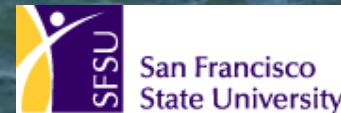


Effects of the Emergency Drought Barrier on the transport of zooplankton to delta smelt habitat

Wim Kimmerer
Anne Slaughter
Ed Gross
Steve Andrews

No copepods allowed



The theme

1. Low-Salinity Zone is also low productivity
2. High mortality of copepods
3. Subsidies from freshwater to LSZ
4. Barrier: blocked dispersion
5. Did it reduce food supply to fishes in the LSZ?



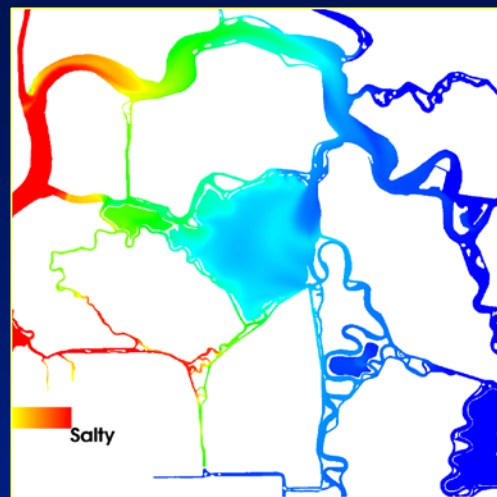
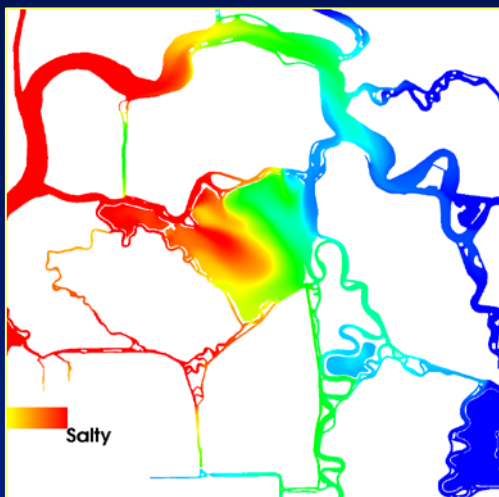
Yes!

Barrier effects on salinity

No Barrier

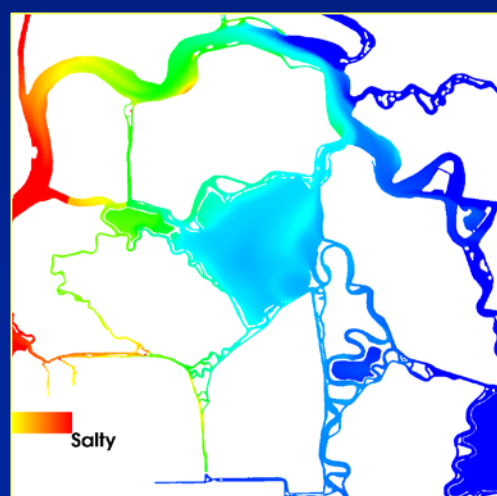
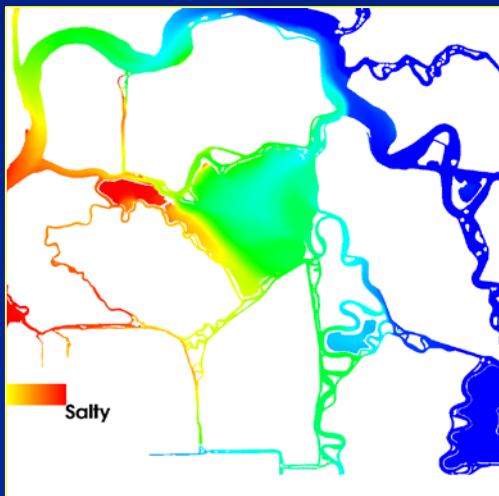
Barrier

Flood



Fresh
Brackish

Ebb



The original question...



Here be
delta
smelt

*Pseudodiaptomus
forbesi*



Here be
predators

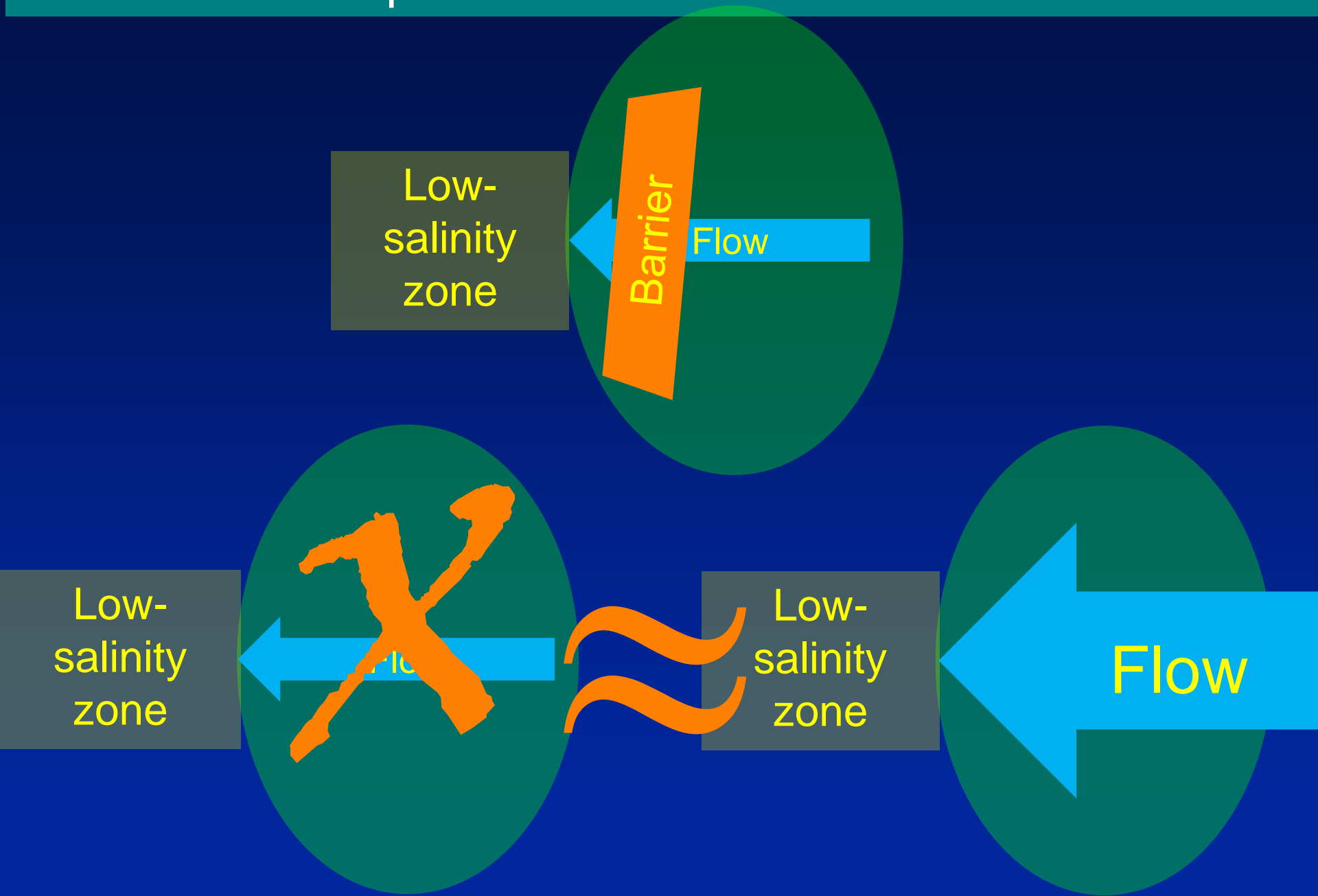


Low-
salinity
zone

Barrier?

Flow,
dispersion

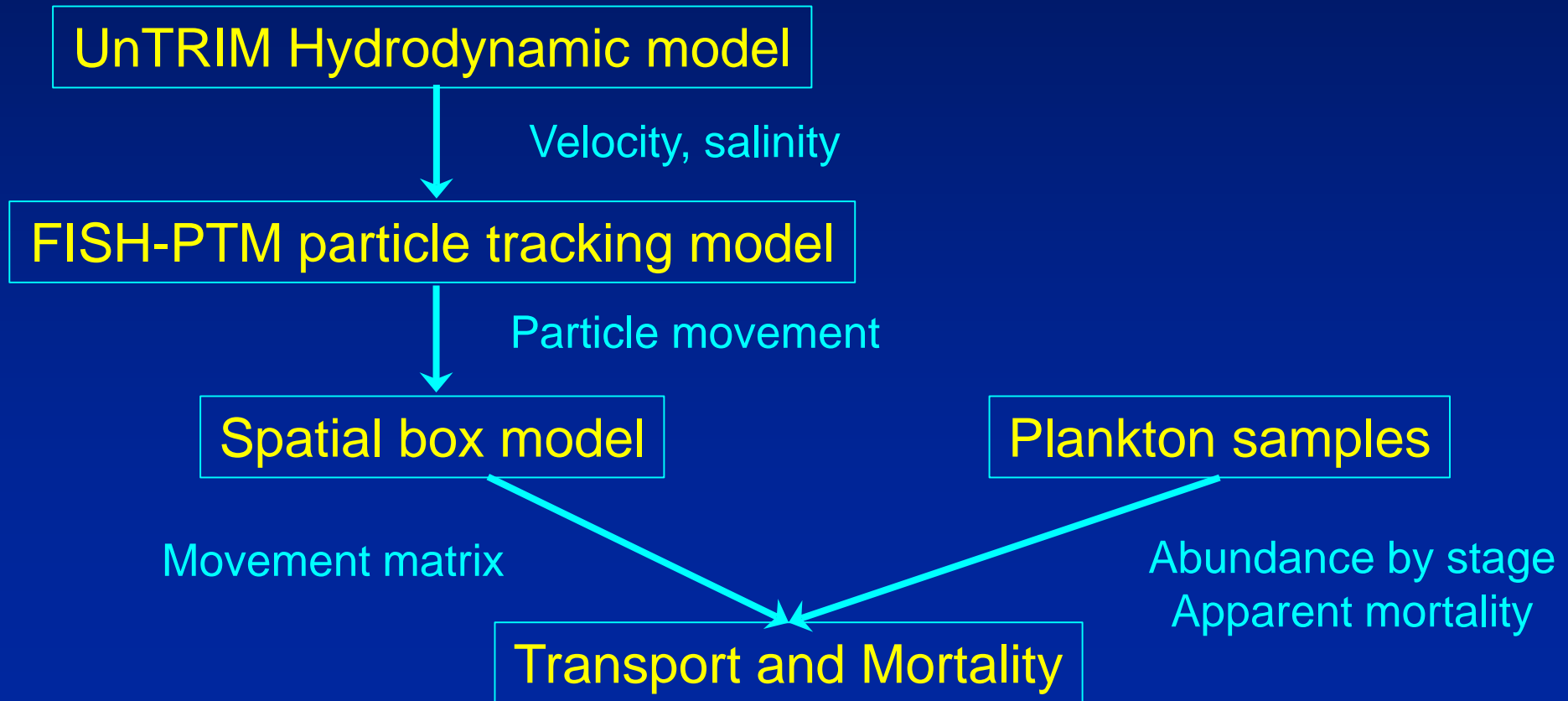
What is the comparison?



Questions and approach

Questions

- Mortality rate of copepods in Low-Salinity Zone?
- Role of tidal transport to the LSZ?
- Did barrier reduce food for delta smelt?



Plankton samples: stations (2010-2012, 2015)

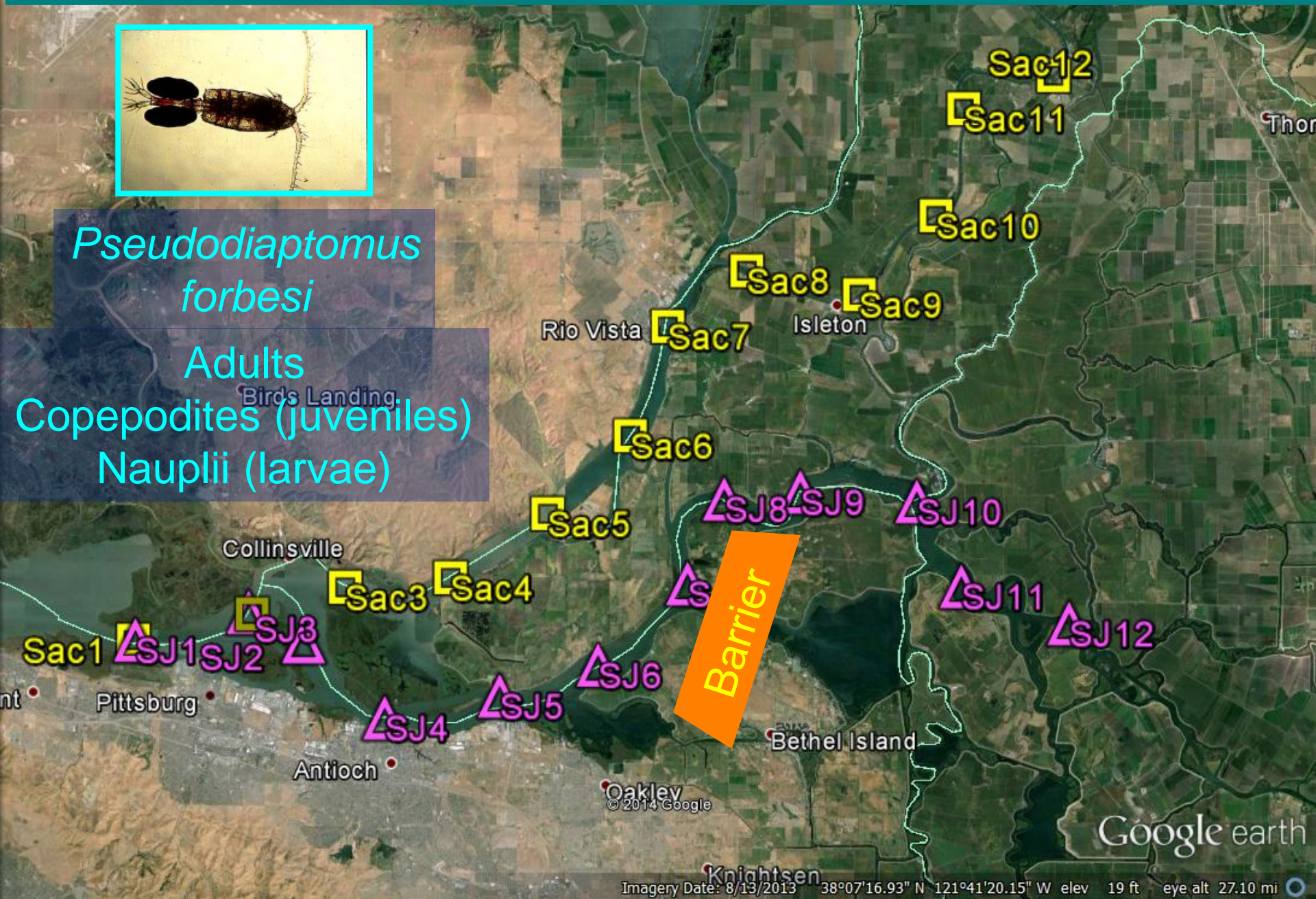


Pseudodiaptomus forbesi

Adults

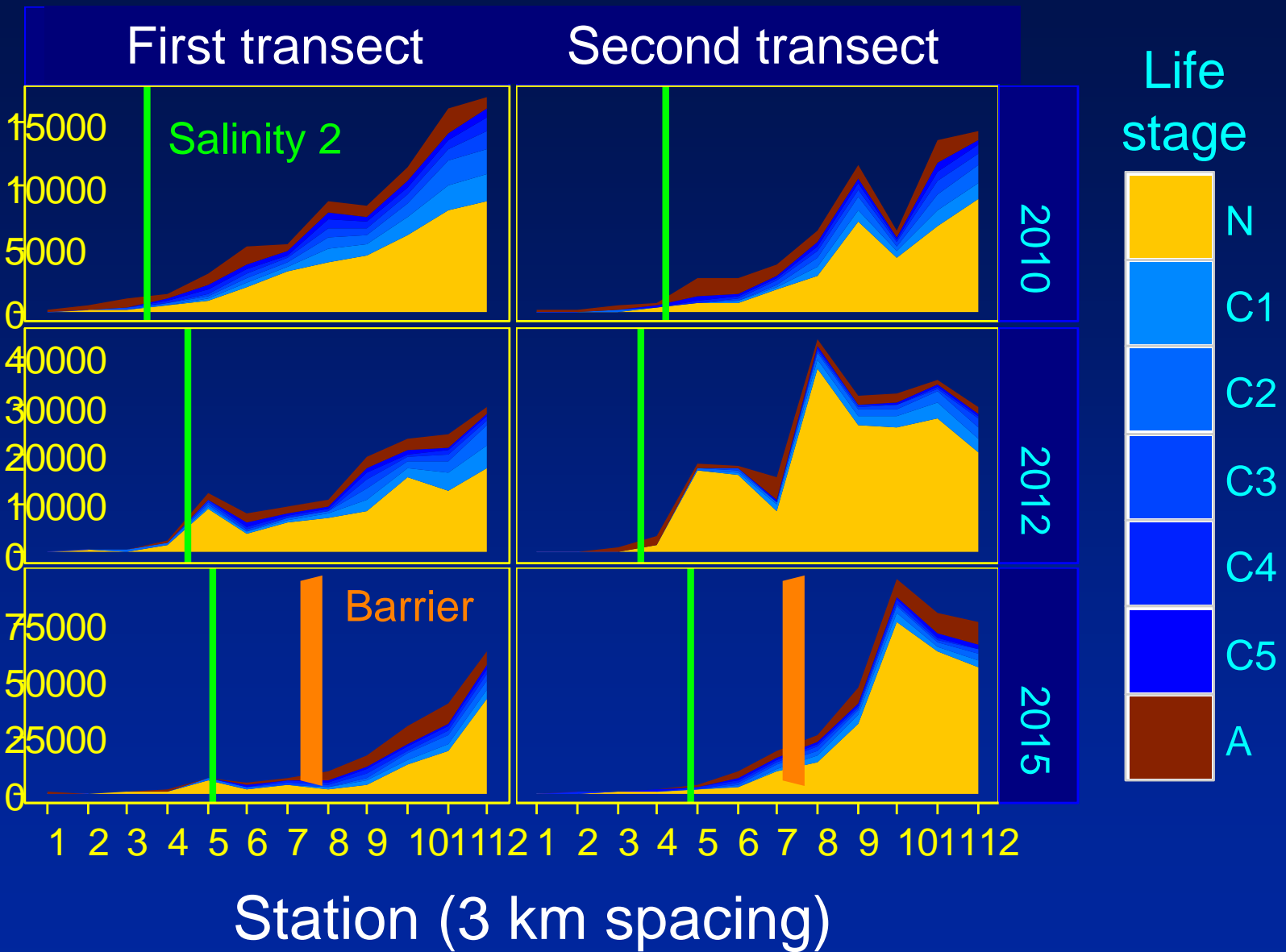
Copepodites (juveniles)

Nauplii (larvae)

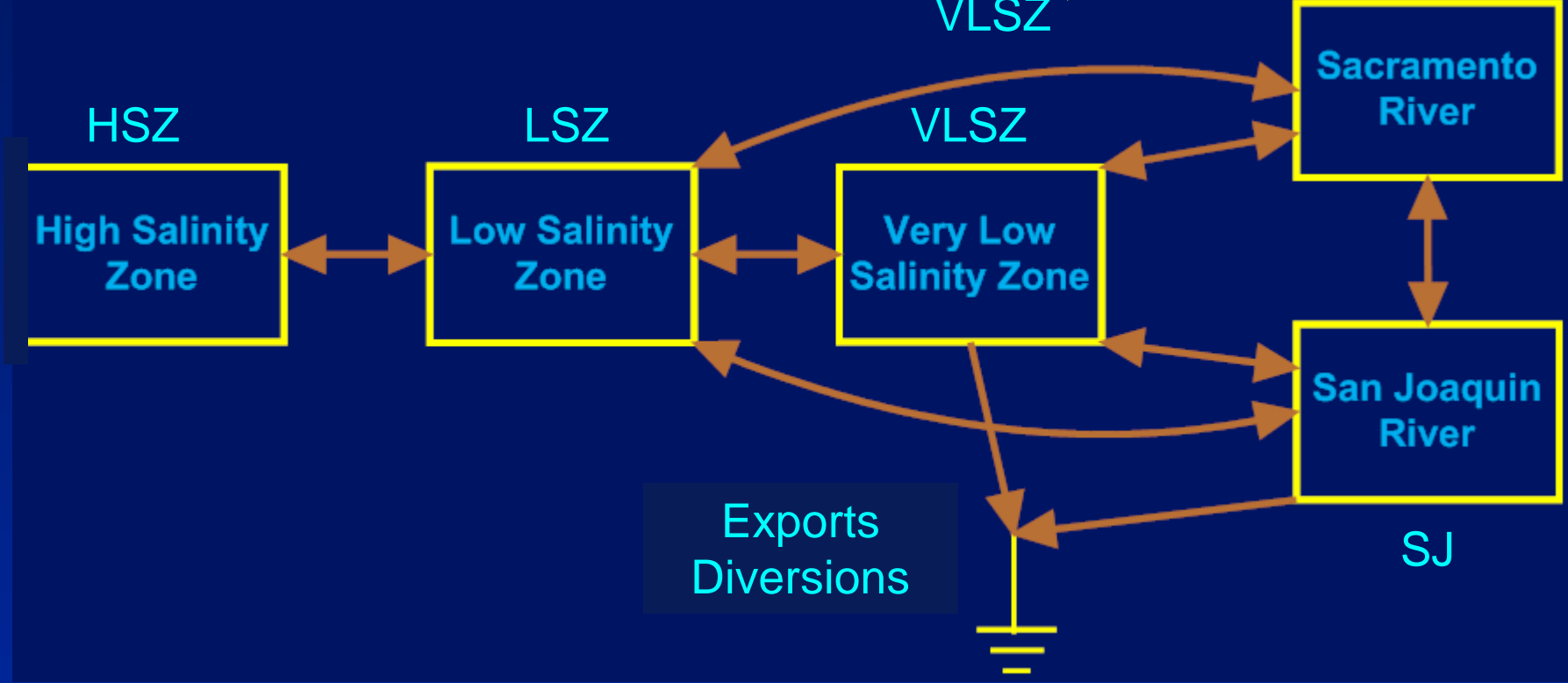


Plankton samples: San Joaquin River September 2015

Abundance, m^{-3} nce



Previous work: Spatial box model to estimate exchange

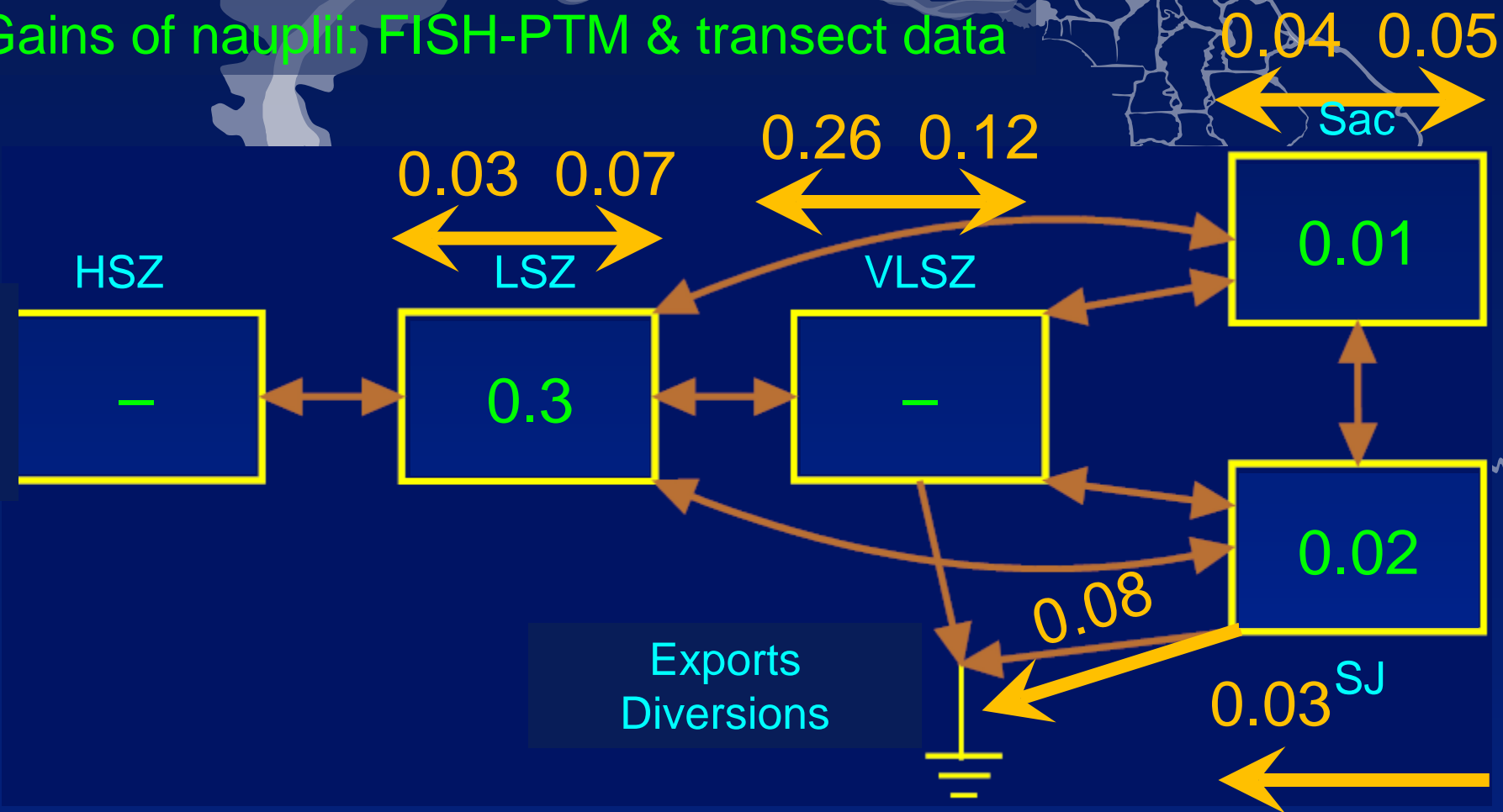


Spatial box model: daily proportional gains and losses

Low outflow ($X2 = 90$ km), No barrier

Losses: FISH-PTM

Gains of nauplii: FISH-PTM & transect data



Spatial box model: daily proportional mortality

Mortality by life stage, d^{-1}

Adults
Copepodites
Nauplii

HSZ

ND

LSZ

A 0.1
C 0.4
N 0.7

VLSZ

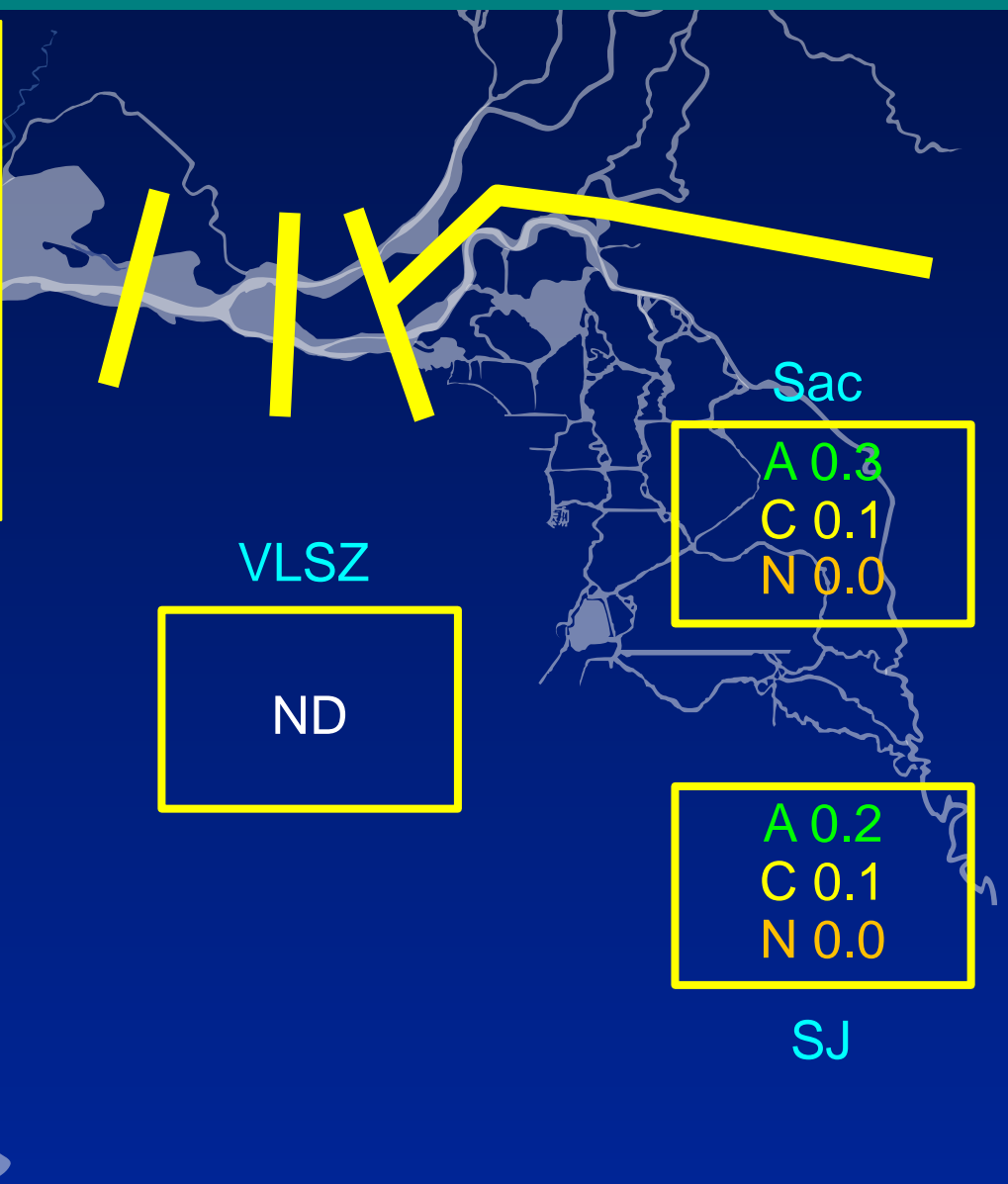
ND

Sac

A 0.3
C 0.1
N 0.0

A 0.2
C 0.1
N 0.0

SJ

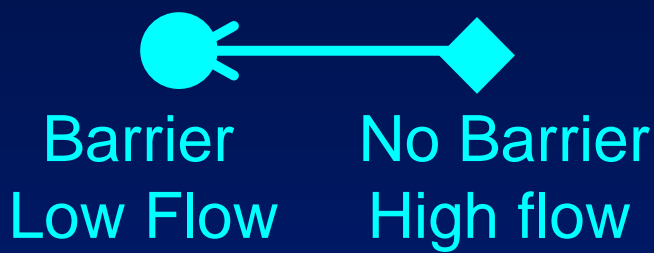


Spatial box model: floating boxes unsuitable!

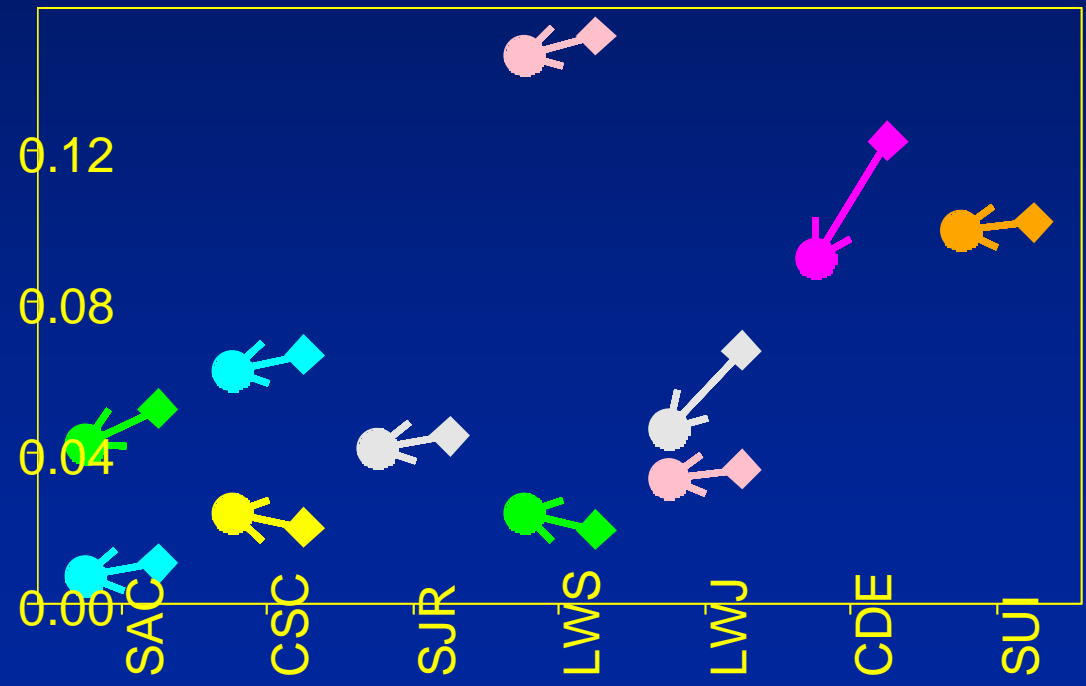
Revised spatial box model: fixed boxes



Exchange fractions usually lower with barrier...



Exchange fraction



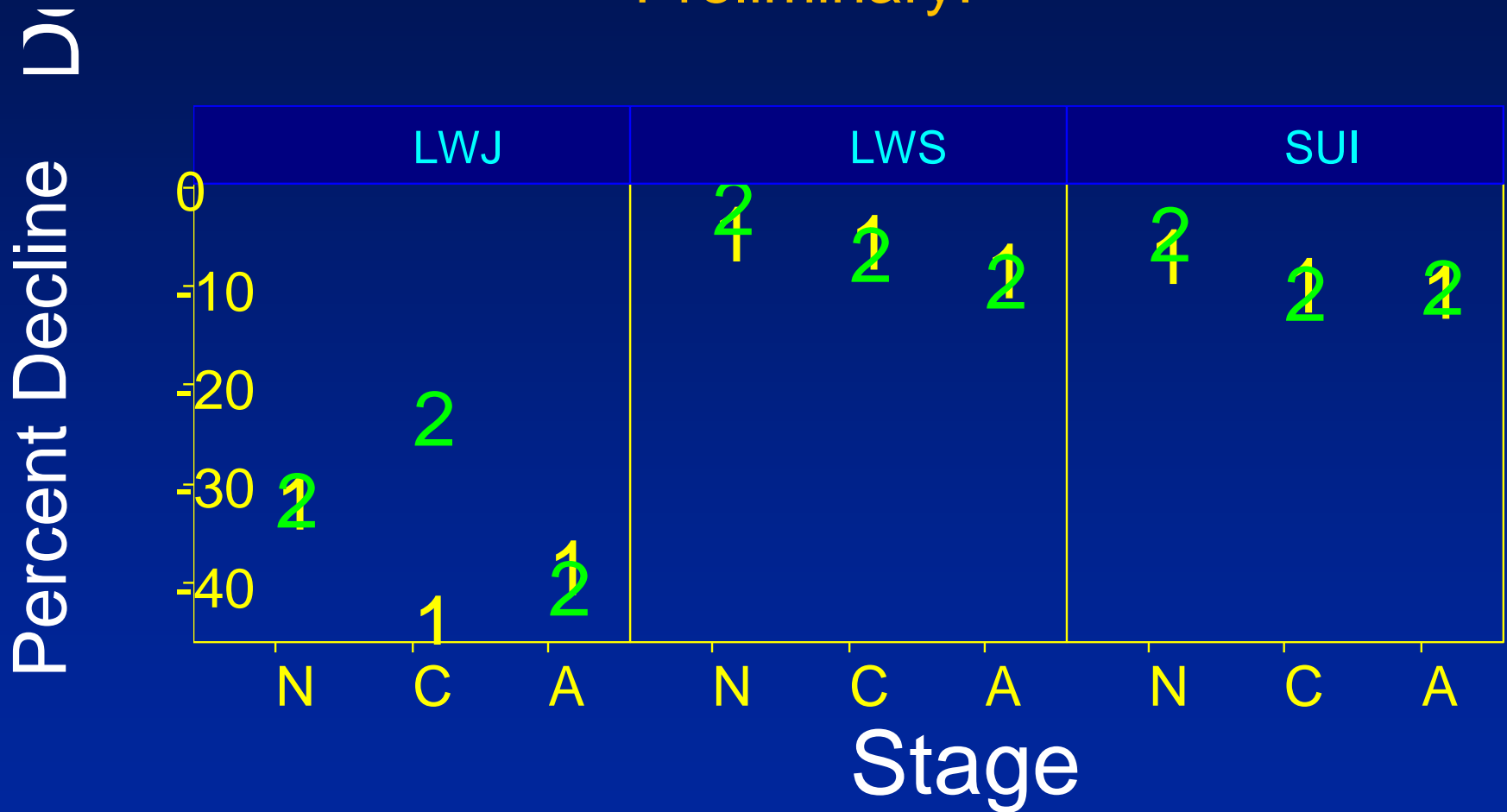
- Destination Box:
- Upper Sac R
 - Cache Sl. Complex
 - Lower Sac R
 - Lower San Joaquin
 - Central Delta
 - Suisun
 - Seaward

Source Box

... therefore barrier reduced flux of copepods

Change in proportional gains of copepods

Preliminary!



Consequences

- **Assumptions:**
 - Steady state
 - Constant mortality
- **Extrapolation:**
 - 2015 conditions
- **Conclusion:**
 - Moderate reductions in some areas
 - ~30% reduction in lower San Joaquin region

Thank you!



DELTA STEWARDSHIP COUNCIL

Karen Kayfetz
Toni Ignoffo, Ann Holmes,
Richard Rachiele Stacie Grinbergs
The Drought Barrier research team

UnTRIM hydrodynamic model grid