

Flood, Farms, Fins & Feathers Managing Agricultural Lands for Multiple Benefits

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In collaboration with:
California Trout, Cal Marsh and Farm,
DWR, NMFS, CDFW, BOR



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CENTER FOR WATERSHED SCIENCES

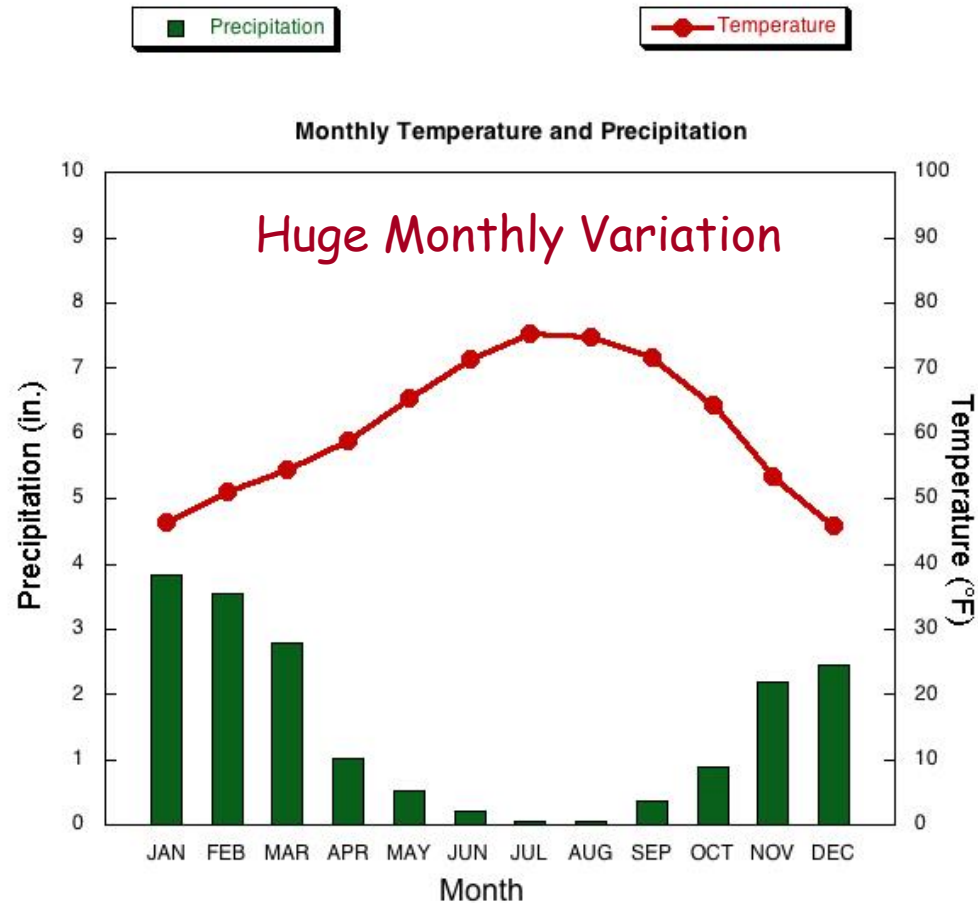
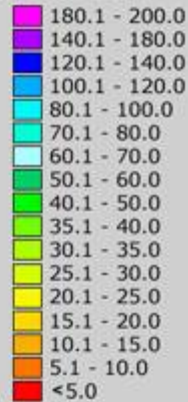
California

Land of Extremes

Water Resources of California

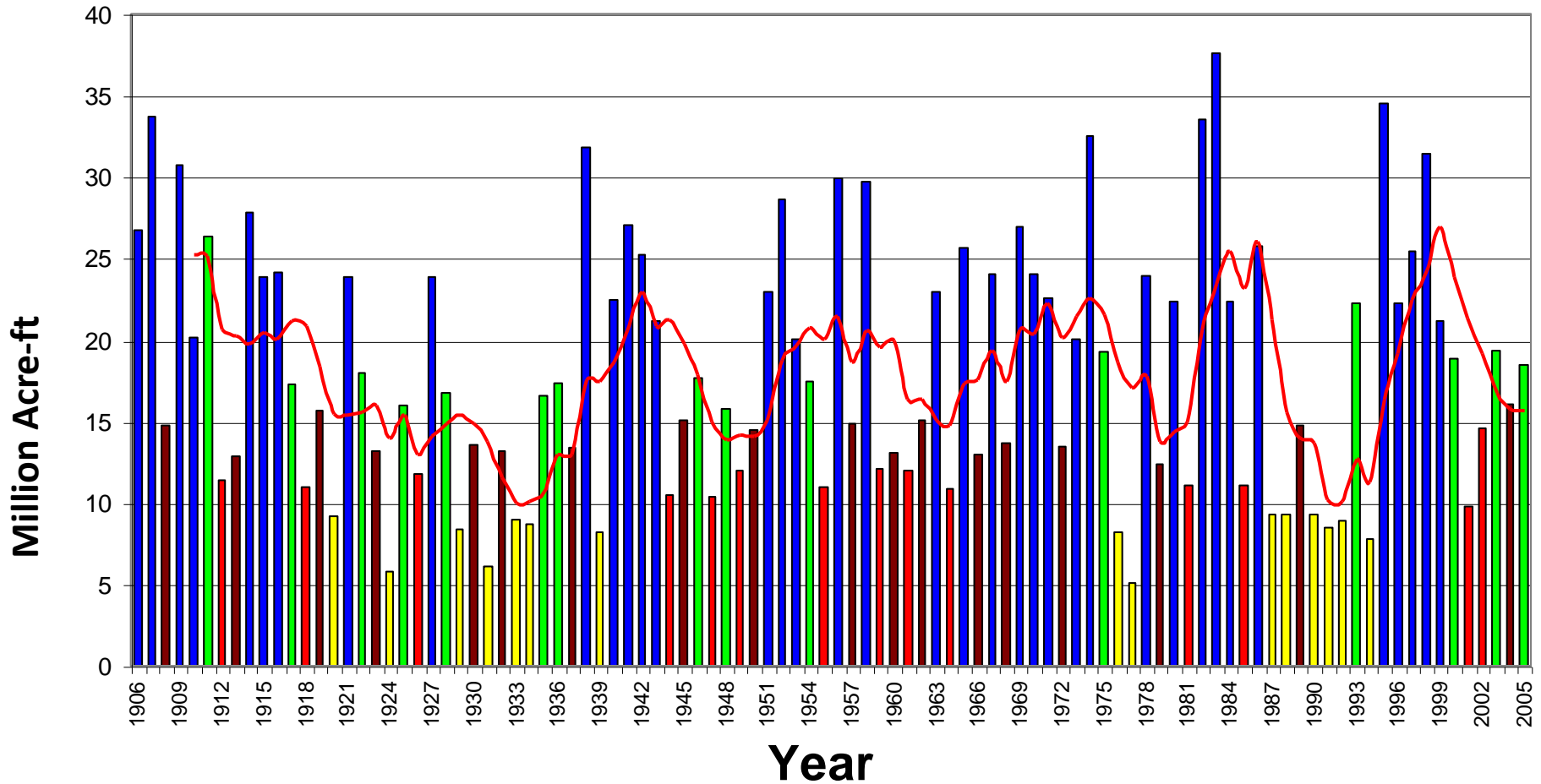
Streams, Lakes, and Reservoirs

(With Average Annual Precipitation in Inches: 1961-1990)



100 miles

High variability among years



Sacramento River outflow

FLOOD



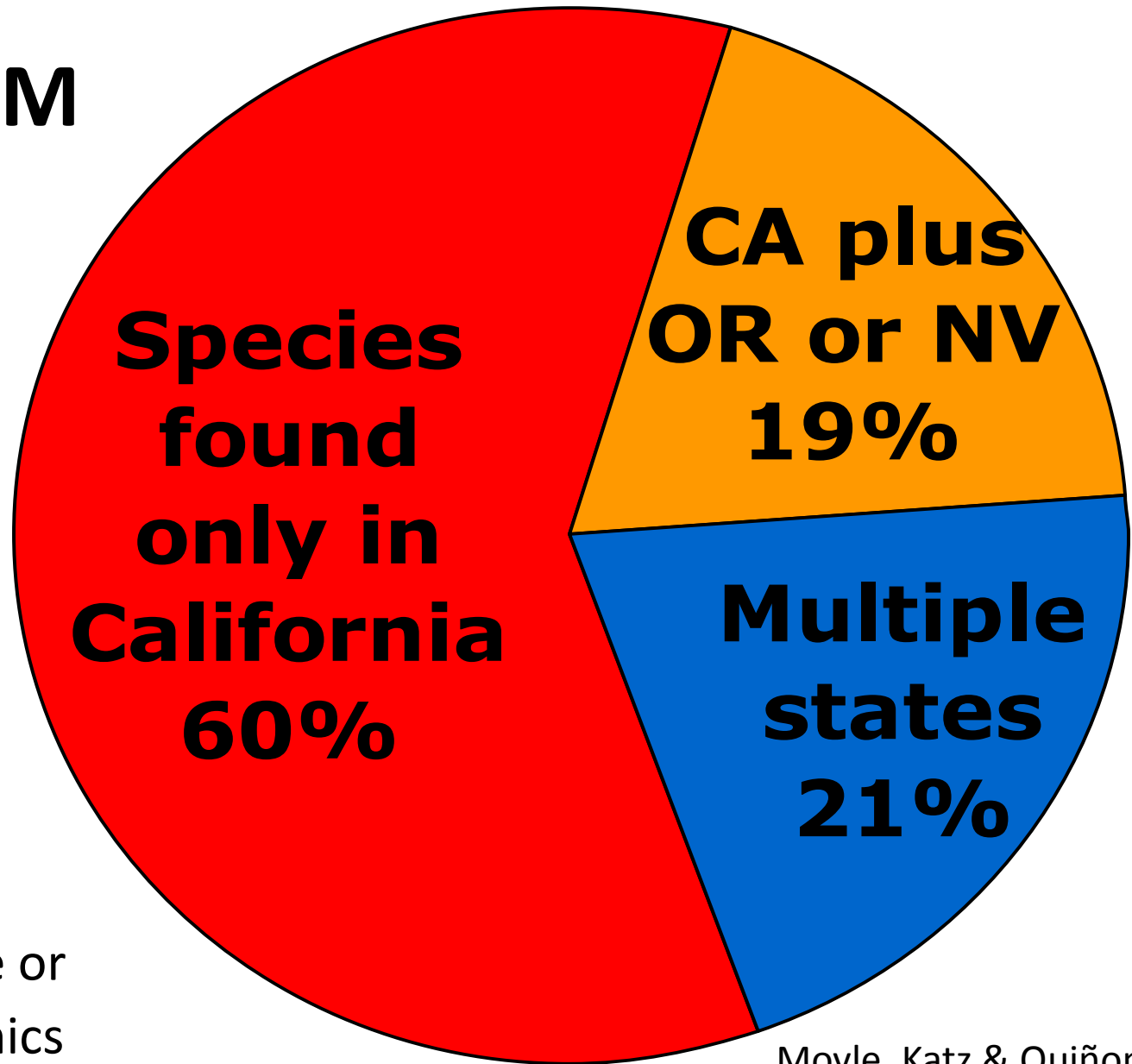
Guerneville 1997

Drought



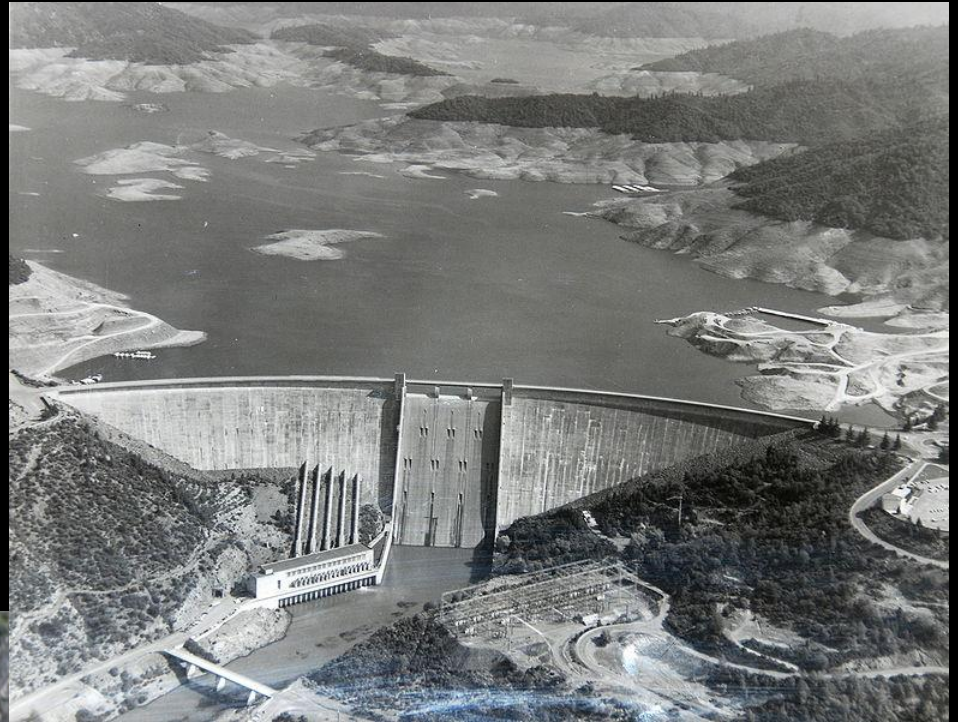
California's
Native Fishes
have evolved with
and are adapted to these
extreme variations

**ENDEMISM
IN CALIF.
FISHES**



79% are state or regional endemics

Every major river in California dammed-



At least
once

6,500 miles of levees



Homogenization!



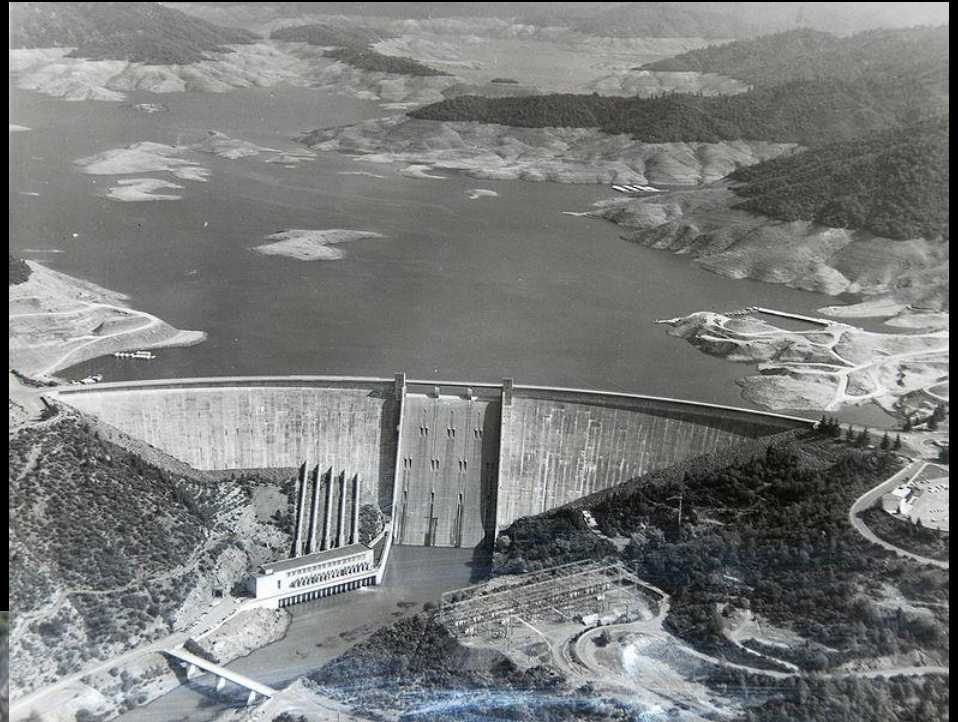
Native species need
to be able to
recognize their
environment

Chinook salmon



and Water Infrastructure

Every major river in California dammed-



At least
once

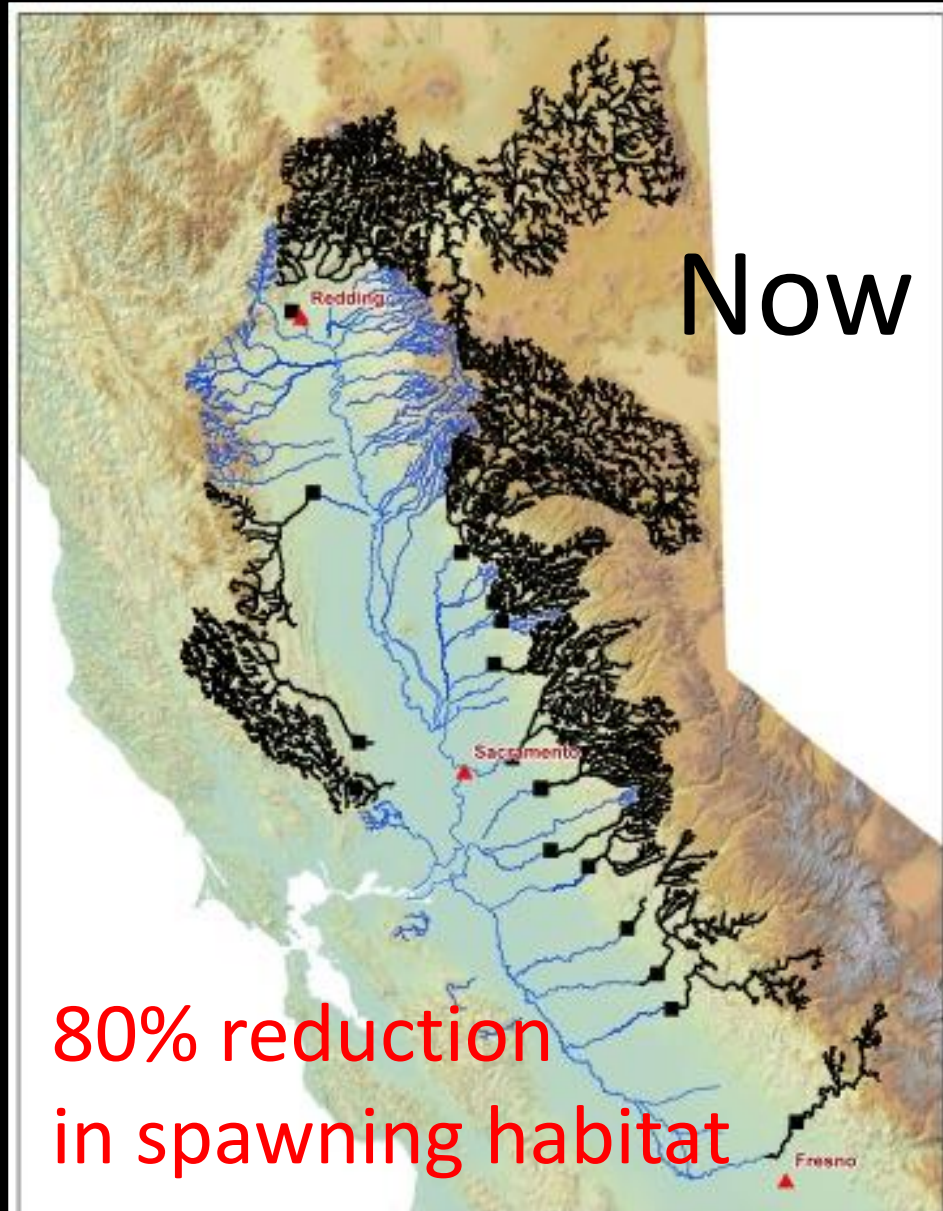
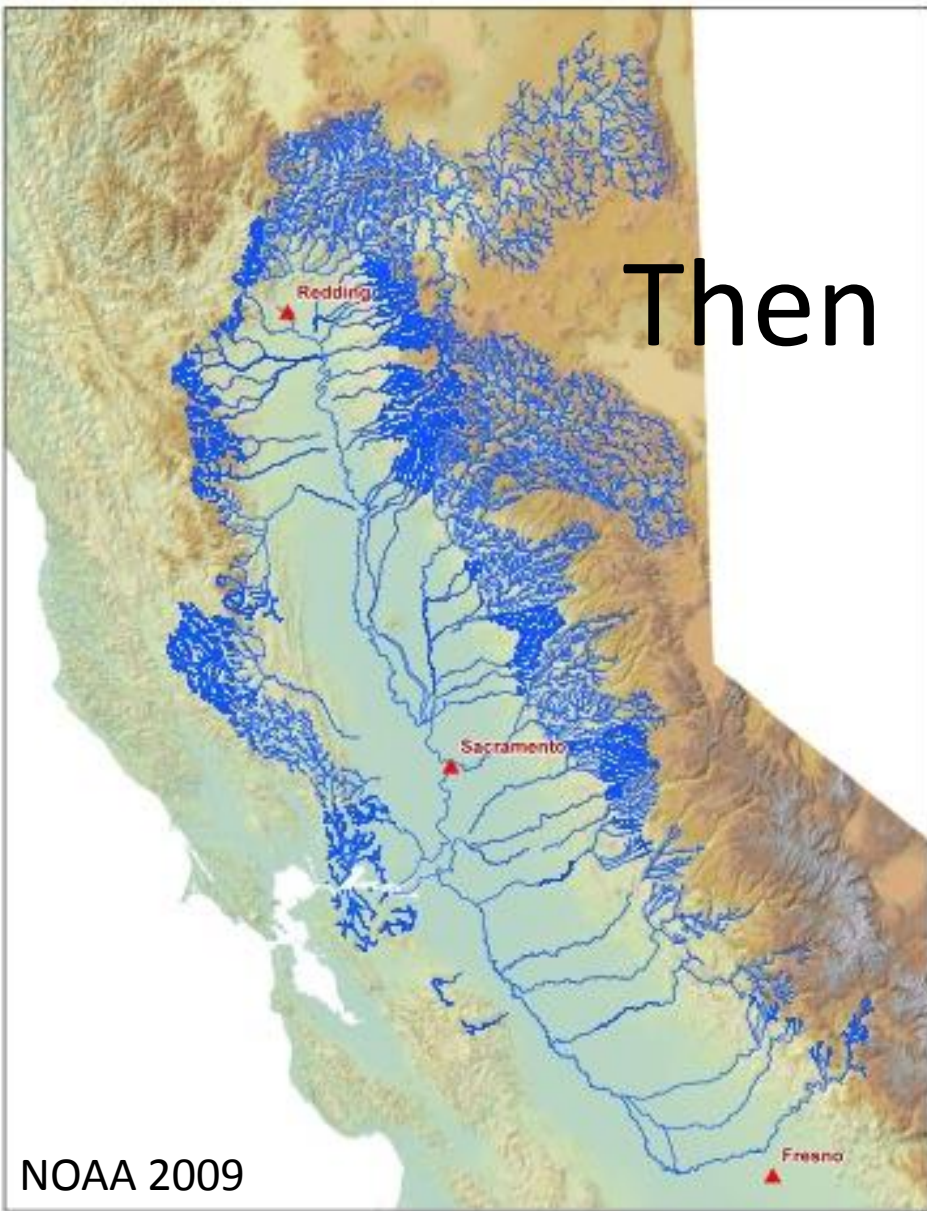
Central Valley Water Infrastructure – Dams

Then

Now

NOAA 2009

80% reduction
in spawning habitat



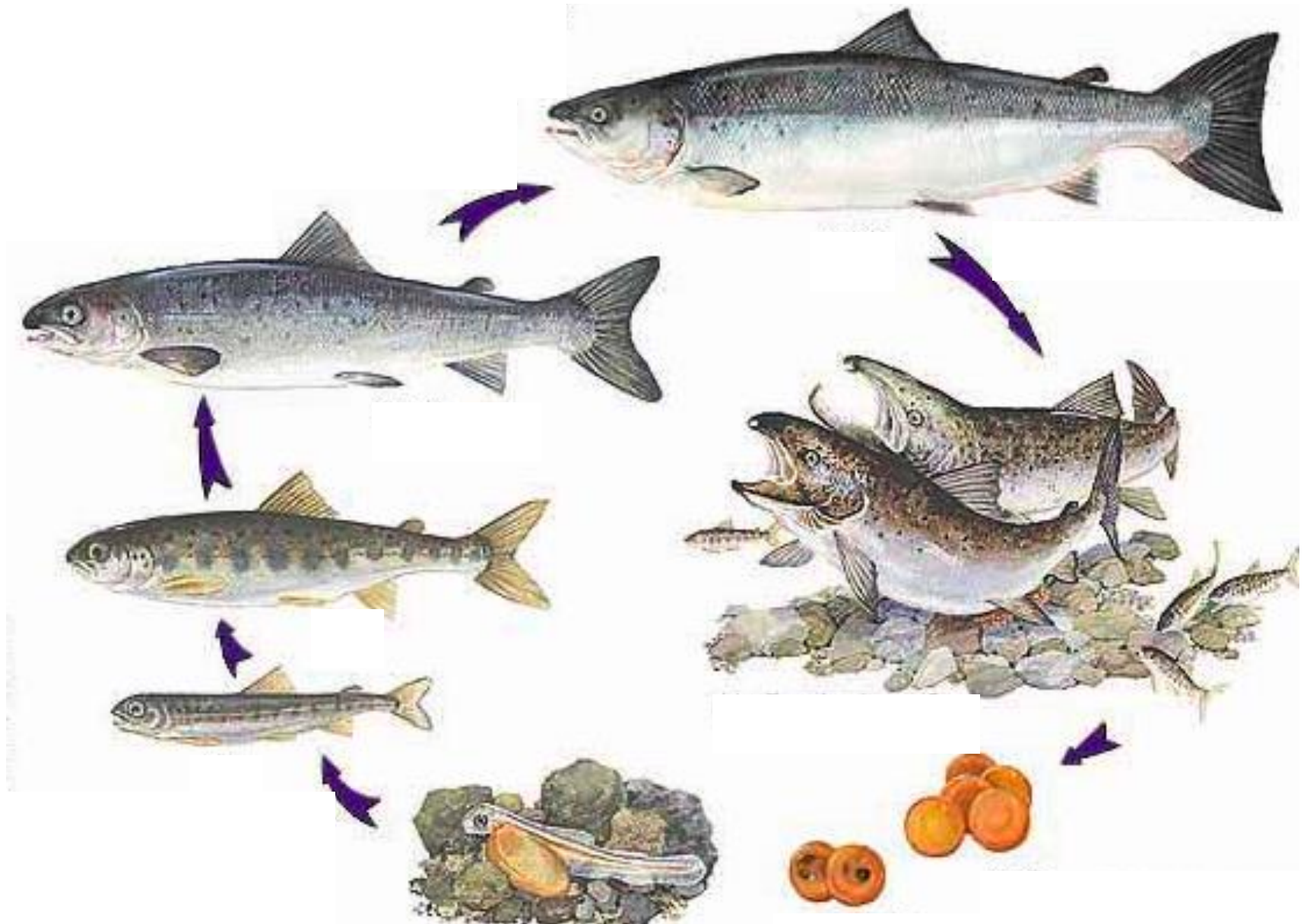
Gravel Augmentation

Millions of dollars spent annually on gravel augmentation

This is critical habitat, but not the only critical habitat

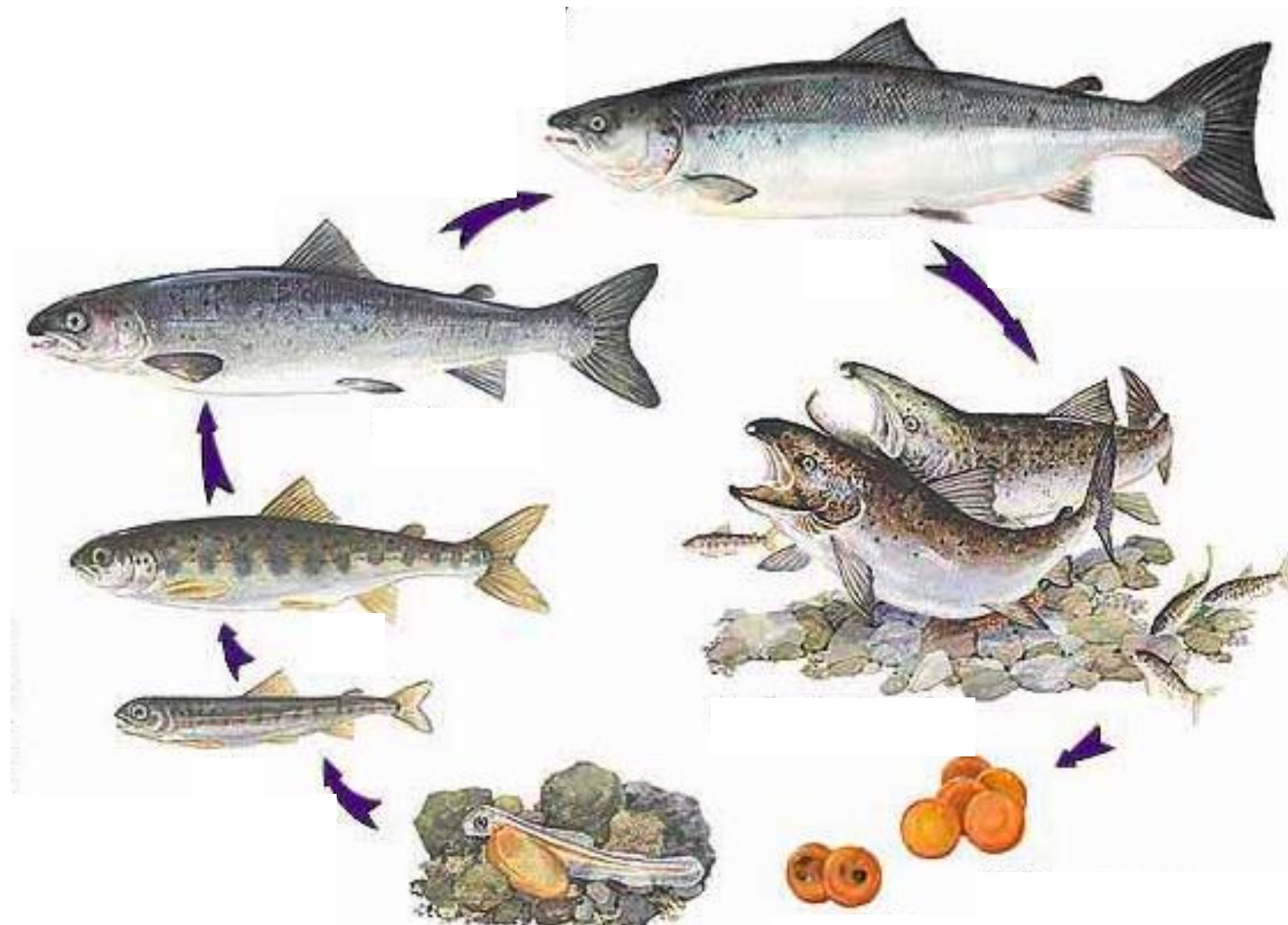


Like any chain...



is only as strong as weakest link



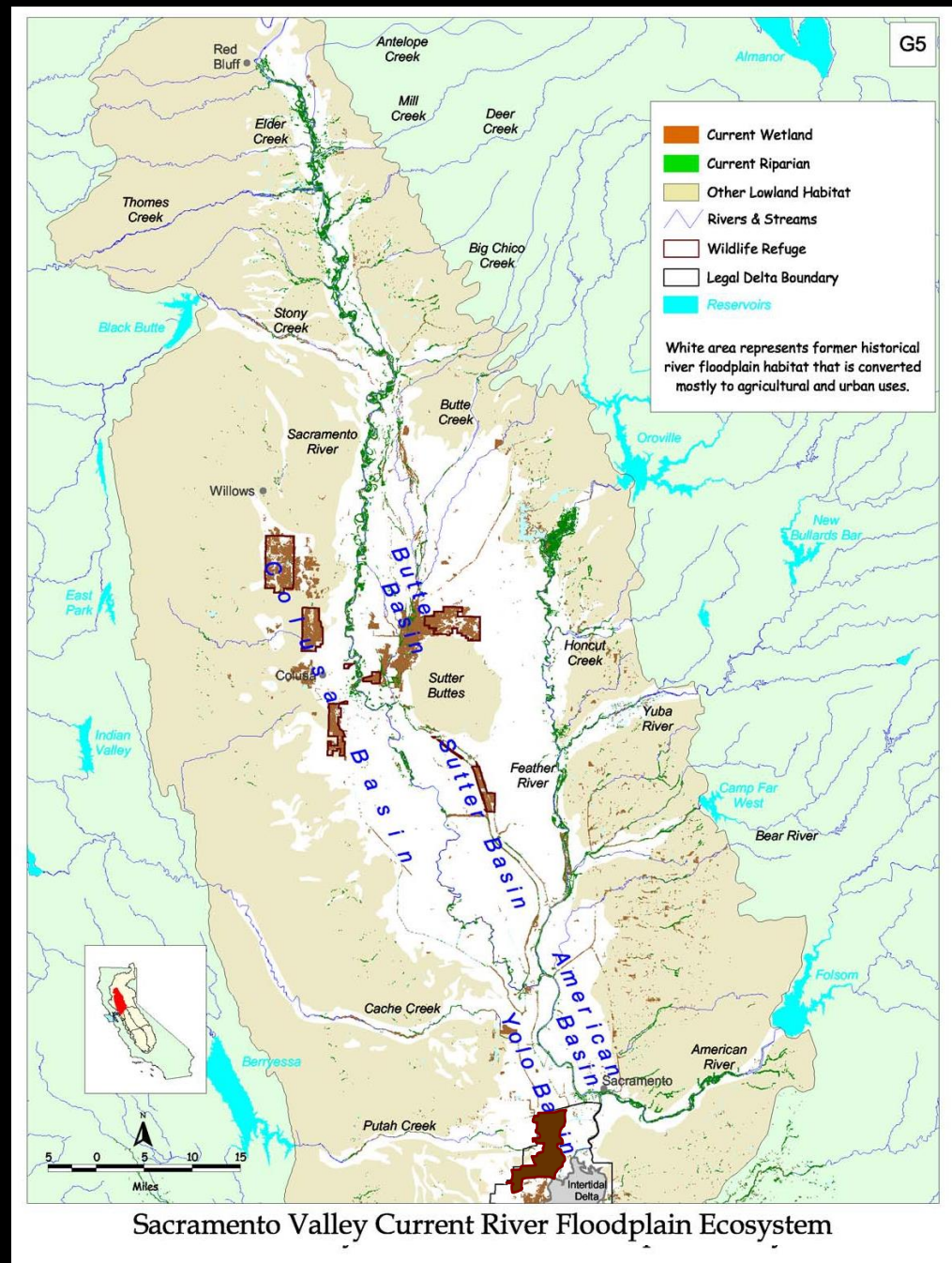


Historic:

Fall run Chinook evolved rearing on floodplains

TODAY:

- 95% of floodplains lost
- Converted to agriculture and urban development.



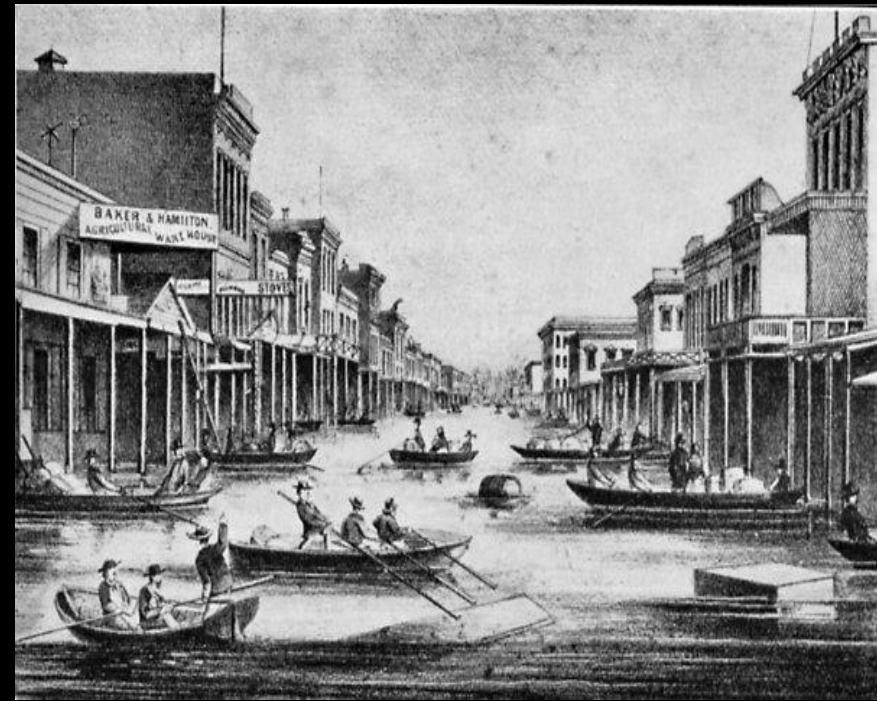
Inland Sea



K, STREET, FROM THE LEVEE.

INUNDATION OF THE STATE CAPITOL, City of Sacramento, 1862.

Published by AROSENFELD, San Francisco



J street



Flood of 1862

6,500 miles of levees



We are never going back!

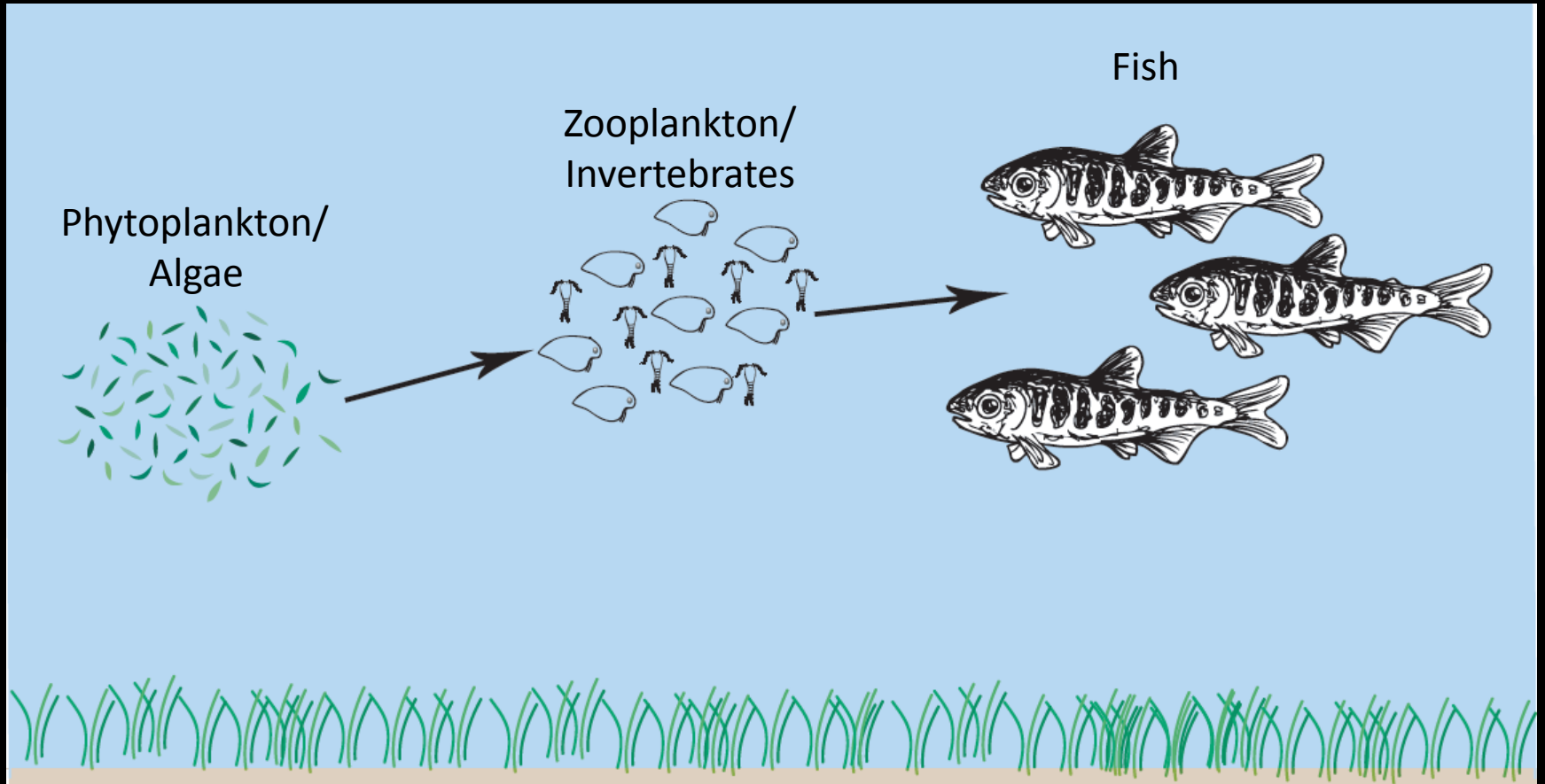
But we must look back in order to
move forward.

We must understand how natural
systems worked in order to
incorporate historic natural processes
into modern resource management

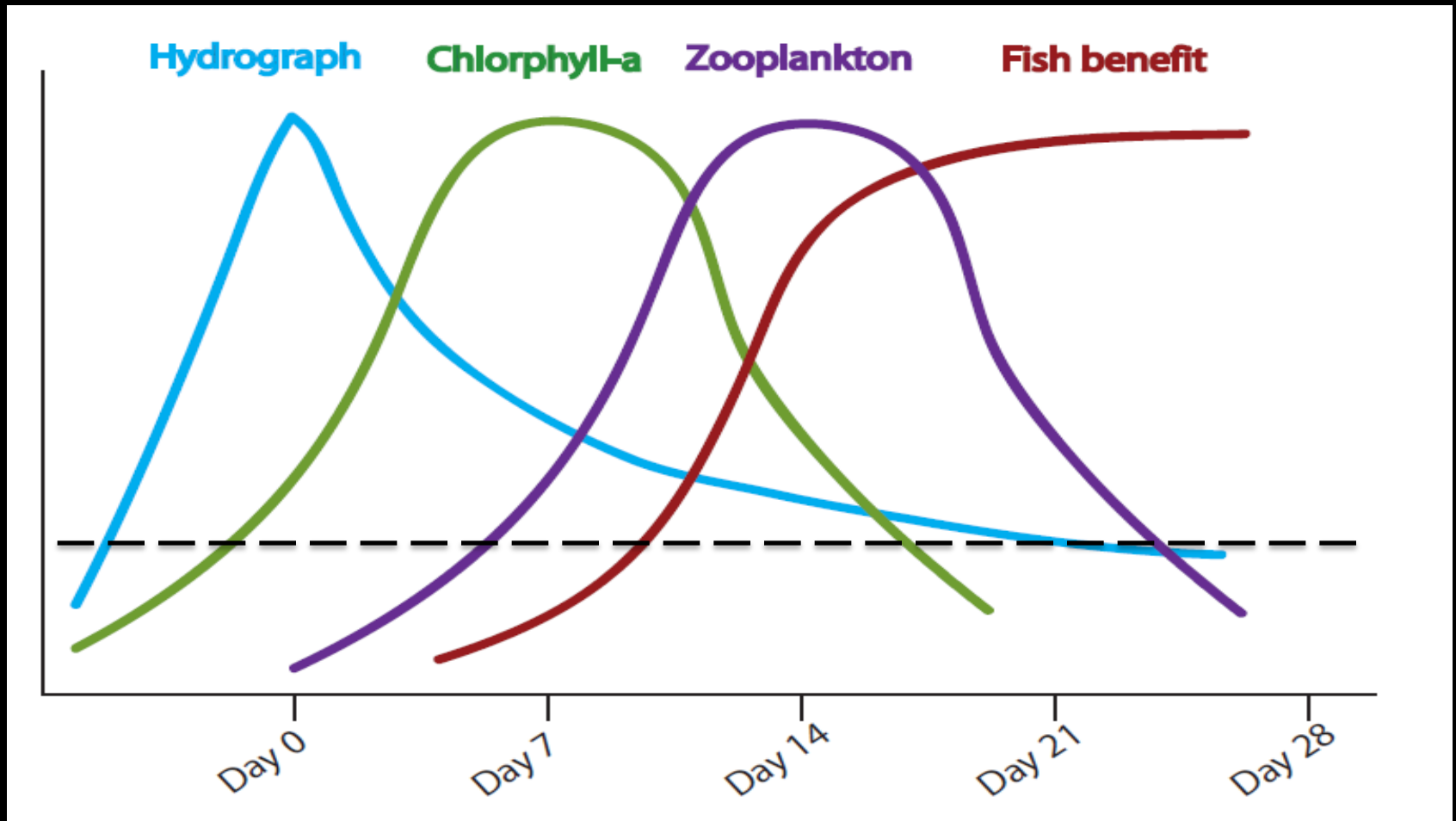
Cosumnes River



Floodplain Food Web



Timing, Duration, Magnitude



River

Floodplain

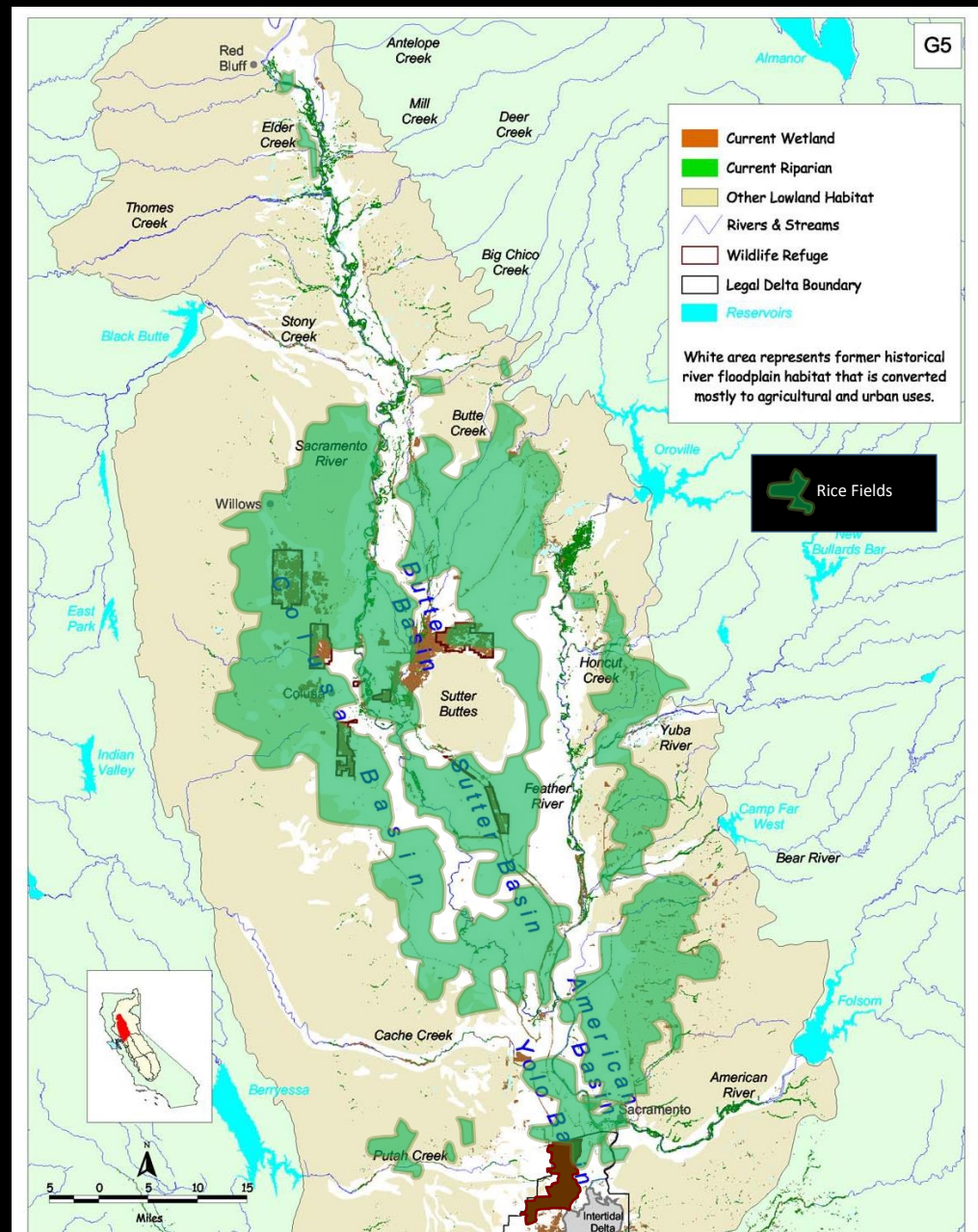


Historic:

Fall run Chinook evolved rearing on floodplains

TODAY:

- **95%** of floodplains lost
- drained and converted to rice.
- In California 550,000 acres of rice is farmed annually.
- Now, many of the rice fields are managed for migrating birds during winter months.



Sacramento Valley Current River Floodplain Ecosystem

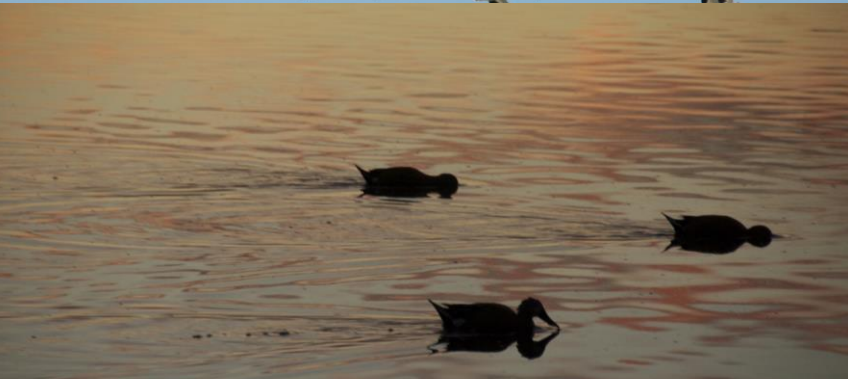
Mimicking Natural Processes in Managed Floodplains

Restored Floodplains

=

Managed Floodplains?

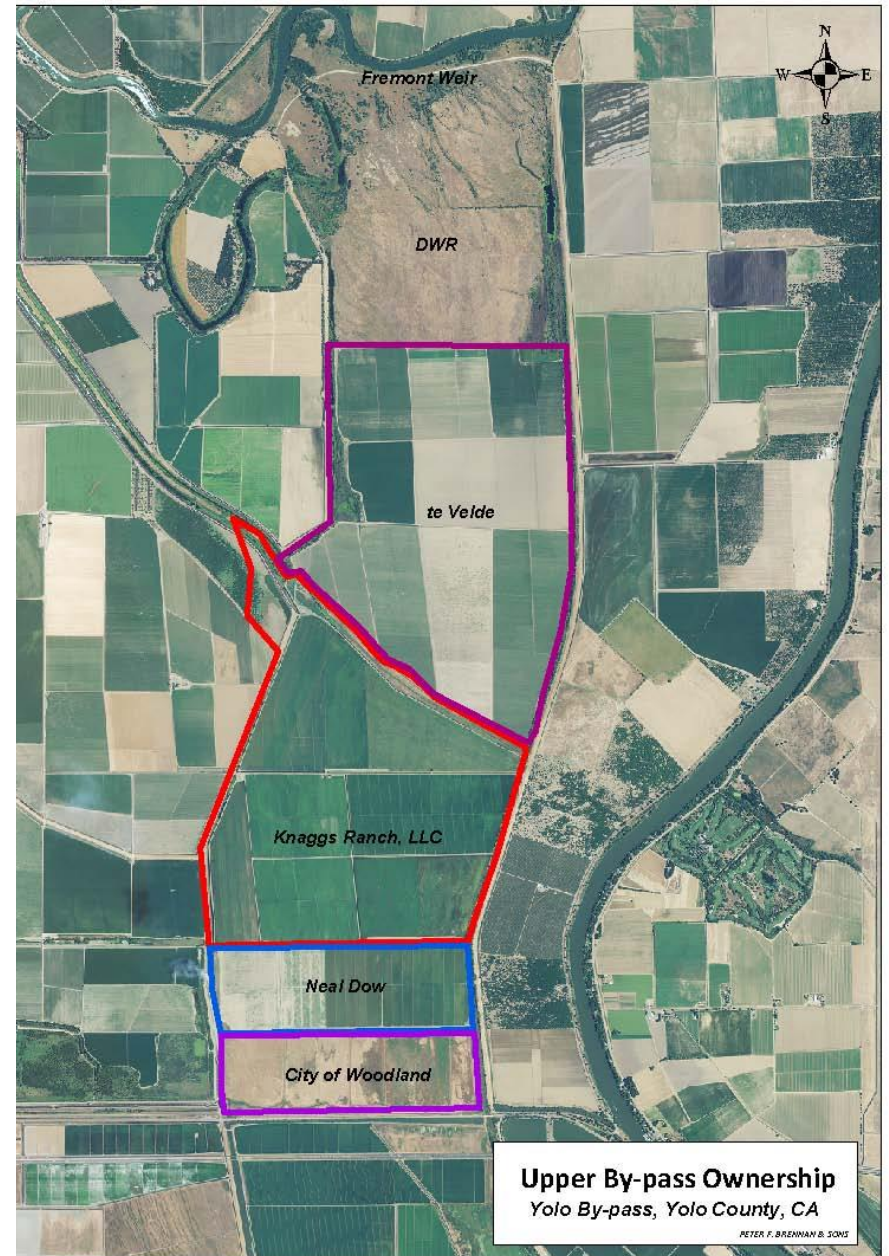
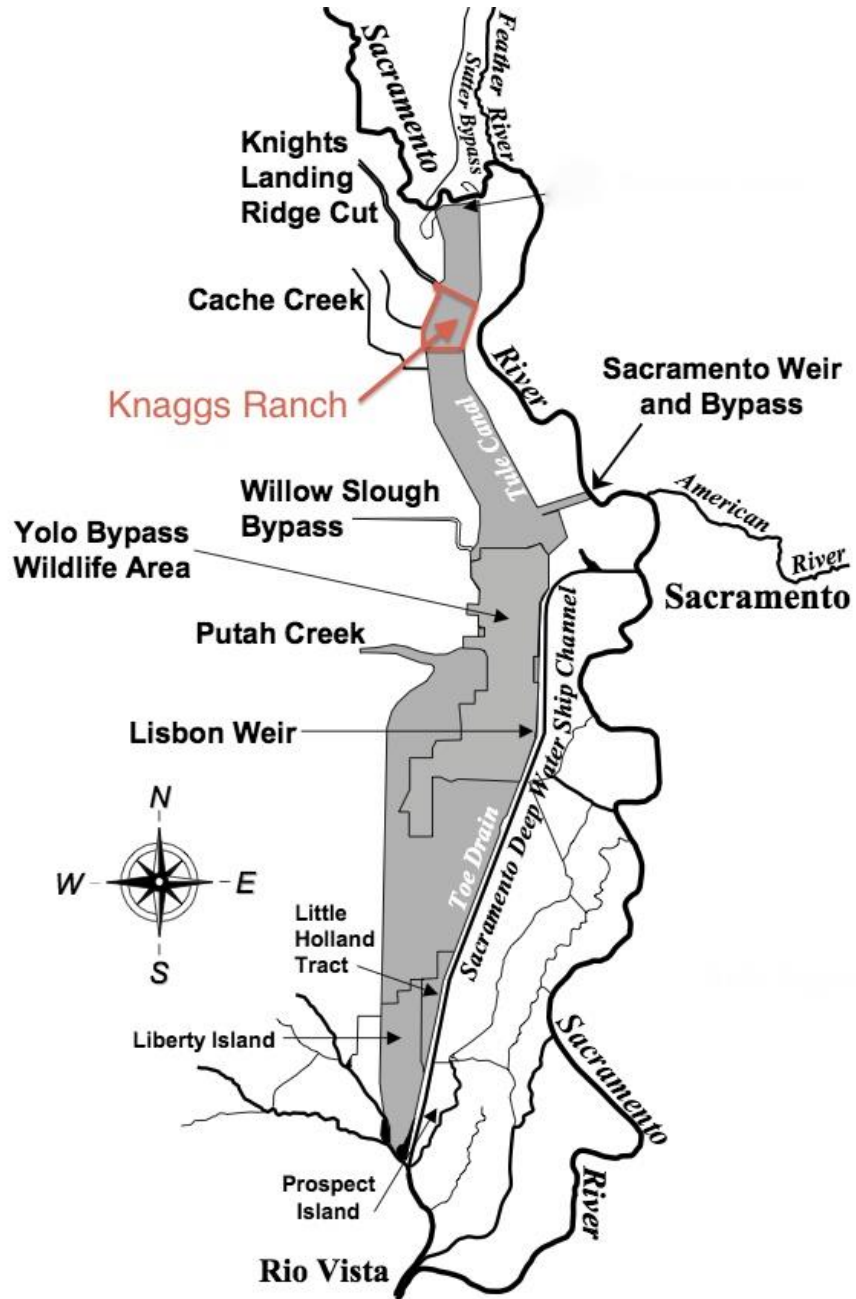




Managed floodplain for multiple uses:

- Flood protection
- Agriculture
- Fish habitat
- Waterbird habitat
- Aquifer recharge

Knaggs Ranch on Yolo Bypass





Mimicking historic floodplain processes
in post-harvest rice fields

2012 Pilot Study

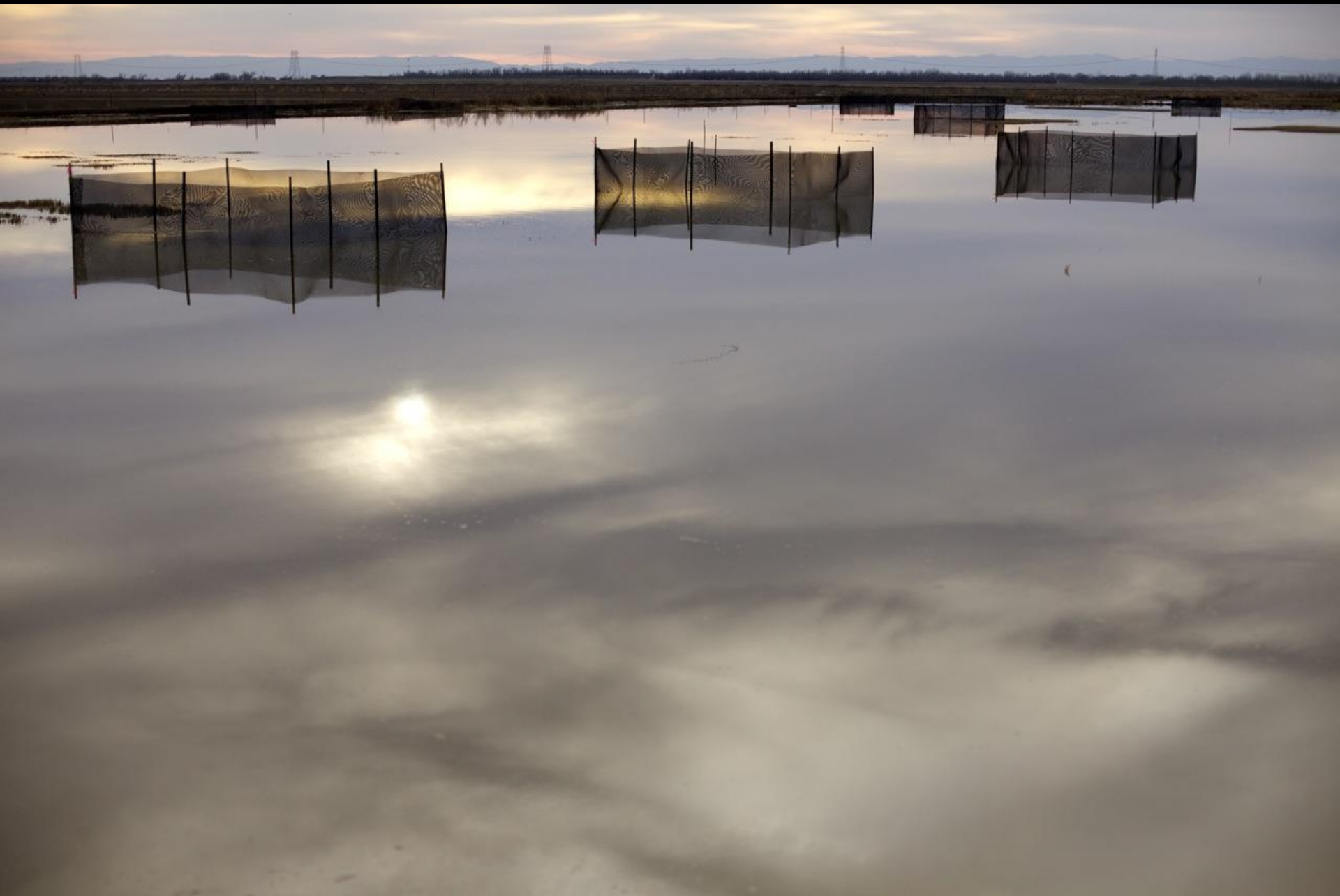
Following rice harvest







Carson Jeffres











Passive integrated transponder (PIT tags)





Fish measured every 2 weeks



After 6 weeks field drained





Fish measured and
tags read

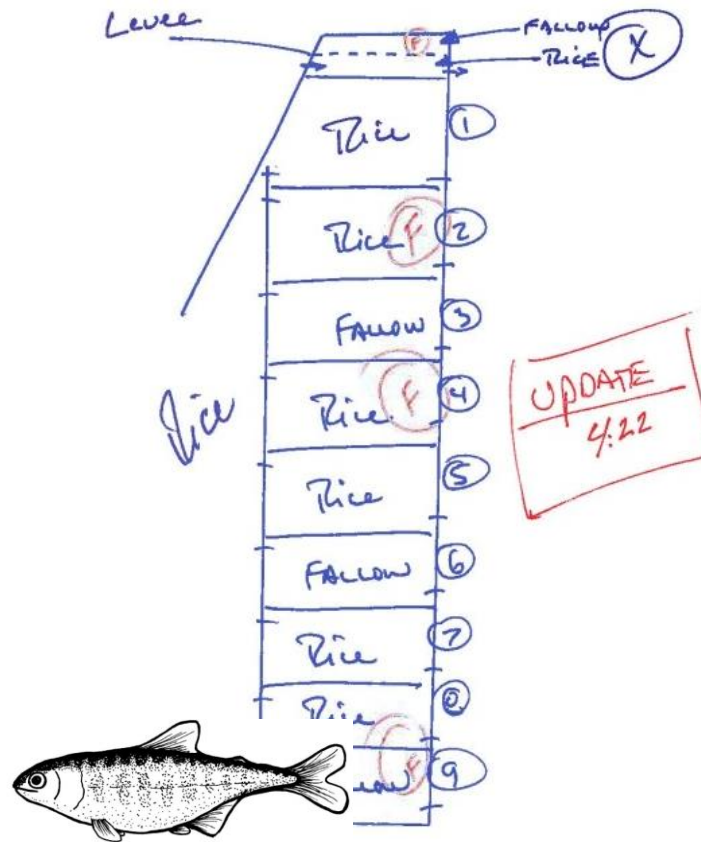
G
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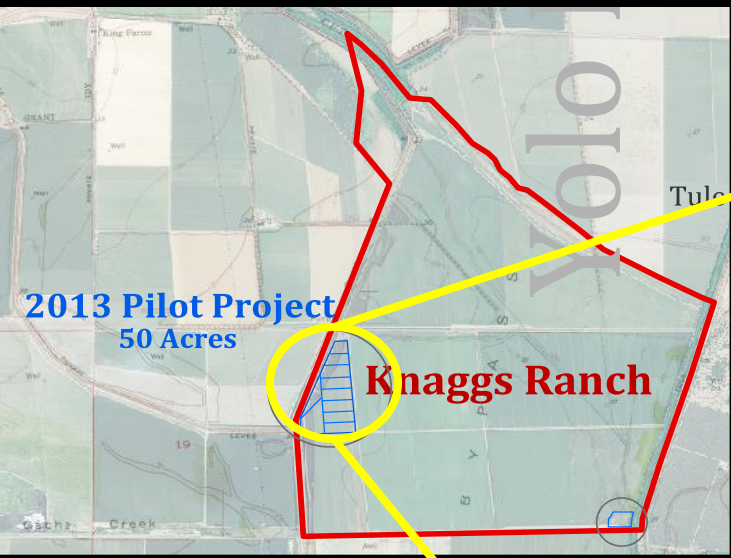




2013 – Nine 2-acre fields

2013





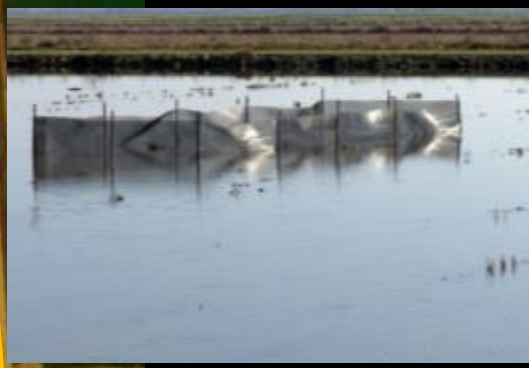
2013: Feb 18 – Apr 4
42,000 hatchery fish



Fallow

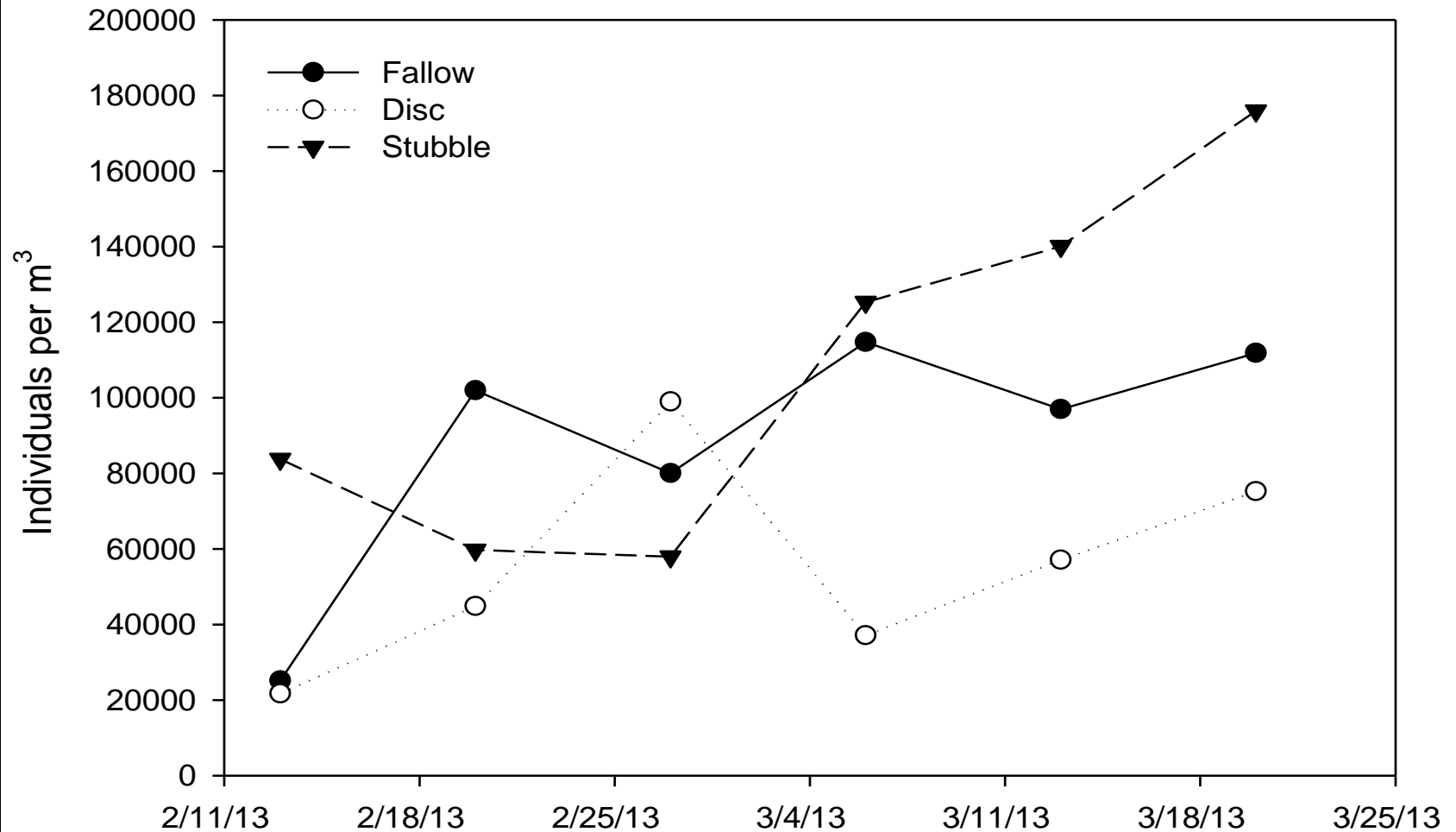


Stubble

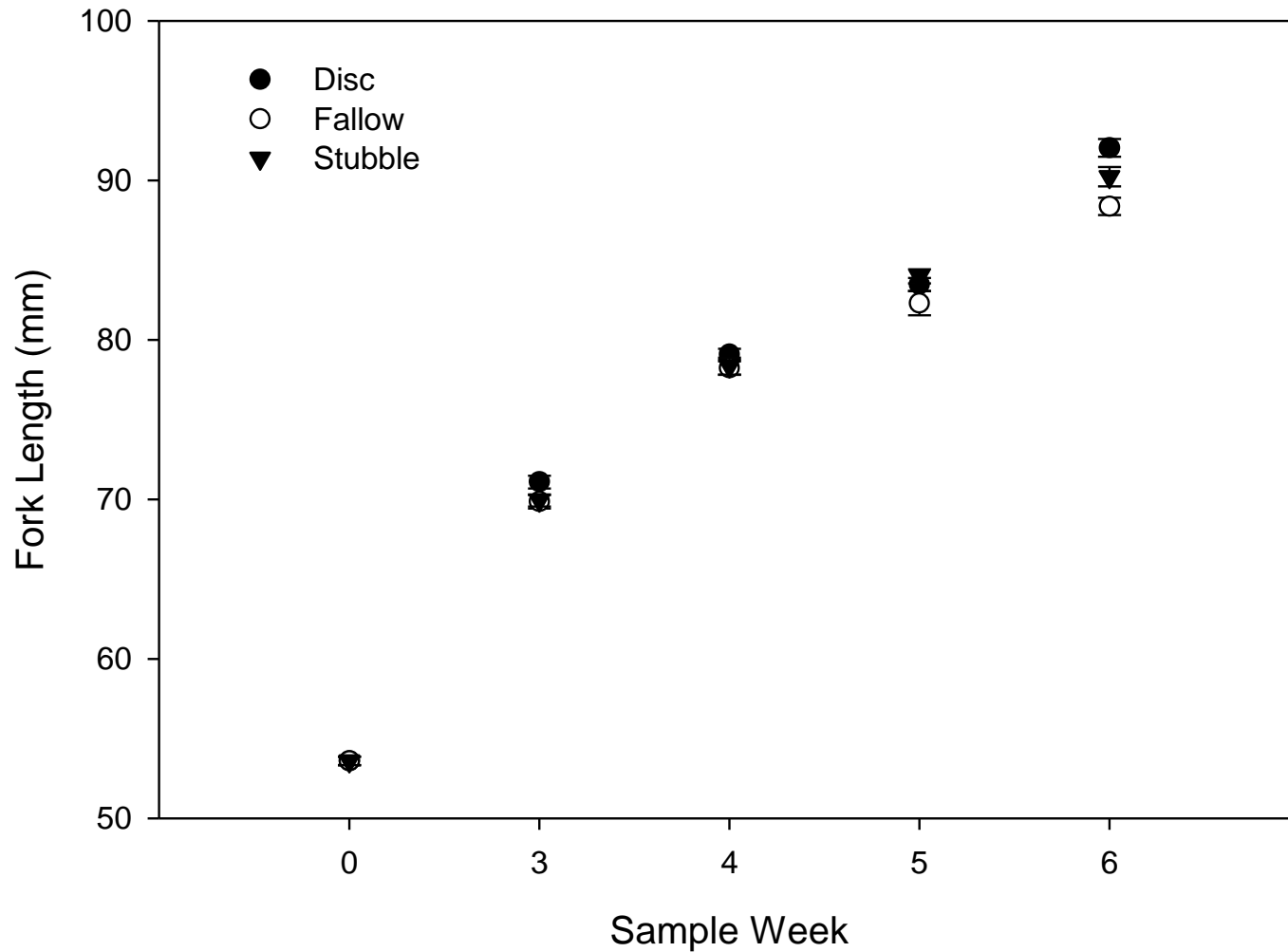


Stomped

Food Web Results



Fish Growth



Day 0

Day 38

3/19

53 mm

1.5 g

4/27

90 mm

9.4 g

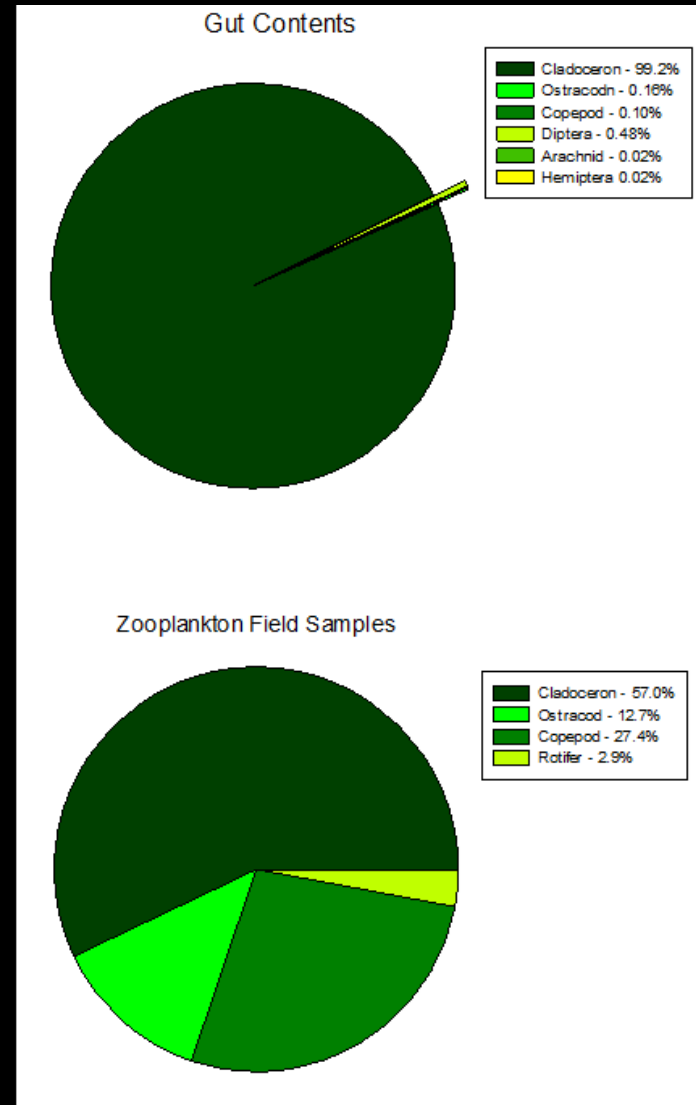
0.94 mm/d

0.18 g/d



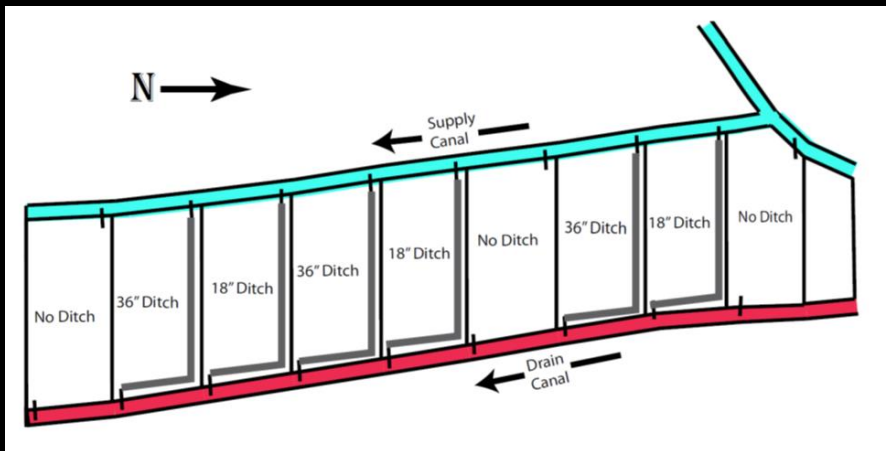
Gut Contents

- Contents from a single 79mm salmon
 - ~460 individual cladocerans

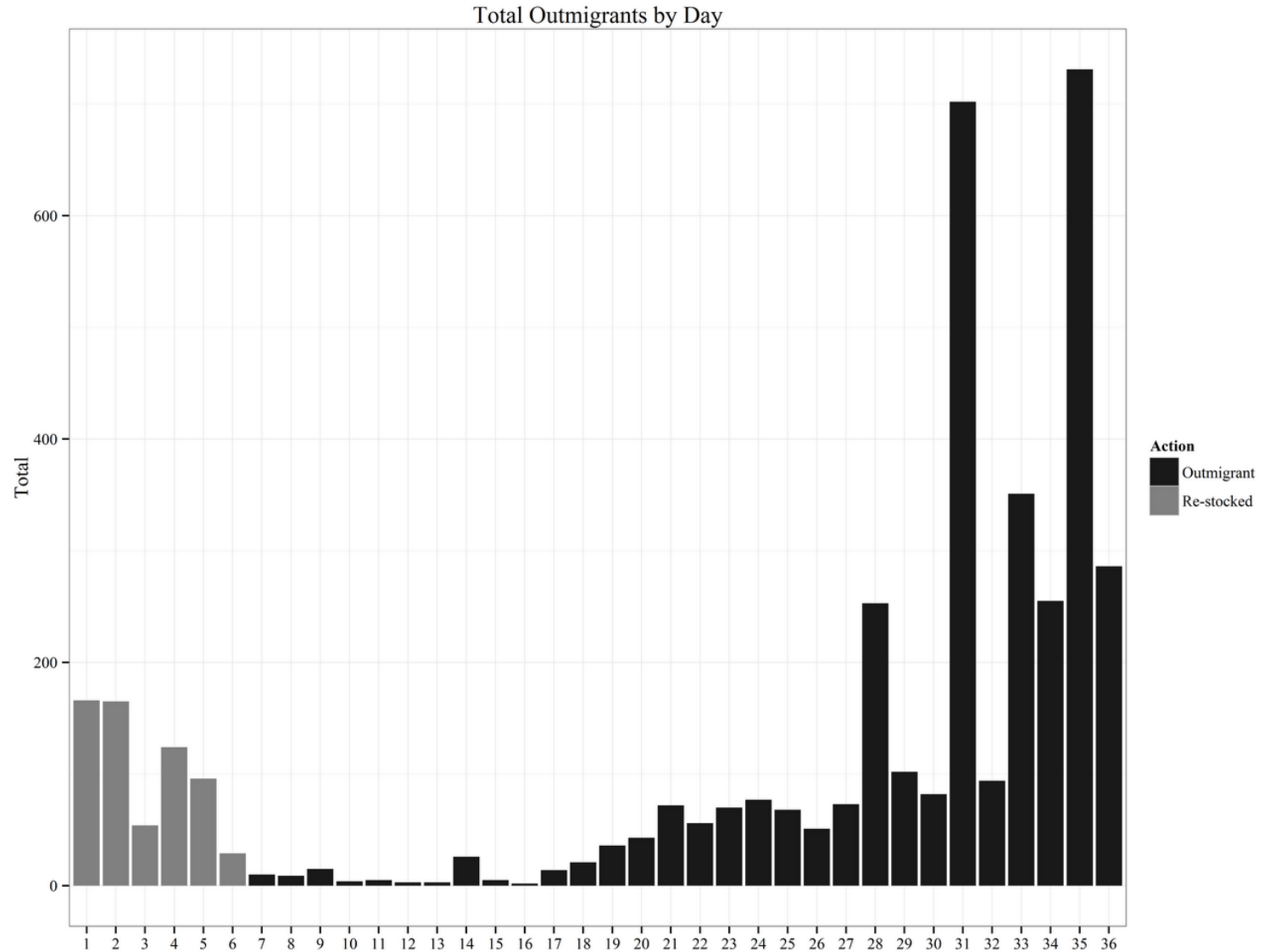


2014 Study

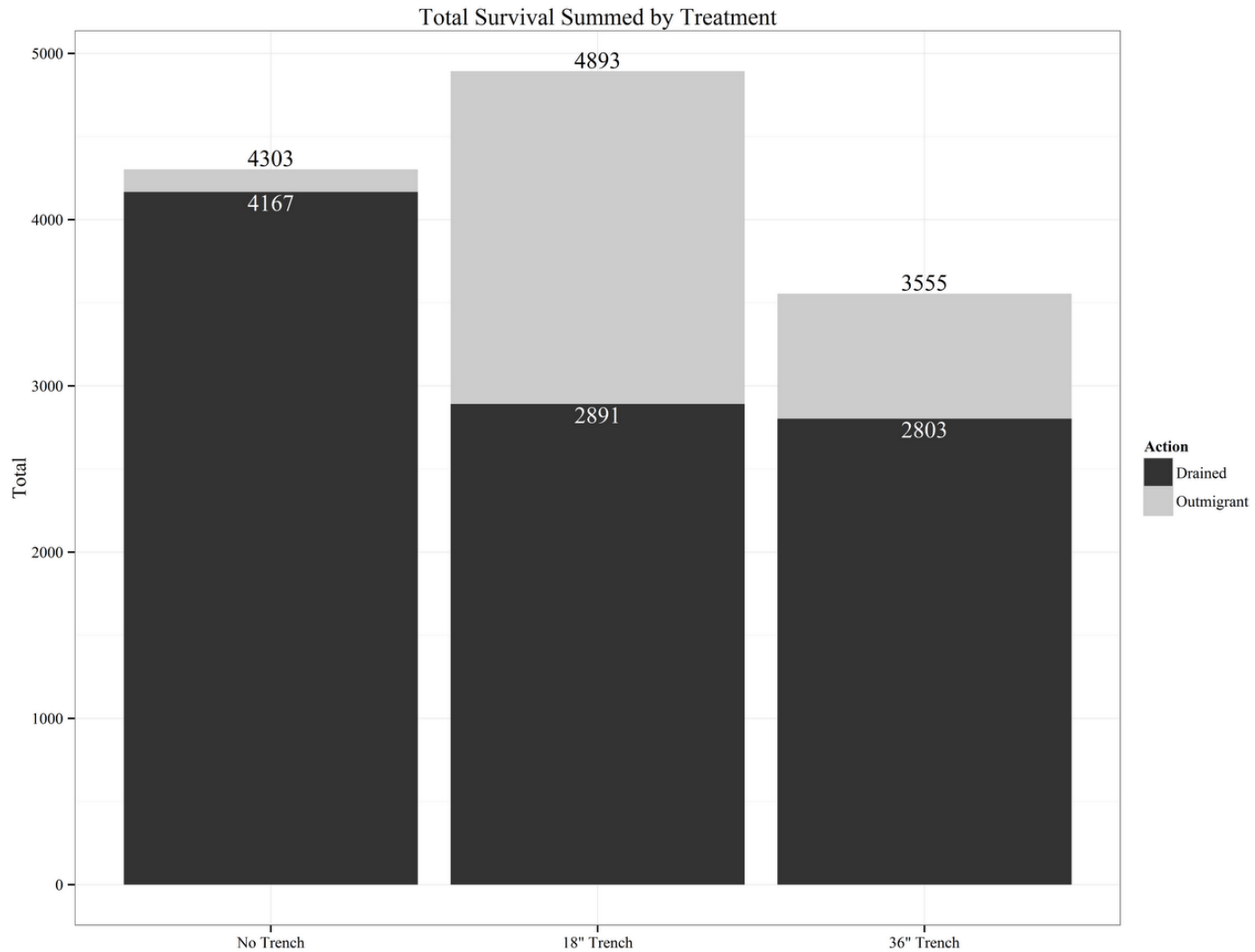
- Volitional Passage
- Ditches/Refuge
- Growth/Food



Volitional Out-migrants



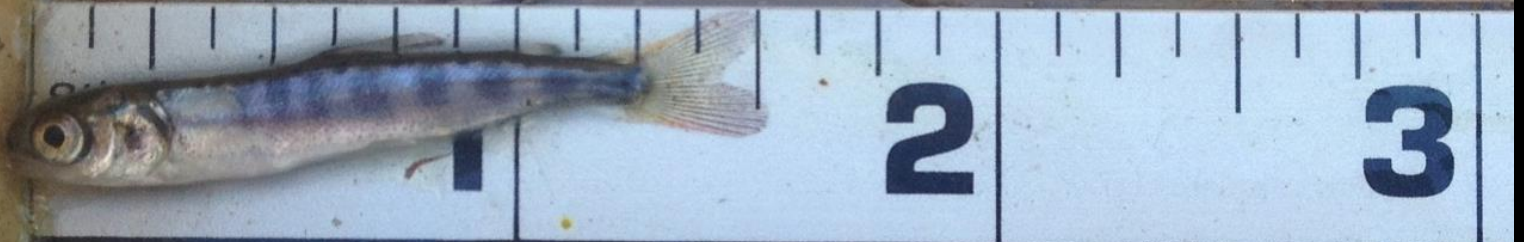
Outmigration by Field Type



Fields 3, 4, and 7 excluded due to escaped fish

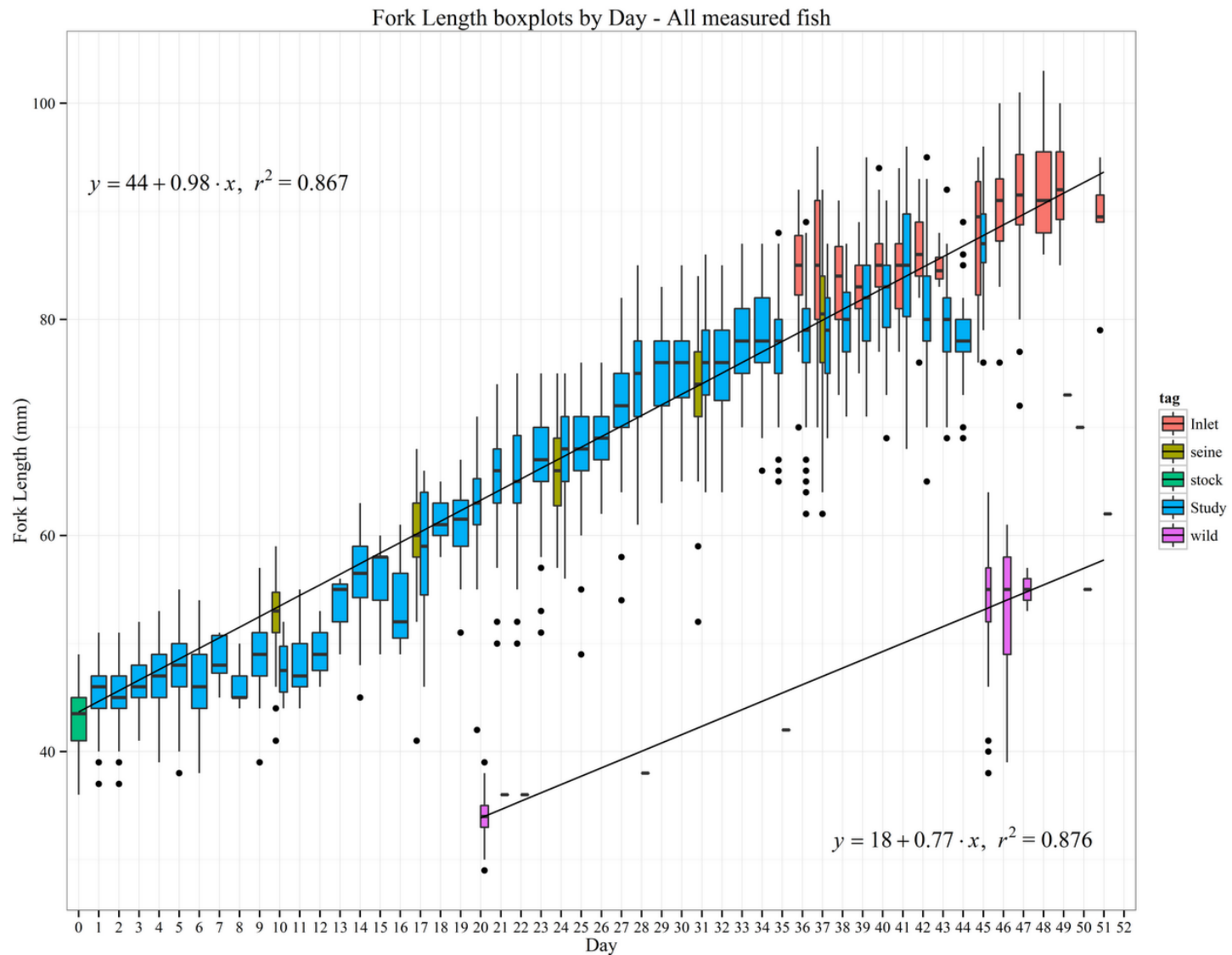
Snapshot: February 24 2014

Feather River

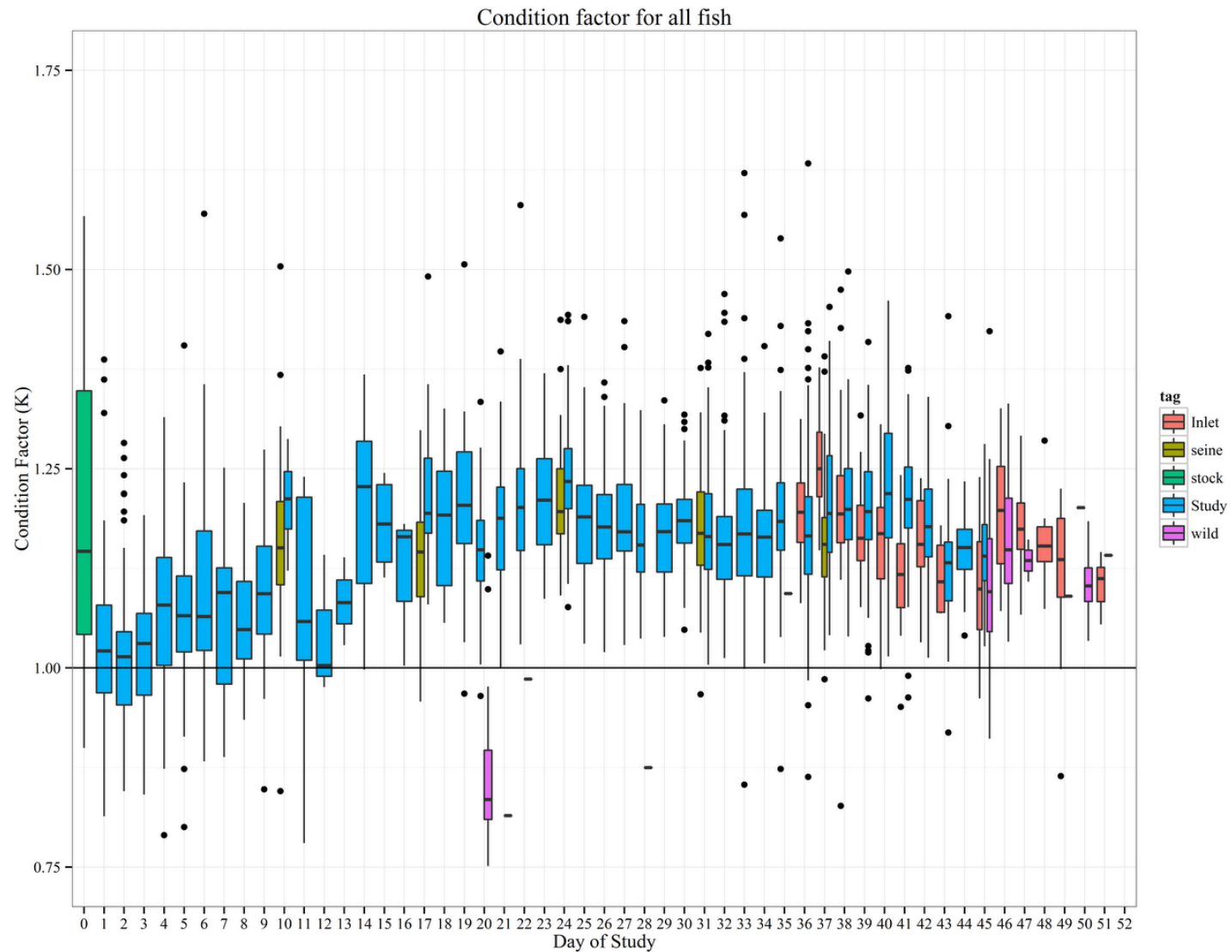


Knaggs Ranch

Growth Rate



Condition Factor



Summary

- Growth Rates are very high on inundated rice fields
- Volitional passage lets fish leave when as they are ready to leave the fields
- Variable habitat within the field may provide benefit



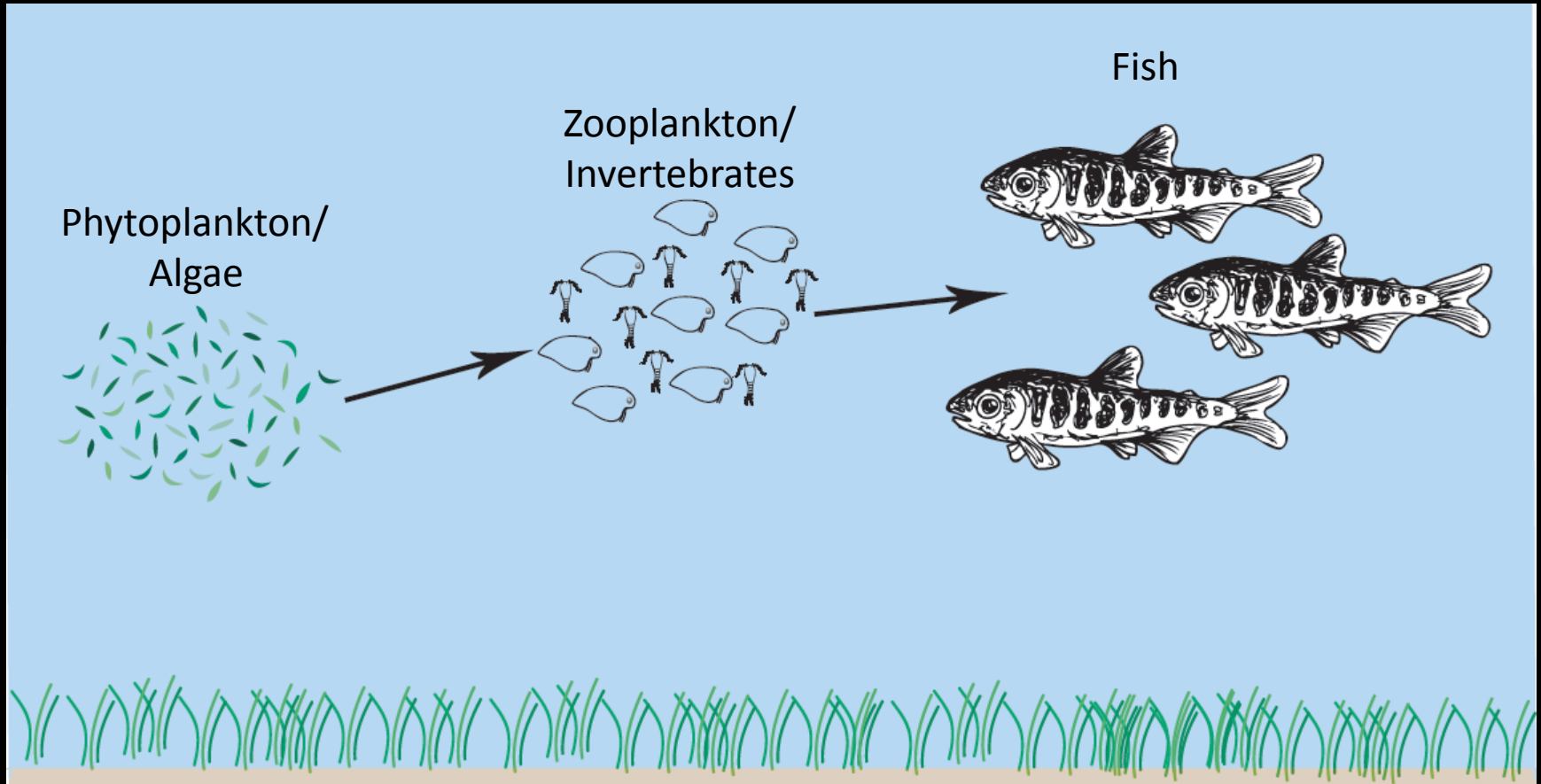
Slow it down!

Spread it out!

Grow them up!




Mimicking the Floodplain Food Web



On Managed Ag Fields

This work is collaborative and could not be achieved without the effort of many:

Ted Sommer, Louise Conrad, Gina Benigno, Steve Brumbaugh, Josh Martinez (DWR), Carson Jeffres, Peter Moyle, Nick Corline, Miranda Tilcock (UCD), Josh Israel (US Bureau of Reclamation), Joe Kiernan (NMFS), Jason Roberts (DFW), John Brennan, David Katz and Huey Johnson (Cal Marsh and Farm)



Questions?

