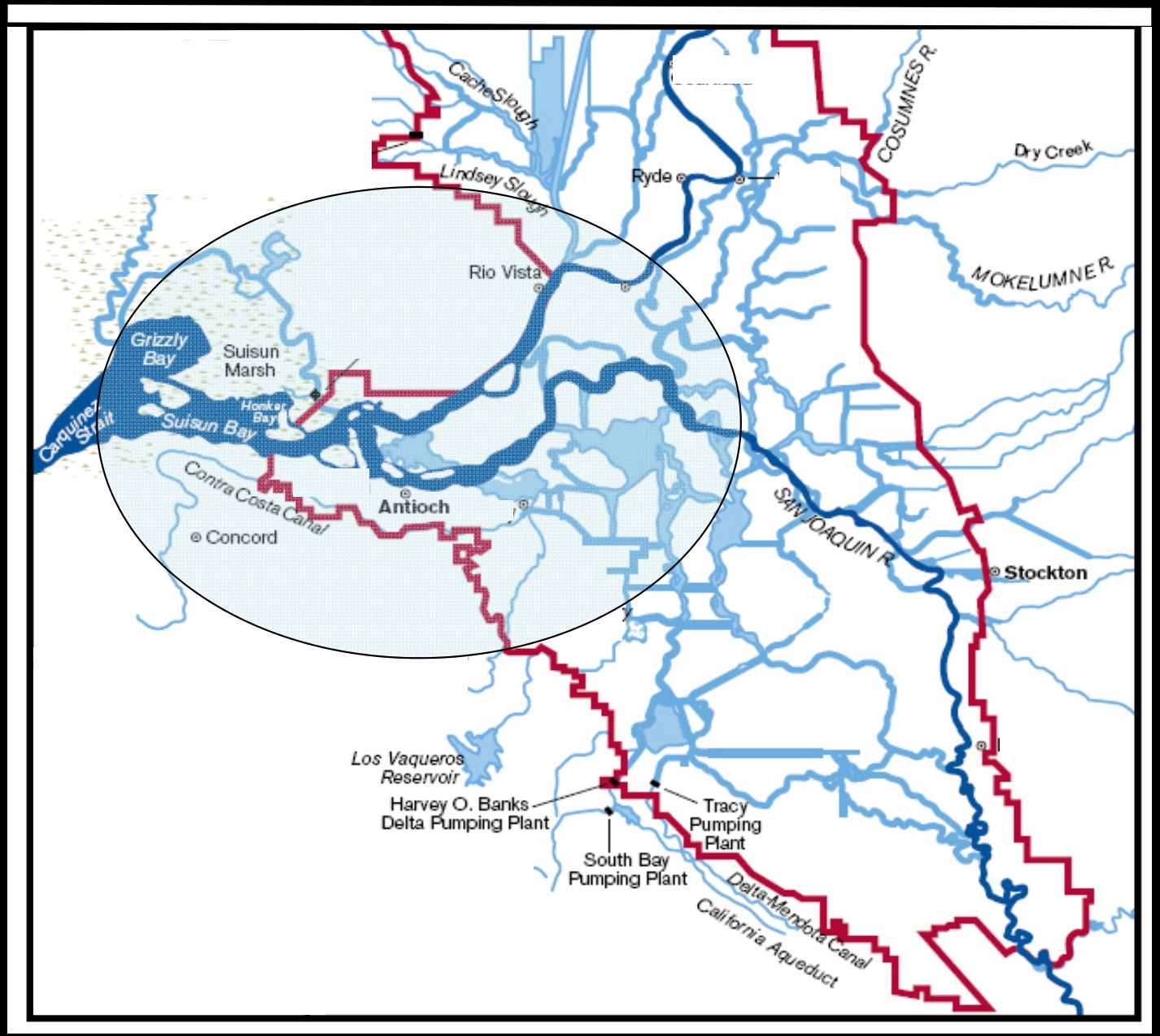
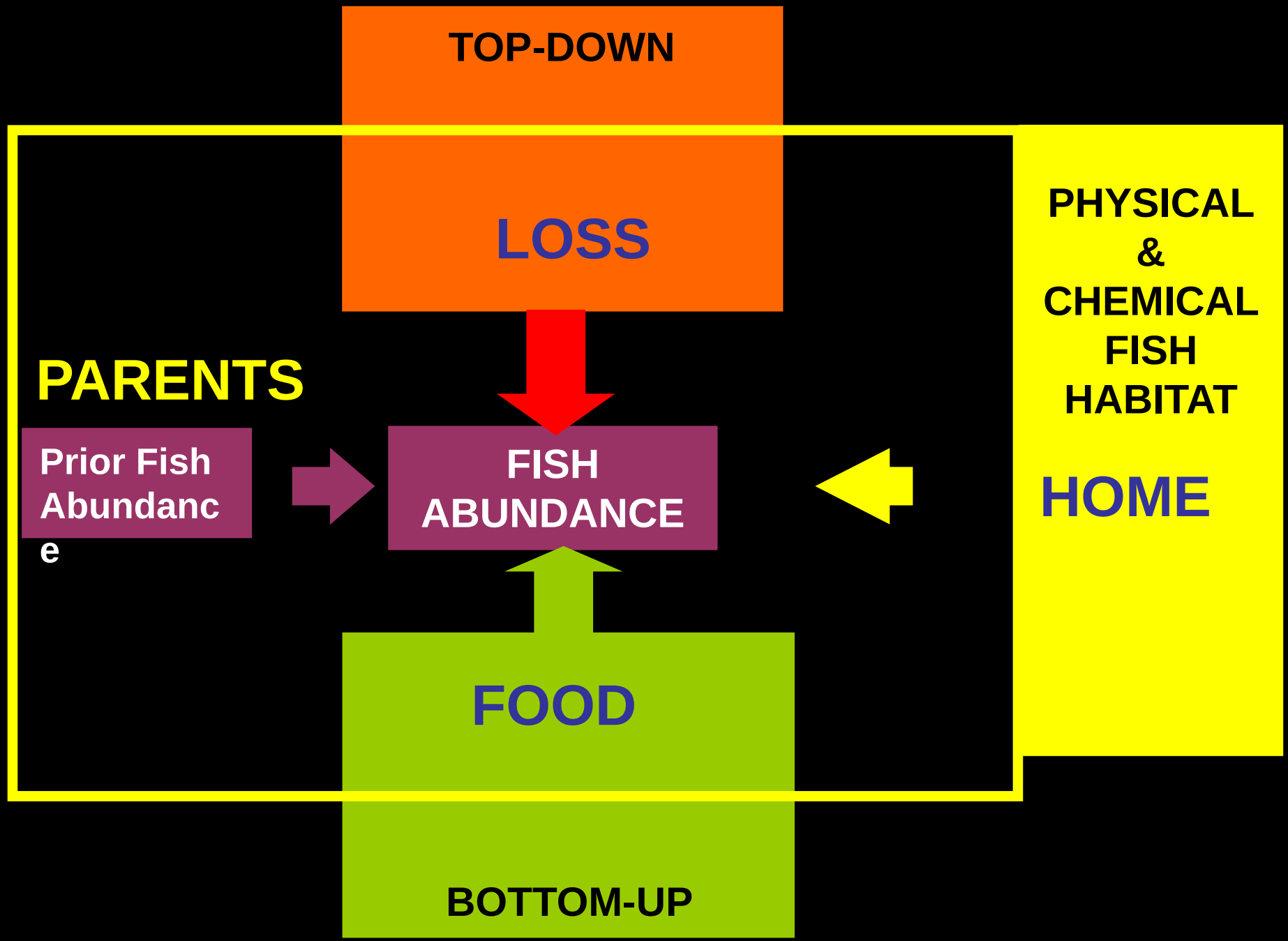
Department of Water Resources Presentation State Water Resources Control Board Workshop 1: Low Salinity Zone



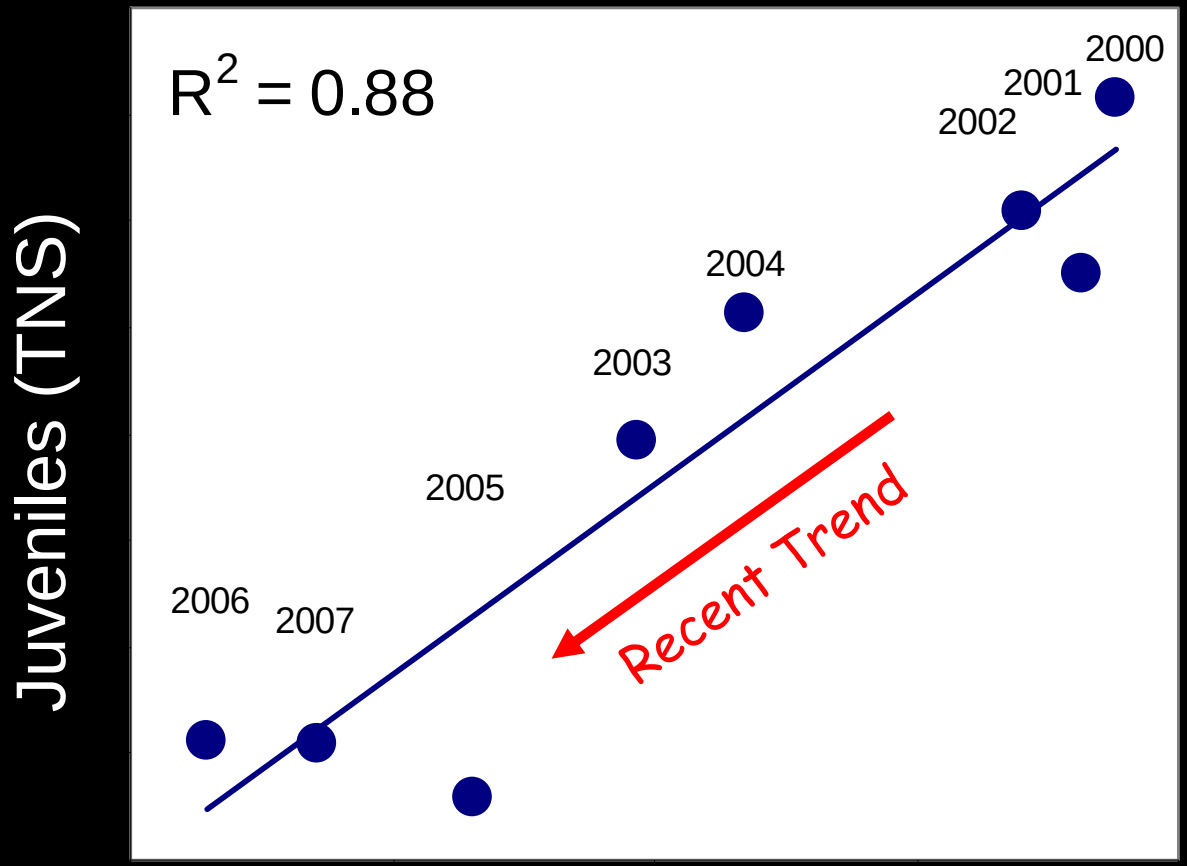
Ted Sommer, DWR Division of Environmental Services

Low Salinity Zone



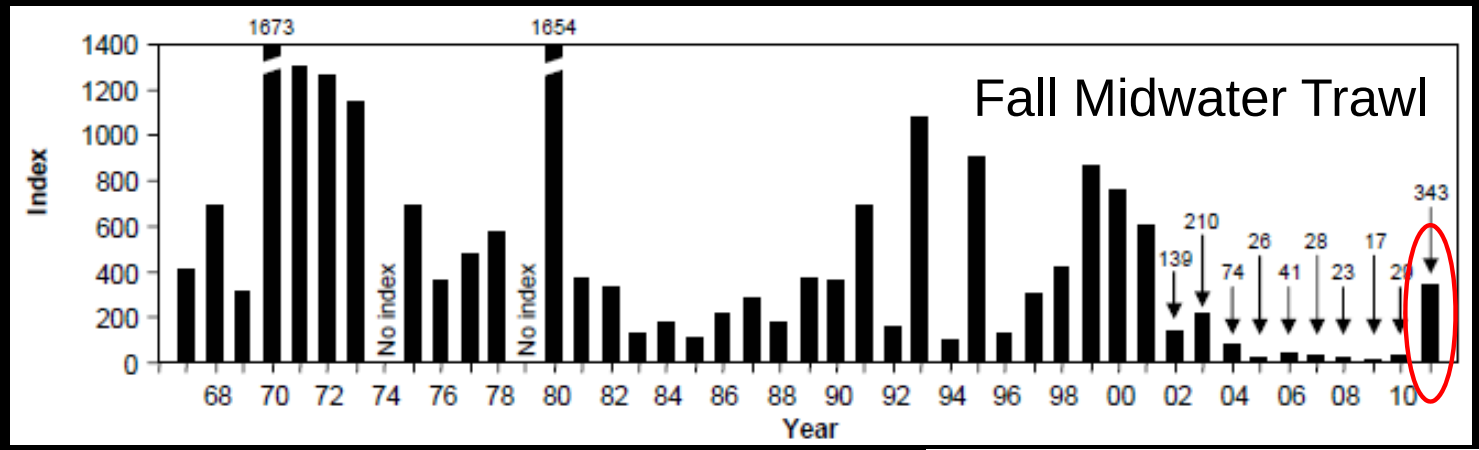

TOP-DOWN
LOSS
PHYSICAL
&
CHEMICAL
FISH
HABITAT
PARENTS
Prior Fish Abundanc
e
FISH ABUNDANCE
HOME
FOOD
BOTTOM-UP

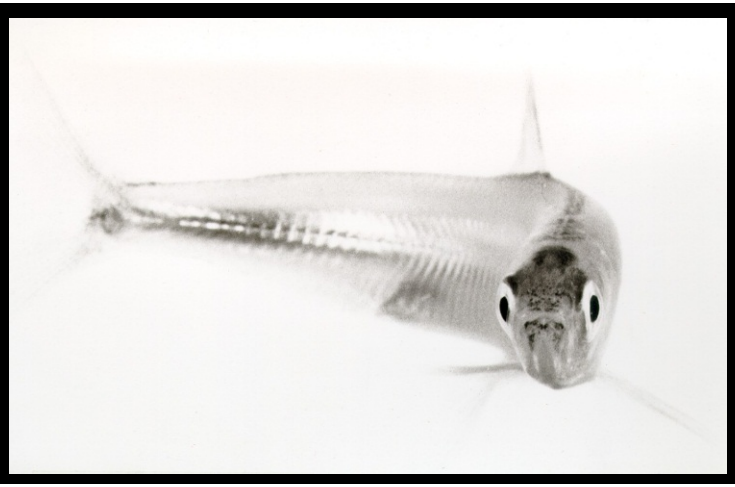
Has The Delta Smelt Population Dropped Below Critical Levels?

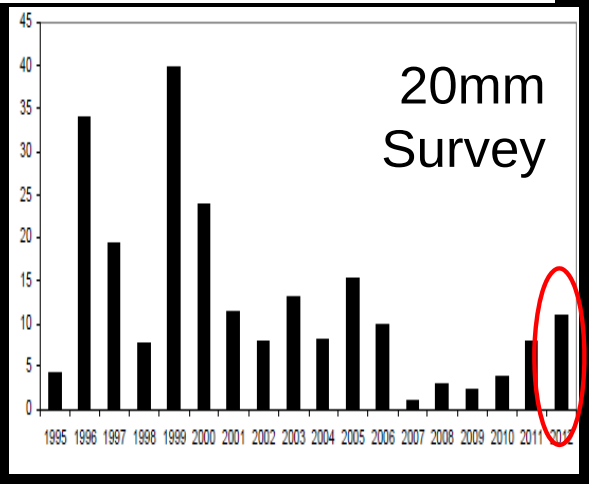


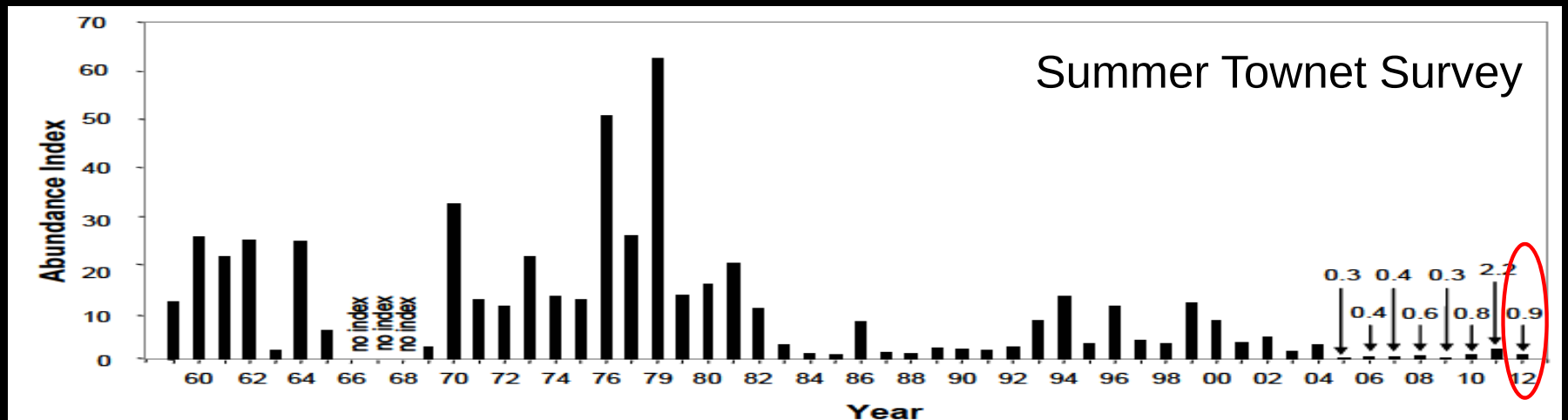
Source: Anke Mueller-Solger (DSC)

Recent Delta Smelt Abundance



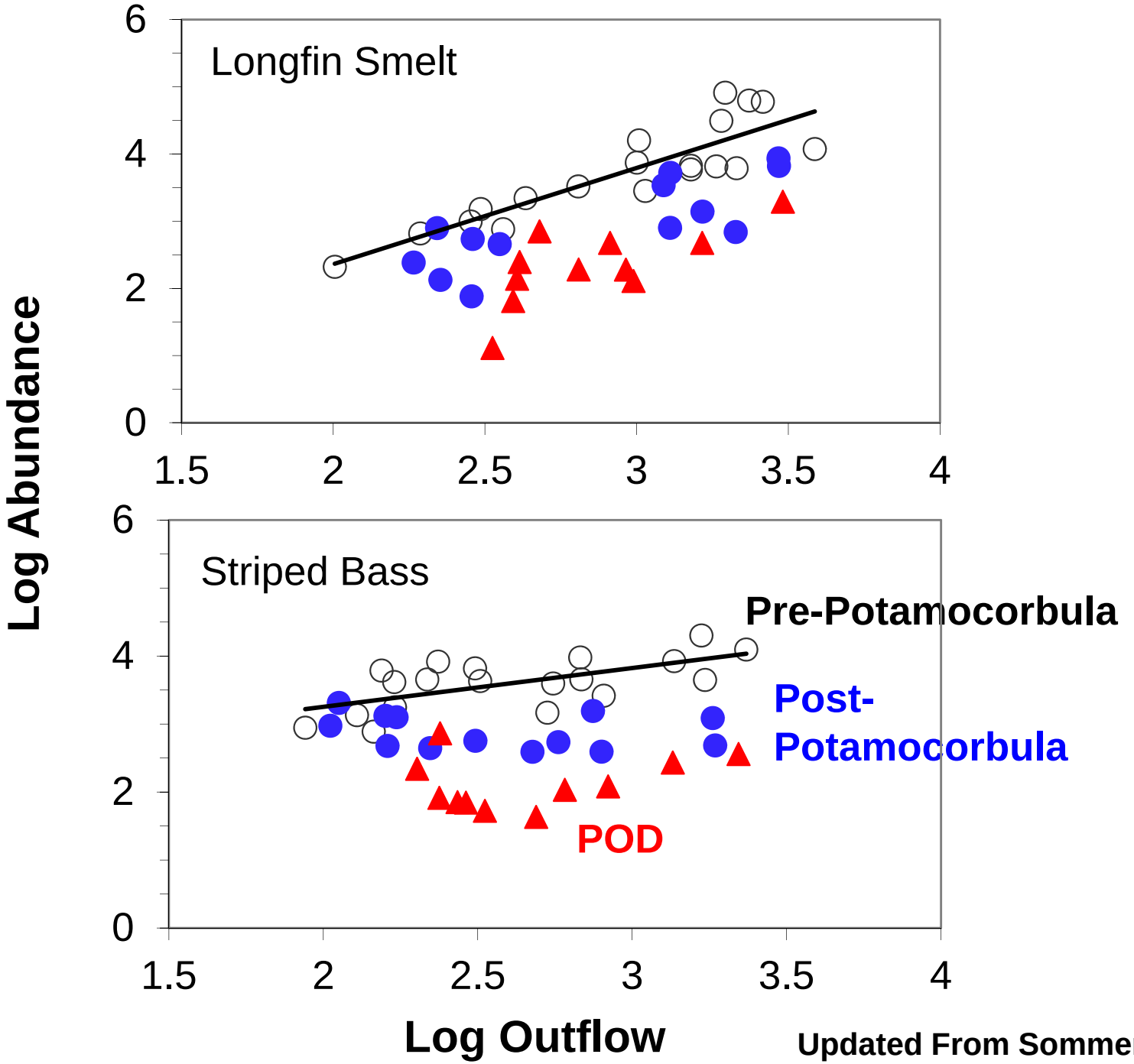






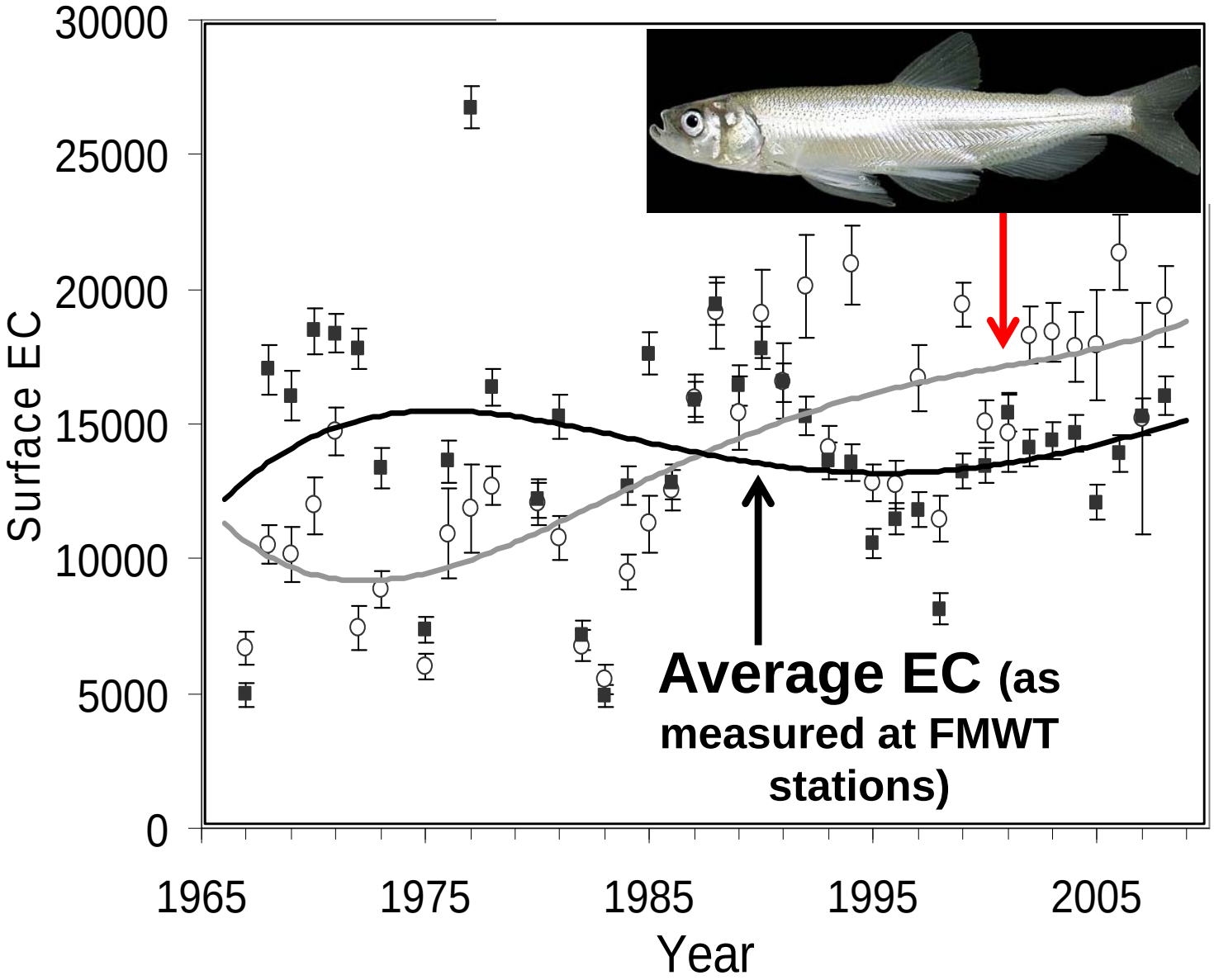
Low Salinity Zone Habitat

Recent Declines Were Not Caused by Lower Outflow



Updated From Sommer et al. (2007)

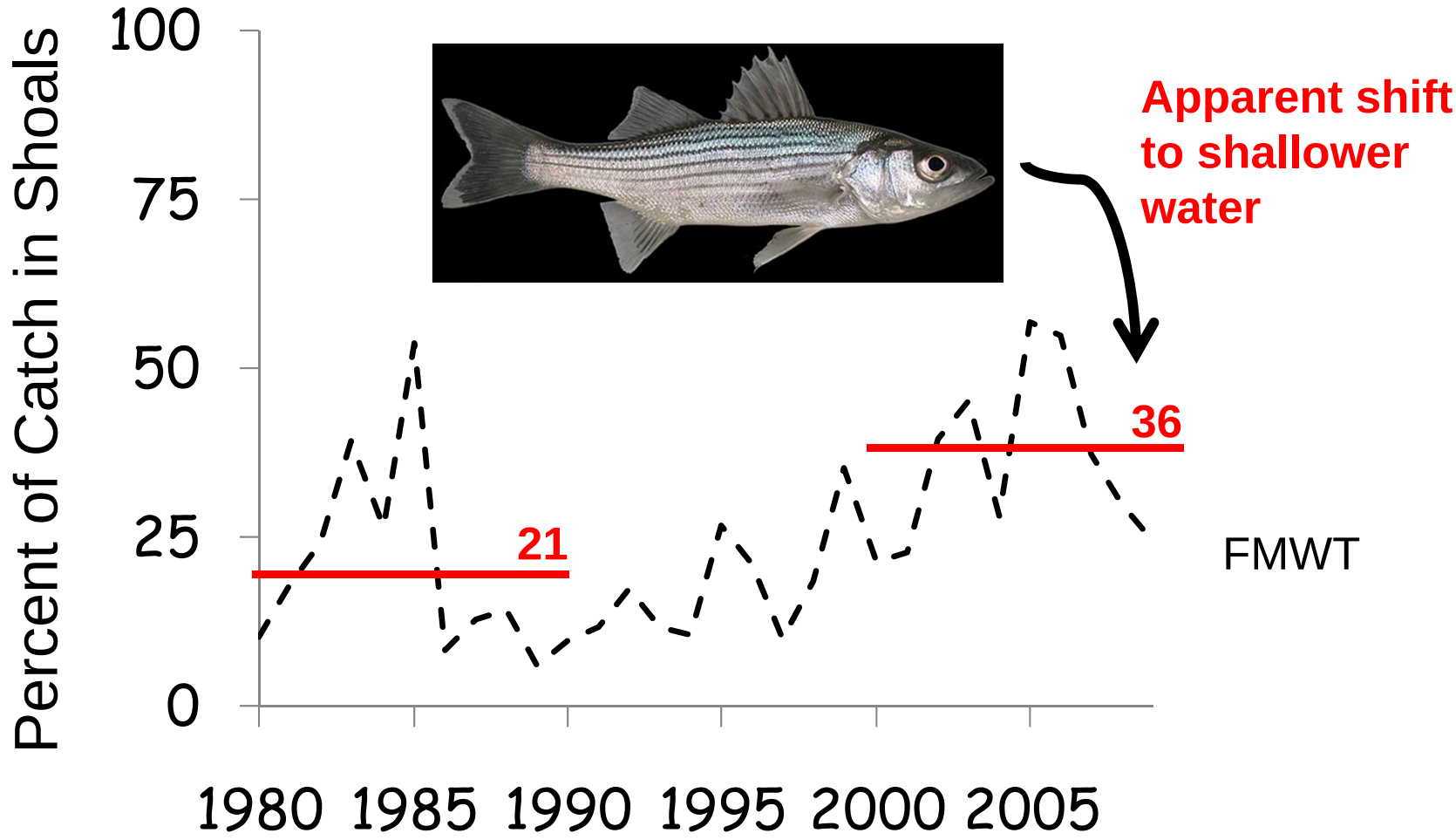
Longfin Smelt Distribution Shifts Likely Affect Abundance Trends



Smelt shift into saltier regions

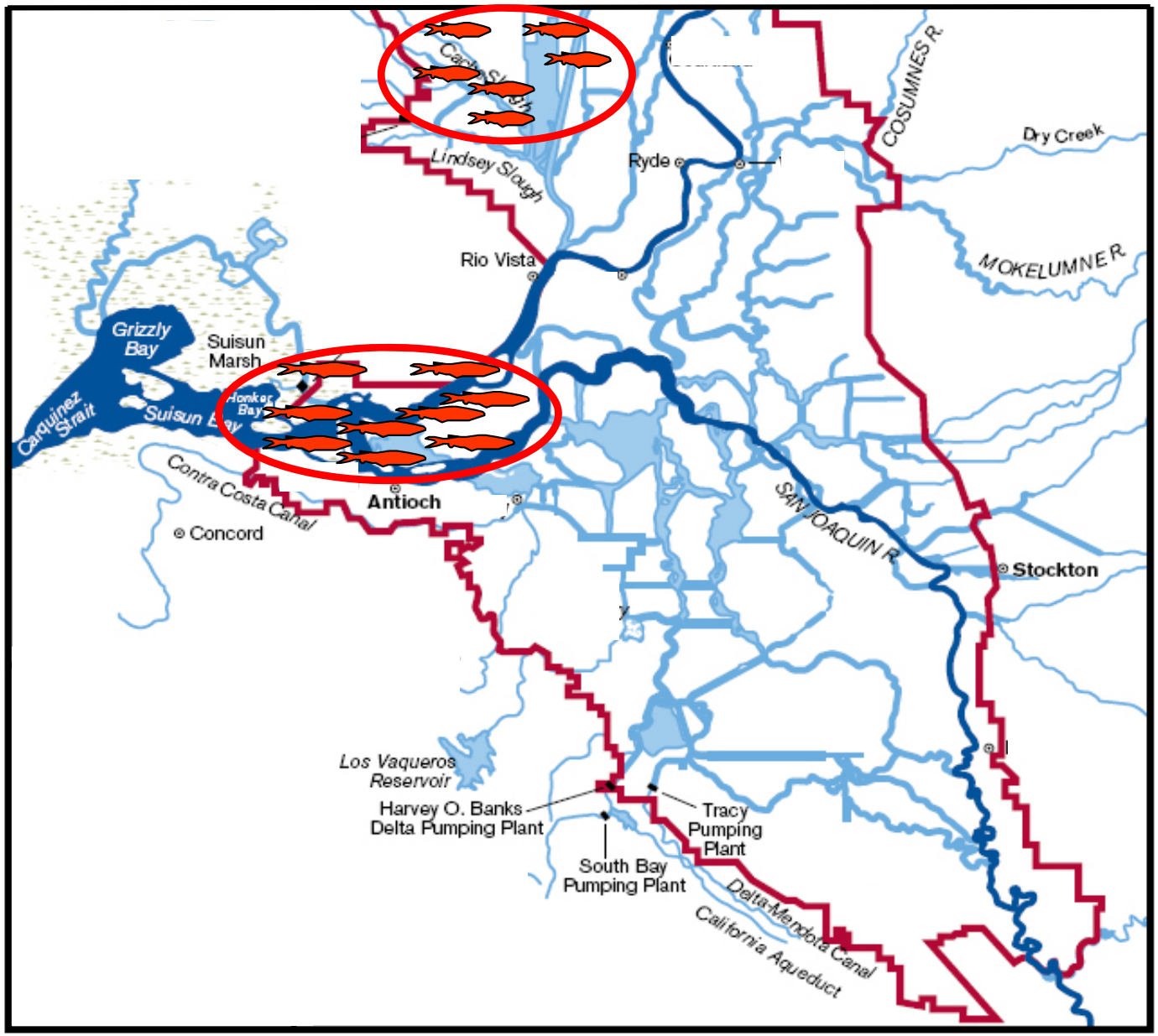
Source: Dave Contreras and Randy Baxter, DFG

Striped Bass Abundance Trends Likely Affected By Distribution Shifts

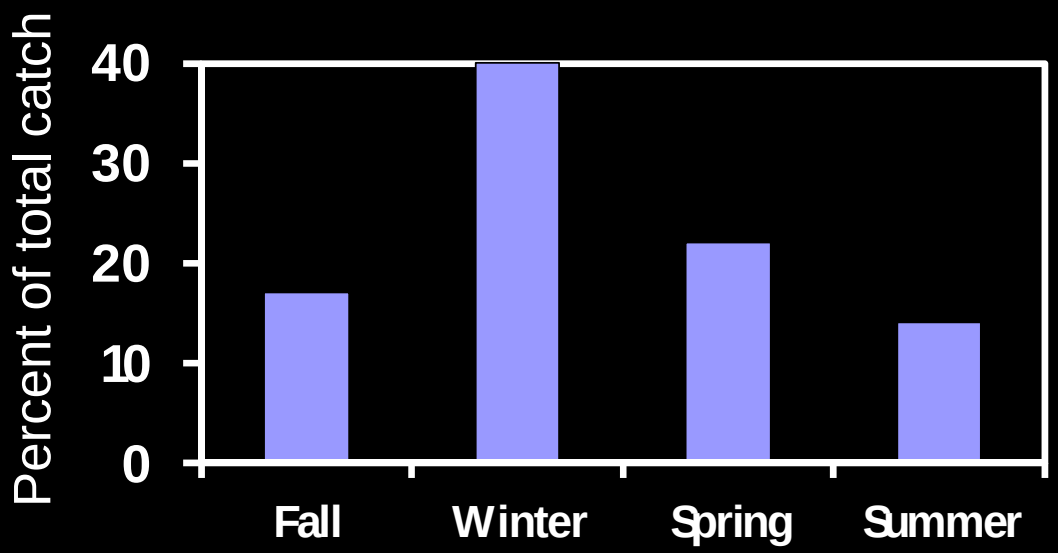


Source: Sommer et al. (2011)

Delta Smelt Habitat Broader Than LSZ

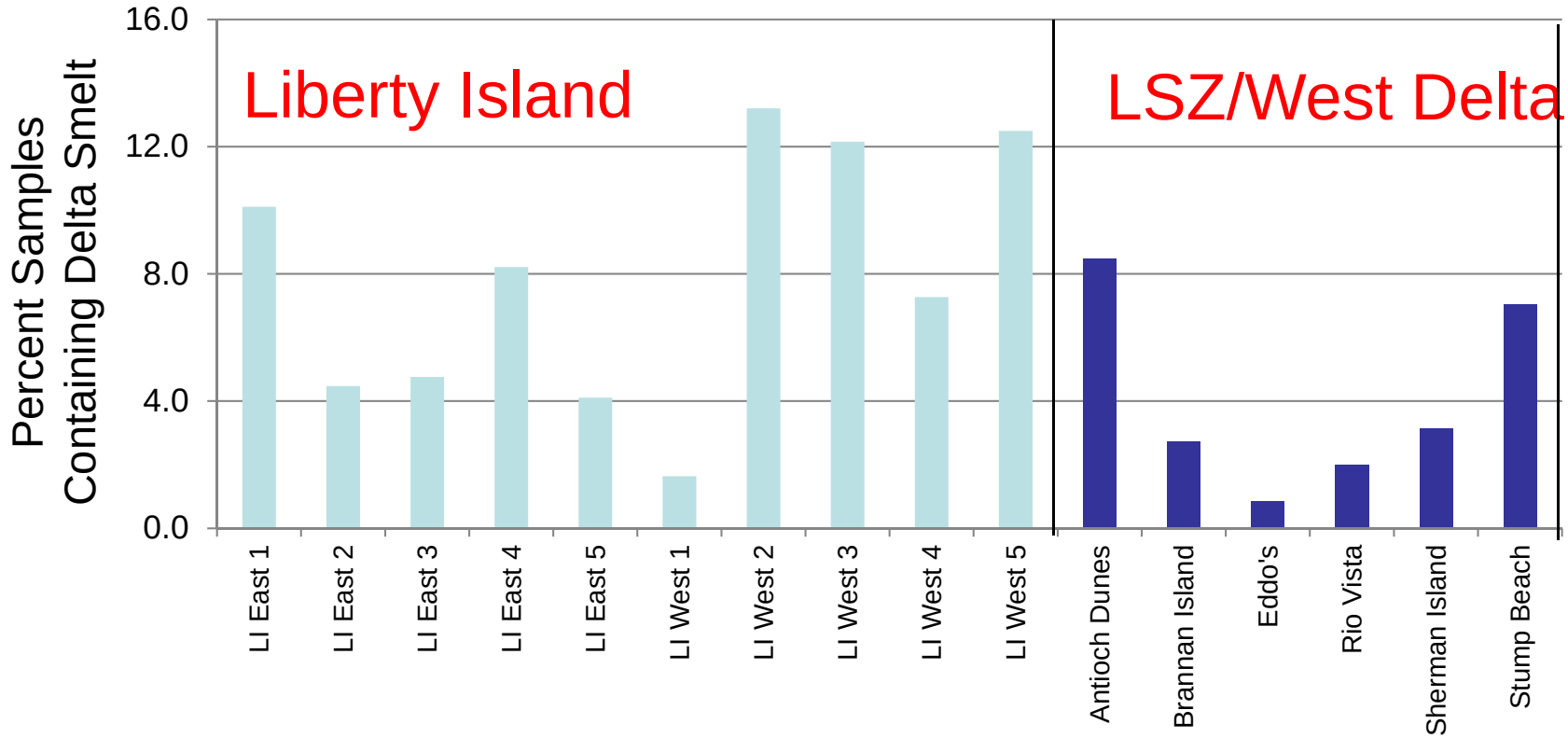


Delta Smelt Can Be Found Year Round In Liberty Island



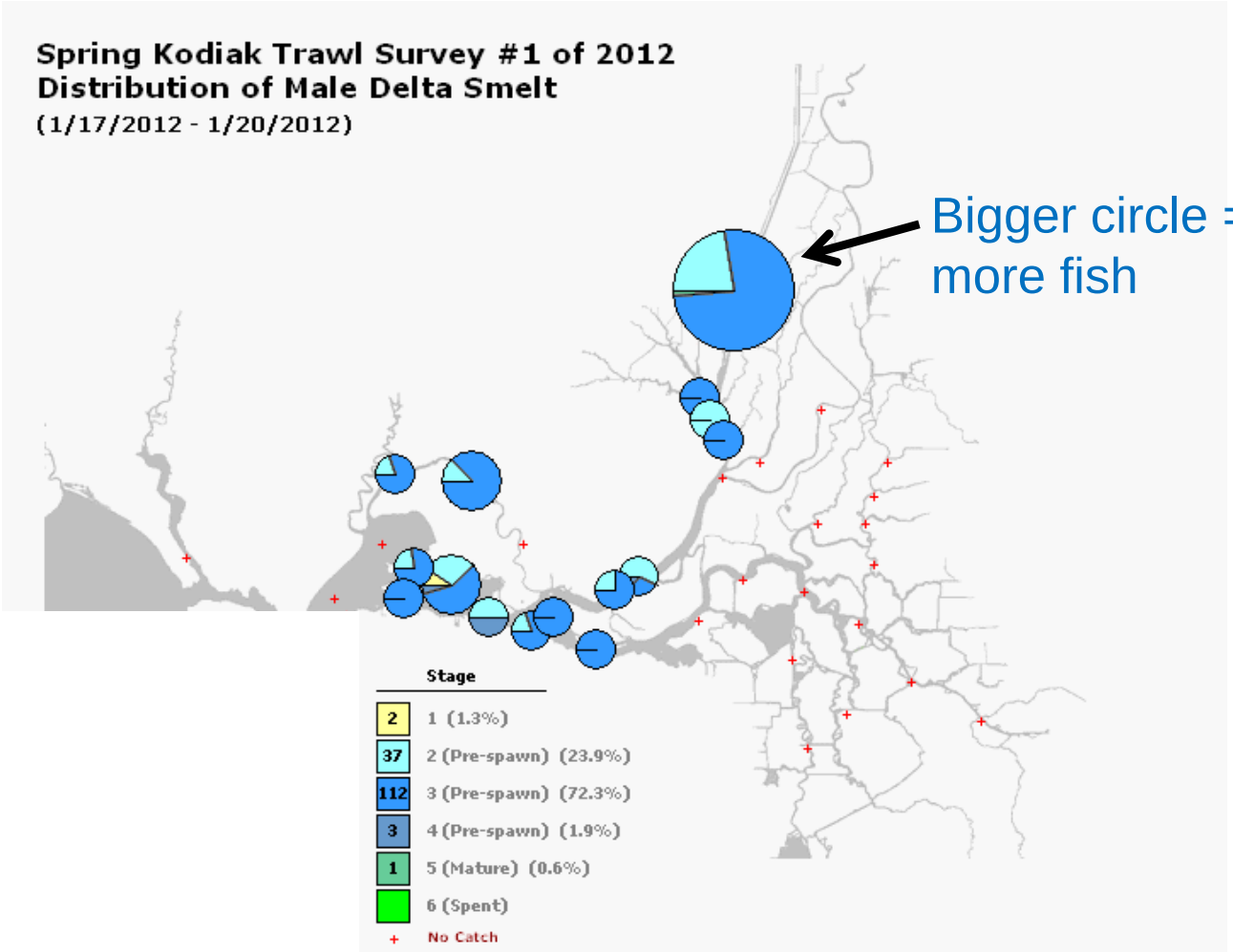
Source: Sommer and Mejia (In Review) based on FWS Seine Results For Delta Smelt (2002-2004)

Occurrence Of Delta Smelt In Liberty Island Is Not Trivial



Source: Sommer and Mejia (In Review)

Relatively High Catch of Delta Smelt in Cache Slough Complex



Source: DFG Kodiak Trawl

http://www.dfg.ca.gov/delta/data/skt/DisplayMaps.asp

Fall Low Salinity Habitat (FLaSH) Study 2011

PRELIMINARY, PREDECISIONAL, AND SUBJECT TO REVISION
DO NOT RELEASE OR CITE

USGS
science for a changing world

In Cooperation with the Bureau of Reclamation and Interagency Ecological Program

Synthesis of Studies in the Fall Low Salinity Zone of the San Francisco Estuary, September-December 2011

By Larry R. Brown, Randy Baxter, Gonzalo Castillo, Louise Conrad, Steven Culberson, Greg Erickson, Frederick Feyrer, Stephanie Fong, Karen Gehrts, Lenny Grimaldo, Bruce Herbold, Joseph Kirsch, Anke Mueller-Solger, Steve Slater, Ted Sommer, Kelly Souza, and Erwin Van Nieuwenhuyse

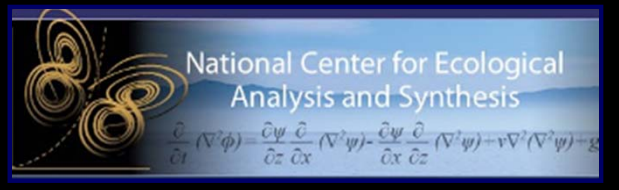
Report Series XXXX–XXXX

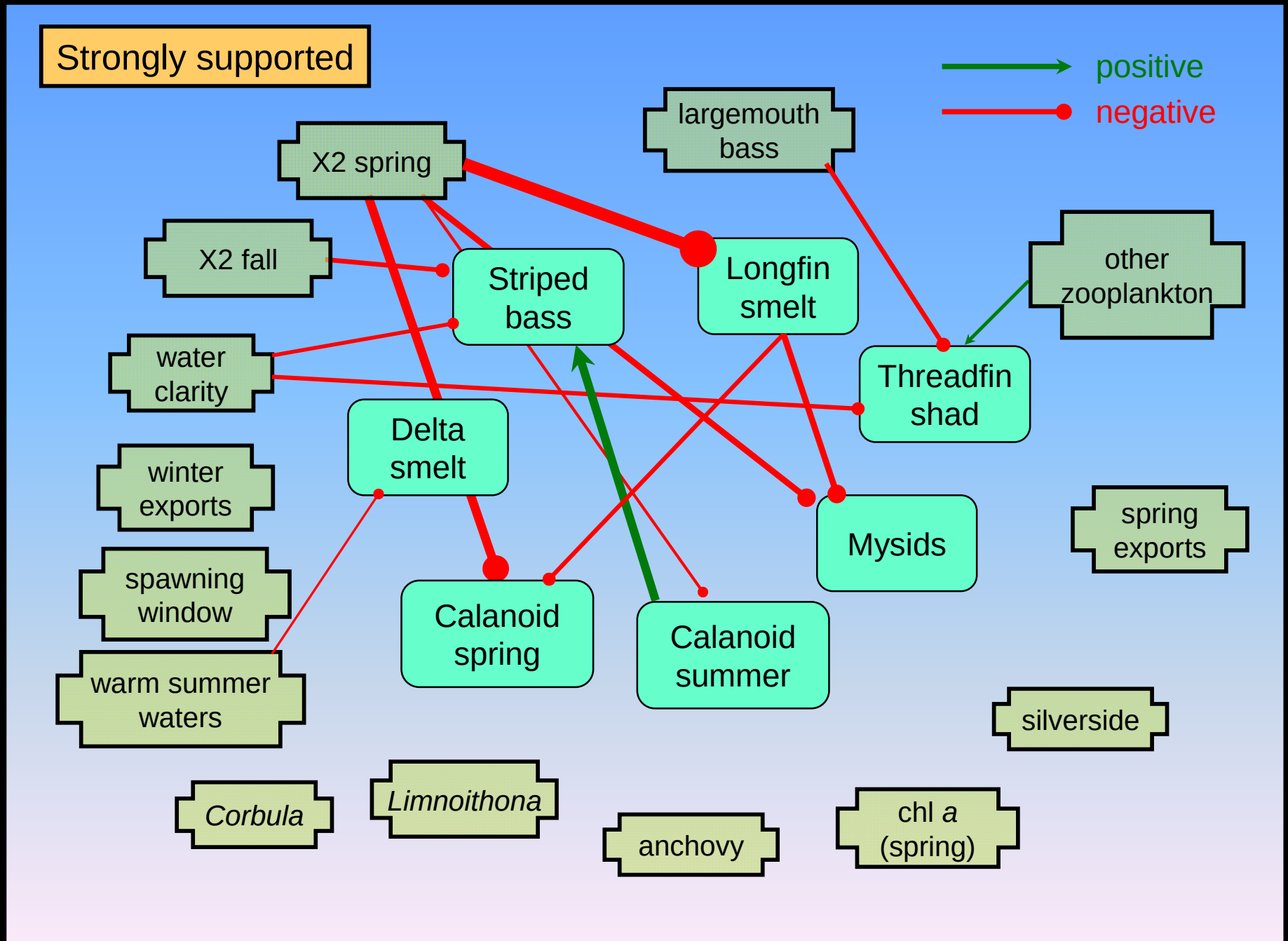
U.S. Department of the Interior
U.S. Geological Survey

Why The FLaSH Study Results Were Inconclusive

- Just one year (“n = 1”).
- 2011 investigation incomplete.
- Peer-review not complete.
- Fall 2011 conditions vs. rest of the year?
- Some contradictions in the results.

POD fish trends driven by many factors (Mac Nally et al 2010)

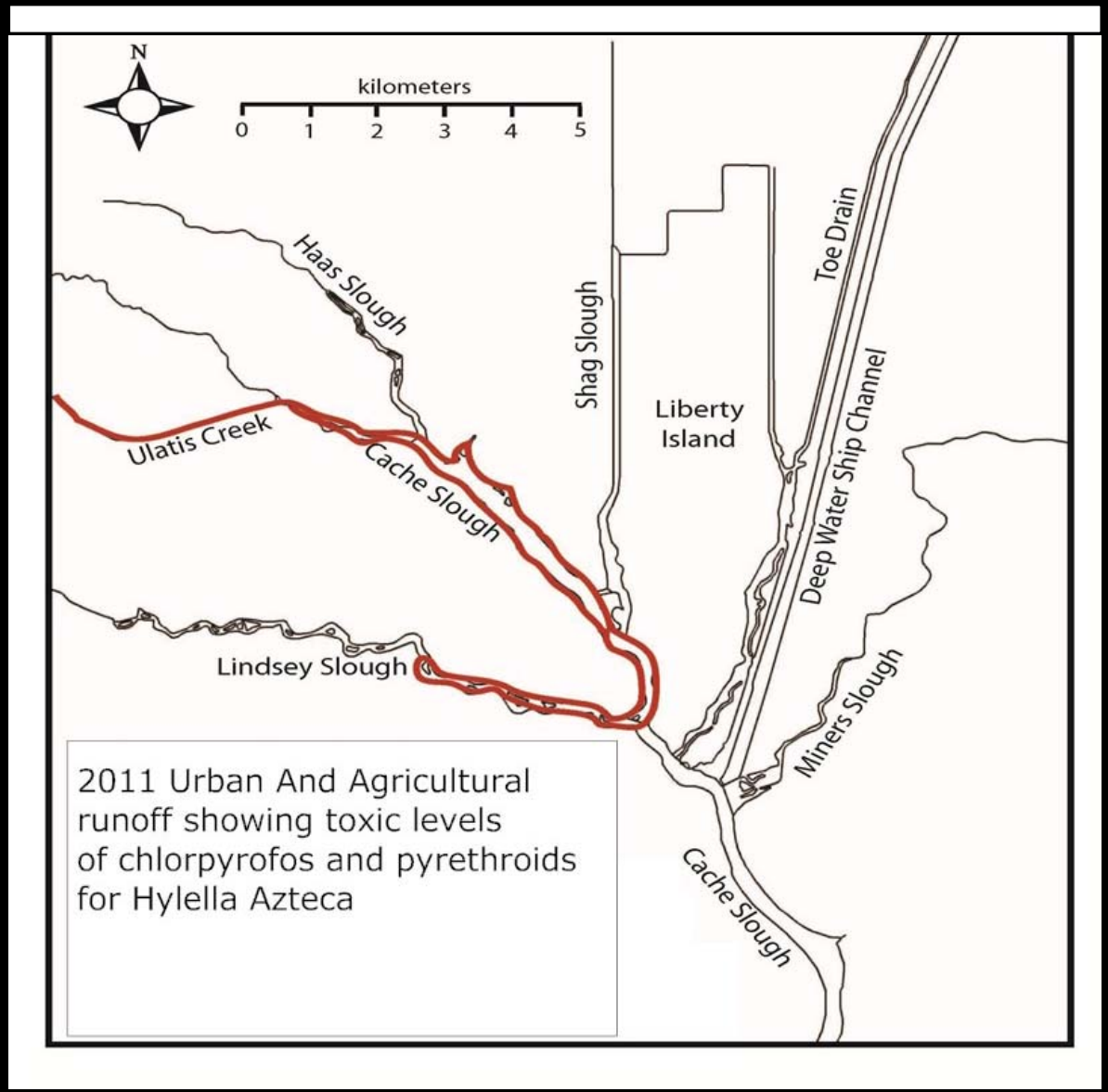




PHYSICAL & CHEMICAL FISH HABITAT

- *Temperature*
  Turbidity
  Salinity
- *Contaminants*
- *Disease*
- *Toxic algae*

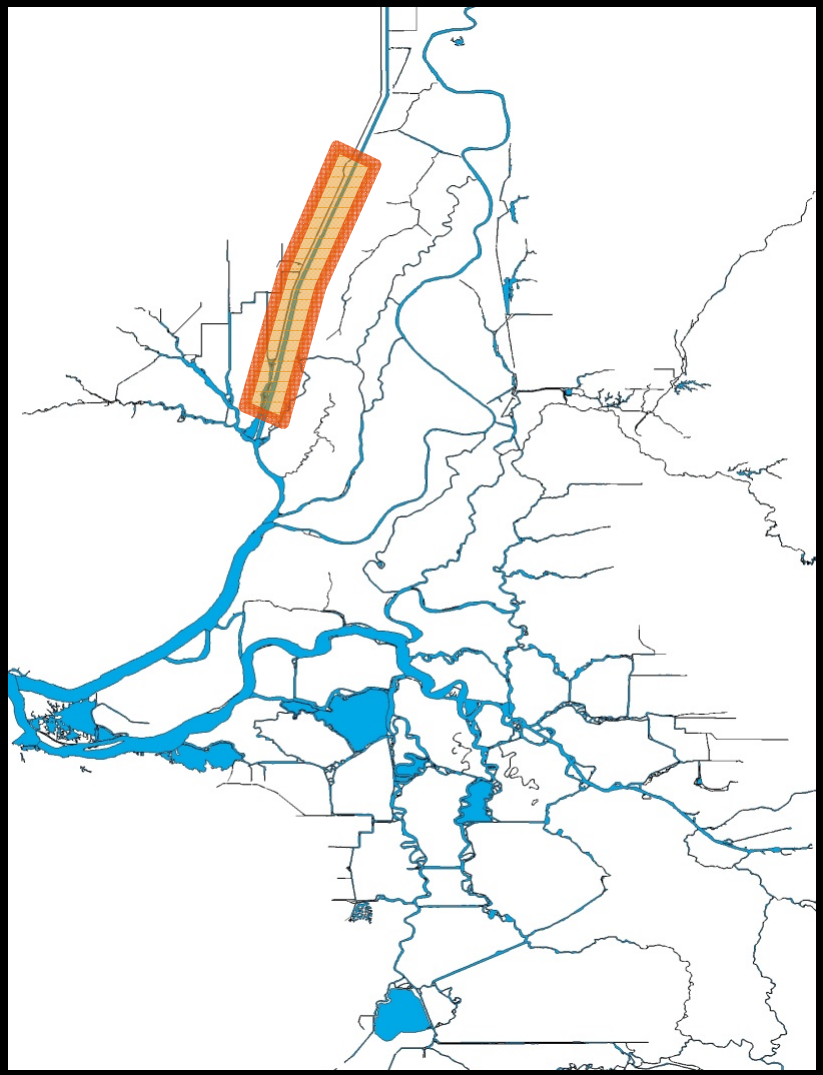
Urban Pesticide Use an Increasing Concern to the D



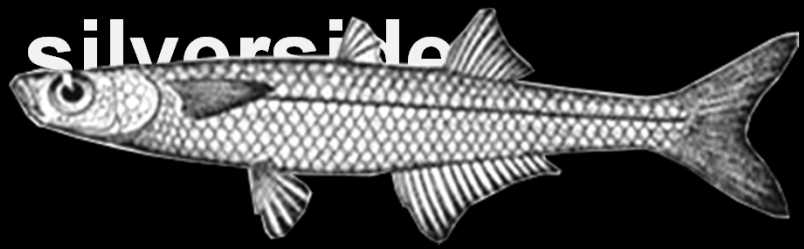
Weston et al., unpublished data 2012

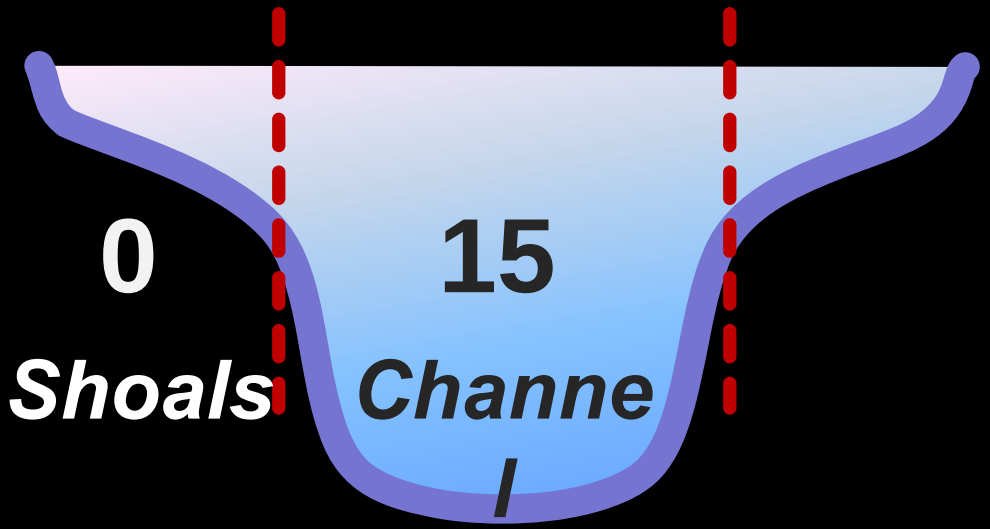
Top Down Effects

Silverside Predation on Larval Delta Smelt



658 dissected silverside

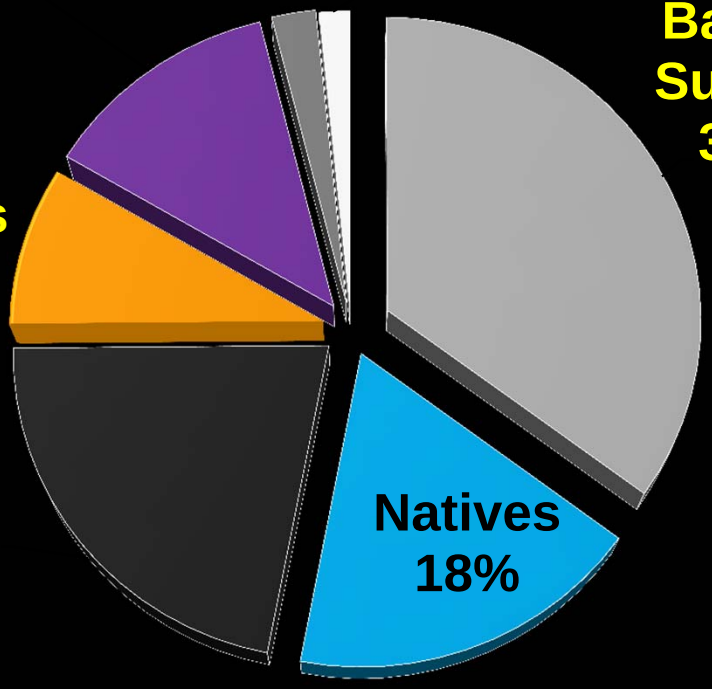




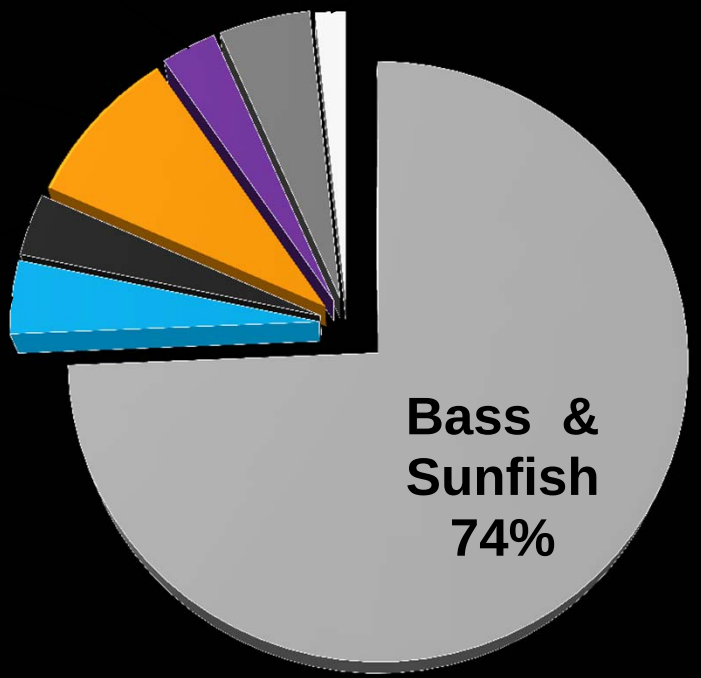
Silversides positive for smelt

Baerwald et al. (2012). *Transactions of the American Fisheries Society*.

Rise of the Centrarchids



1981-82



2009-10

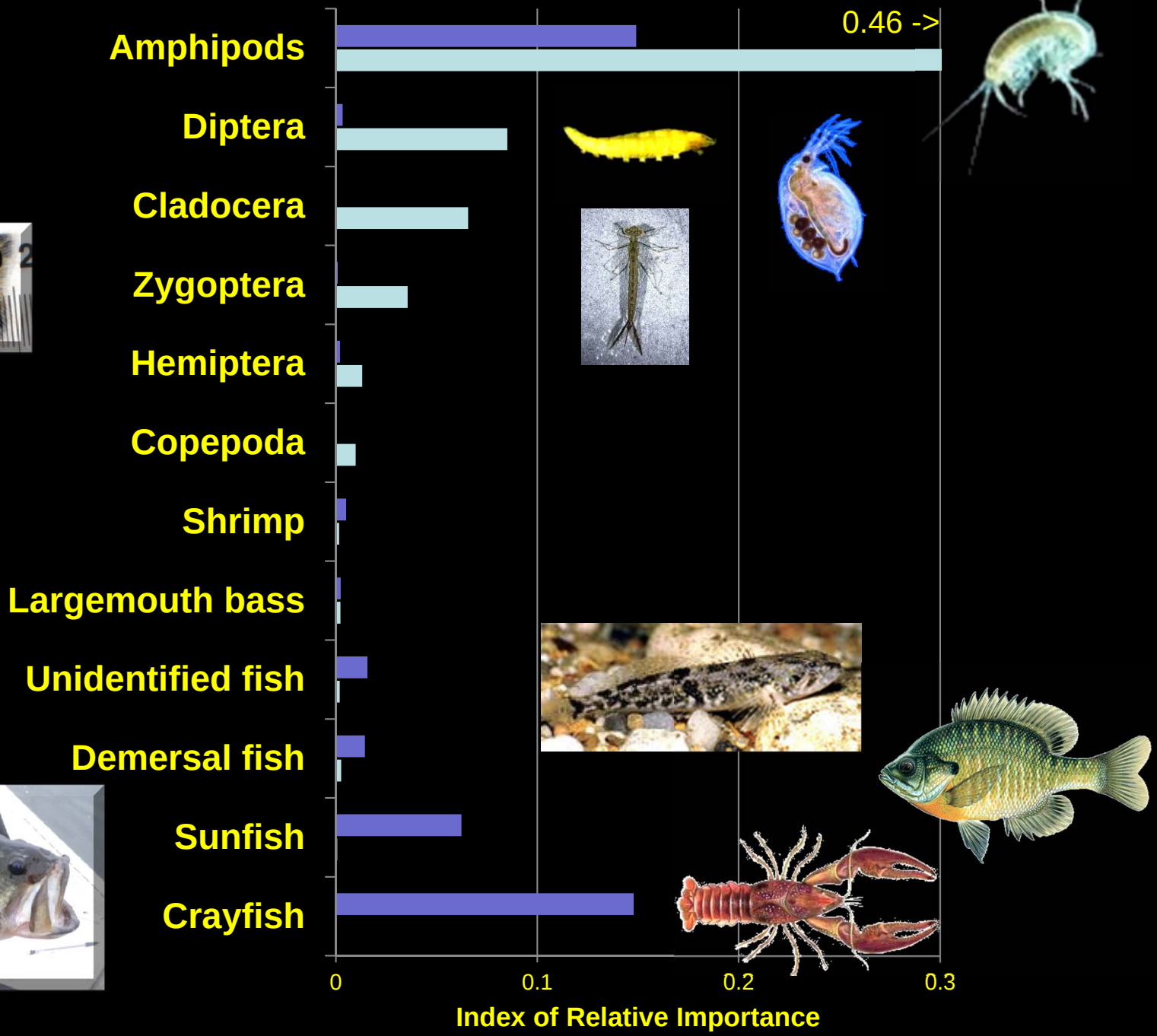
STB = Striped bass
TFS = Threadfin shad

Source: CDFG Resident Fish Survey (‘81-’82). UC Davis Study (‘09-’10). Catch for months of February, April, June, August.

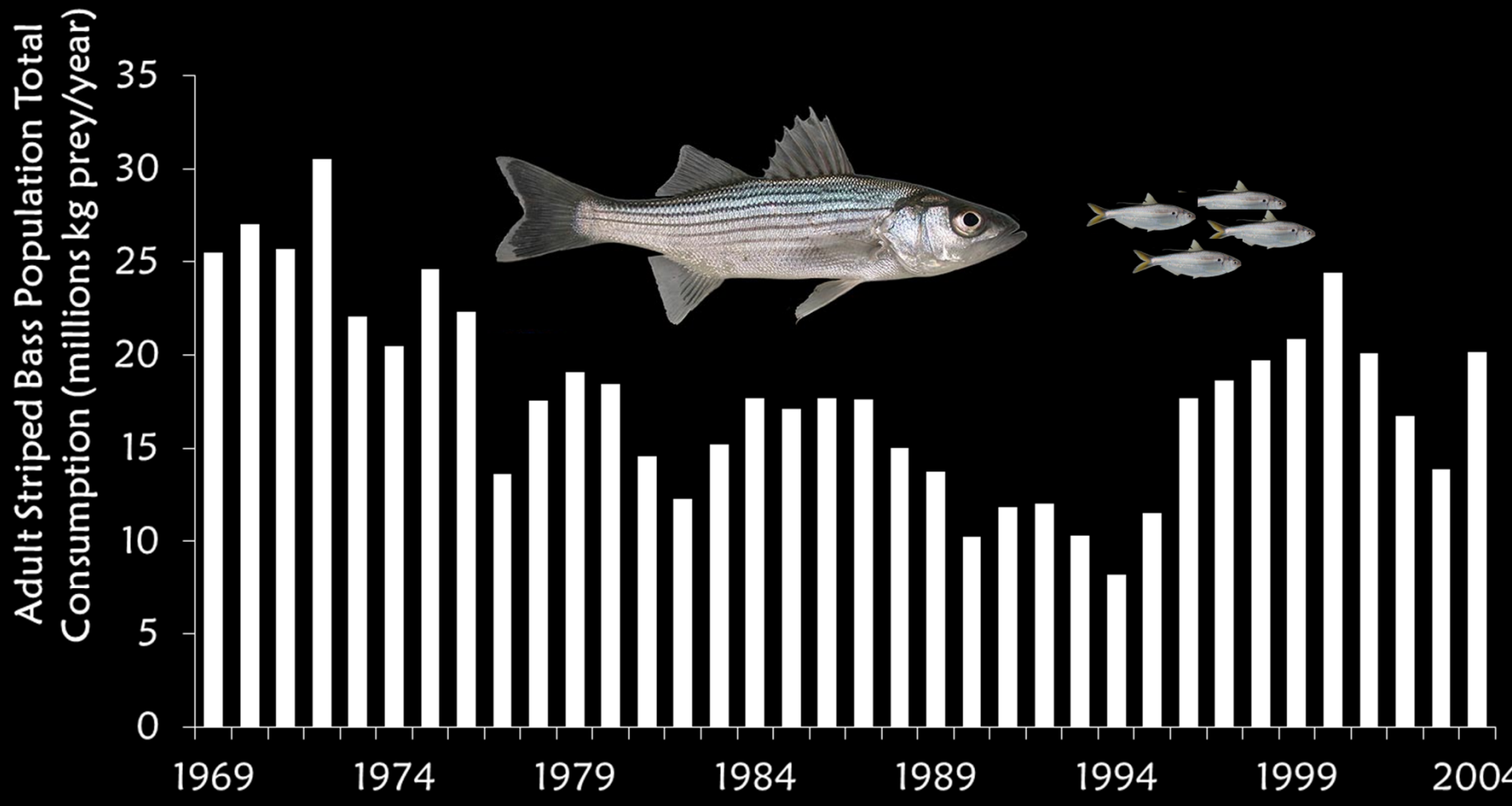
Largemouth Diet Composition

≤125 mm

> 125 mm

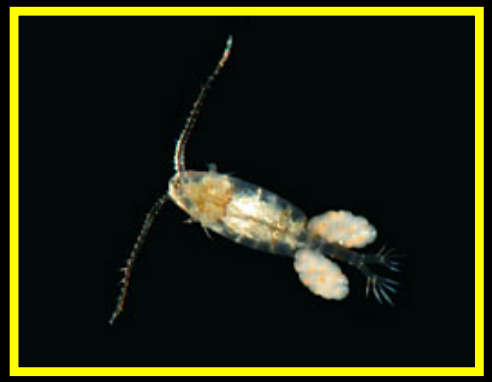


New Estimates of Prey Consumption by Striped Bass

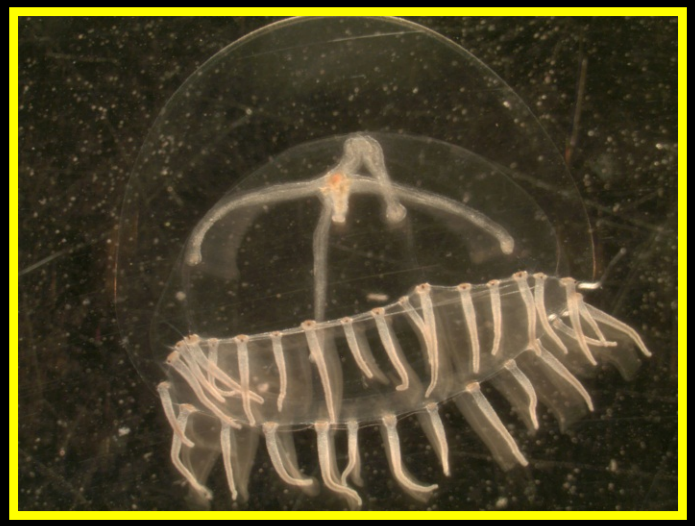


Source: Loboschefsky et al. (2012

Continued Major Food Web Changes



Zooplankton

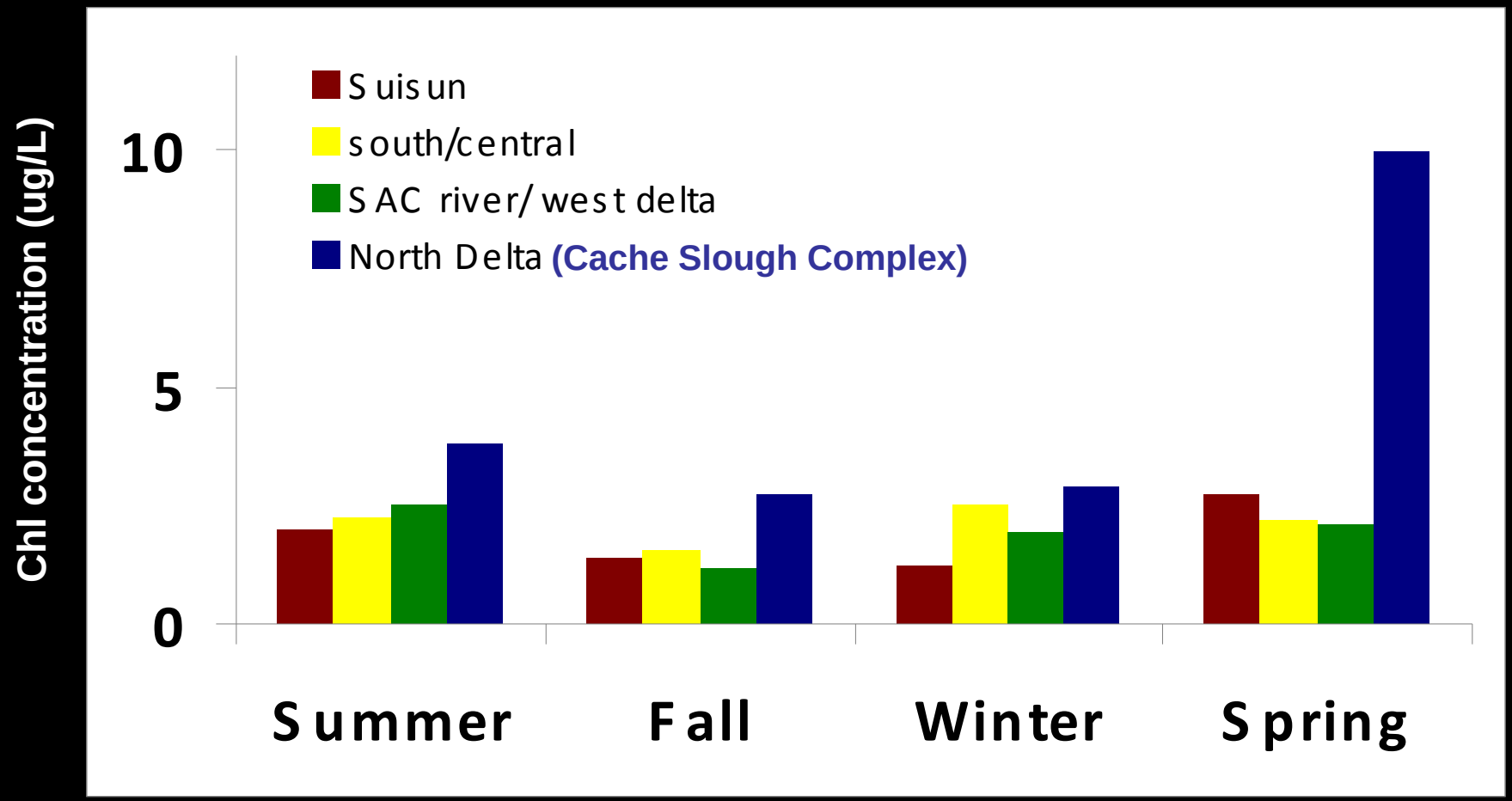


Jellyfish

Shrimp

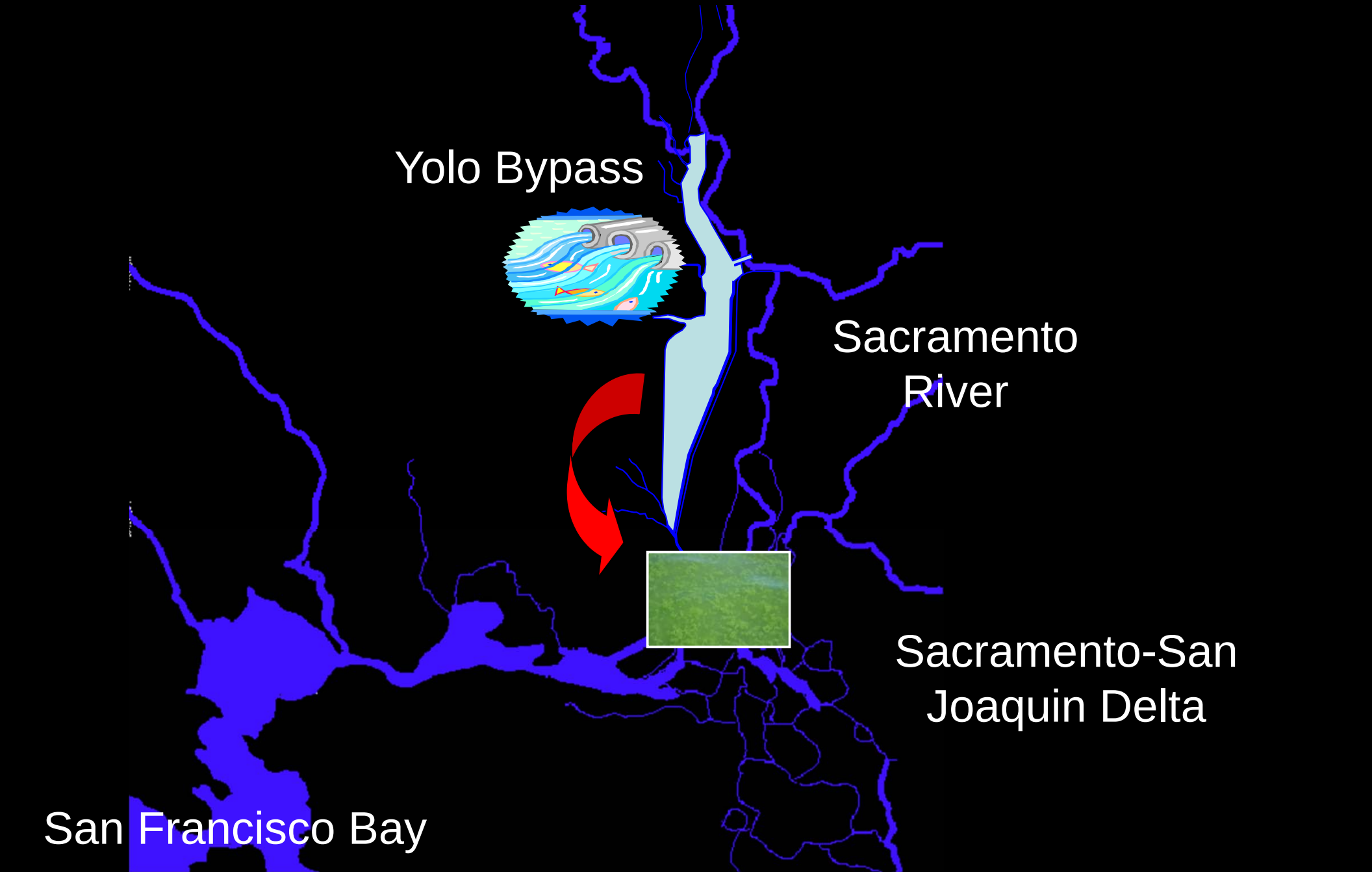
Clams

Cache Slough Complex Is A Food Web "Hot Spot" For The Delta



Source: Benigno et al., In Preparation

Evidence Of Food Web Subsidies From The North Delta – Fall 2011 Studies



Key Recommendations

- Continued research to examine the mechanisms by which flow and other drivers affect aquatic species.
- Regulations to decrease loading of contaminants.
- Response plans for specific changes such as invasive species
- Enough information to justify large scale restoration projects.

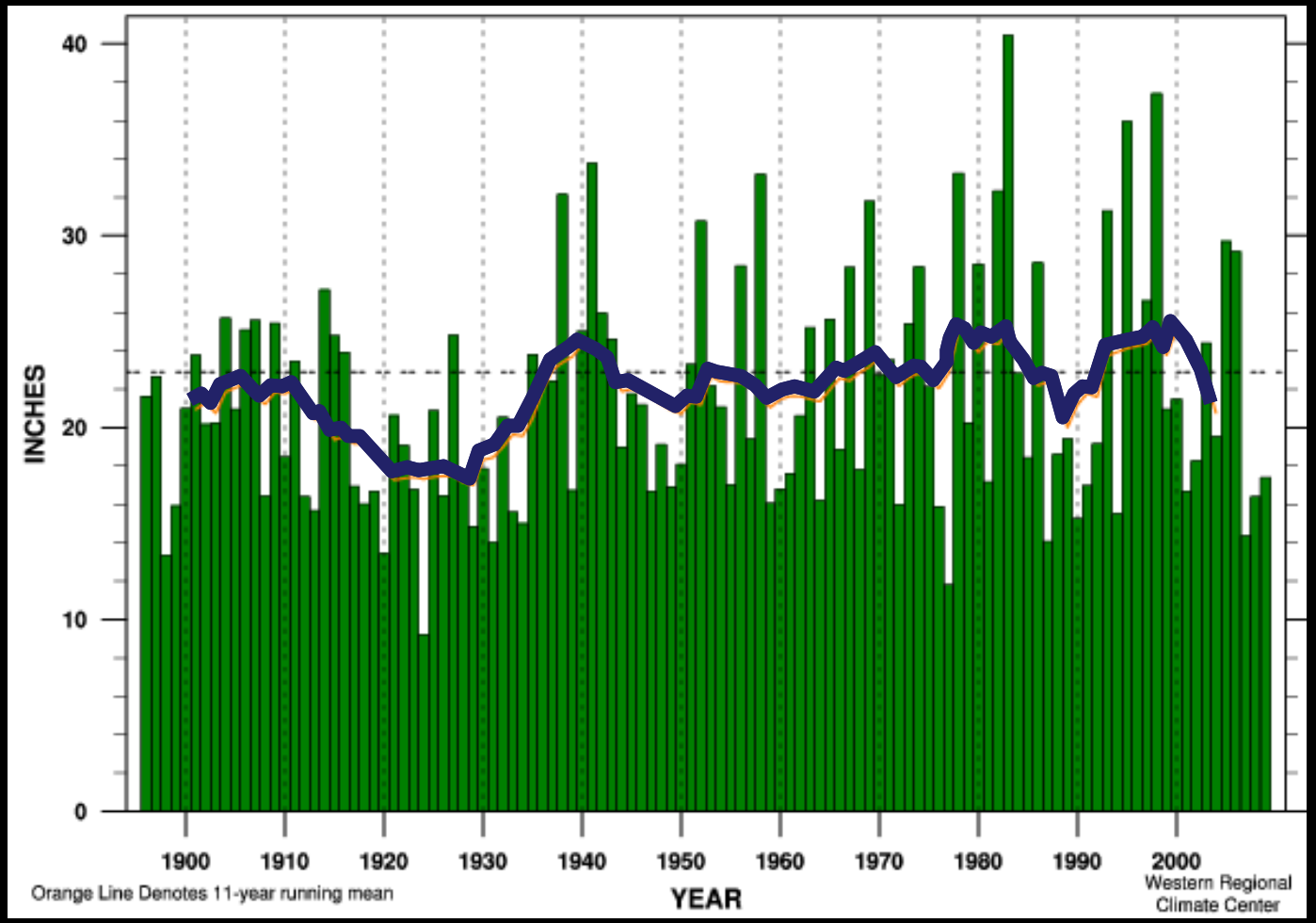
CLIMATE CHANGE
ANDREW SCHWARZ, DWR

Take Home Points

- Historical observations are no longer enough to project future conditions
- Our ability to manage inter-annual variability is changing

California Historical Precipitation

California Statewide Precipitation (Oct-Sep.)

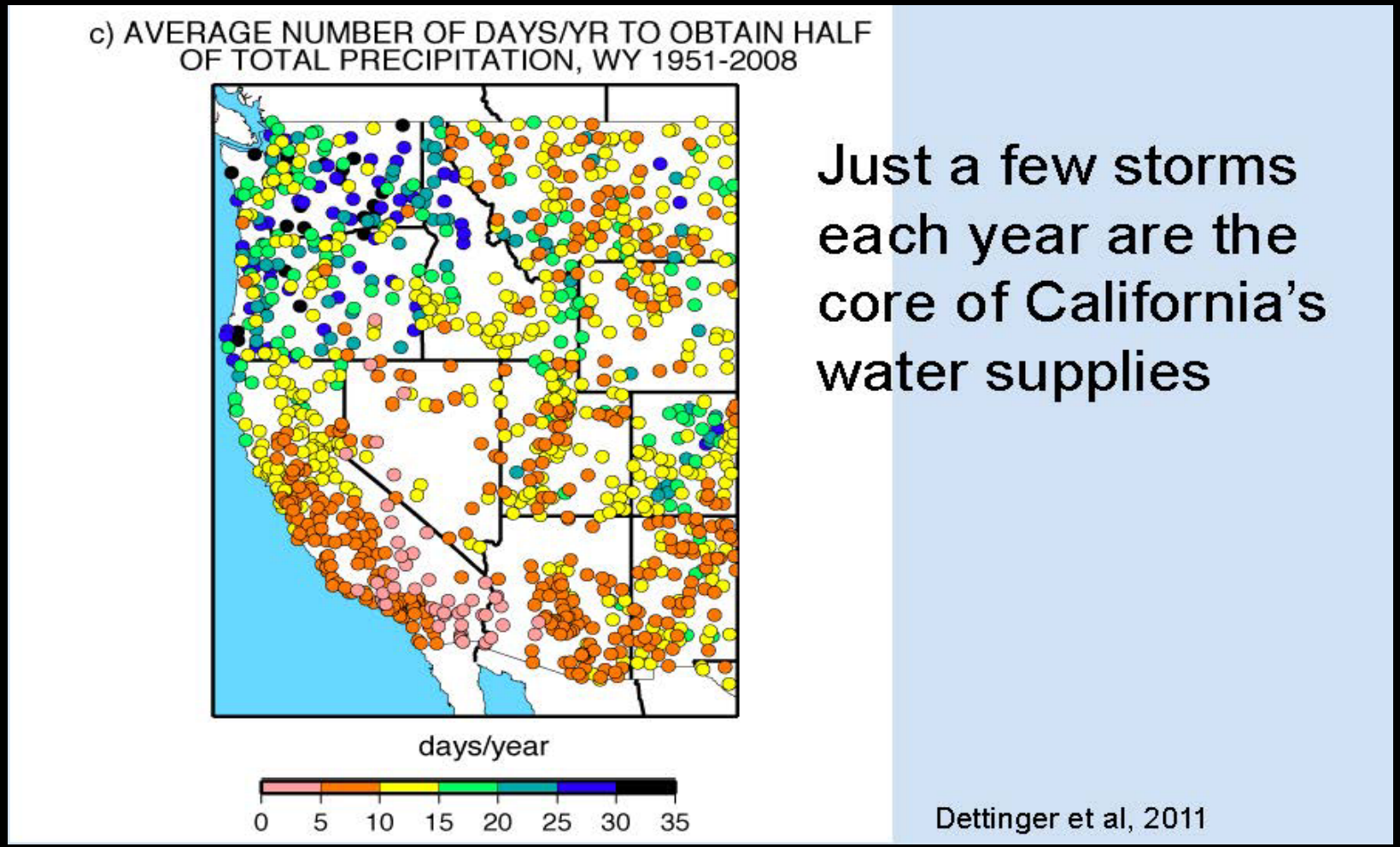


Driest 30 years: 1908-1937 21.28 inches

Wettest 30 years: 1977-2006 24.88 inches

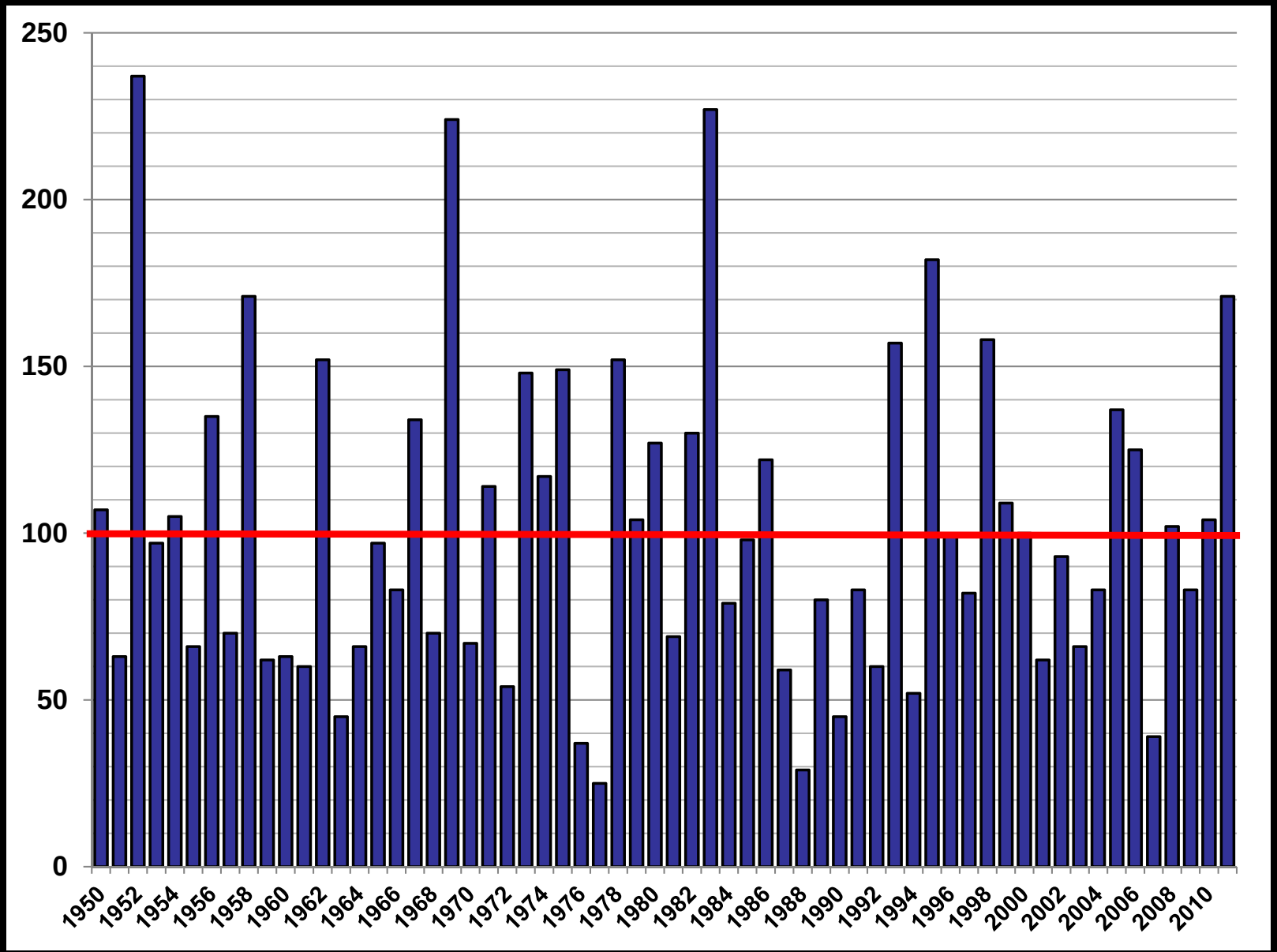
116 year average: 23.88 inches

California's Wild Precipitation Regime



Snowpack Water Content

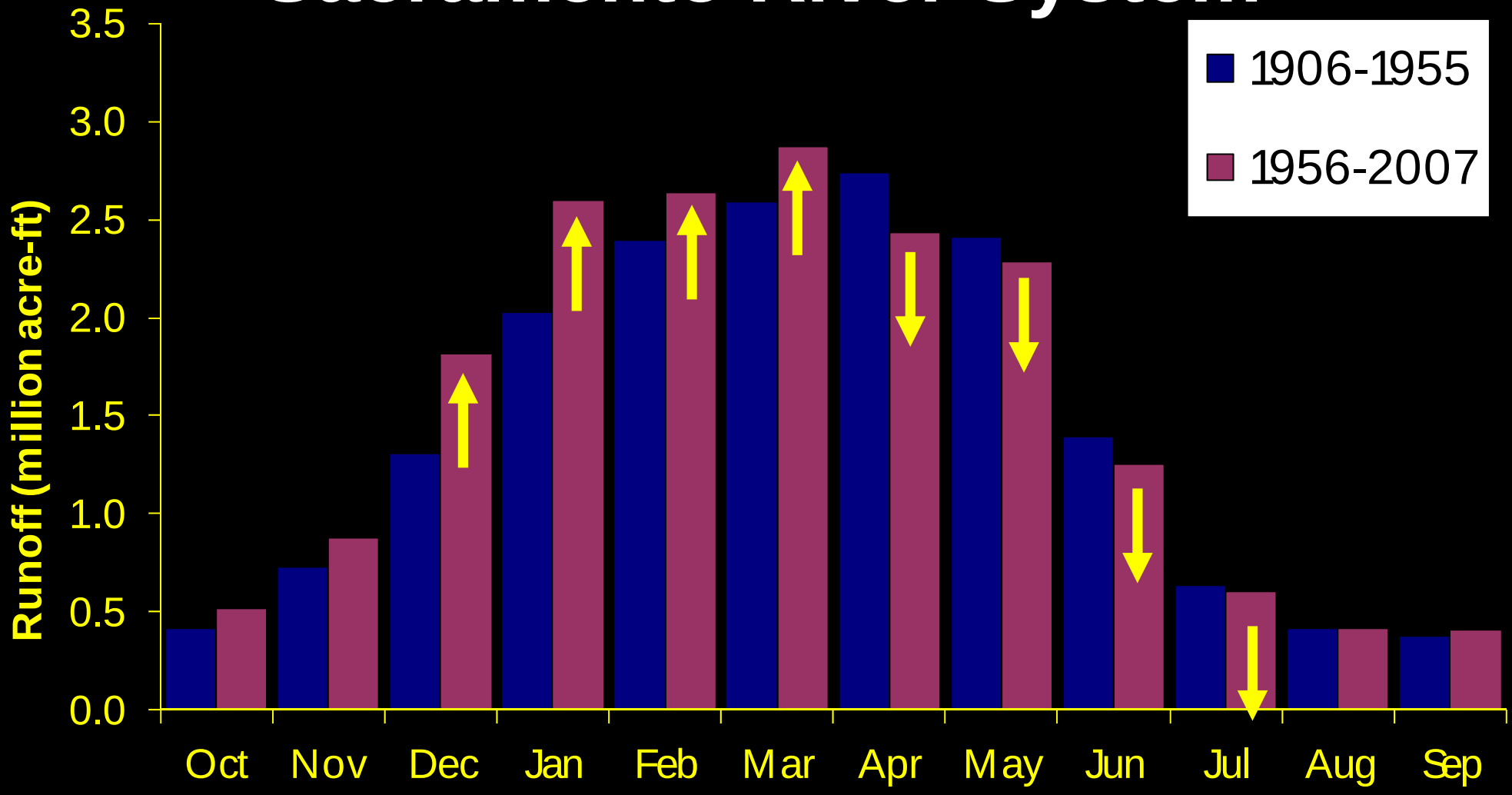
Statewide Percent of Average



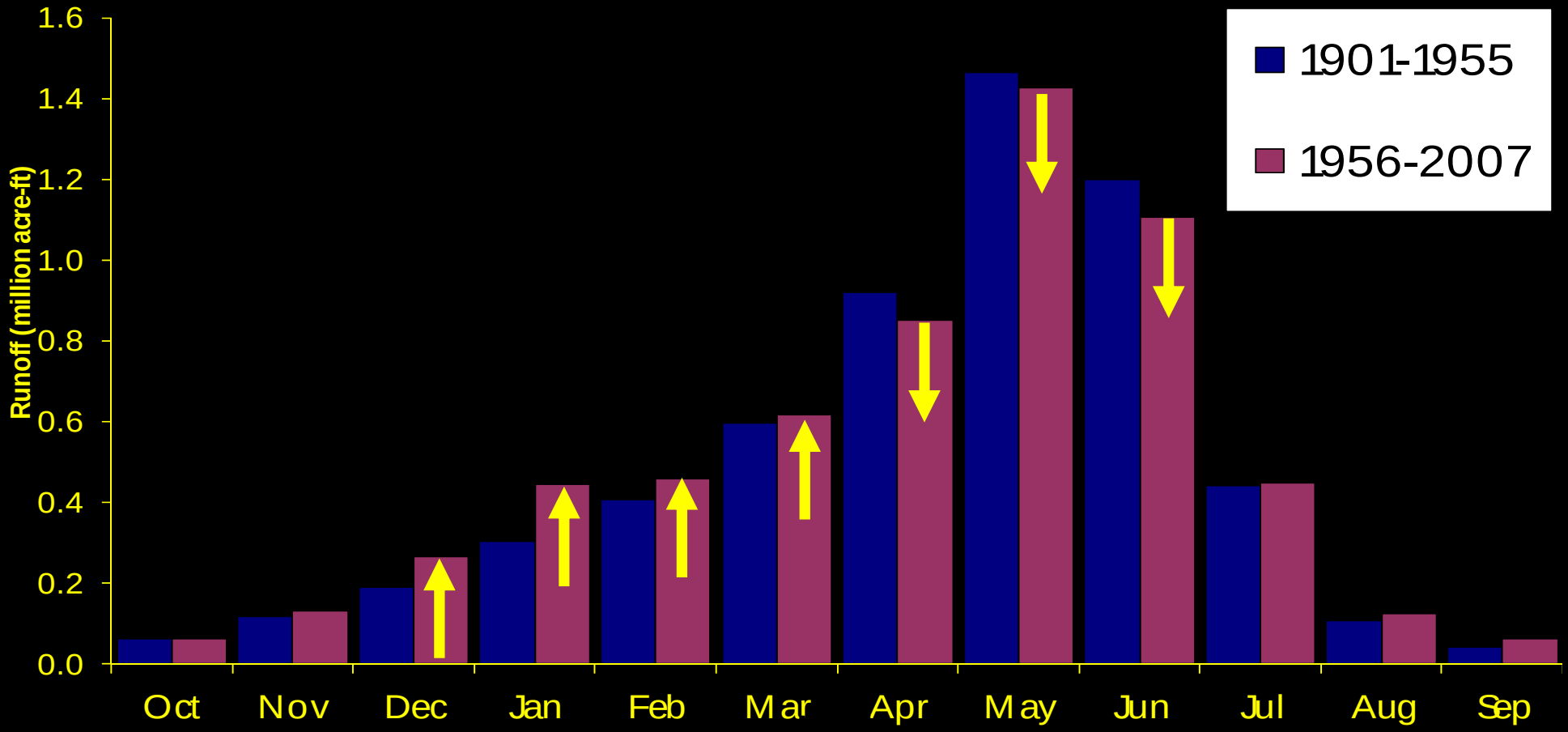
1/3 of California's Water Supply comes from Snowpack

We need that snow to stay high in the watershed until after the flood season has passed

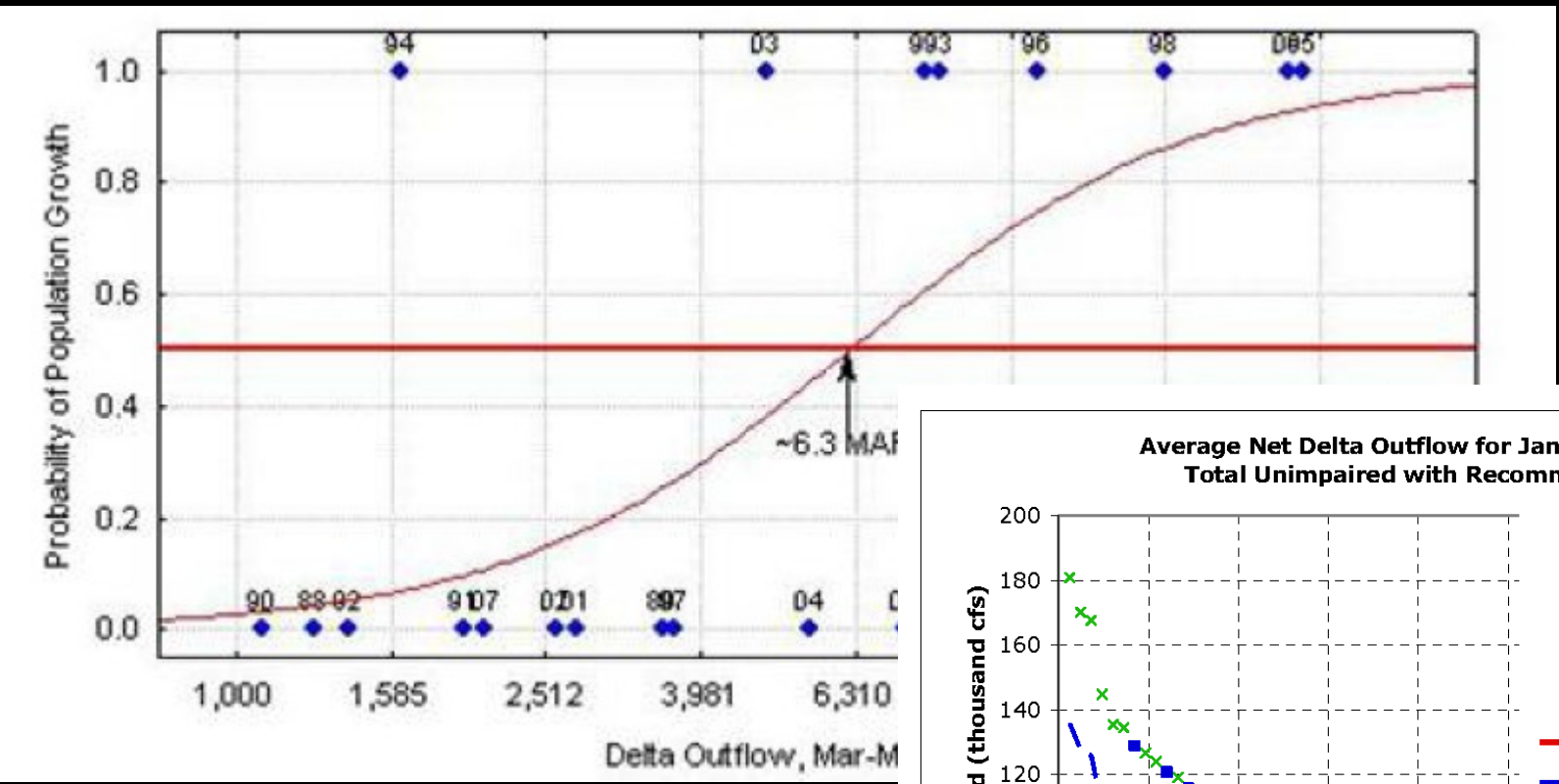
Monthly Average Runoff of Sacramento River System

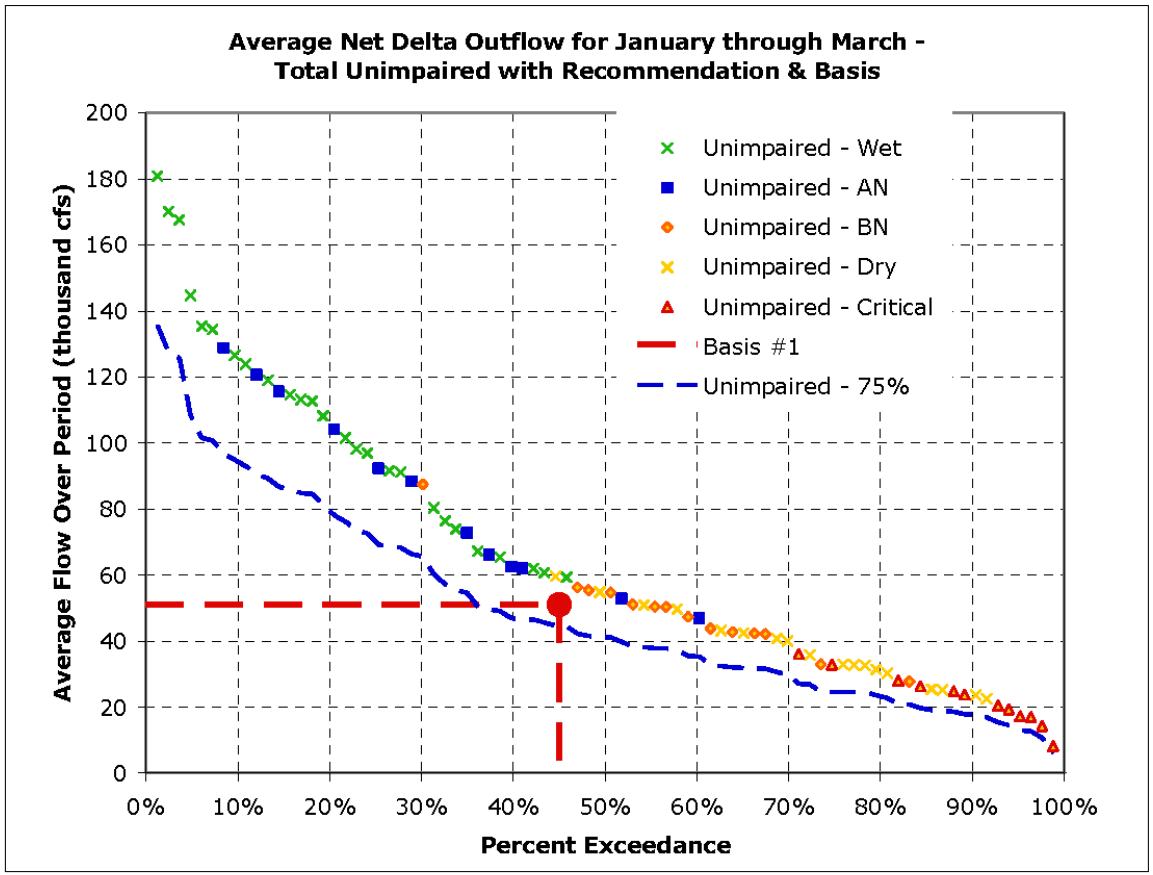


Monthly Average Runoff in San Joaquin River System

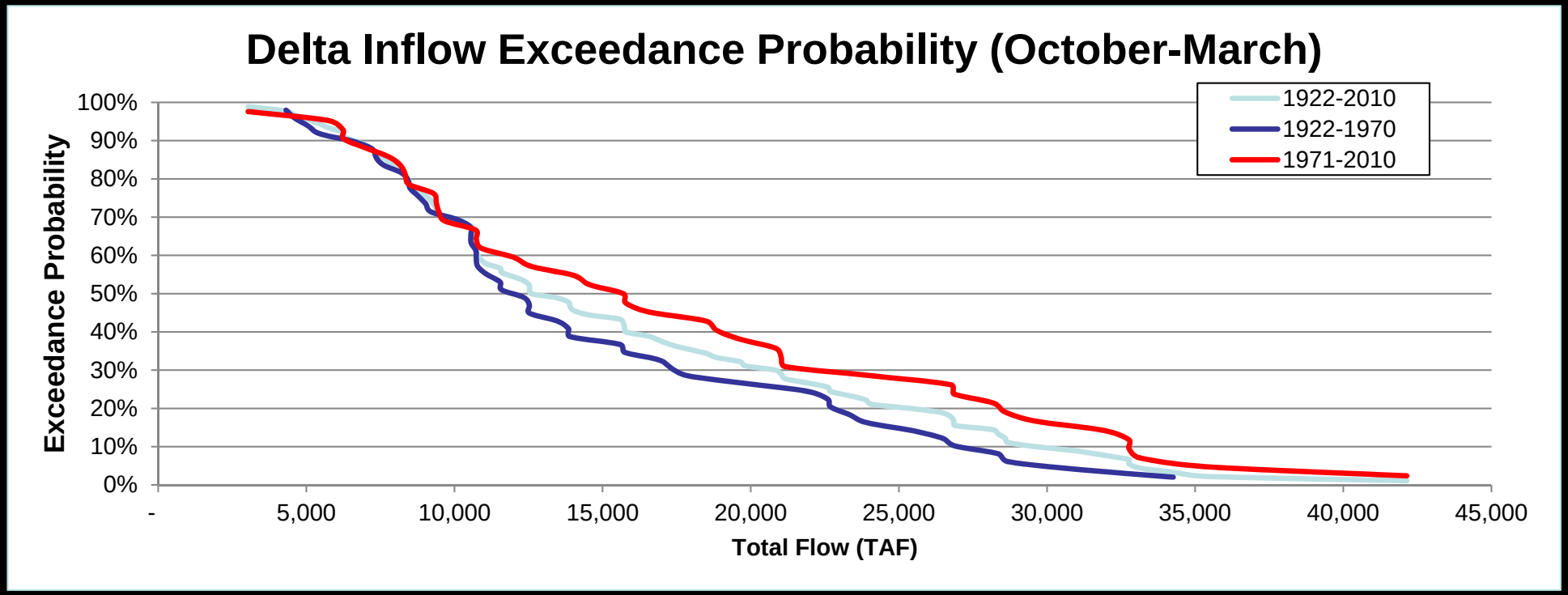


March through May Delta Outflow and Generation-over-Generation Change in Abundance of Longfin Smelt





Source: SWRCB, 2010


Delta Inflow Exceedance Probability (October-March)
Exceedance Probability
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
-
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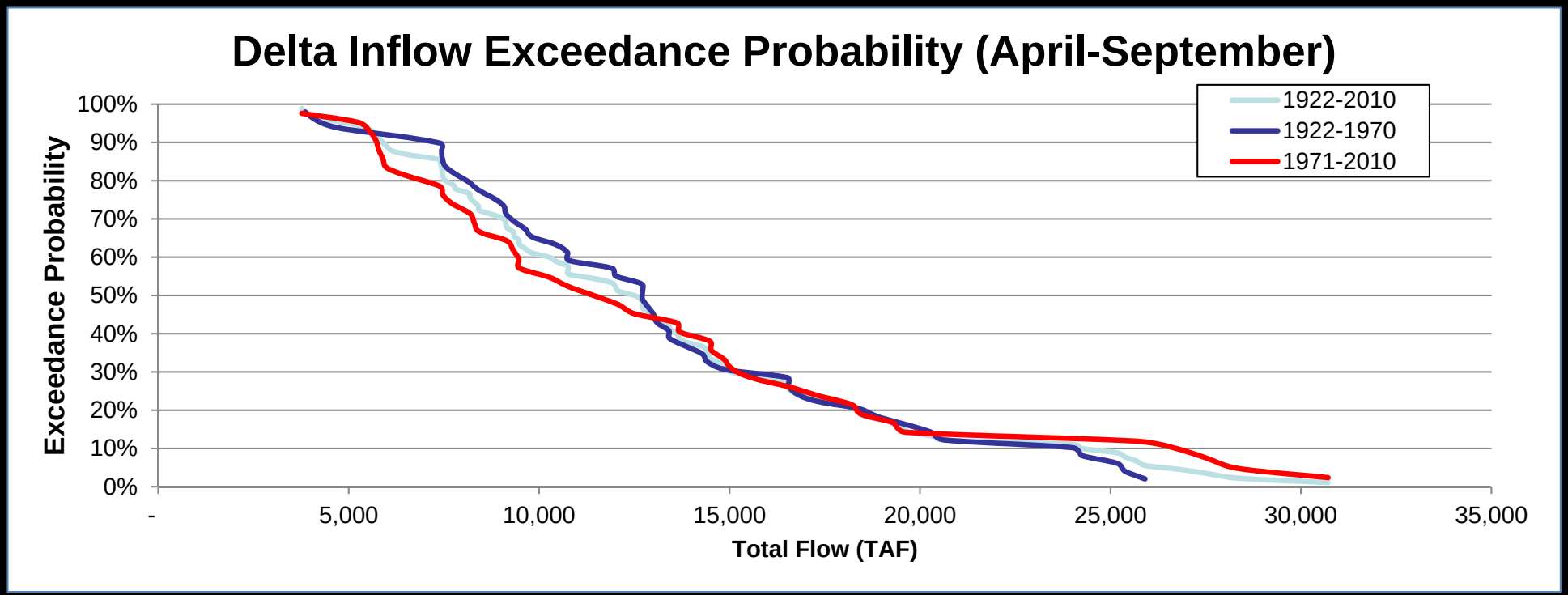
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
Total Flow (TAF)
1922-2010
1922-1970
1971-2010


Delta Inflow Exceedance Probability (April-September)
Exceedance Probability
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
-
5,000
10,000
15,000
20,000
25,000
30,000
35,000
Total Flow (TAF)
1922-2010
1922-1970
1971-2010

If Historical Data Isn't Enough, What Do We Need To Add?

- DWR and Others have used a number of techniques…

  "Climate Change Characterization and Analysis in California Water Resources Planning Studies". California Department of Water Resources. December 2010.

- DWR is continuing to develop newer and better techniques though engagement with an independent Technical Advisory Group

  http://www.water.ca.gov/climatechange/cctag.cfm

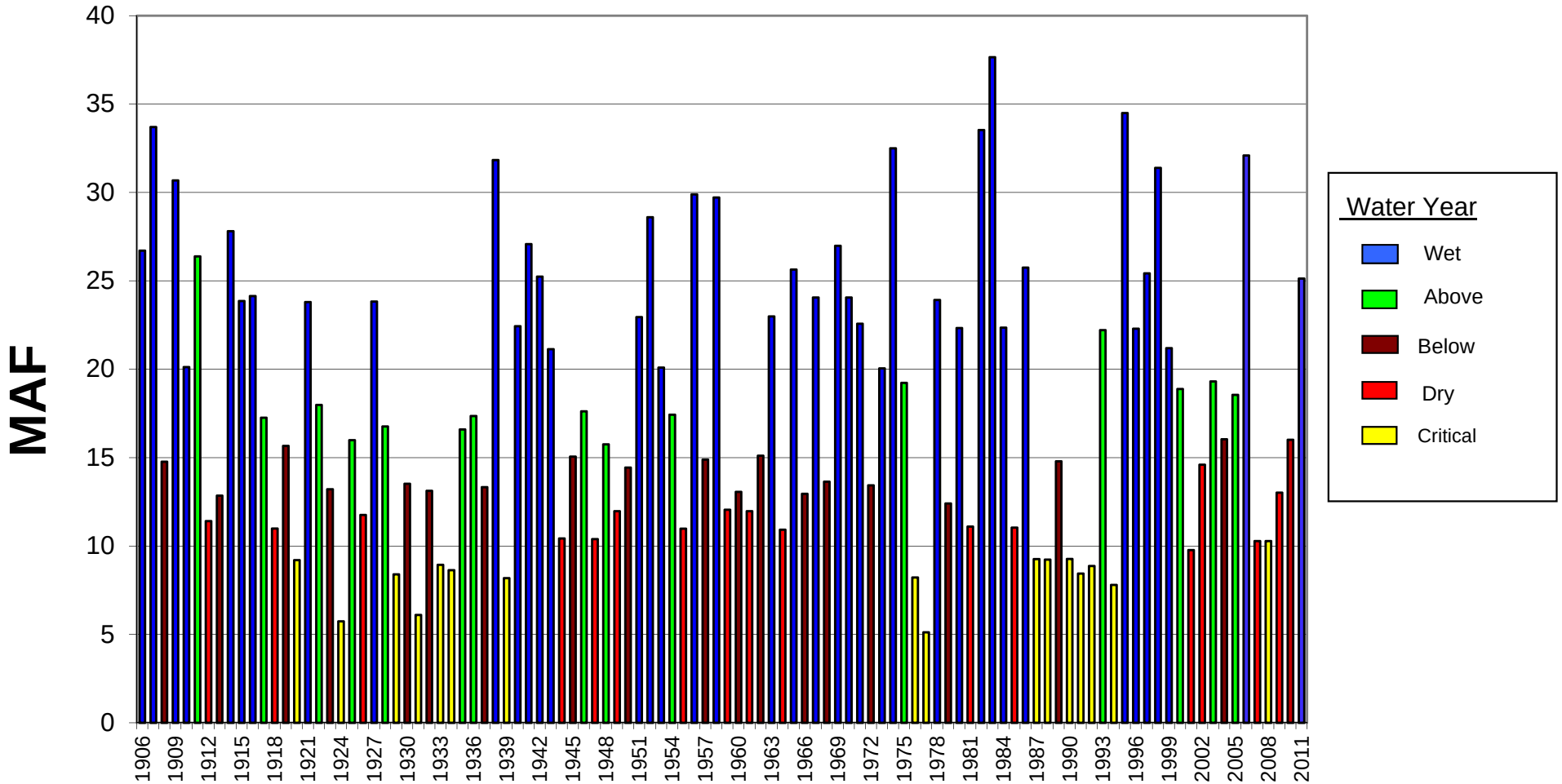
Managing Uncertainty

John Leahigh
State Water Project Water Operations
SWRCB Workshop
September 5, 2012

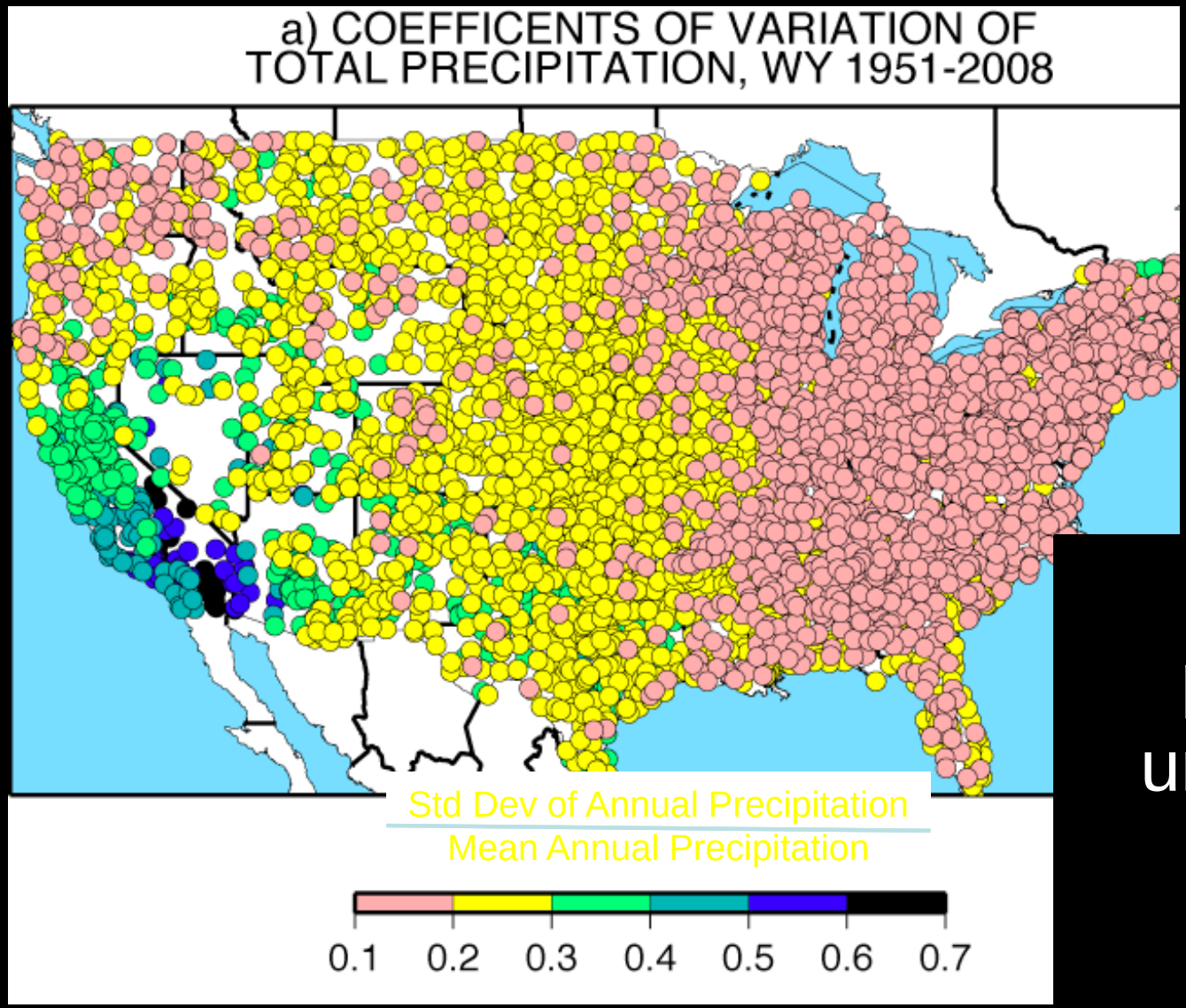
Talk Overview

- Hydrologic Variability
- Managing Variability
- Ecological and Regulatory Uncertainty
- Balancing Benefits with Uncertainty

Sacramento Valley Unimpaired Runoff



California's Wild Precipitation Regime



California precipitation is uniquely variable

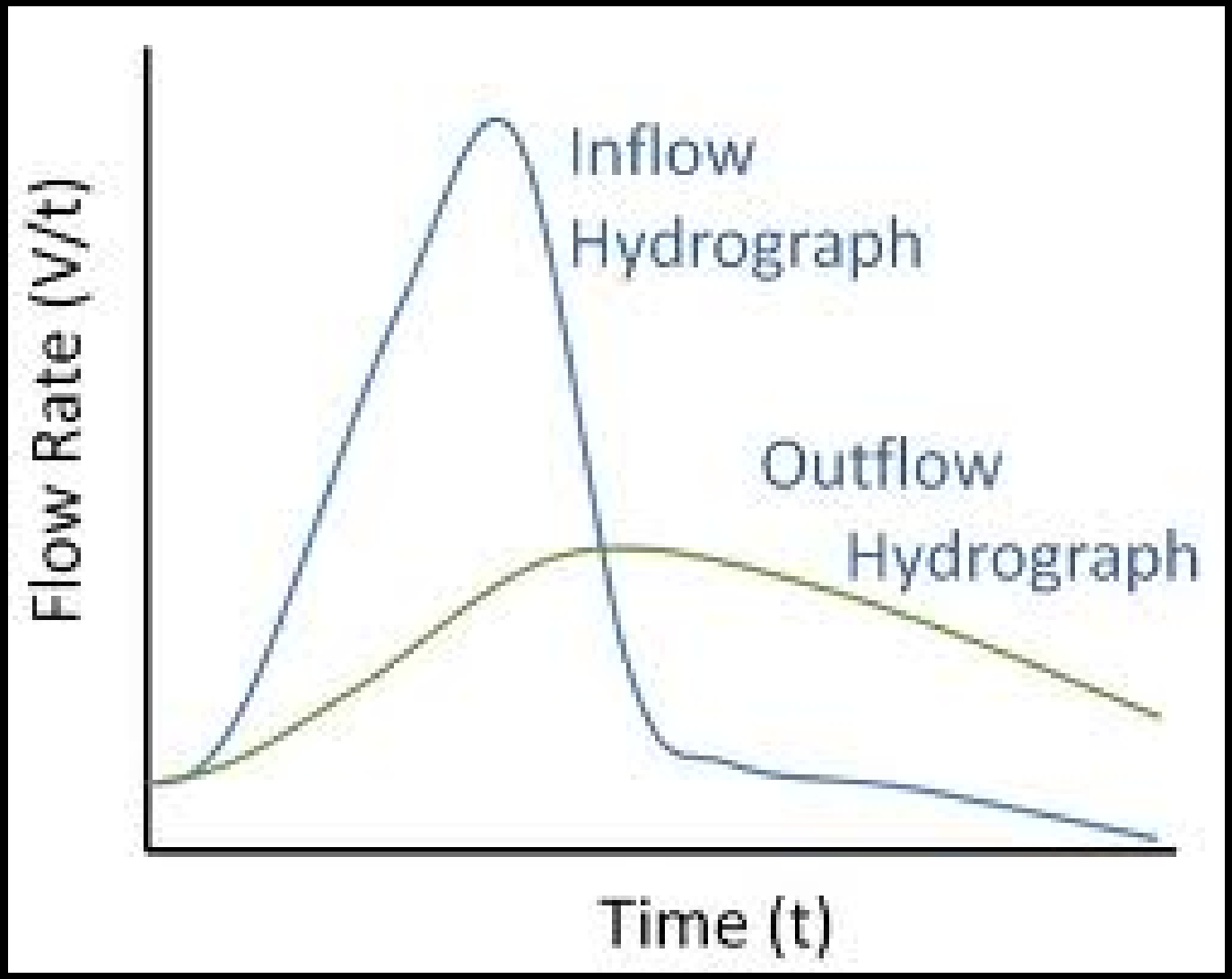
Dettinger et al, 2011

Managed Hydrology Benefits

- Short-Term
  - Flood Mitigation
- Inter-Seasonal
  - Limit Delta Salinity Intrusion
  - Pairing Supply with Demand
  - Temperature Management
- Inter-Annual
  - Drought Mitigation

Short-term Impairment

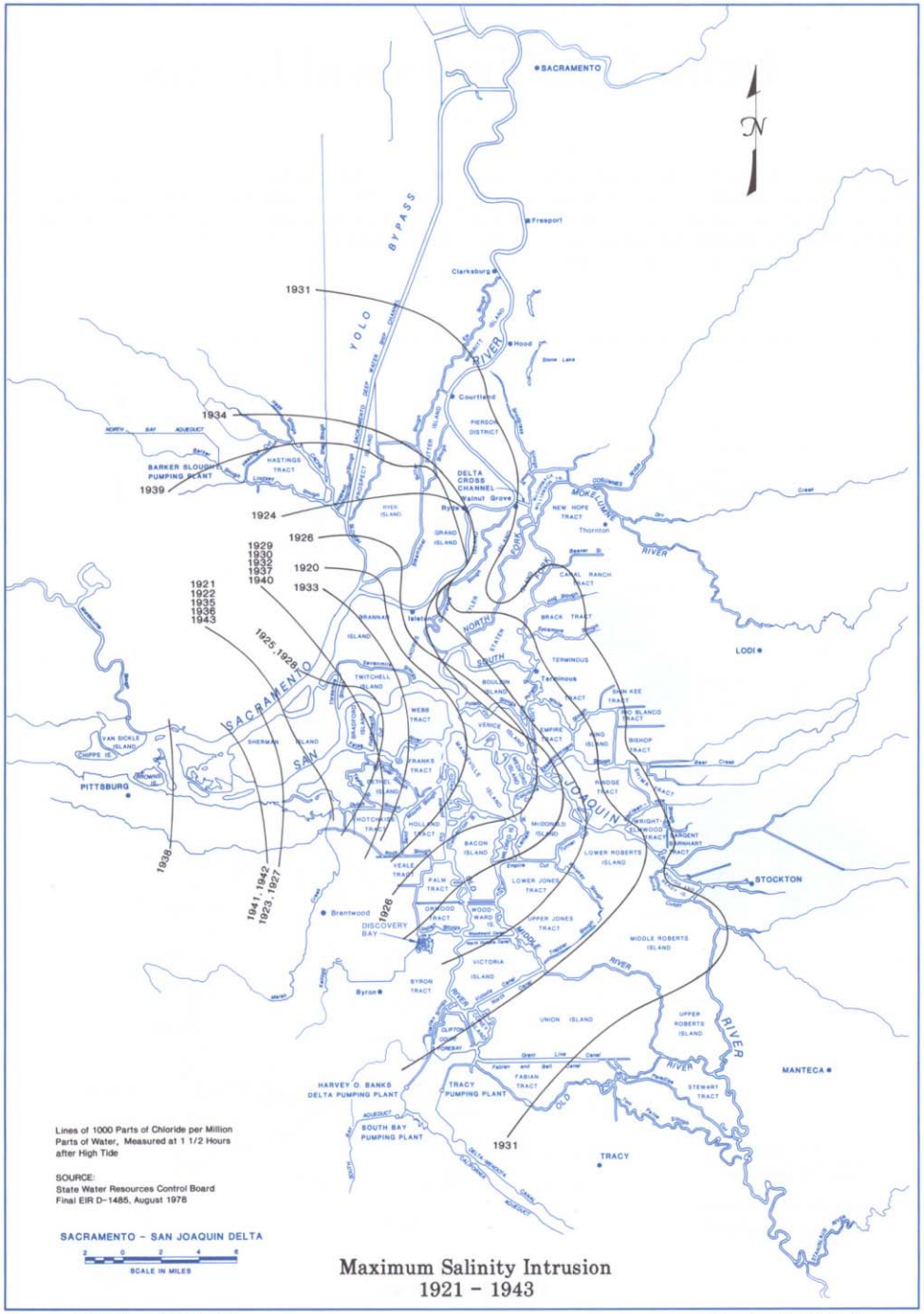
Catastrophic flooding is greatly reduced



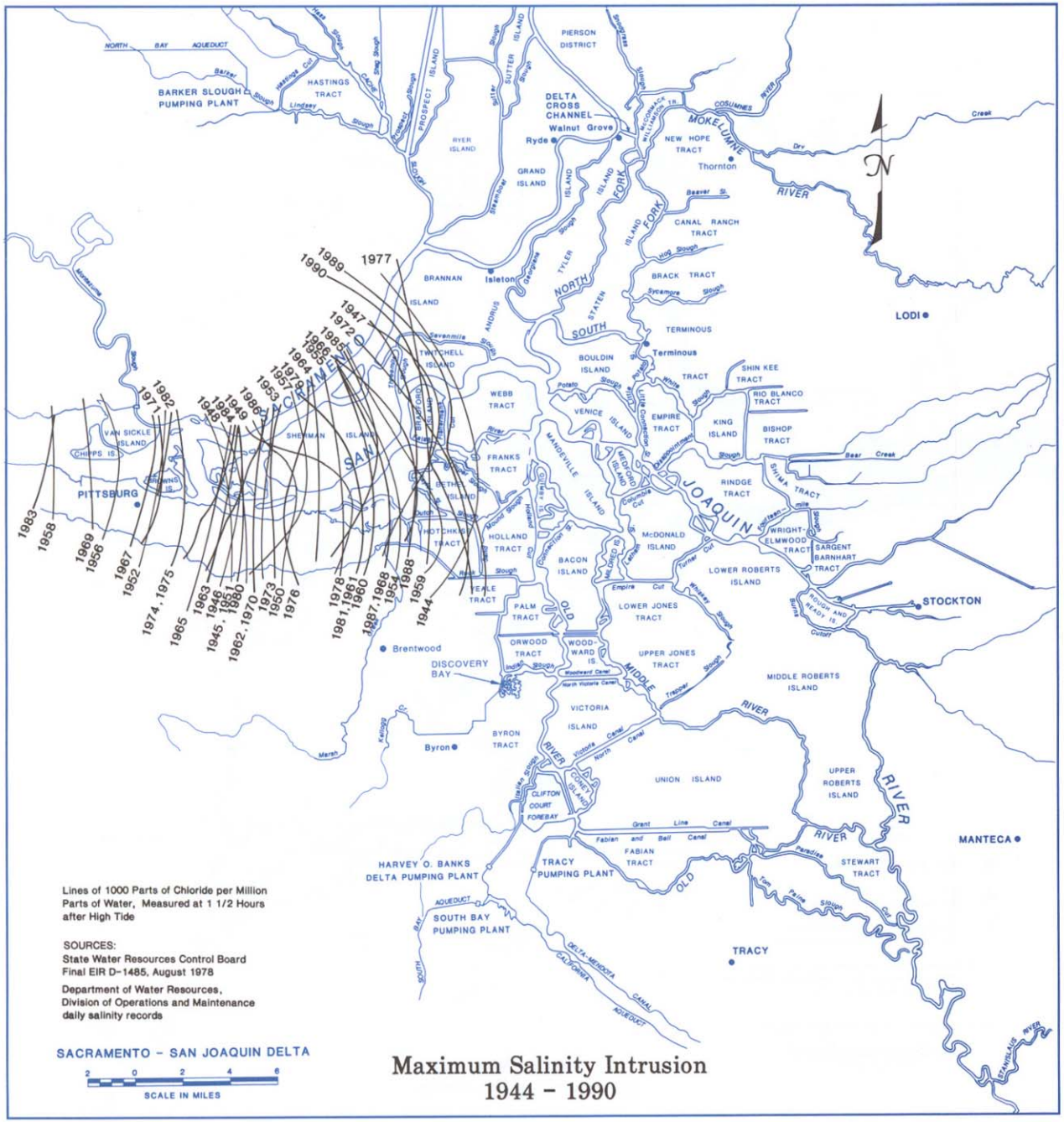
Inter-Seasonal Management

Stored water during the winter and spring is released during summer and fall to:

- Limit salinity intrusion per SWRCB standards for Delta agricultural and M&I uses
- Provide supply for water project exports
- Manage river temperatures



Maximum Salinity Intrusion
1921 – 1943


1989
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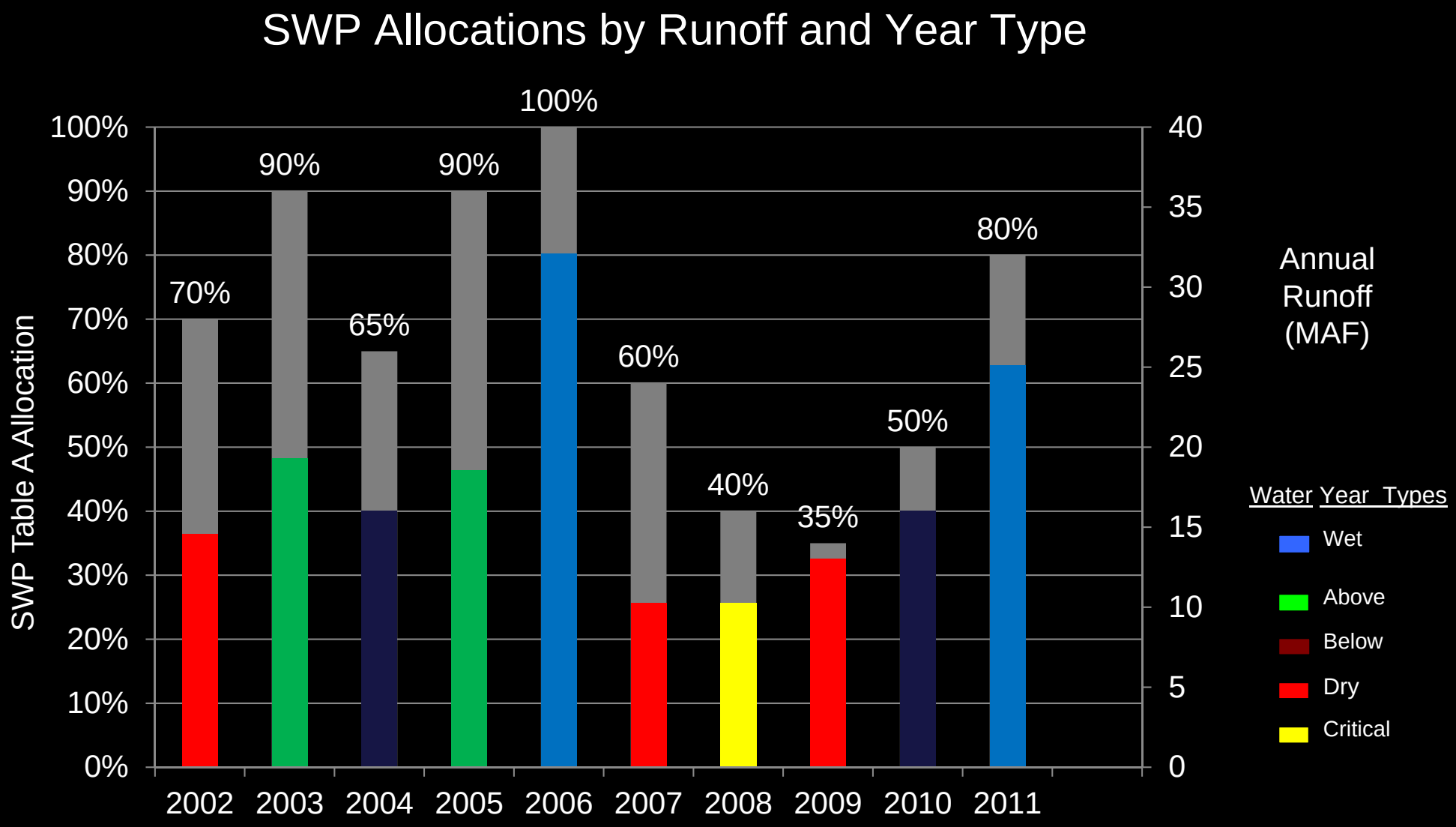
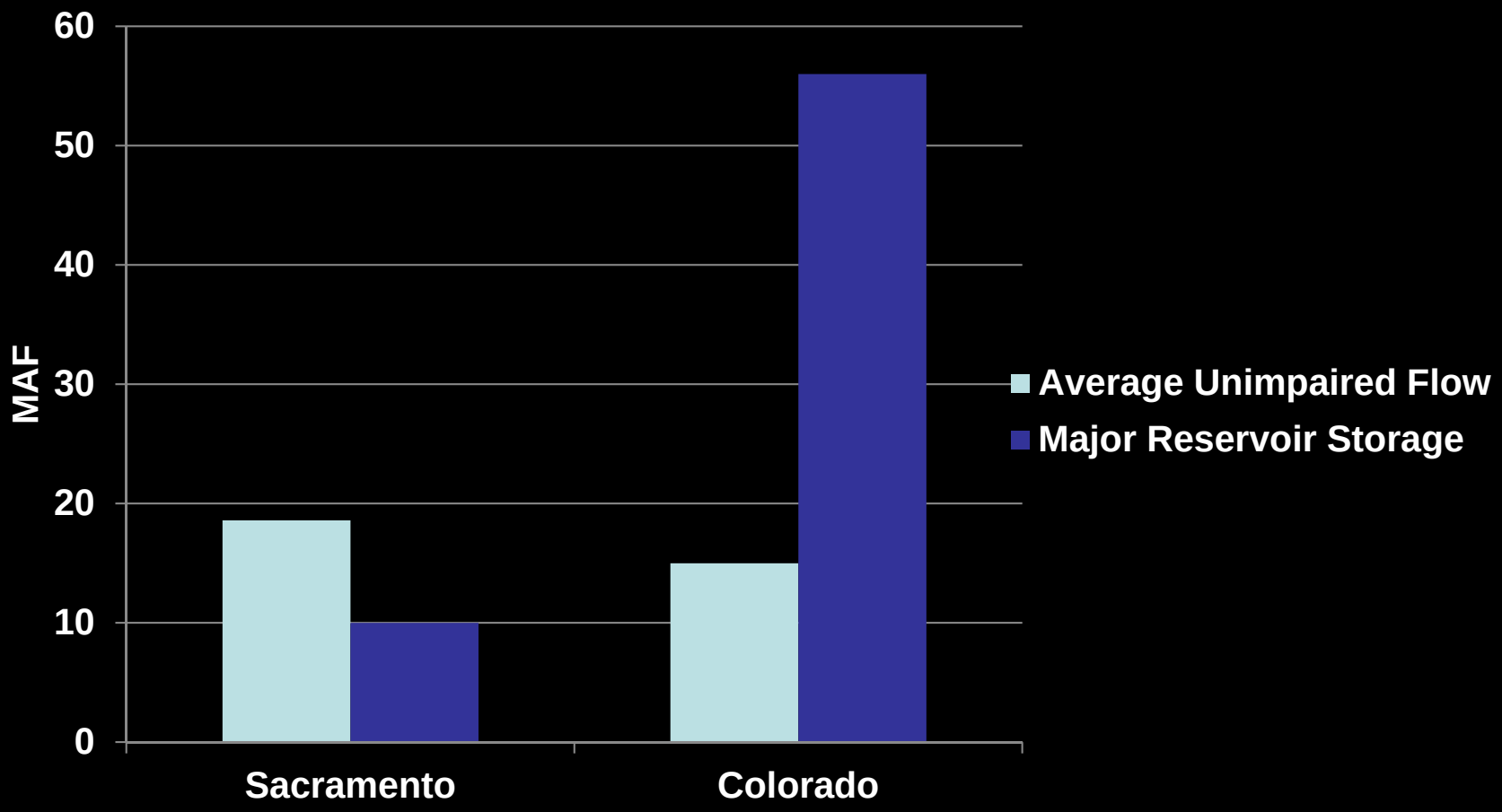
1981, 1961
1960
1987, 1968
1954
1988
1959
1944
SACRAMENTO - SAN JOAQUIN DELTA
Lines of 1000 Parts of Chloride per Million Parts of Water, Measured at 1 1/2 Hours after High Tide
SOURCES:
State Water Resources Control Board
Final EIR D-1485, August 1978
Department of Water Resources,
Division of Operations and Maintenance
daily salinity records
2 0 2 4 6
SCALE IN MILES
Maximum Salinity Intrusion
1944 - 1990
N
NORTH BAY AQUEDUCT
BARKER SLOUGH PUMPING PLANT
HASTINGS TRACT
PIERSON DISTRICT
DELTA CROSS CHANNEL
Walnut Grove
Ryde
COSUMNES RIVER
MOKELUMNE RIVER
NEW HOPE TRACT
Thornton
CANAL RANCH TRACT
BRACK TRACT
LODI
GRAND ISLAND
BRANNAN ISLAND
Isleton
NORTH FORK MOKELUMNE RIVER
SOUTH FORK MOKELUMNE RIVER
TERMINOUS
Terminous
BOULDIN ISLAND
SHIN KEE TRACT
RIO BLANCO TRACT
EMPIRE TRACT
KING ISLAND
BISHOP TRACT
WEBB TRACT
VENICE ISLAND
FRANKS TRACT
MANDEVILLE ISLAND
MEDFORD ISLAND
RINDGE TRACT
SHERMAN ISLAND
VAN SICKLE ISLAND
CHIPPS IS.
BROWNS IS.
PITTSBURG
HOLLAND TRACT
McDONALD ISLAND
WRIGHT-ELMWOOD TRACT
SARGENT-BARNHART TRACT
LOWER ROBERTS ISLAND
BACON ISLAND
EALE TRACT
PALM TRACT
LOWER JONES TRACT
STOCKTON
ORWOOD TRACT
WOODWARD IS.
UPPER JONES TRACT
Brentwood
DISCOVERY BAY
MIDDLE ROBERTS ISLAND
VICTORIA ISLAND
BYRON TRACT
Byron
UNION ISLAND
UPPER ROBERTS ISLAND
CLIFTON COURT FOREBAY
CORAL ISLAND
HARVEY O. BANKS DELTA PUMPING PLANT
TRACY PUMPING PLANT
FABIAN TRACT
STEWART TRACT
MANTECA
SOUTH BAY AQUEDUCT
SOUTH BAY PUMPING PLANT
TRACY
DELTA-MENDOTA CANAL
CALIFORNIA AQUEDUCT
SAN JOAQUIN RIVER
SACRAMENTO RIVER
OLD RIVER
MIDDLE RIVER

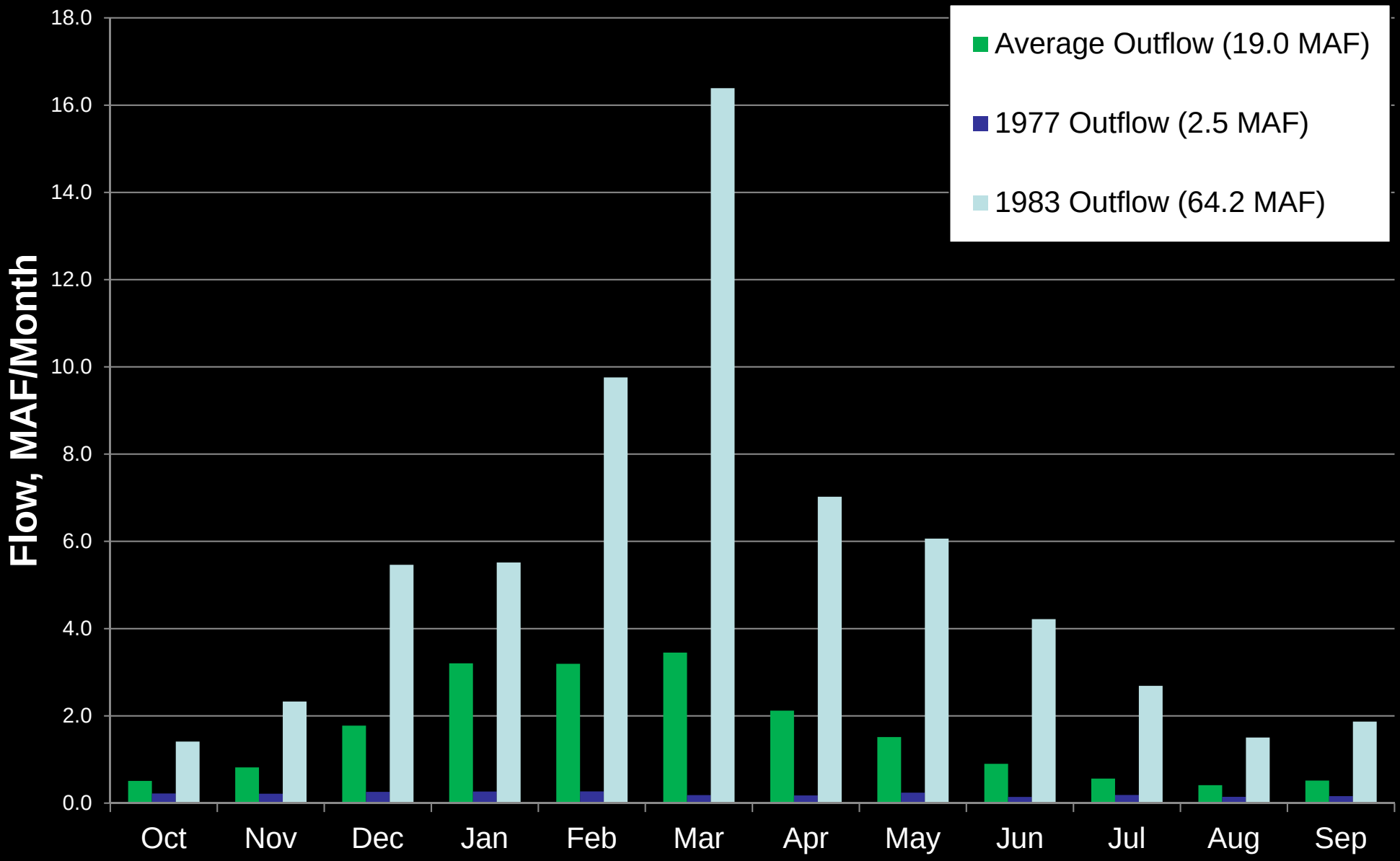
Inter-Annual Management
(Droughts Mitigated but Delivery Variability Remains High)



Even with existing water management infrastructure, California impaired hydrology remains highly variable



Impaired Delta Outflow (WY 1970-2011)



- Flood control and water supply benefits are achieved through water management activities on the margins of a highly variable hydrologic system.

- Expectation is that any reduction of impairments will result in adverse impacts to benefits derived from those impairments.

Ecological Uncertainty

- Regulation is rapidly changing in accordance with continuing changes to Delta ecological understanding
- 2008/2009 USFWS/NMFS Biological Opinions
  - Increased flow requirements and export restrictions
  - Rely heavily on real-time monitoring
  - Use a range of flow objectives
  - Remanded in 2010/2011 and new process underway
- Interim operations agreements have been implemented over the past two years which differ from actions in the last set of Biological Opinions

Adaptive Approach

- Rapidly evolving scientific understanding does not fit well with prescriptive standards
- Fishery agencies relying more heavily on real-time monitoring to set flow within a range of objectives
- Adaptive management helps to tailor protective actions to limit impacts to other beneficial users

Balancing Uncertainty

- Relative importance of enhanced flows uncertain relative to other stressors
- Trade-offs with other beneficial uses is likely to be certain and substantial
- Adaptive management recommended as most effective approach to balance uncertainty

Science is necessary to inform actions and proposals, but does not provide the entire, prioritized, integrated analysis needed. Societal and political considerations are also important factors in determining the most appropriate policy (NRC 2012).