



**Restoration lessons from the  
Yolo Bypass floodplain**  
*Ted Sommer*

*California Department of Water Resources*

Knights Landing Ridge Cut

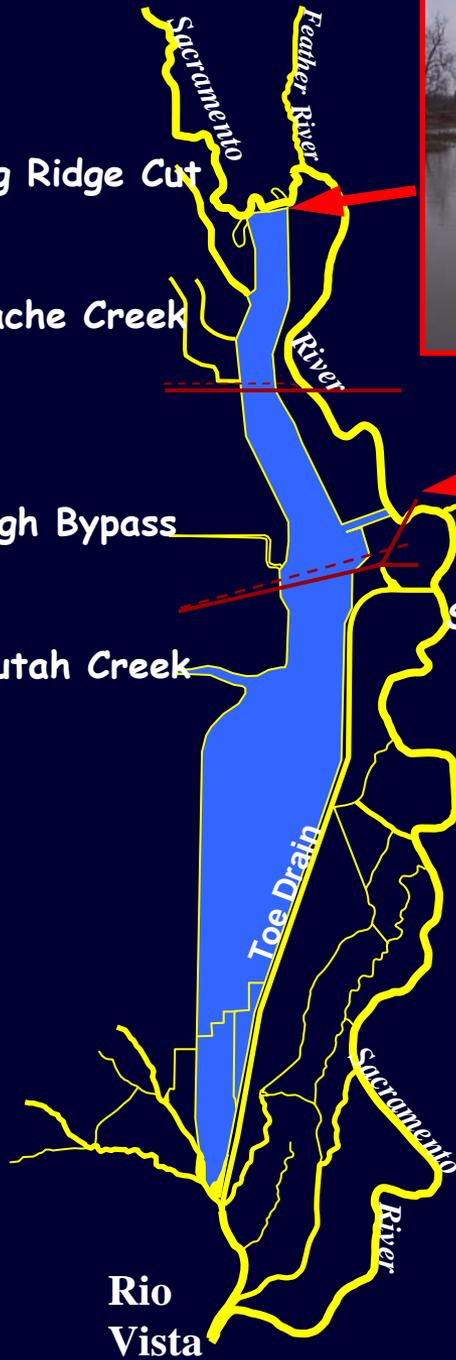
Cache Creek

Willow Slough Bypass

Putah Creek

*Yolo Bypass  
Inputs*

Rio  
Vista

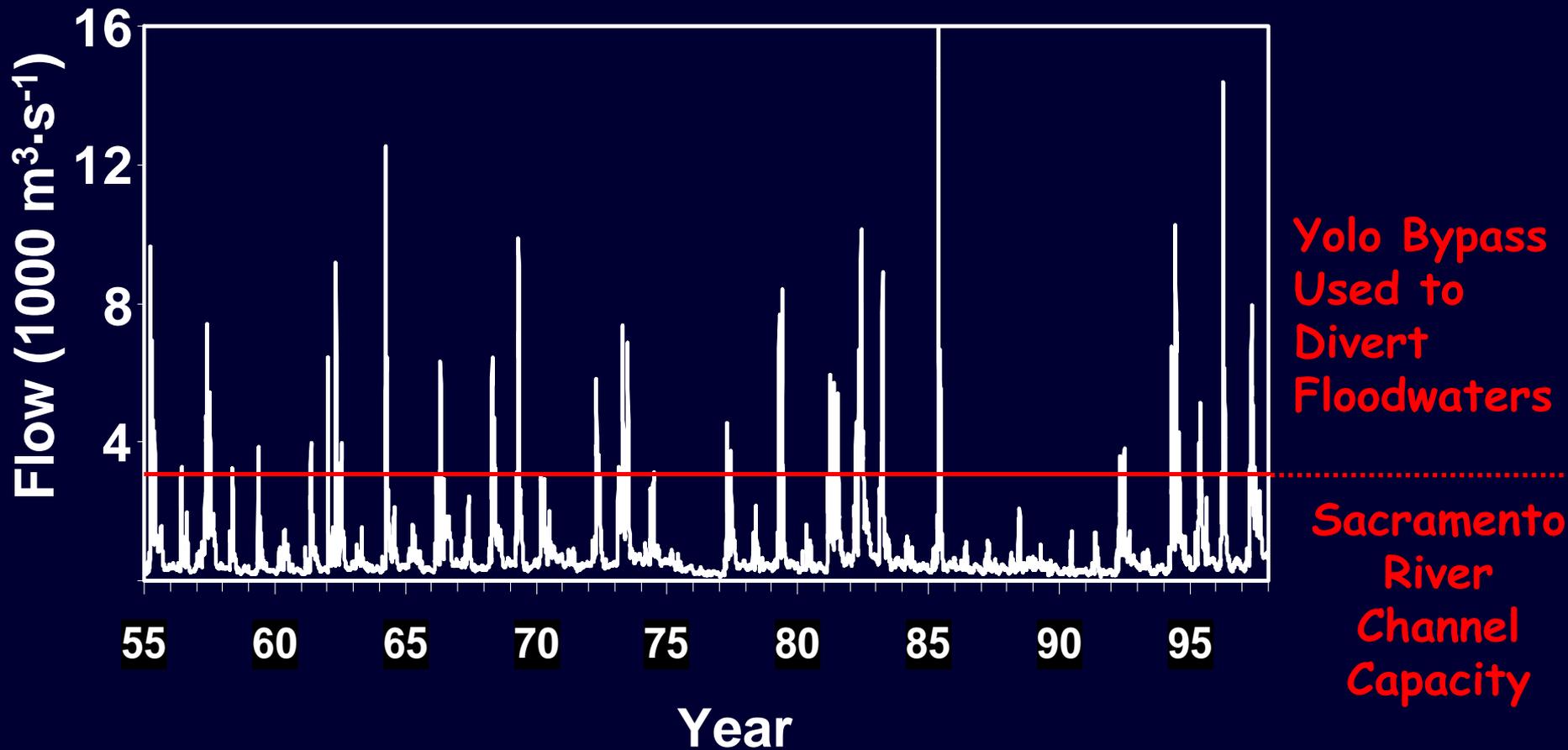


**Fremont  
Weir**



**Sacramento  
Weir**

# Flood Protection Benefits of Yolo Bypass







?????



# Yolo Bypass Sampling



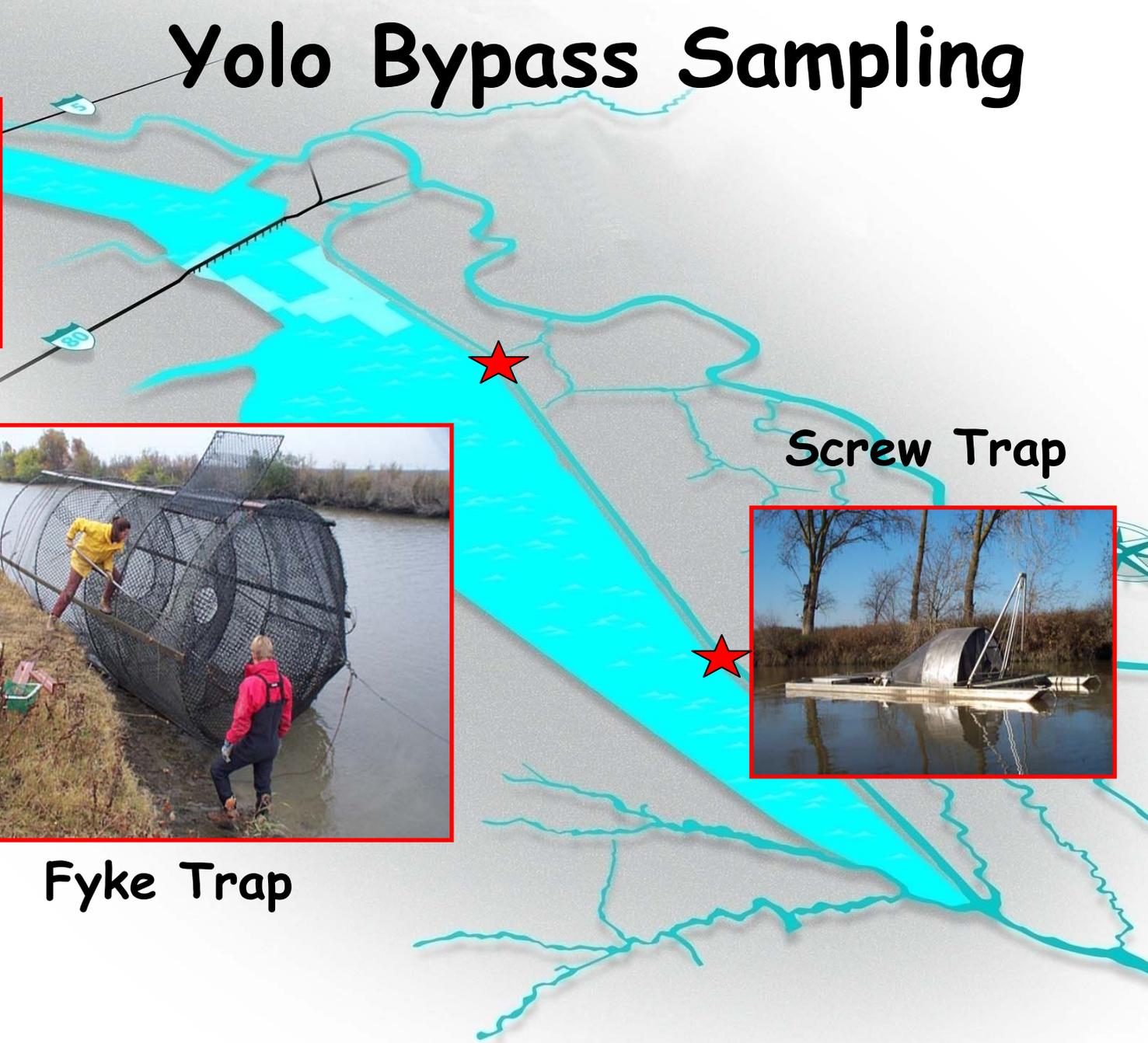
Beach Seine



Fyke Trap



Screw Trap

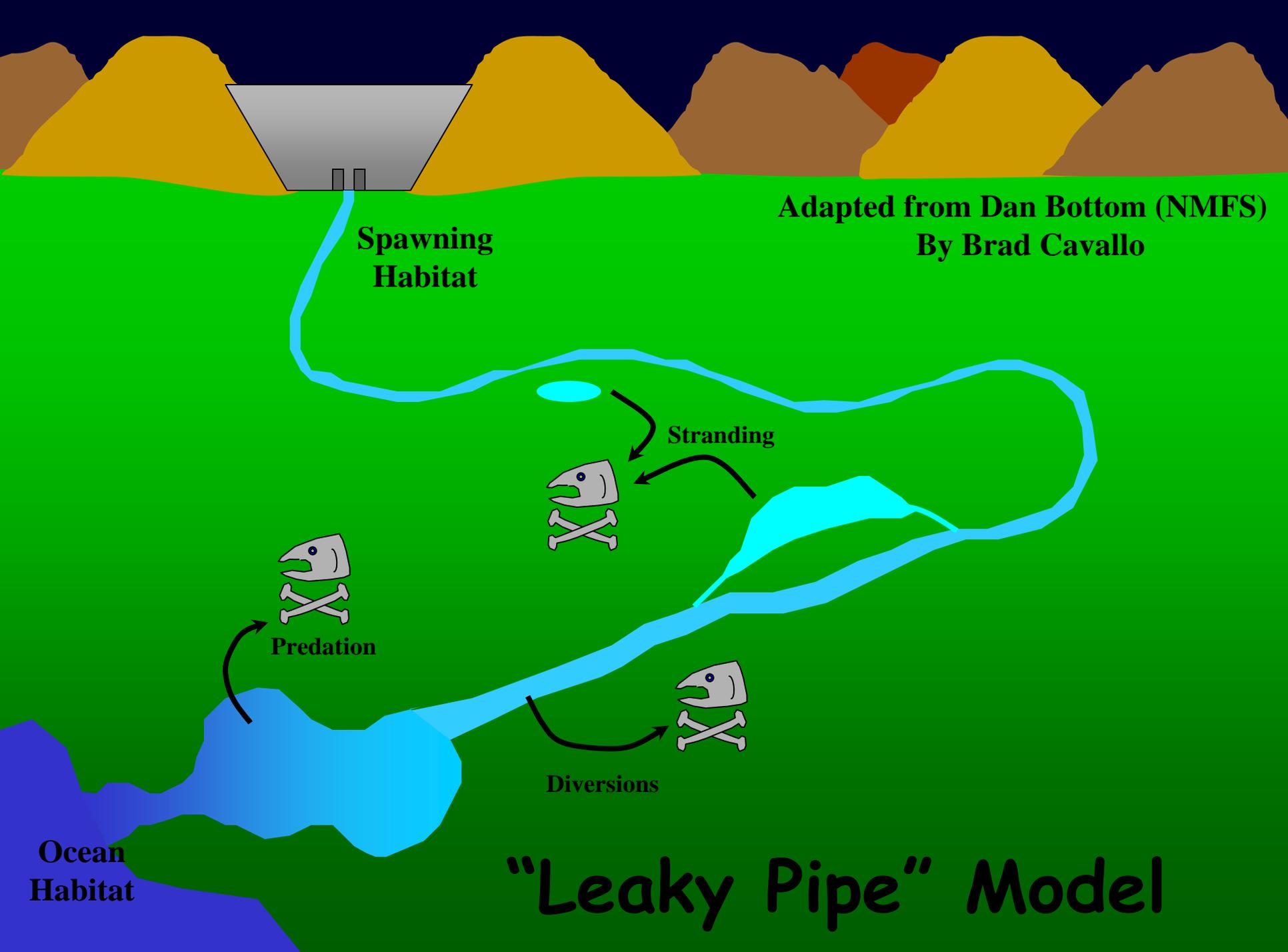


## *Lessons for Habitat Restoration and Flood Control*

- Floodplain is a source, not a sink for salmon production.
- Hydrology matters....a lot!
- An important (albeit imperfect) migration corridor.
- Habitat features matter, but not as much as you might think.
- A large potential food bank.

# Juvenile Chinook Salmon





Adapted from Dan Bottom (NMFS)  
By Brad Cavallo

Spawning  
Habitat

Stranding

Predation

Diversions

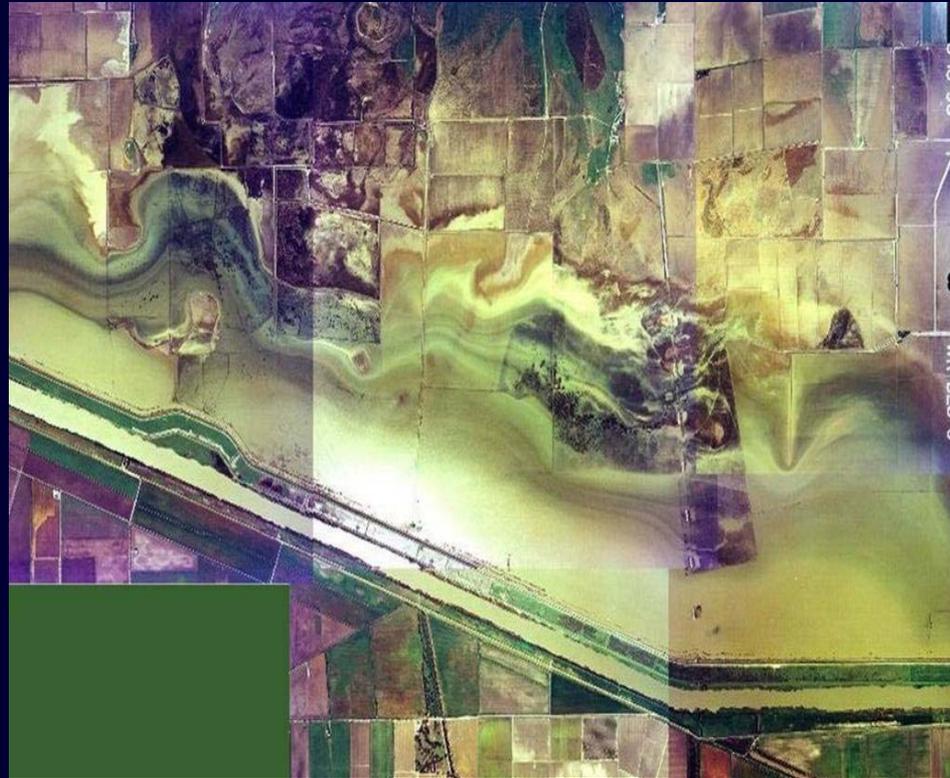
Ocean  
Habitat

"Leaky Pipe" Model

# Extended Residence Time in Yolo Bypass

1998	33 days (range = 16-46)
1999	56 days (range 4-76)
2000	30 days (range = 28-37)

# What happens when the floodplain drains?



# Simulated Total Surface Area



- An insignificant portion of the floodplain becomes isolated ponds
- Densities of salmon in these ponds are not high.

# So...is floodplain a net source or sink?



# Evidence Based on Growth Comparisons



**Yolo Bypass**



**Sacramento  
River**

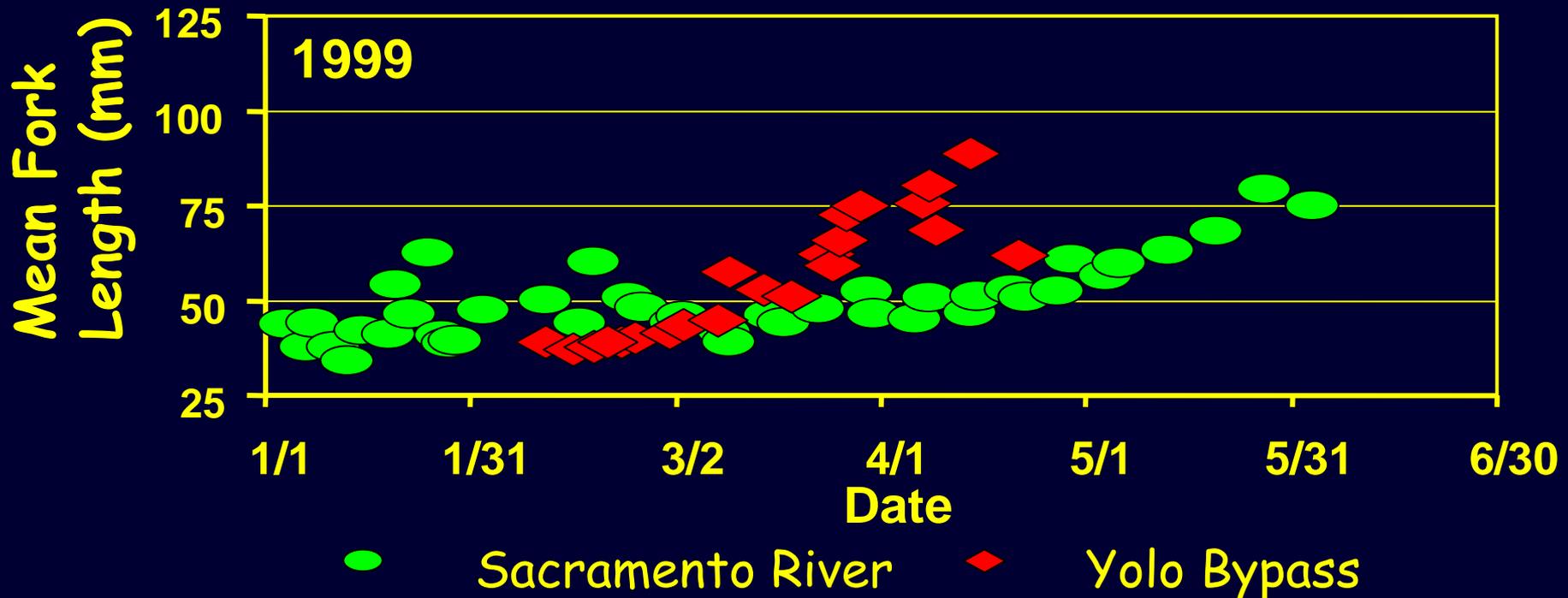
**San Francisco Bay**

**Sacramento-  
San Joaquin  
Delta**

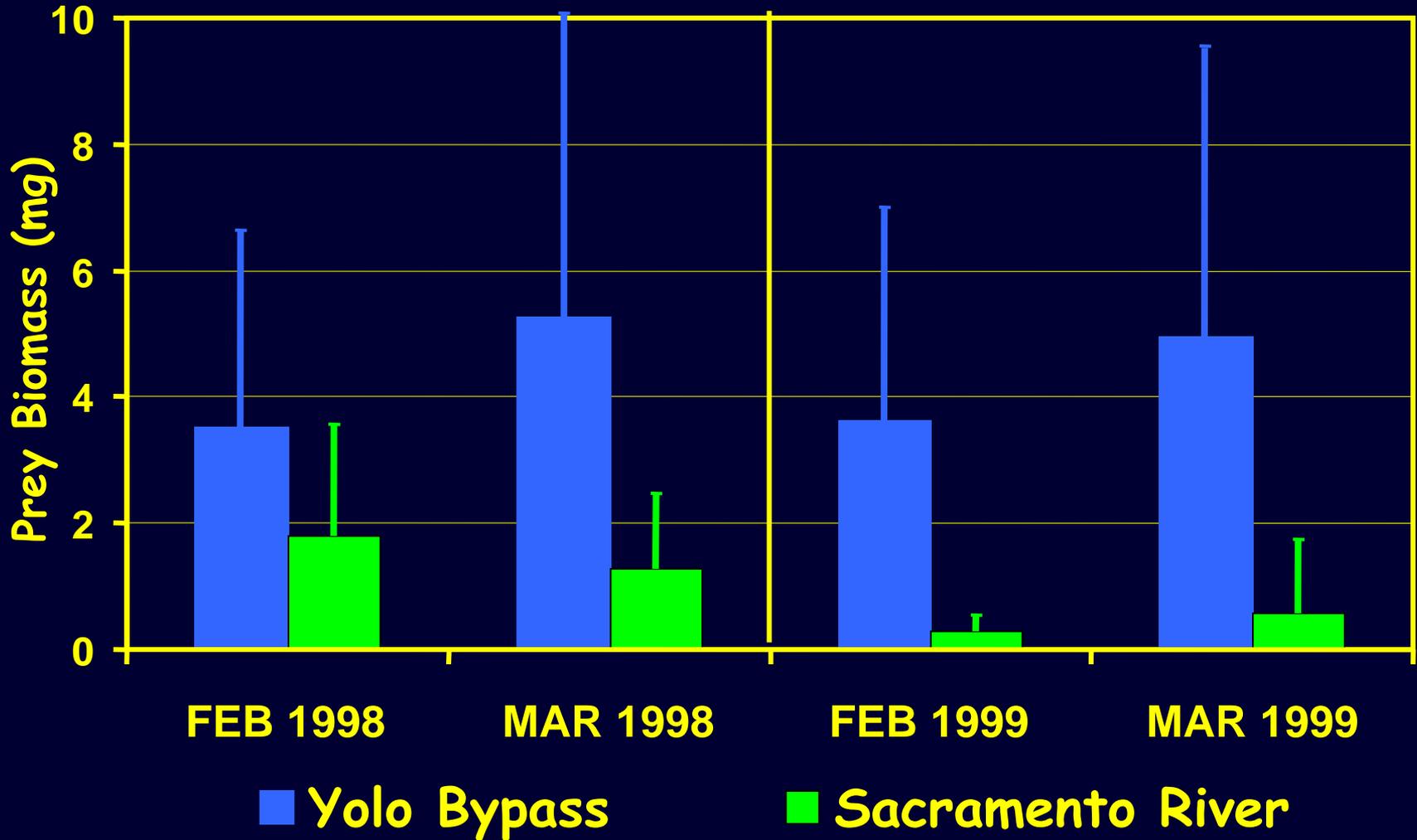
# Floodplain Habitat Supports Phenomenal Growth



*Photo: Jeffres et al. (2007)*



# Feeding is Greater on the Floodplain



Source: Sommer et al. (2001)

# Fish grow faster because there is so much food

## Drowning in bug soup on the Yolo Causeway



Sacramento Bee/José M. Osorio

**Fred David of Santa Rosa cleans the bugs off his windshield at the Union 76 station off Mace Boulevard in Davis. The place is buzzing at nightfall, when the swarms attack.**

By Matthew Barrows  
BEE STAFF WRITER

**Y**ou'd expect the area around the Yolo Causeway to be a bit buggy, what with all the rice fields, duck ponds and standing water to make insects feel right at home.

But travel the causeway between 8:30 and 9:30 p.m. and you quickly realize that "buggy" is an understatement. A better word is "biblical."

About midway across the bridge, motorists are being engulfed by clouds of tiny, winged insects performing kamikaze missions against the windshield.

Truckers pull over to the side of the road to remove thousands of carcasses blocking their

### Back-seat driver



A weekly column about transportation issues in the region

view. Motorists desperately turn their wipers to the "full" position in a futile attempt to remove the gooey mess. And everyone wonders what in the name of hellfire and damnation is going on.

Try as they might, they can't escape the swarm.

The Back-seat Driver witnessed the phenomenon, or at least its grisly aftermath, one day last week at the Union 76 gas station off Mace Boulevard in Davis. (I took one of The Bee's cars, of course.)

The 76 is the first station after the causeway for drivers heading west on Interstate 80, and once the sun goes down, it's buzzing with activity.

About 8:15 p.m., employee Mike Cecil went out to change the soap and water in the squee-

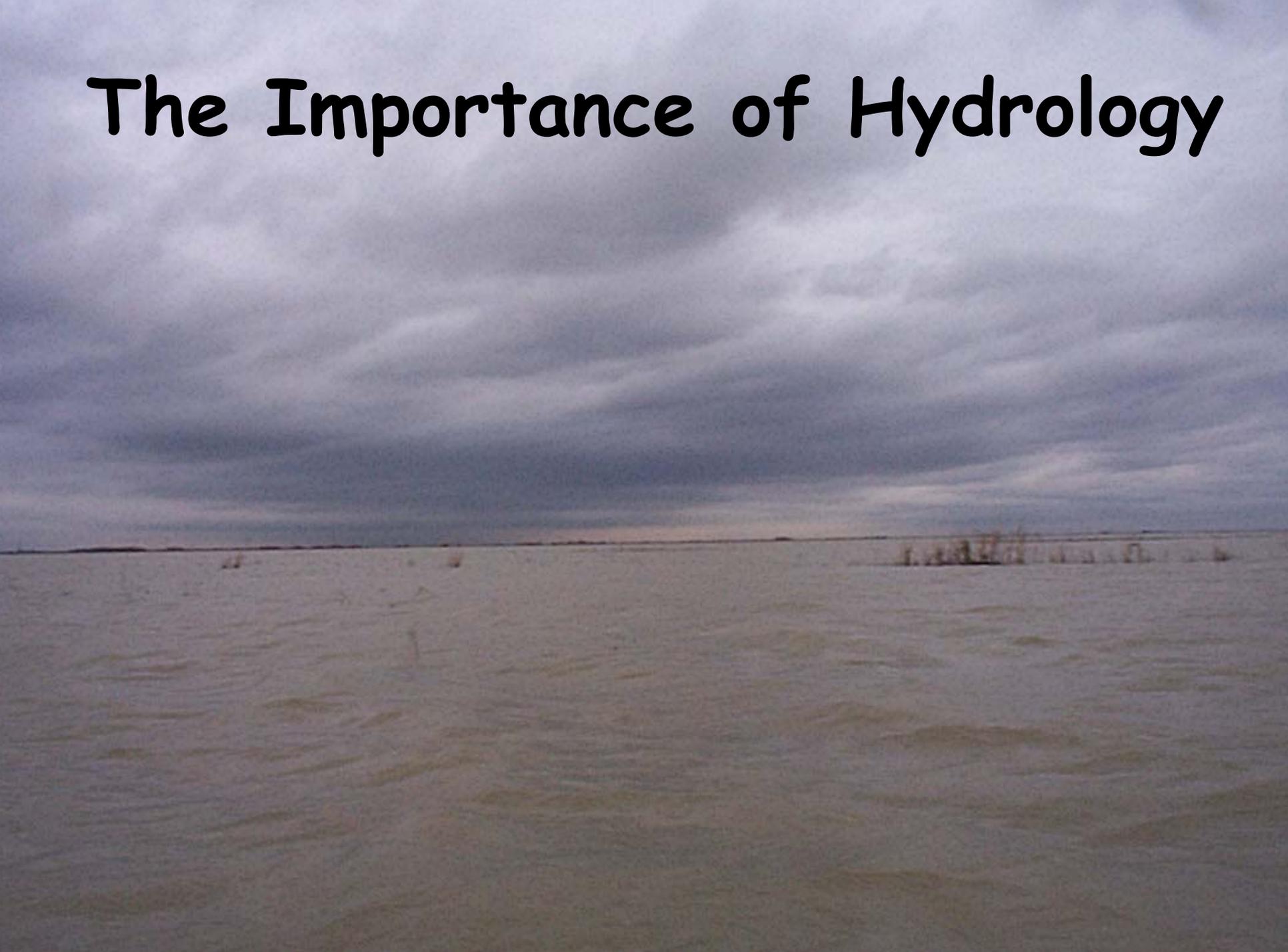
► **BUGS, page B2**

# *Hydrobaenus saetheri*

- Discovered in collaborative studies with Dr. Pete Cranston (UCD) and Gina Benigno (CSUC/DWR).
- Floodplain sediments provide seed bank of cocoons.
- Life history = floodplain specialist.
- Rapid response to floods!
- Totally dominates drift during floods.



# The Importance of Hydrology

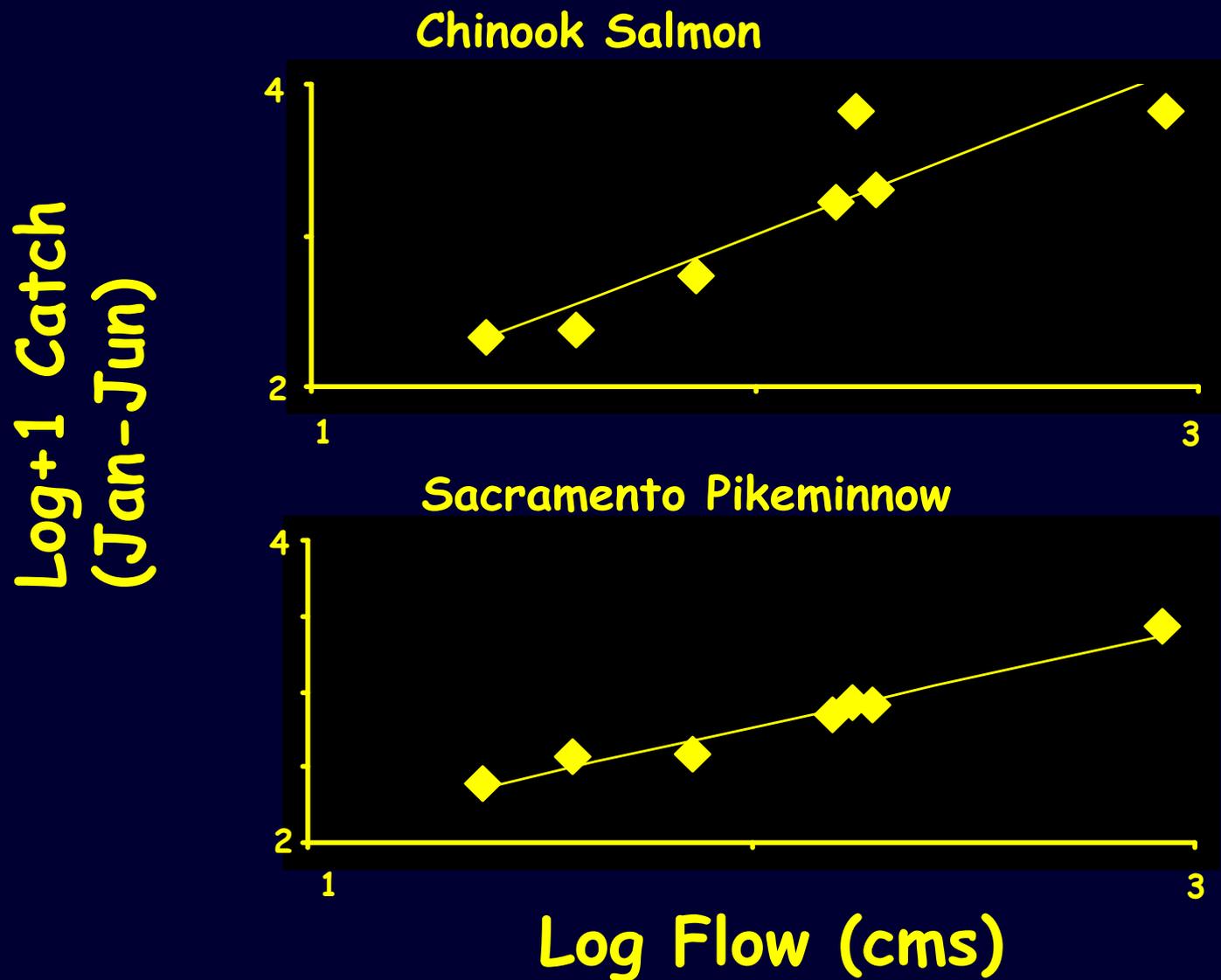


*Even Modest Flood Events Create Large Amounts of Shallow Habitat (Area <2 meters depth)*



From: Sommer et al. (2004).

# Longer Duration Flooding = More Fish Use the Floodplain



# Survival Studies

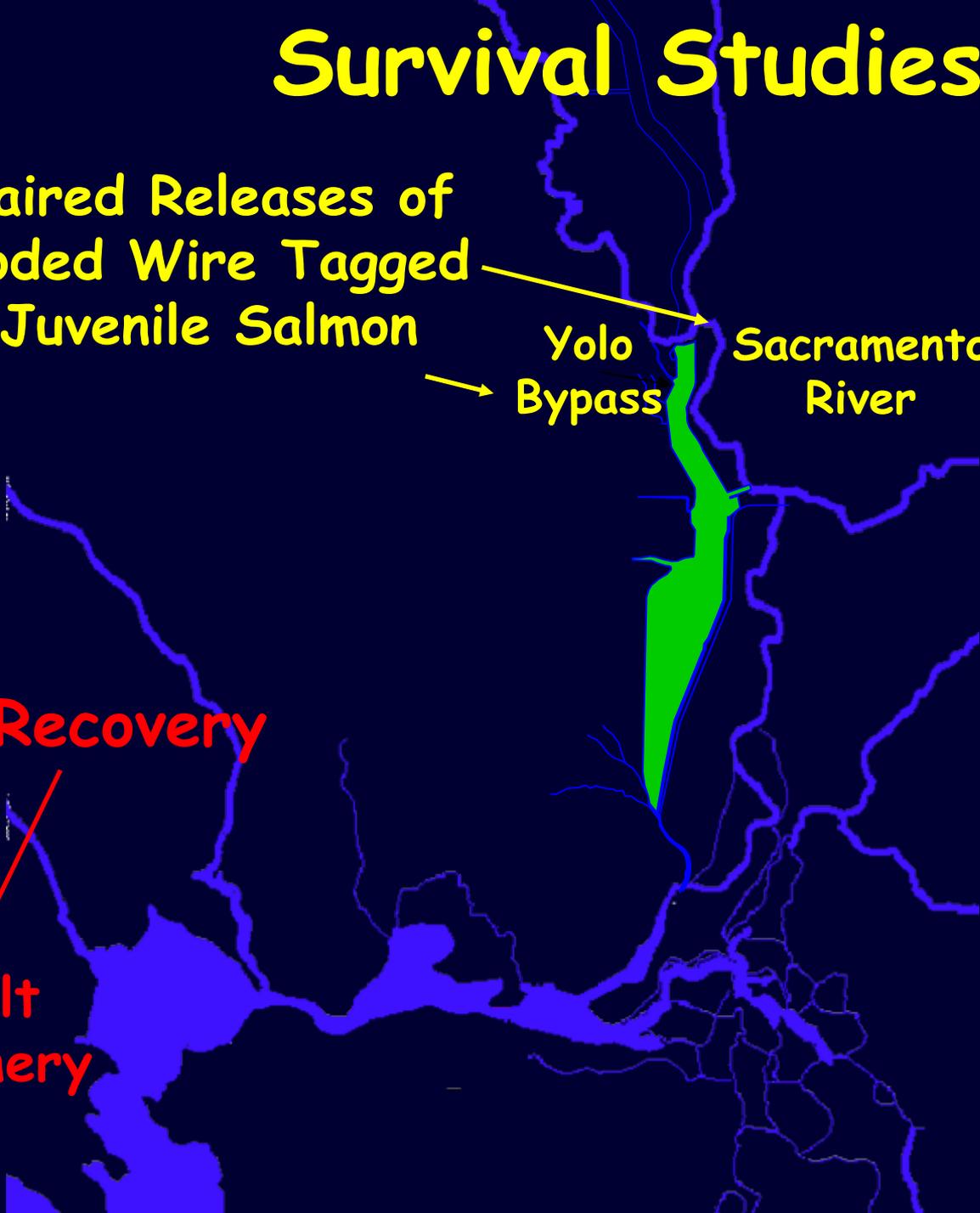
Paired Releases of  
Coded Wire Tagged  
Juvenile Salmon

Yolo  
Bypass

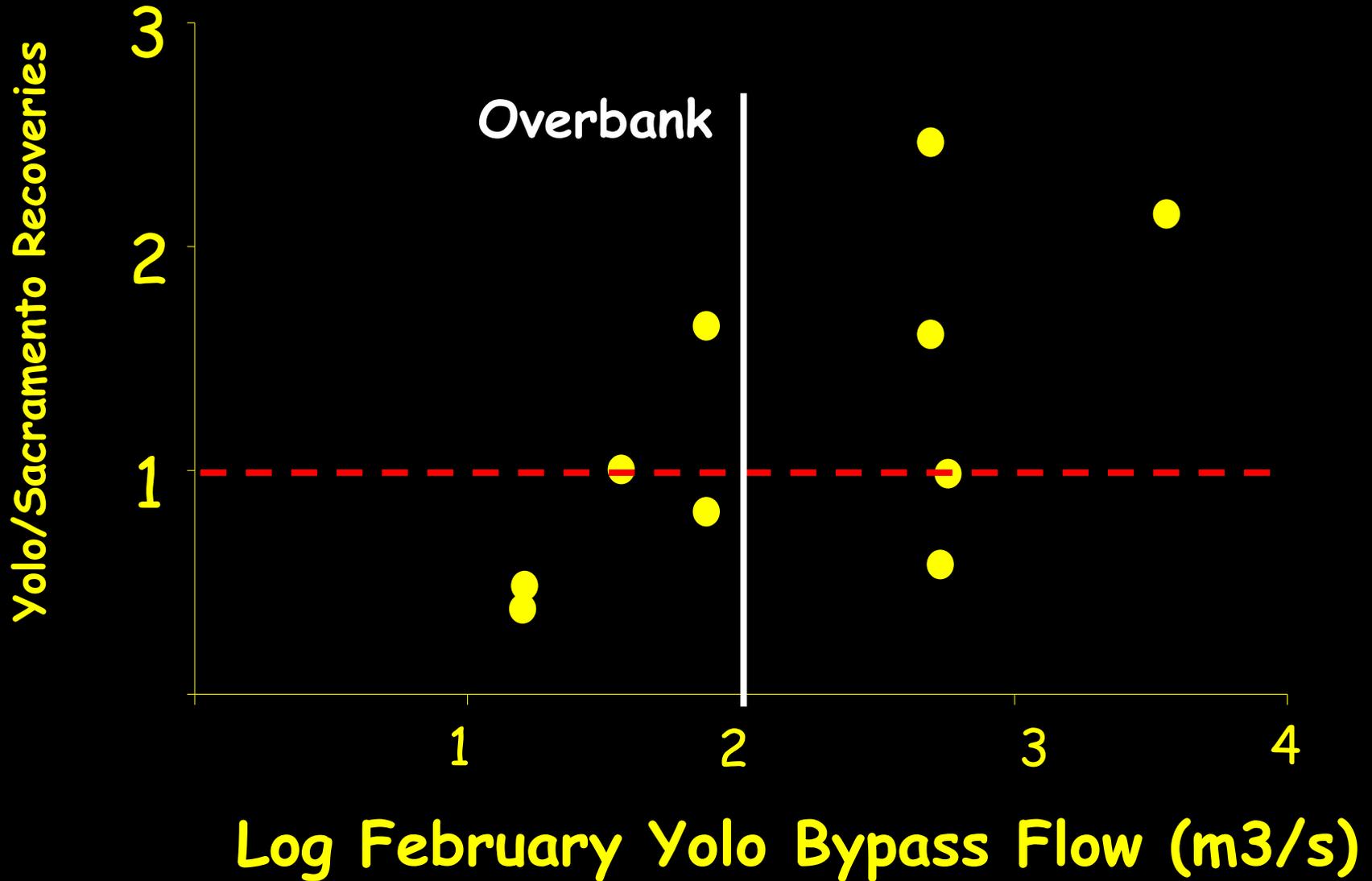
Sacramento  
River

Recovery

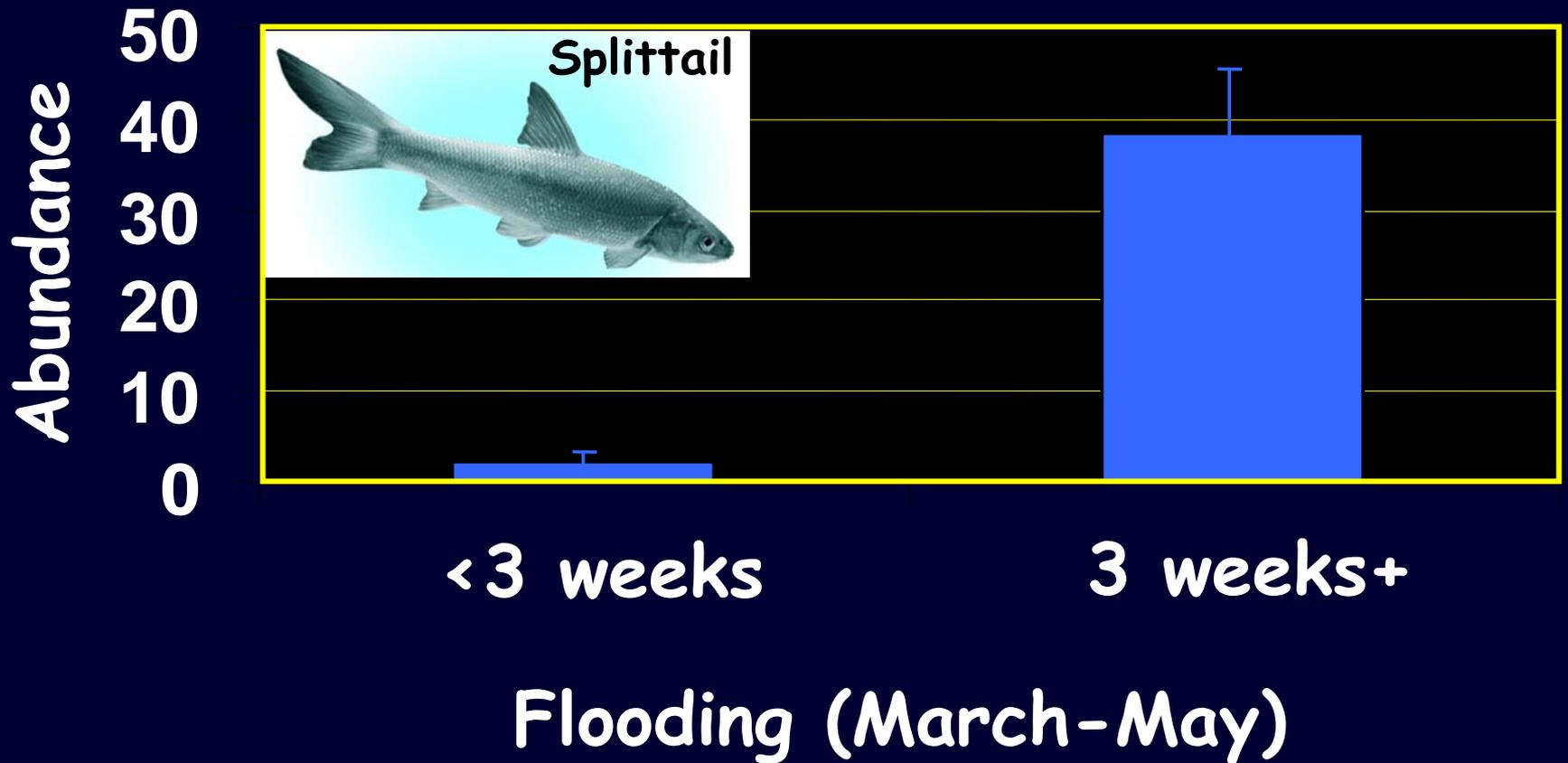
Adult  
Fishery



# Recovery of Adult Salmon in Ocean Fishery from Experimental Fish Releases (1998-2004)



# Importance to other species....



Source: Sommer et al. (2001)

# The Importance of Habitat



# Chinook Salmon Were Found on All Substrate Types That We Sampled



**Vegetation: 97%**



**Sand: 100%**



**Pavement: 100%**



**Mud: 70%**

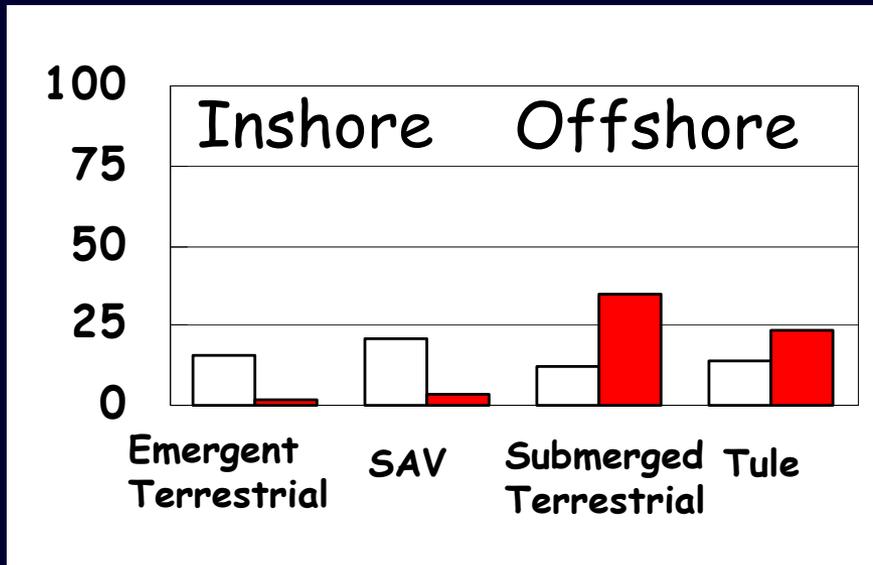


**Gravel: 89%**

Source:

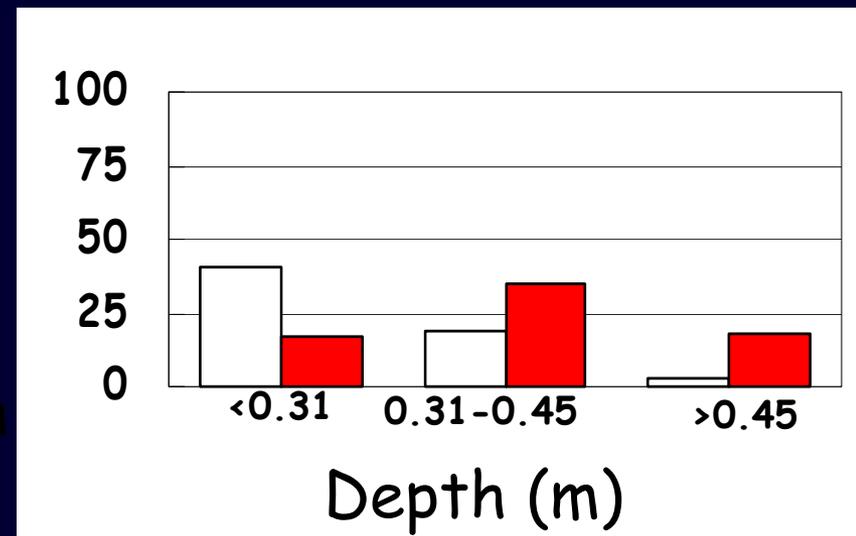
Sommer et al. (2005)

# Young splittail rely on shallow water habitat: Results of 2005 Snorkel Observations



Young splittail were more abundant in inshore habitats

Young splittail were most abundant at the shallowest depths

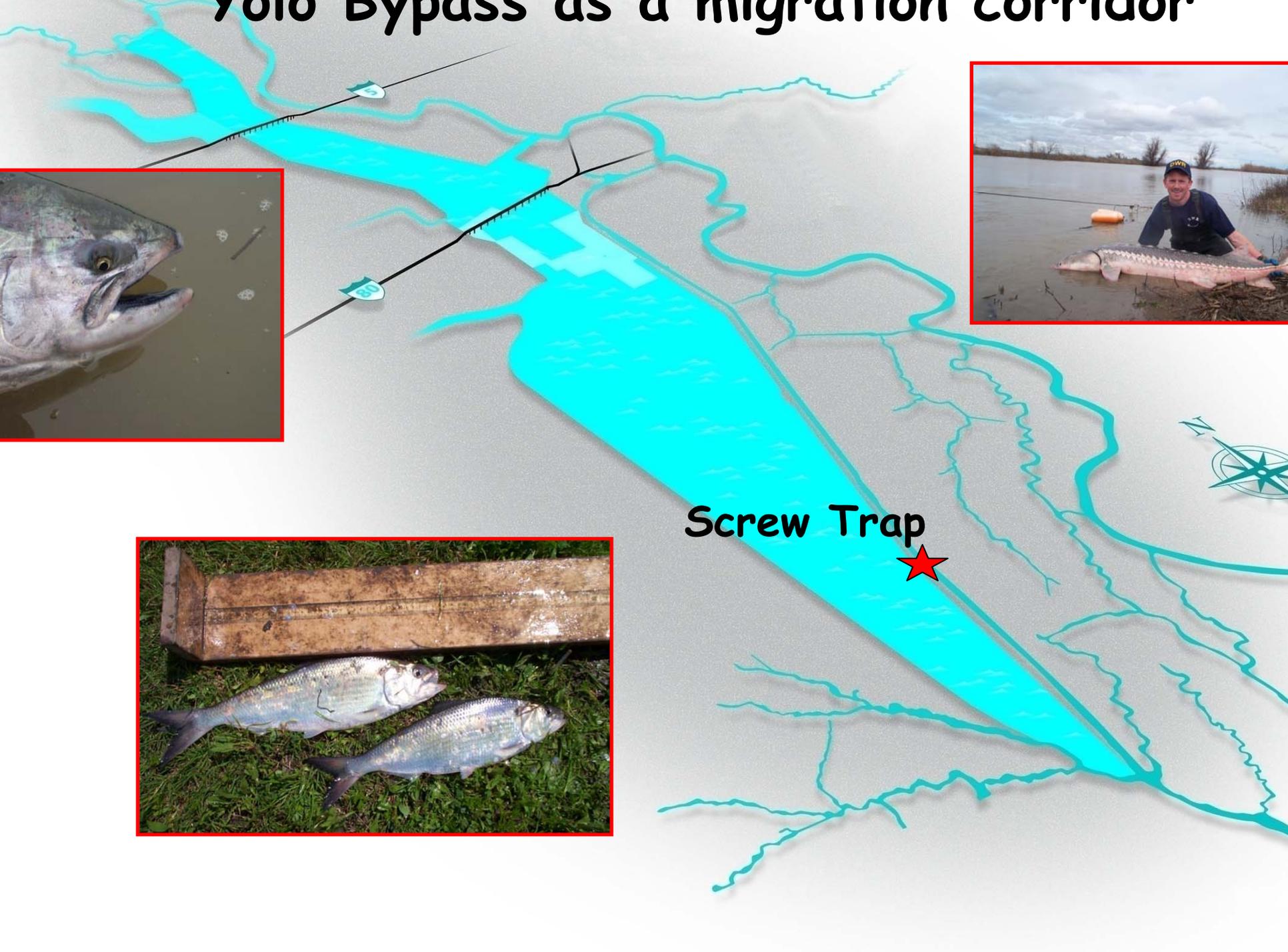


Depth (m)

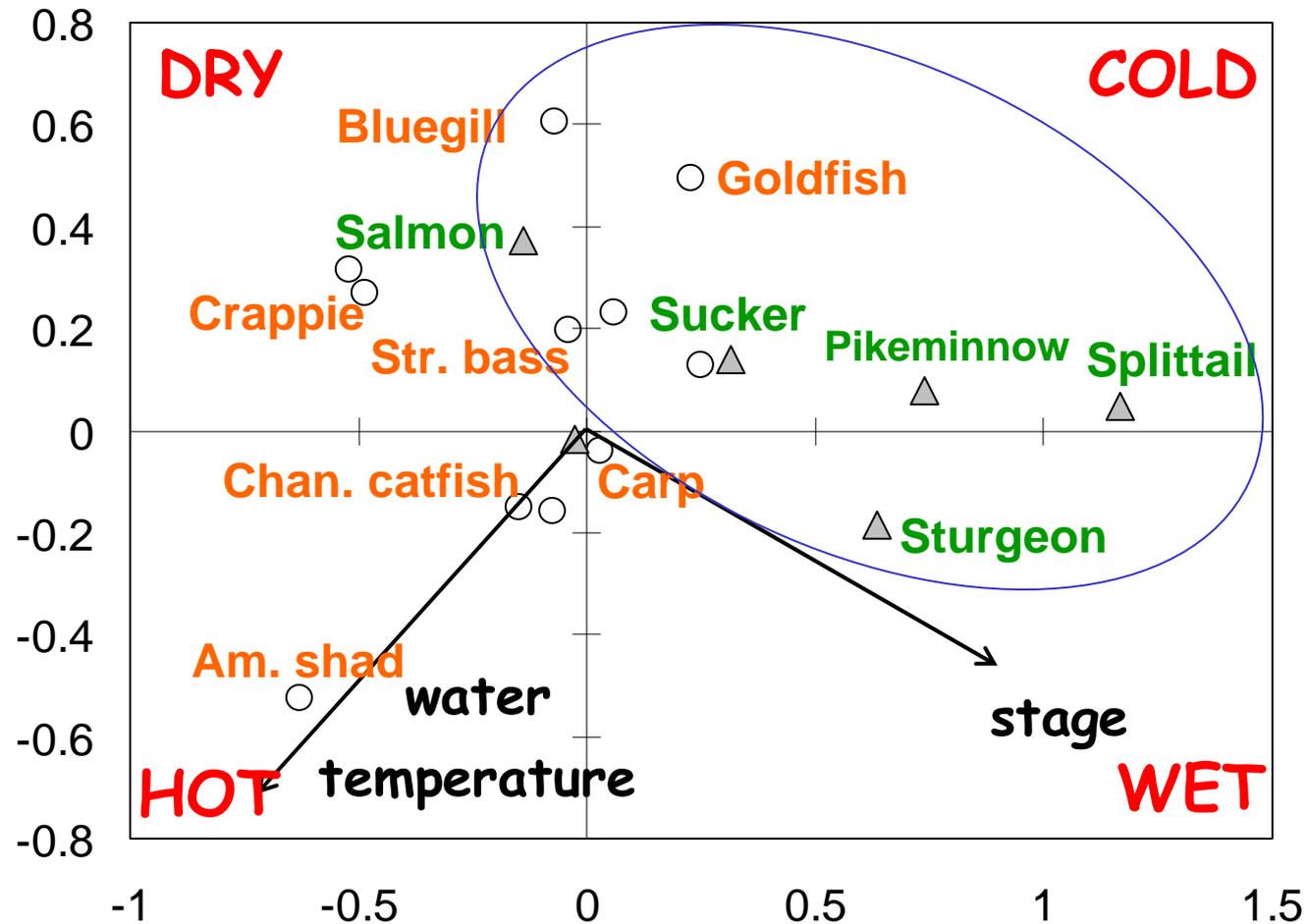
# Yolo Bypass as a migration corridor



Screw Trap

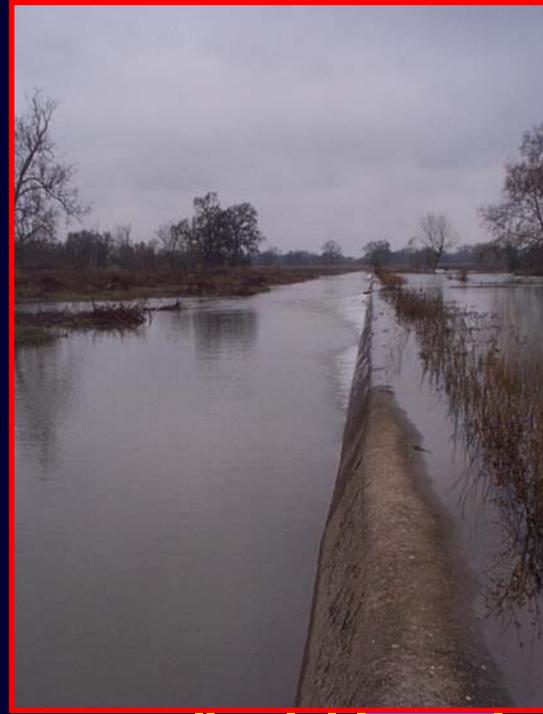


# Native Migrants Respond to Flow Events



Results of Canonical Correspondence Analysis (1999-2006)

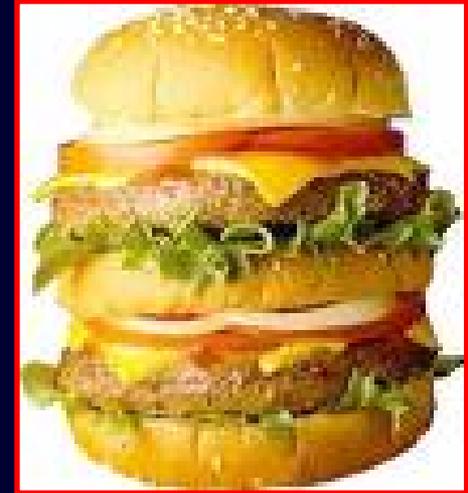
...but passage  
is generally  
poor or  
impossible



Fremont Weir



# FOOD?

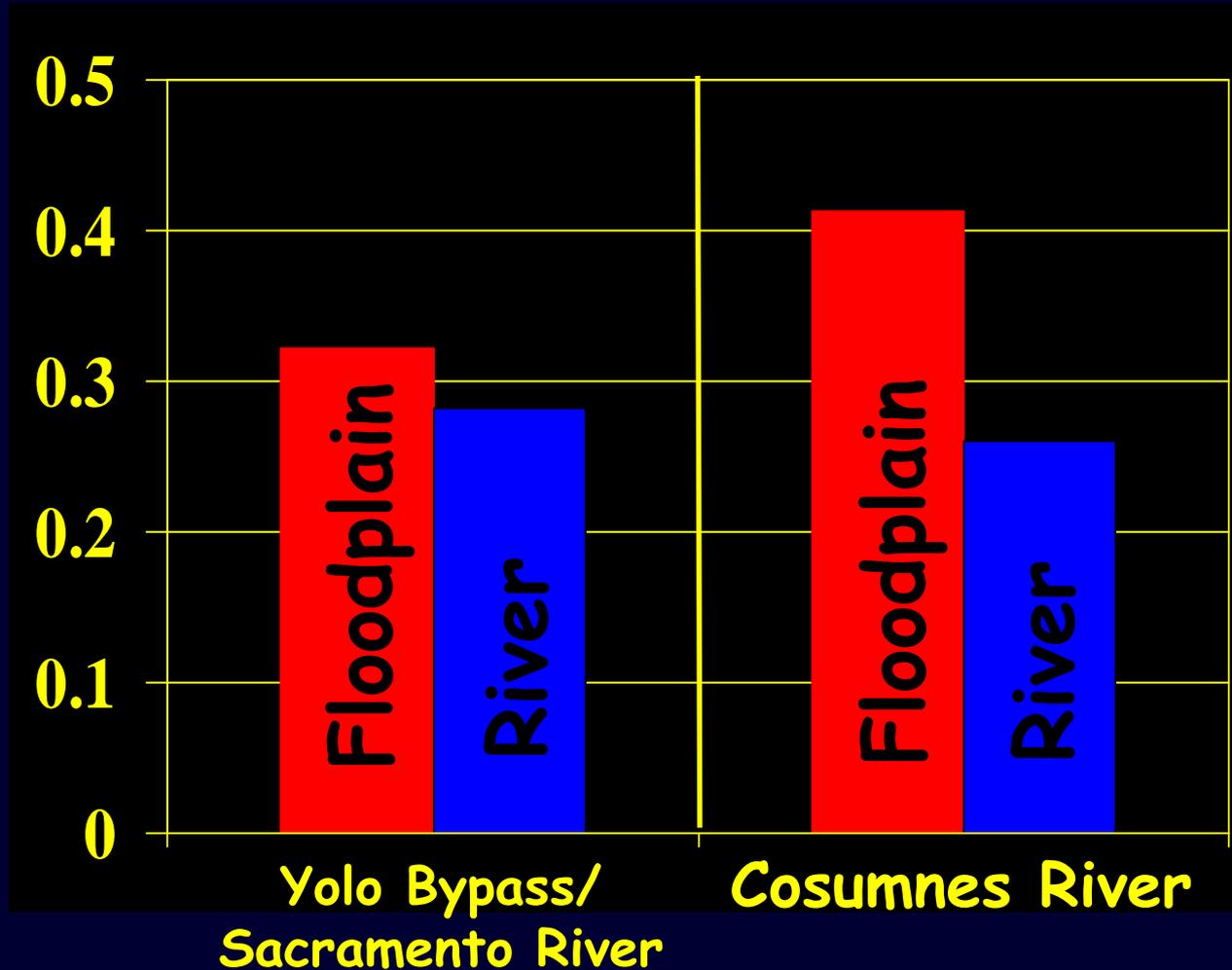


# Floodplain Supports Faster Zooplankton Growth



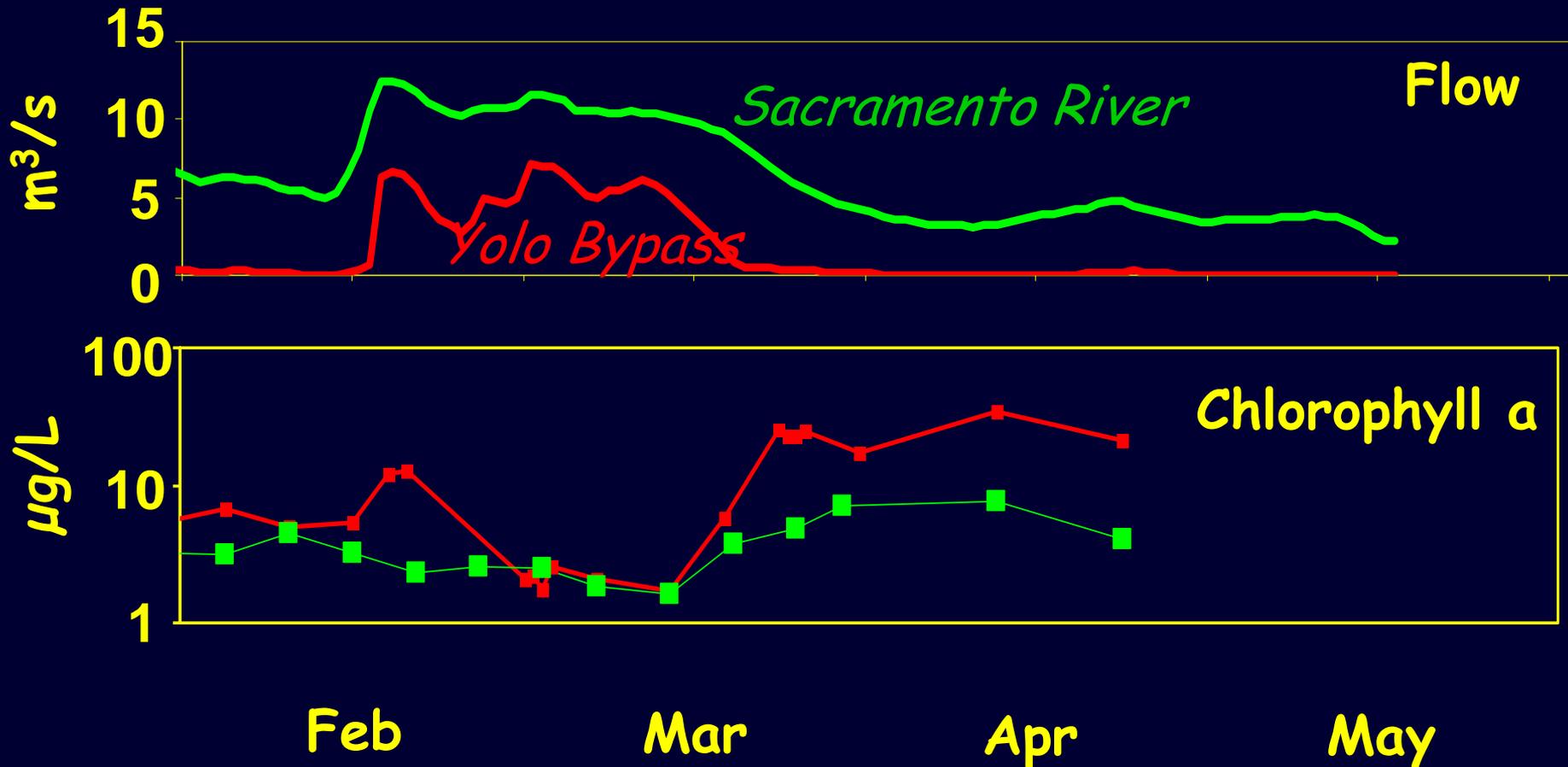
*Daphnia*

Growth Rate (days<sup>-1</sup>)



Source: Mueller-Solger et al. (2002)

# *Chlorophyll a Levels are Higher on the Floodplain Except During Peak Flood Events*

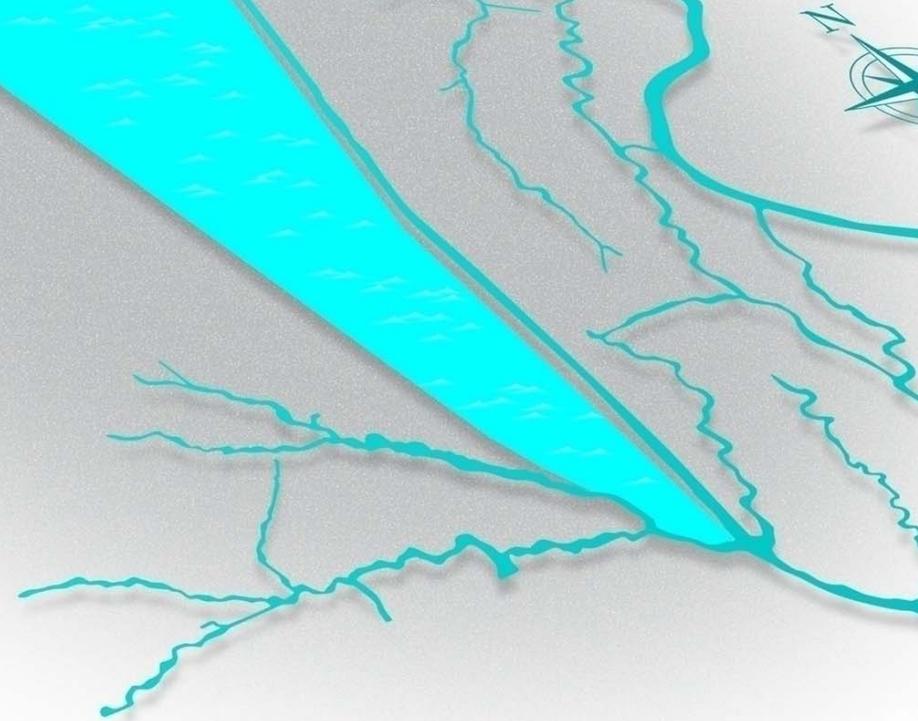


Source: Sommer et al. (2004)

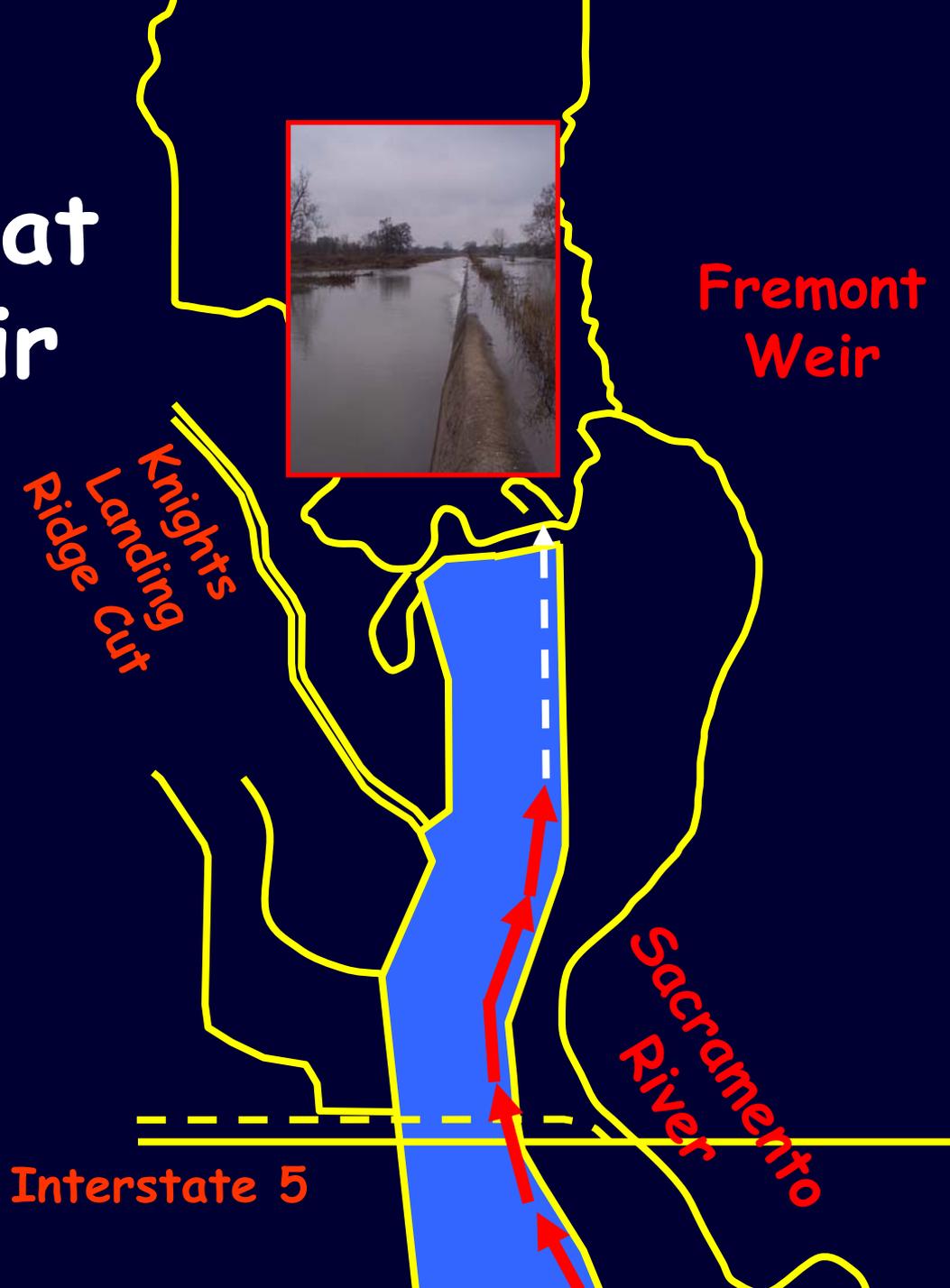
# Key opportunities for restoration in the Yolo Bypass floodplain



Fish passage



# Fish Passage at Fremont Weir



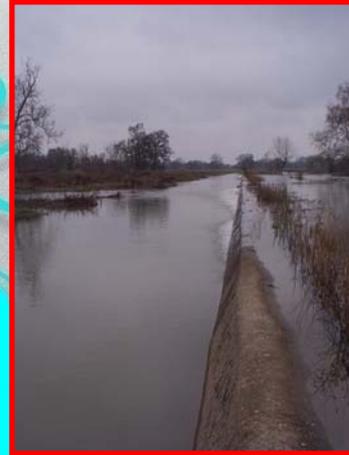
**Fremont Weir, 1955**  
**White Sturgeon, 462 LBS**



# Key opportunities for restoration in the Yolo Bypass floodplain



**Fish passage**



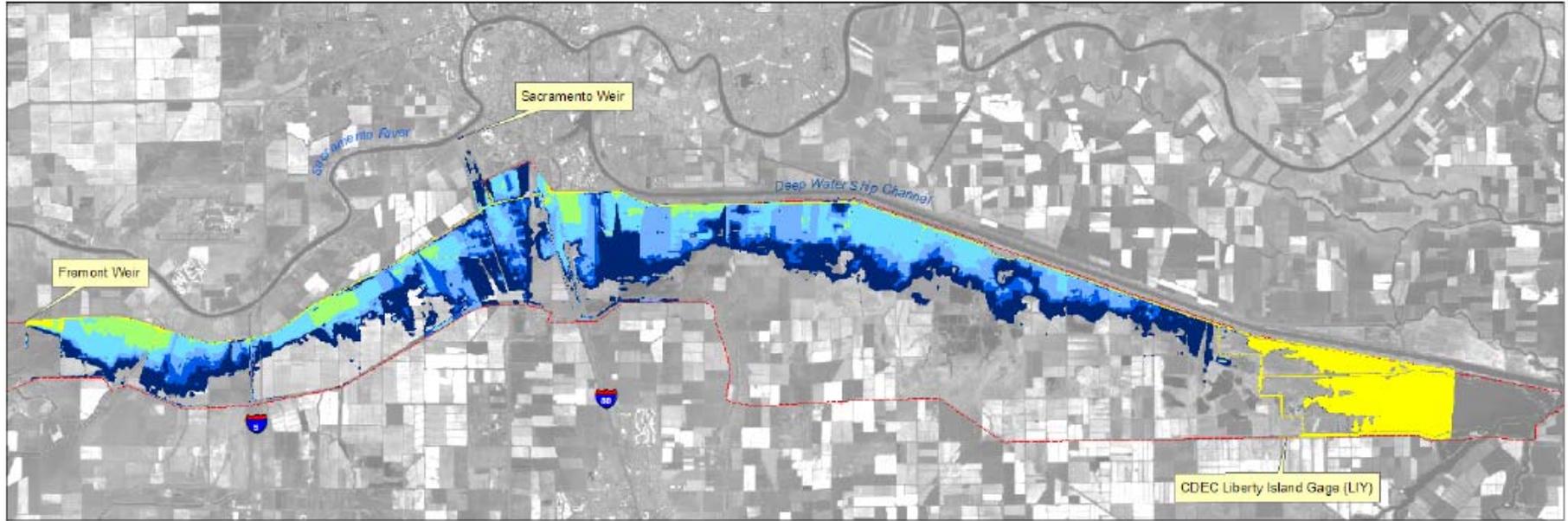
**Managed Inundation**



**Habitat**

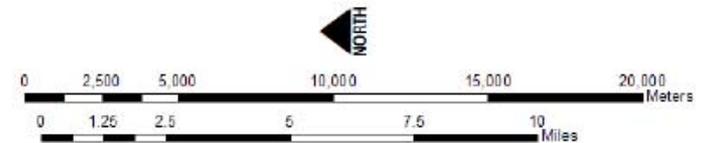


# Managed Inundation Opportunities



## Legend Estimated flood area for different model flows at Fremont weir

- Yolo Bypass Boundary
- b 1000 cfs
- b 2000 cfs
- b 3000 cfs
- b 4000 cfs
- b 5000 cfs
- b 10000 cfs



Results from a Preliminary HEC-RAS run with current elevation obtained from the U.S Army Corps of Engineers Yolo bypass hydraulic model and DWR surveyed cross sections. Cross sections without bathymetry data were estimated. Liberty Island Boundary Condition set to 1.25m of Water Surface elevation. Horizontal datum NAD83, vertical datum NAVD88.

Figure 16: HEC-RAS modeling results showing flooded areas at different Fremont Weir notch flows

# Key opportunities for restoration in the Yolo Bypass floodplain



**Fish passage**



**Managed Inundation**



**Habitat**



**Food**



# For More Information....

<http://www.water.ca.gov/aes/pubs>

