Biomass and Grazing of *Corbicula* and *Potamocorbula* today and in the future

1) What controls bivalve distribution and biomass today?
2) Can we influence their distribution today?
3) How will those controls affect their distribution with restoration and climate change?

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Heather Fuller[1], Jeff Crauder[2] , Dean Messer[2]

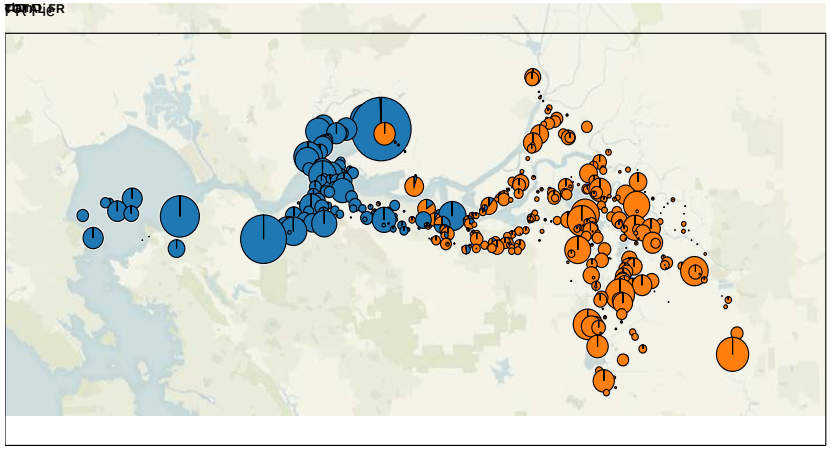
[1] USGS Menlo Park [2] California Department of Water Resources, EMP

Funding: USGS PES, TOXICS, NRP. DWR EMP monitoring. BOR POD. Bay Delta Science Grants (LSZ, CASCADE, Biomass, Se Transport)

What we have learned

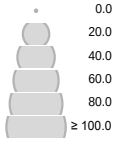
- *Potamocorbula* and *Corbicula* populations overlap in low salinity zone – larval and juvenile salinity tolerance is about 2
- *Corbicula* and *Potamocorbula* can both control phytoplankton biomass and they have opposing seasonal grazing cycles - does a spring bloom help?
- Both bivalves appear to be food limited
- Both bivalves thrive in restoration habitat <u>except seasonal flooded areas and small intertidal sloughs</u>
- Fall increase in freshwater in 2011 limited *Potamocorbula* distribution and grazing but probably not enough for phytoplankton to bloom
- We have found *Potamocorbula* distribution is limited by predation and the salinity required for reproduction
- Neither bivalve is likely to be effected by an increase in temperature and *Corbicula's* reproductive season may lengthen.

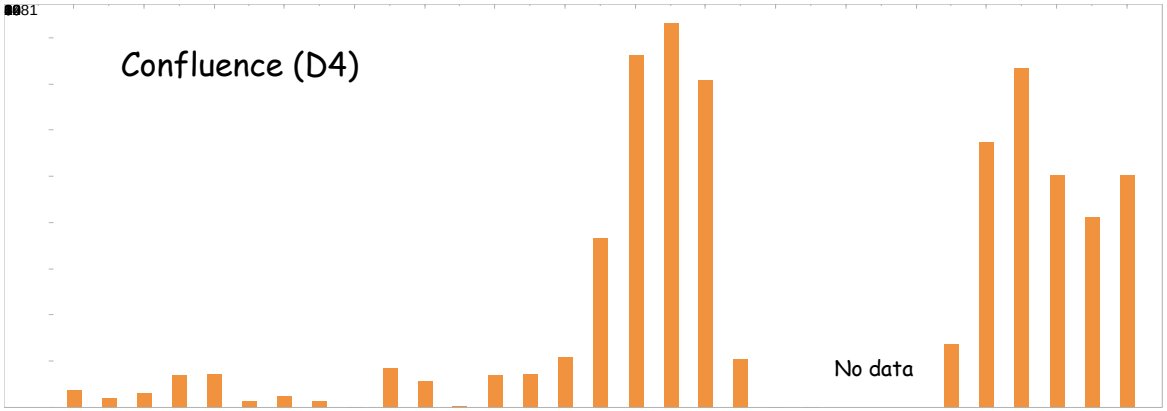
Why we need to consider *Potamocorbula* <u>and</u> *Corbicula* distribution and grazing in restoration plans.



Why *Corbicula*?

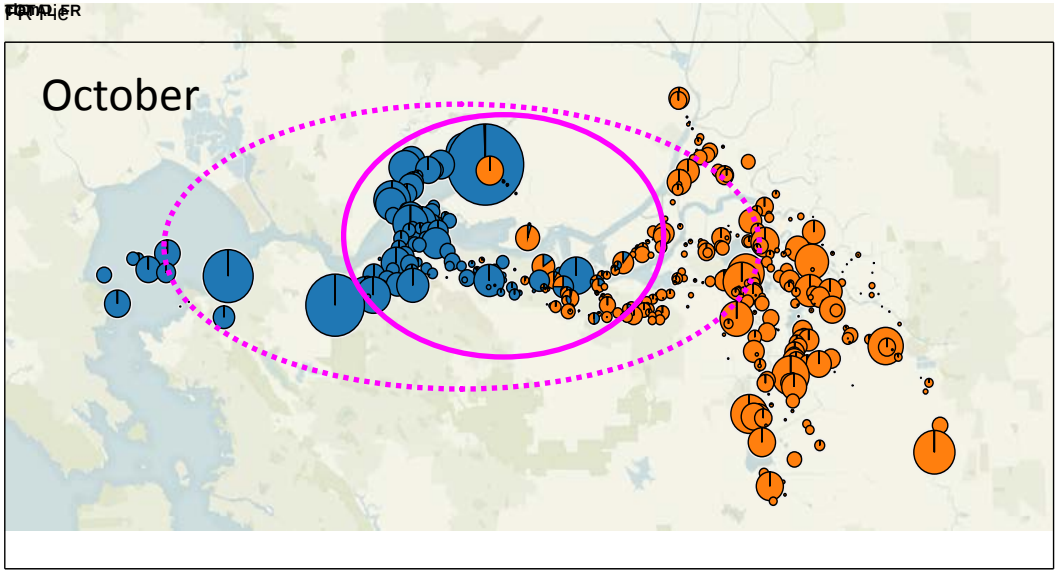
Corbicula distribution overlaps with *Potamocorbula* and is increasing in biomass at some locations.

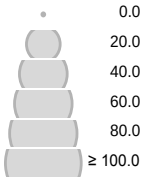




Data from DWR GRTS and monthly monitoring data.

Potamocorbula and *Corbicula* are both present in the ecologically sensitive Low Salinity Zone and its dispersion zone.





Biomass and Grazing of *Corbicula* and *Potamocorbula* today and in the future

1) What controls bivalve distribution and biomass today?
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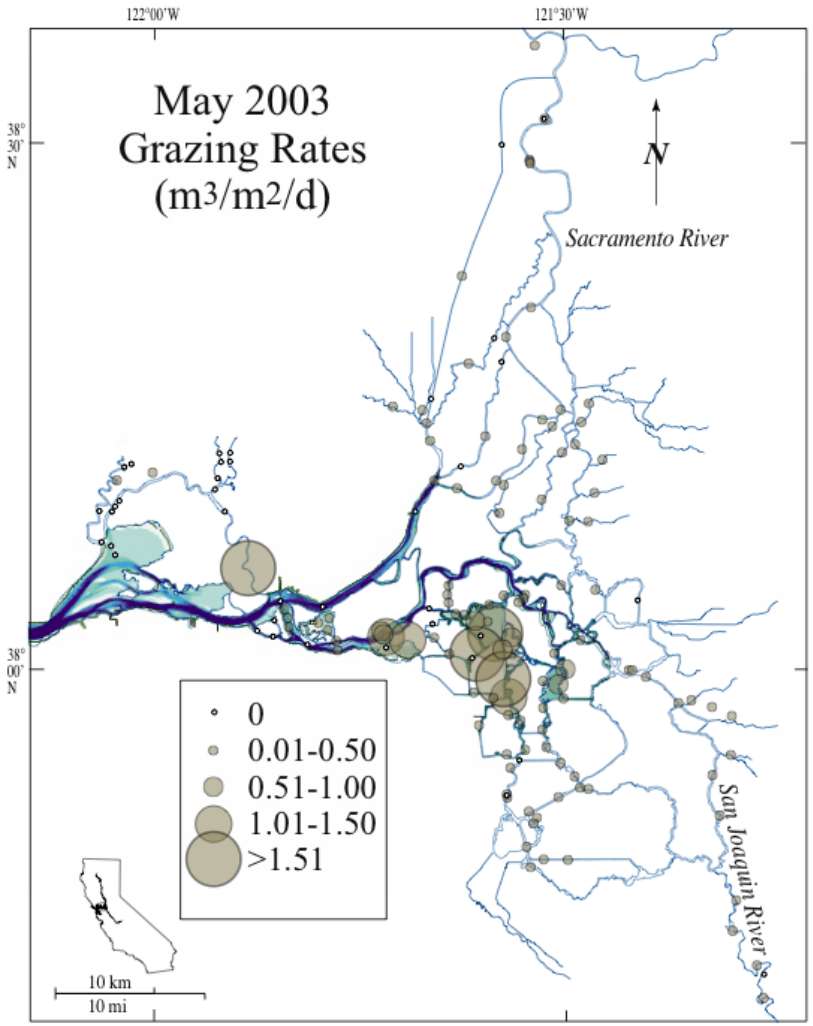
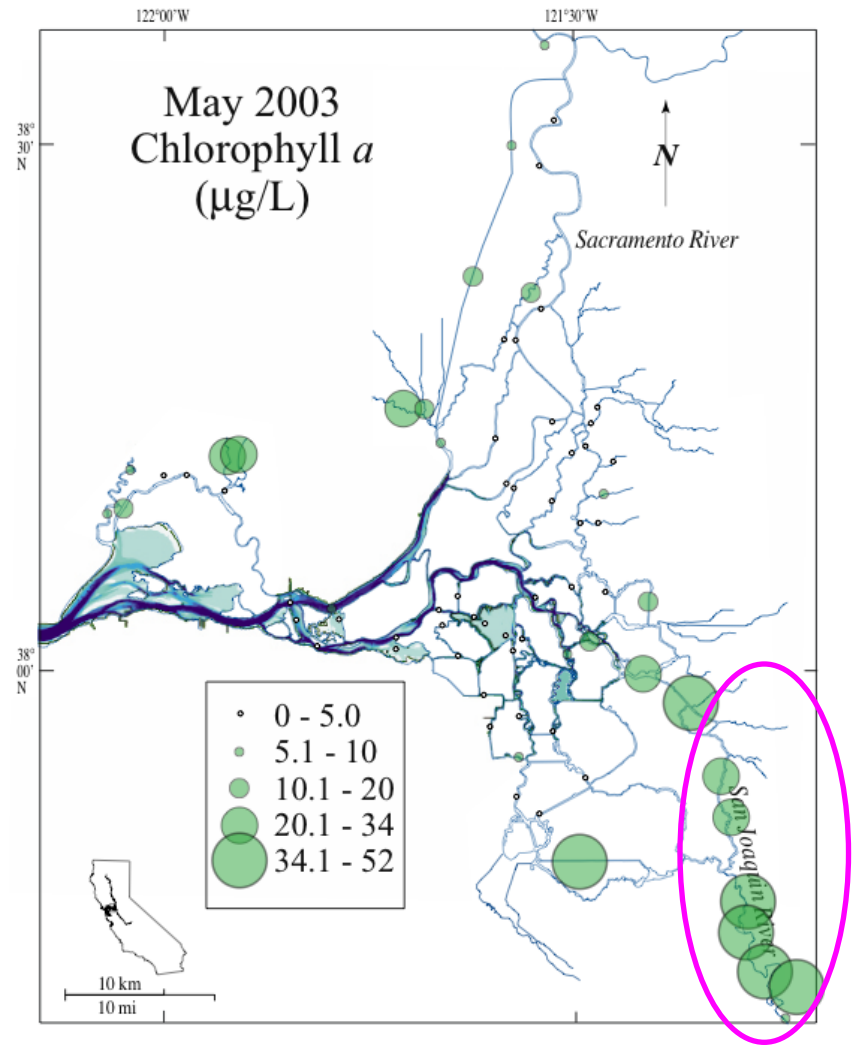
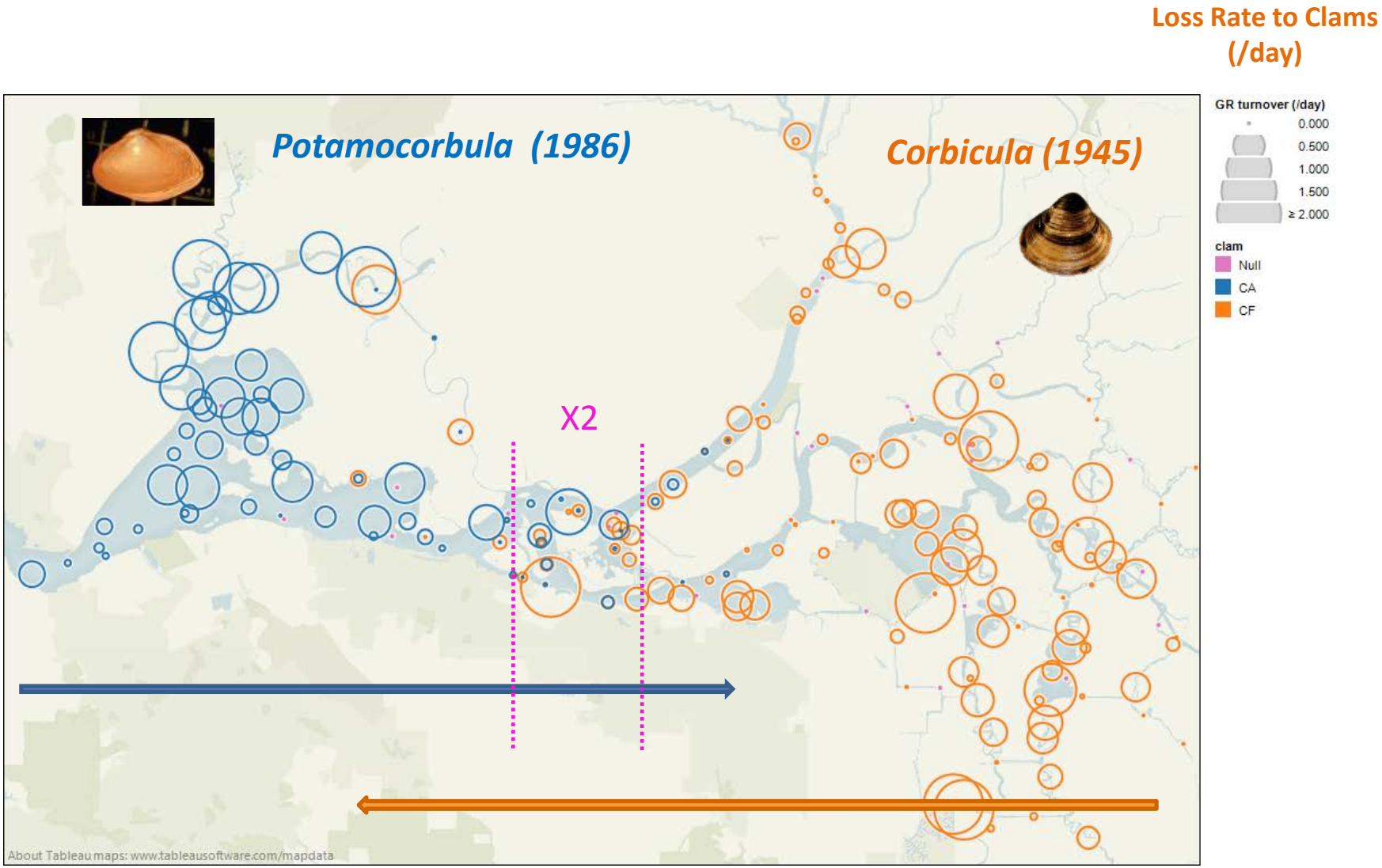
At the Delta-scale high phytoplankton biomass is only found in areas where clam grazing is low. However the converse is not true – it's not <u>all</u> about clams but we do need to understand their distribution.



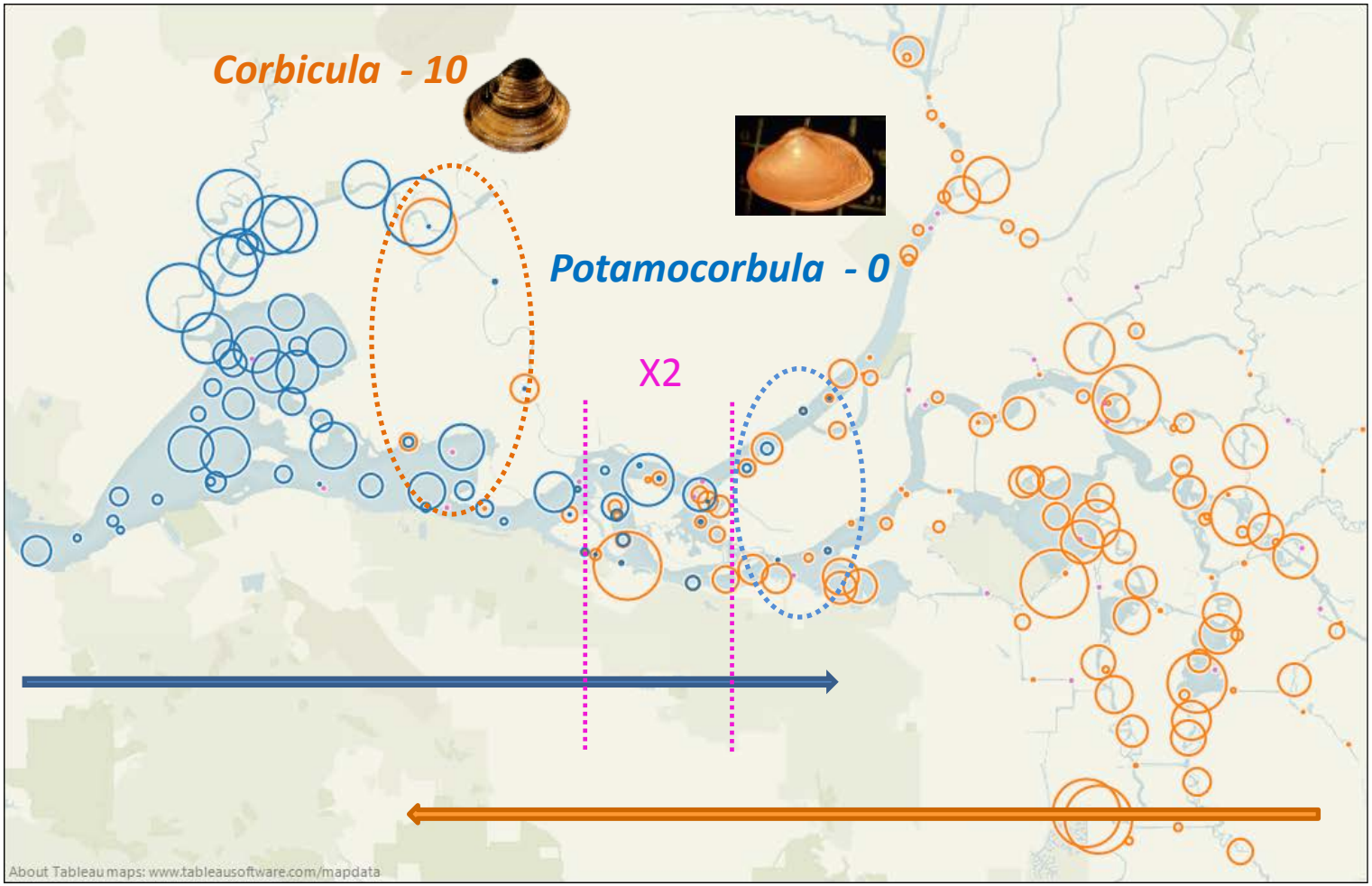


Parchaso and Thompson (in prep)

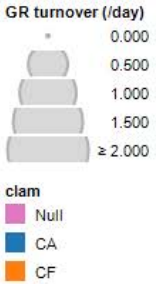
Clam species settle upstream and downstream of a salinity of 2 due to salinity tolerance of juveniles.



Once settled, both bivalves have a legacy distribution as adults tolerate a wider salinity range.



Loss Rate to Clams (/day)



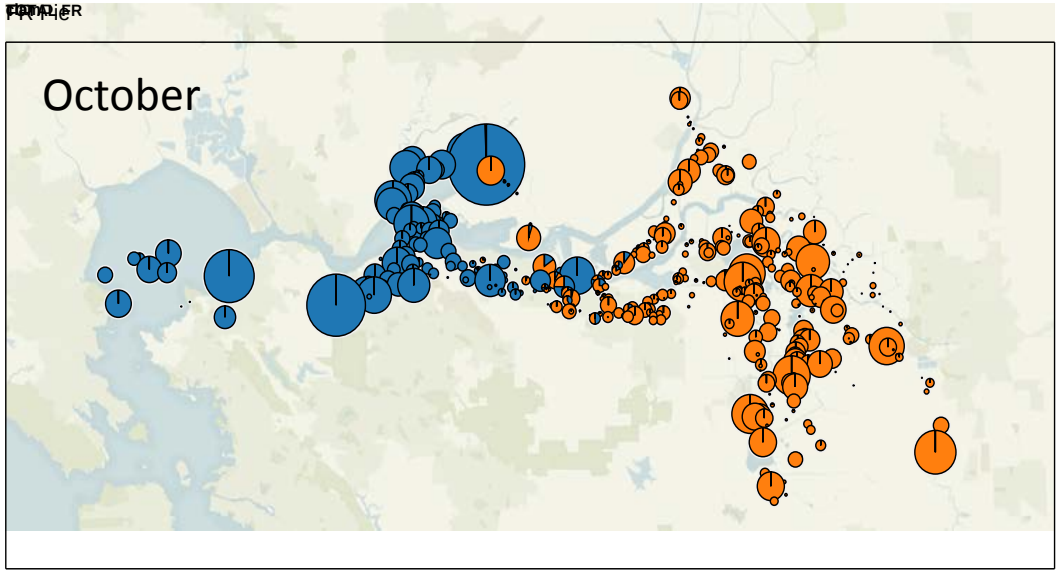
Persistent observations on distribution:

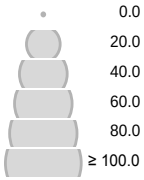
1: ***Potamocorbula*** grazing is greater in fall than spring

2: ***Corbicula*** grazing rate is larger in spring than fall in many areas

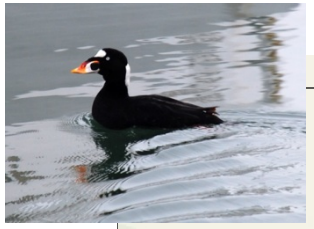
3: Grazing rate is lower around the confluence then upstream and downstream during both seasons.

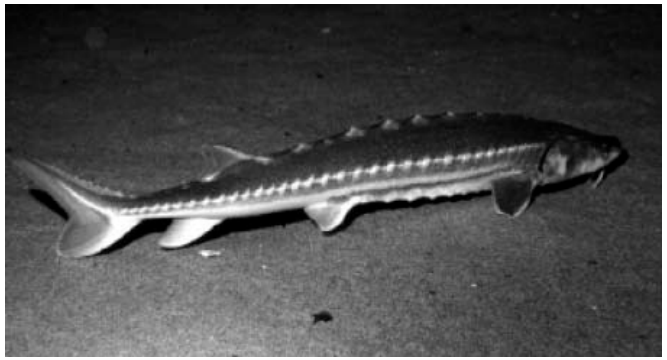
4: Shallow water grazing rate in Grizzly, Suisun and Honker Bays is very low in spring ---

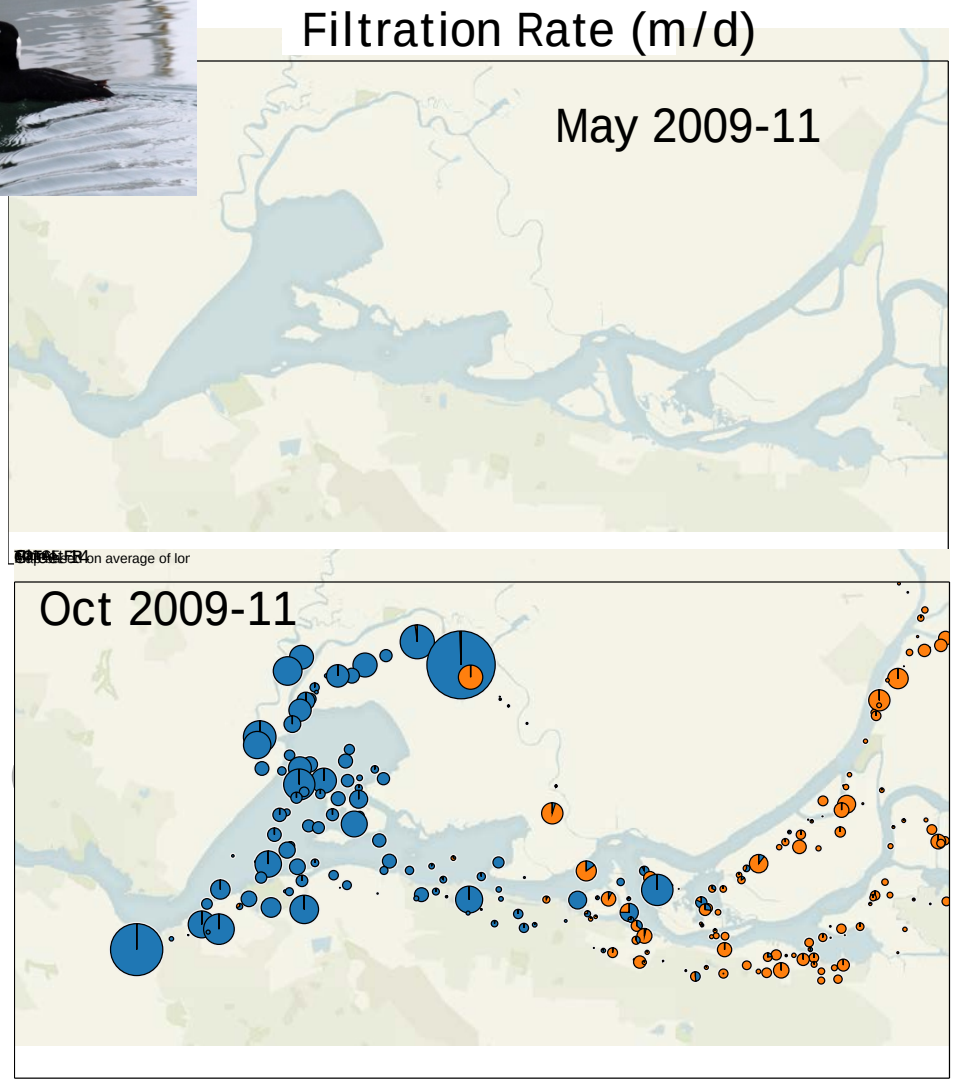


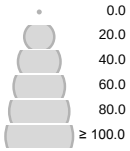


This persistent and spatially consistent pattern is good news if other environmental factors are good for a spring bloom.









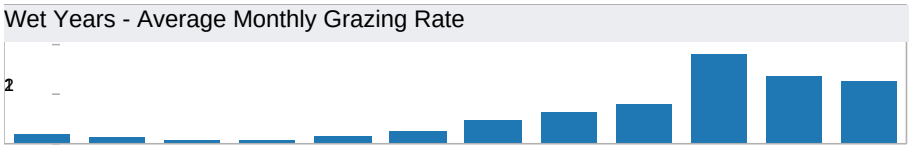
At a finer temporal scale, Potamocorbula…

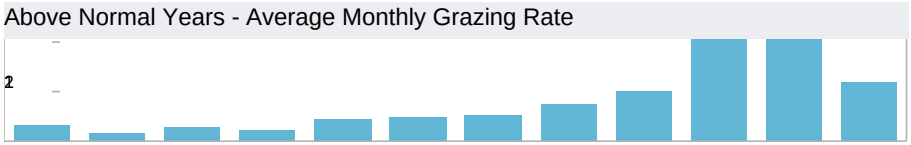
…biomass and thus grazing rate slowly increases from the spring minimum to a peak in fall in wet years.

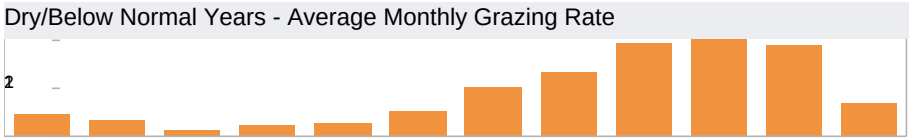
…biomass is greater in spring and the fall increase starts earlier as the years become drier.

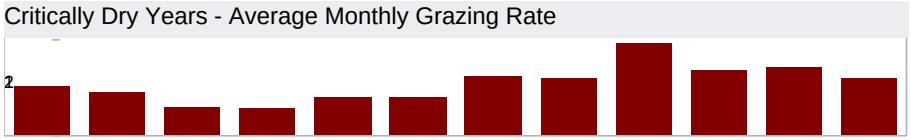
This seasonal pattern could be result of delayed recruitment, increased mortality or reduced growth rate with wetter conditions.

[Grizzly Bay (D7) 1986-2012 – data binned by water year]

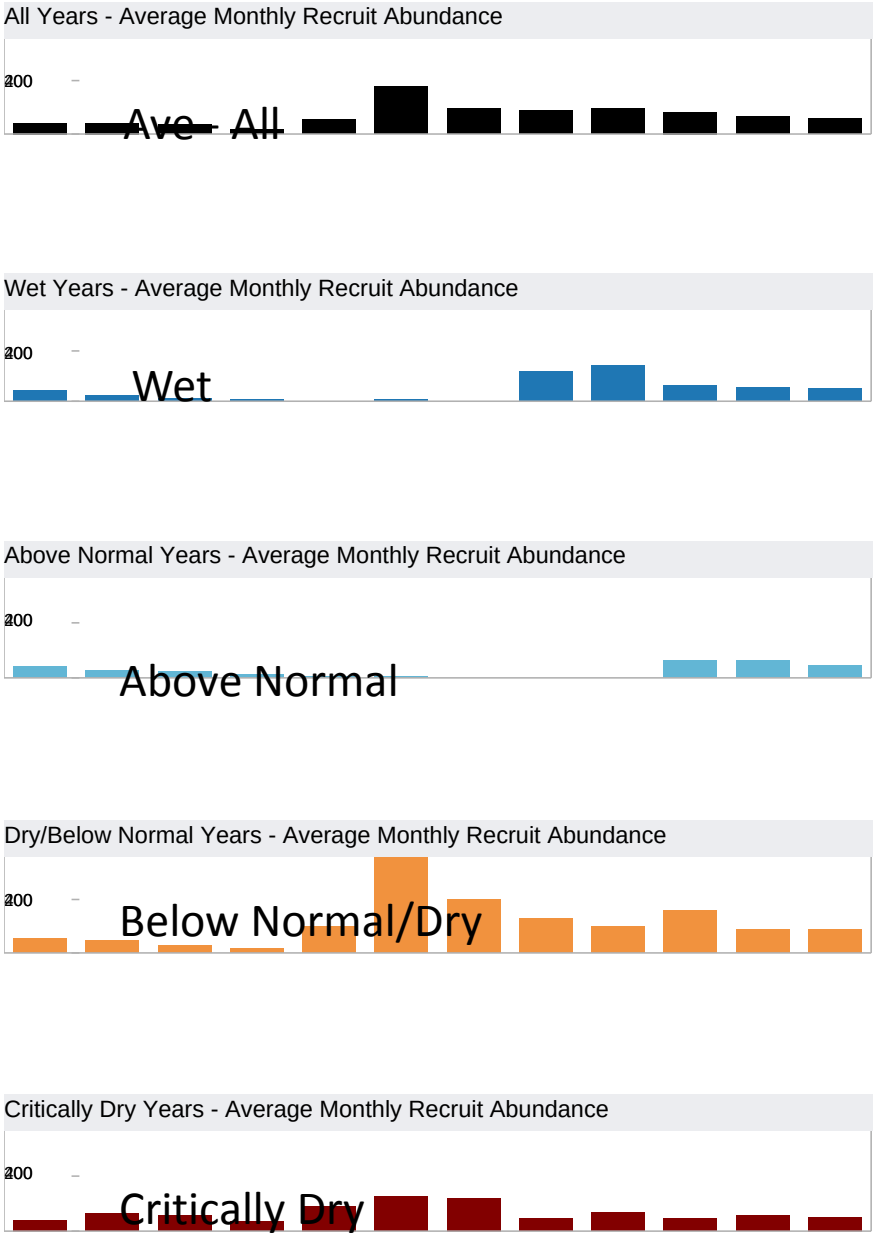


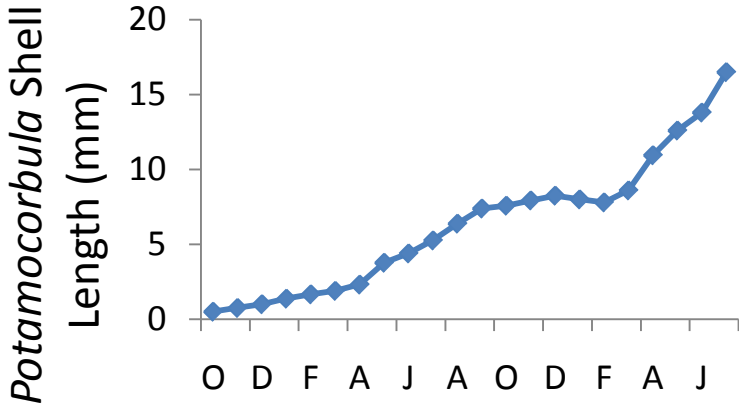






In drier years recruitment can occur year round which allows recruits to take advantage of the faster growth rate in spring and summer.





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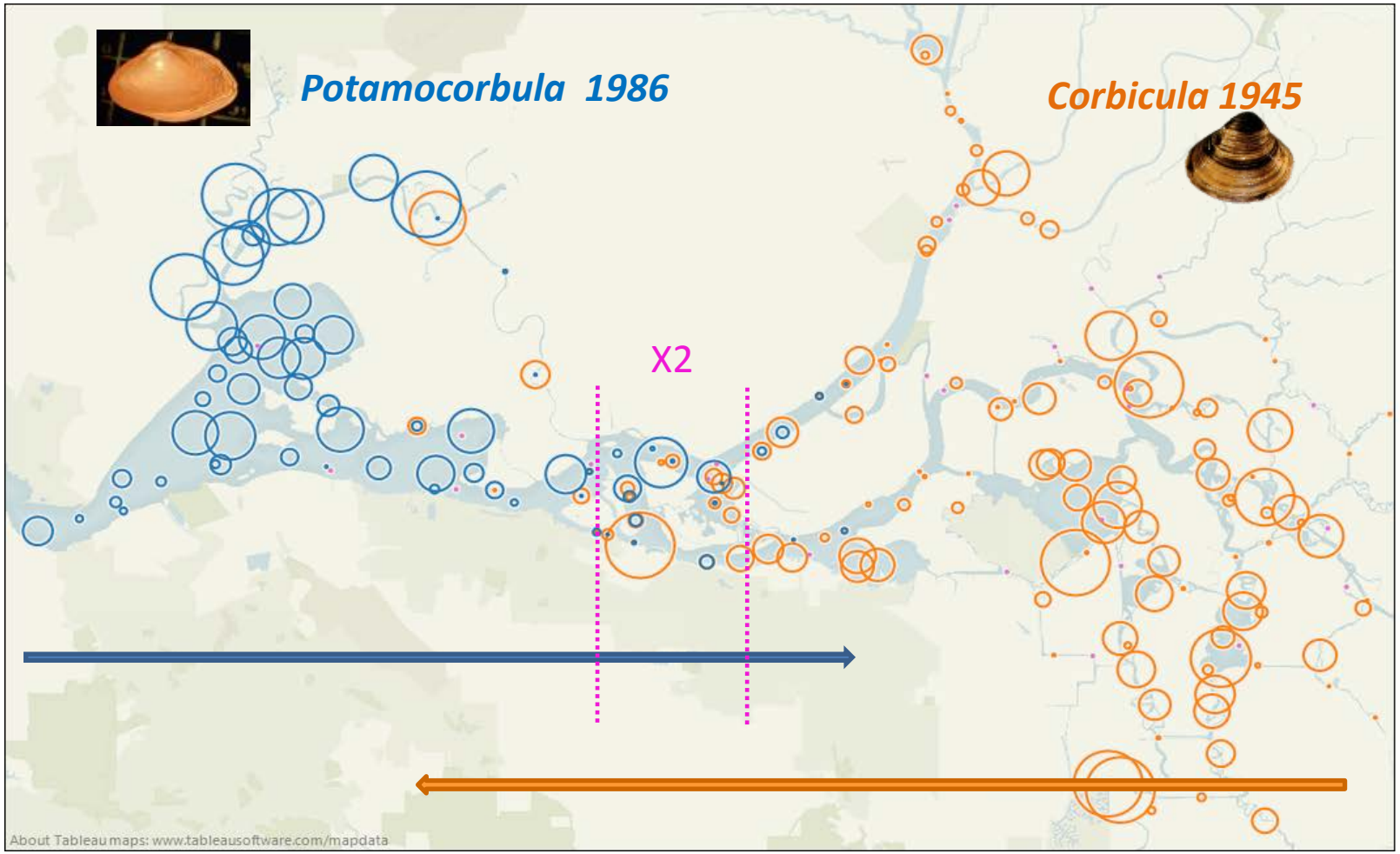
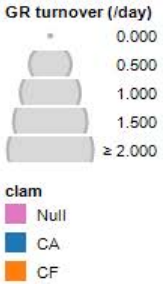
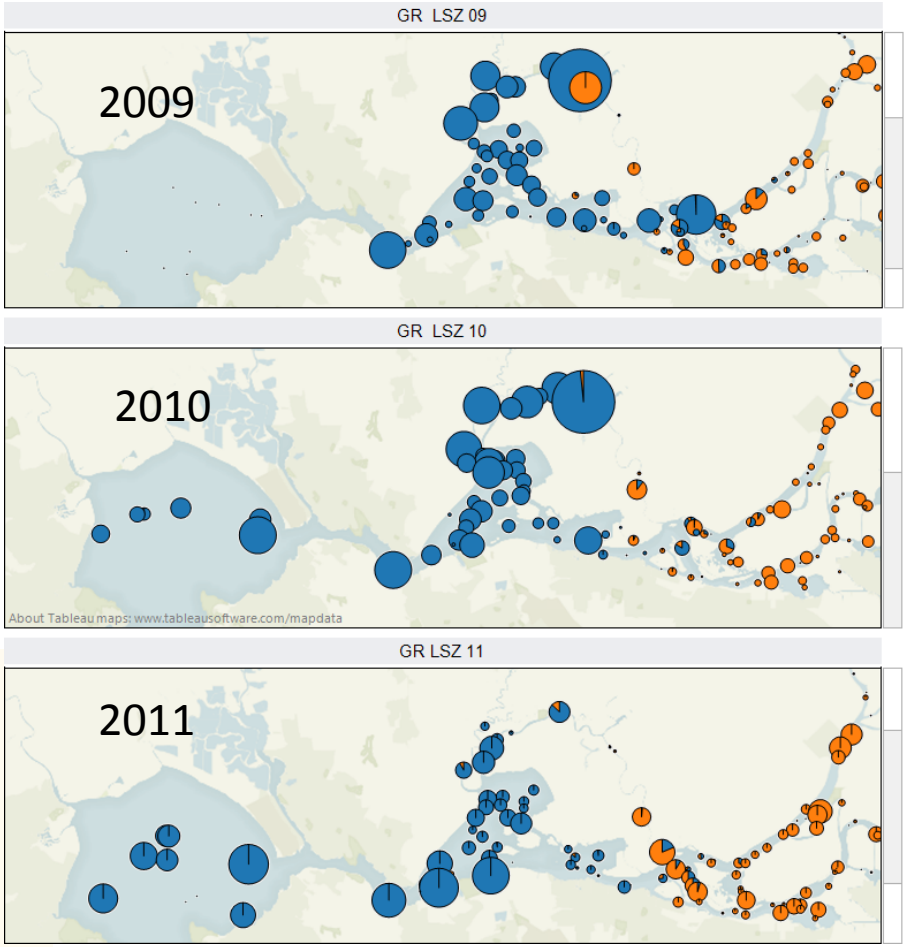
Can we alter salinity to limit *Potamocorbula* without encouraging *Corbicula*? (P. Moyle)

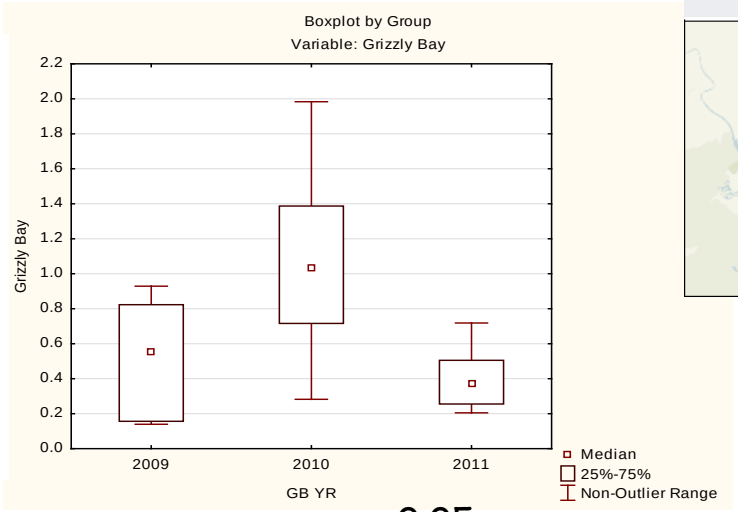


Loss Rate to Clams (/day)

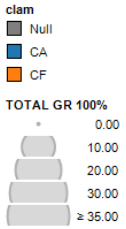


Grazing in Grizzly and Honker Bay was lower in fall of wet year 2011---

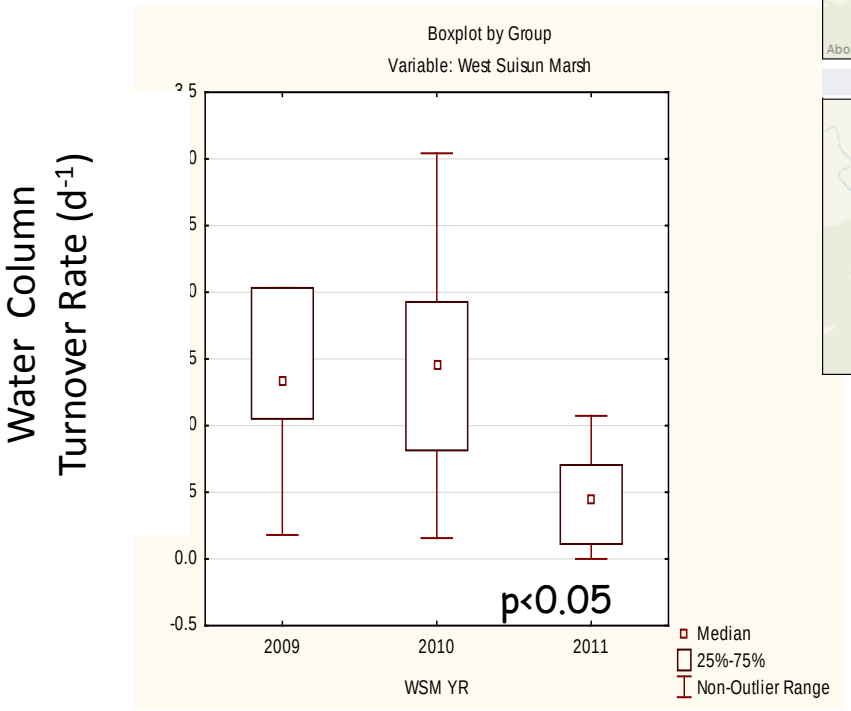


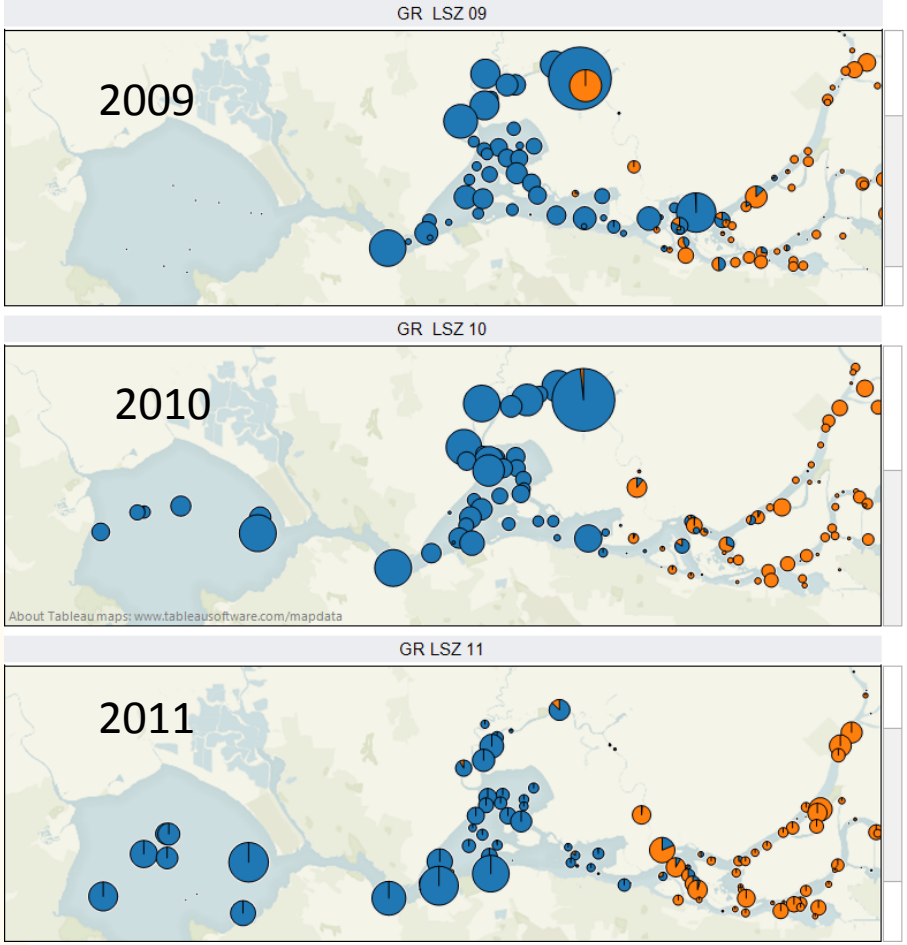


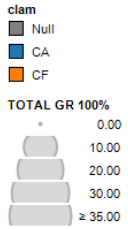
$p<0.05$

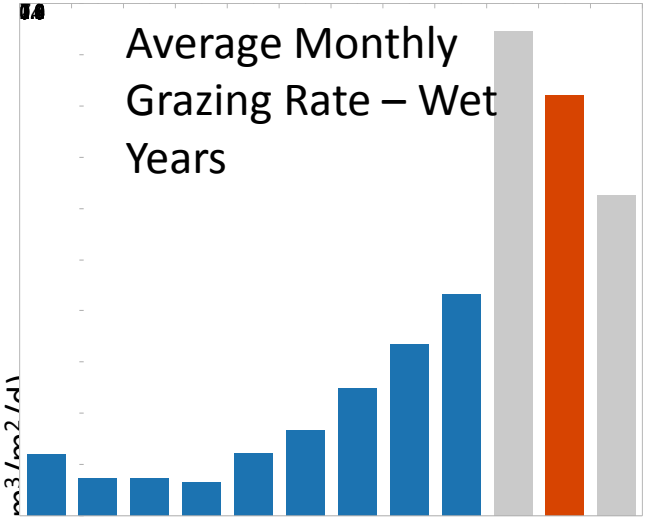


Grazing in Suisun Marsh was lower in fall of wet year 2011---

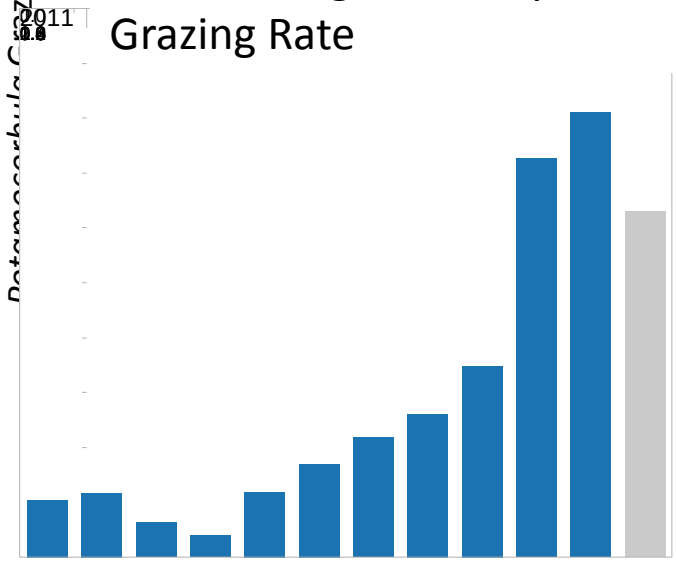


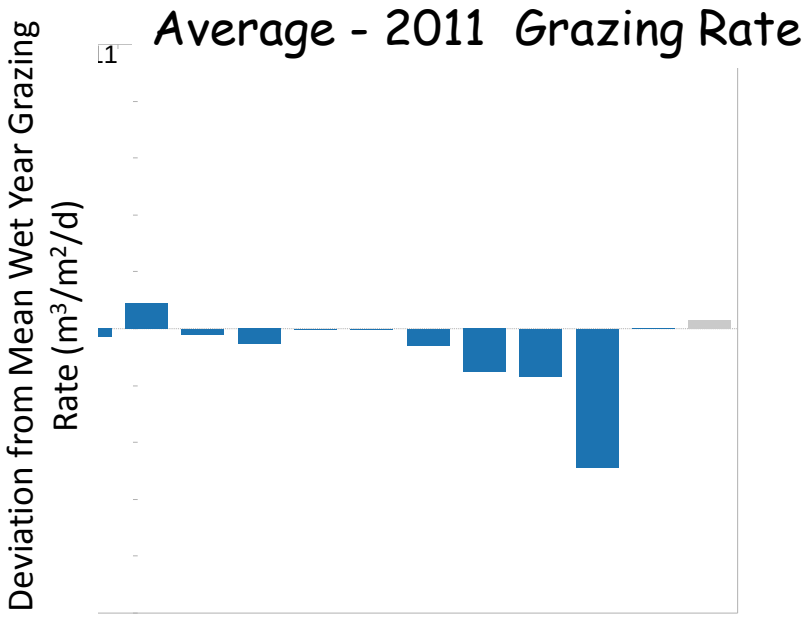




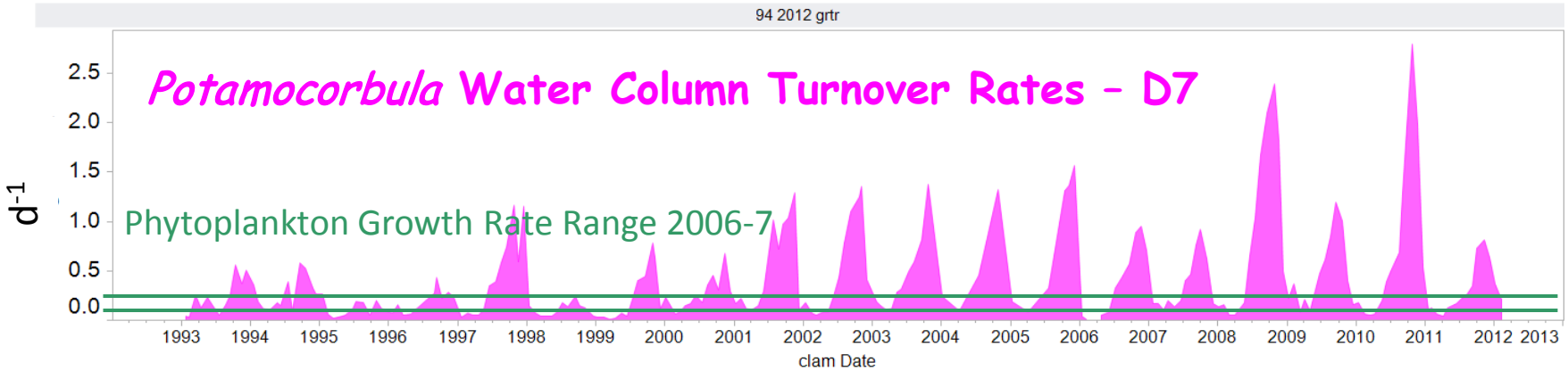


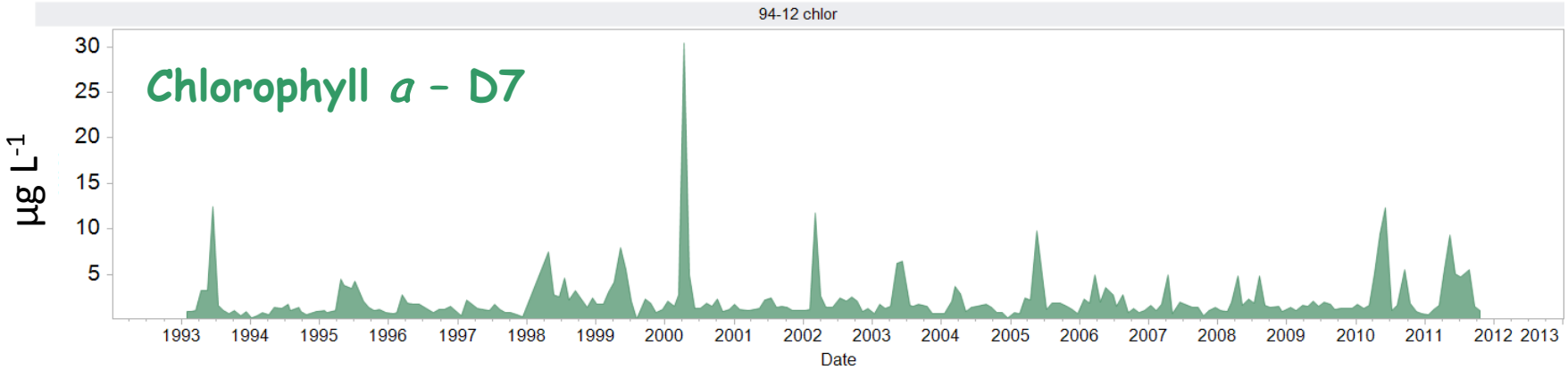
Grazing rate at D7 in 2011 was similar to the wet year average except in early fall.





Conclusion: Grazing rates in the shallow phytoplankton growth habitat were low enough to allow a bloom (assuming zooplankton grazing, light, nutrients, residence time are agreeable) in spring of 2009-2011 and but probably not fall 2011.





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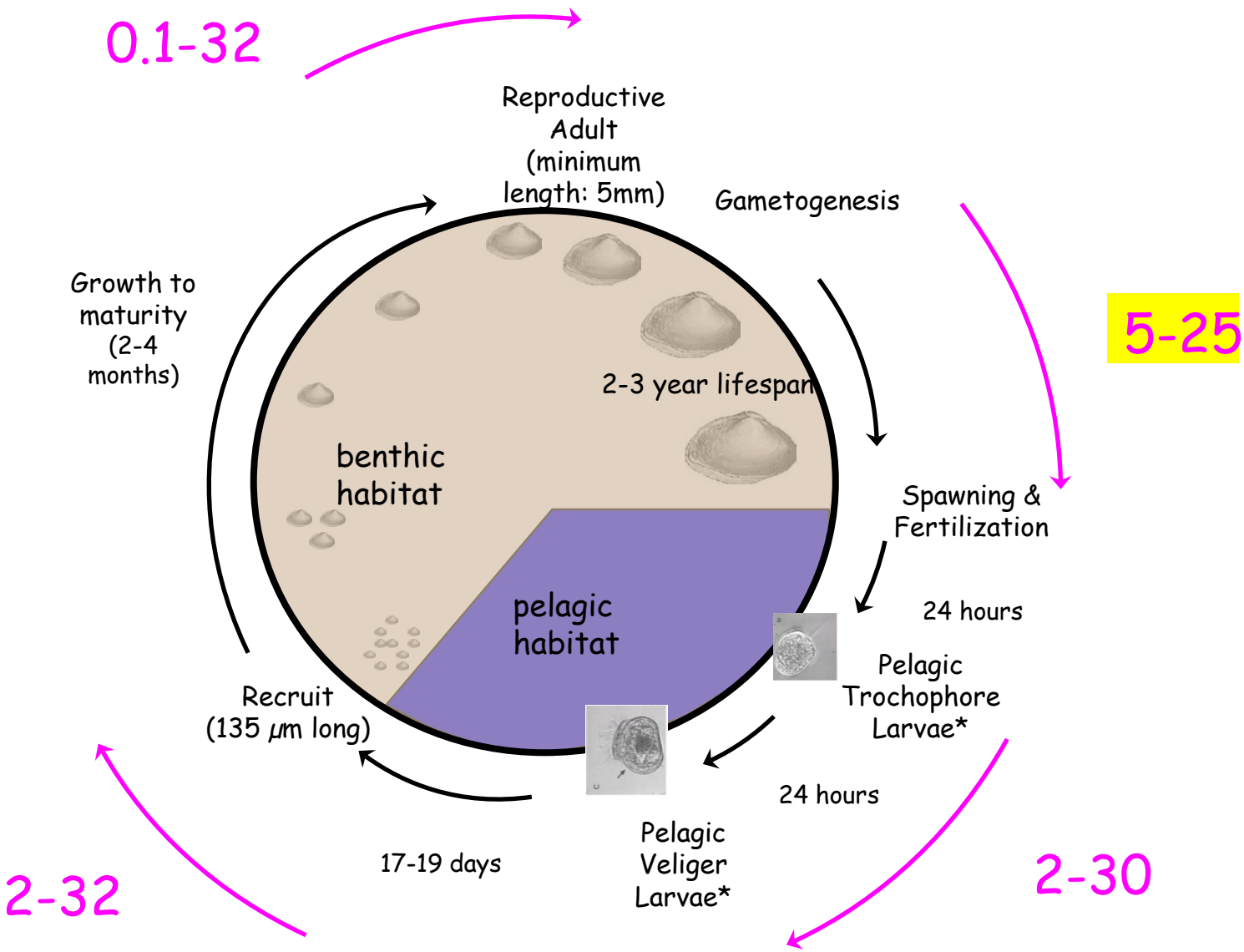
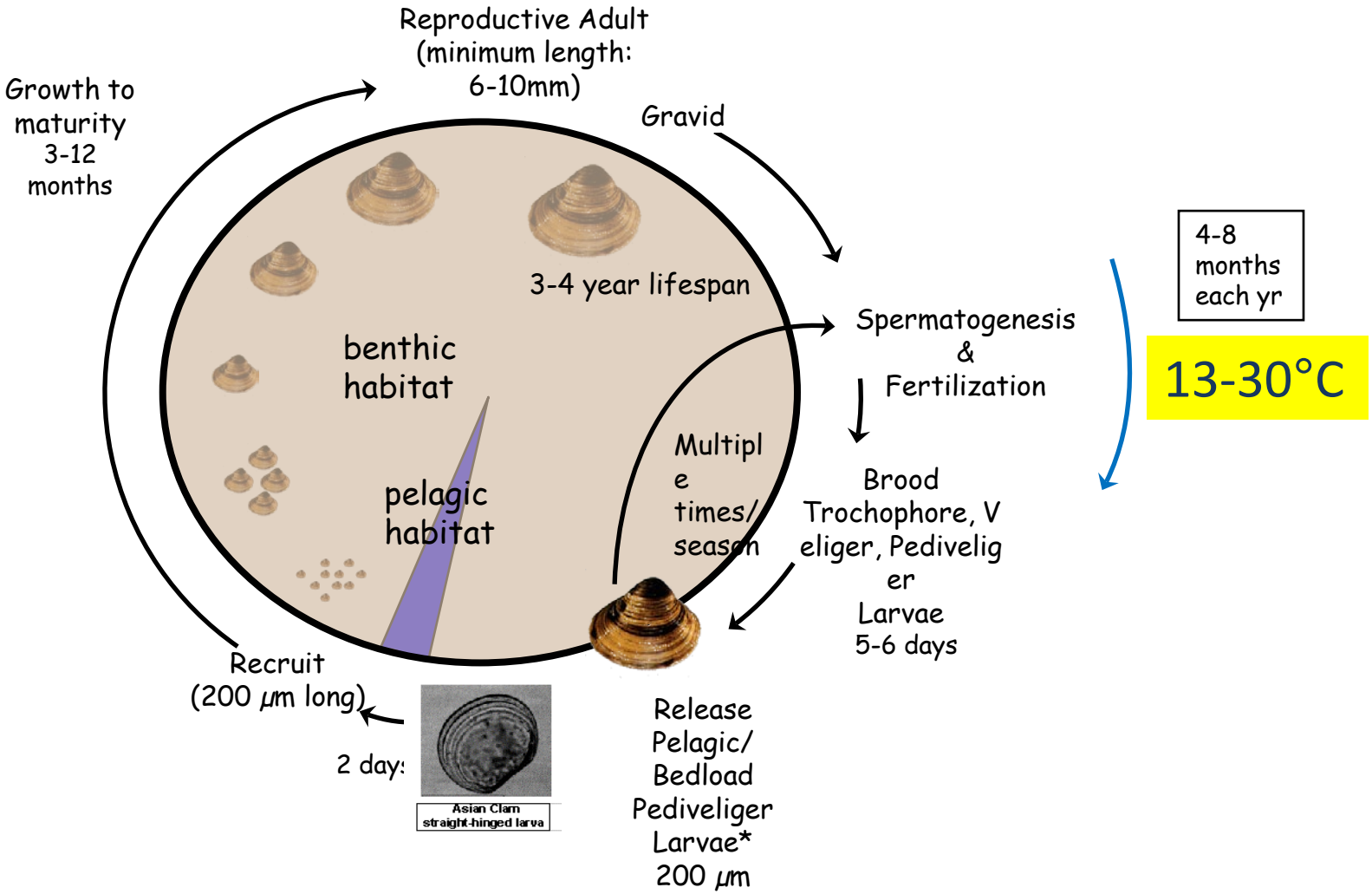
The "bottleneck" for *Potamocorbula* may be the salinity limits on gametogenesis and spawning.



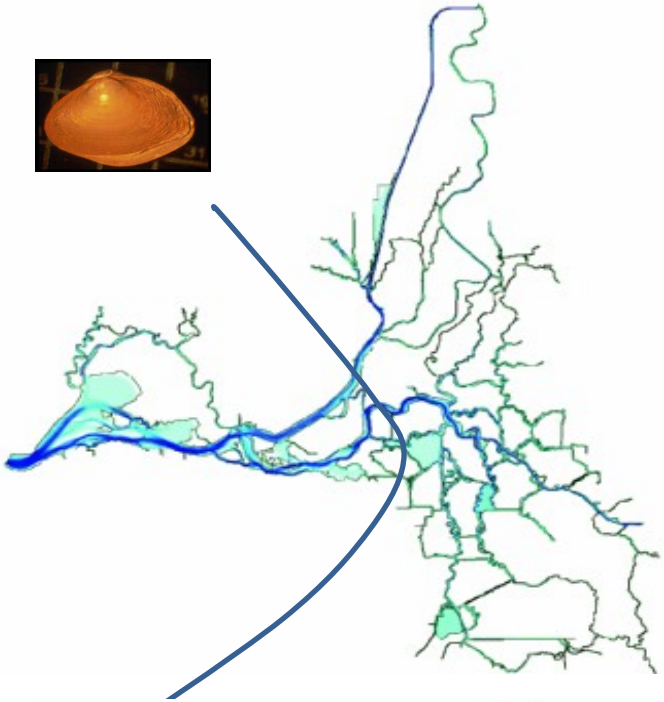
The period of reproductive activity may increase for *Corbicula* with warming.



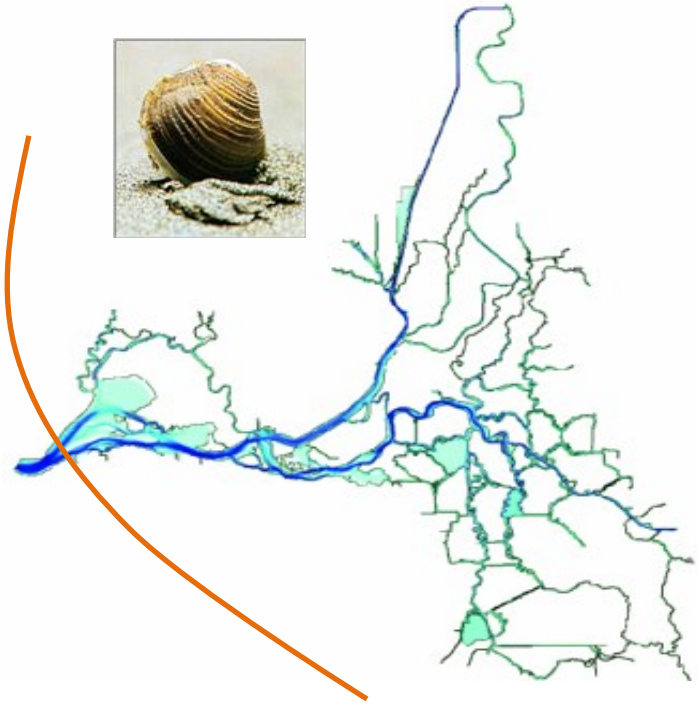
*http://el.erdc.usace.army.mil/zebra/zmis/zmishelp4/distinguishing_between_dreissenid_species.htm

Restore Where?

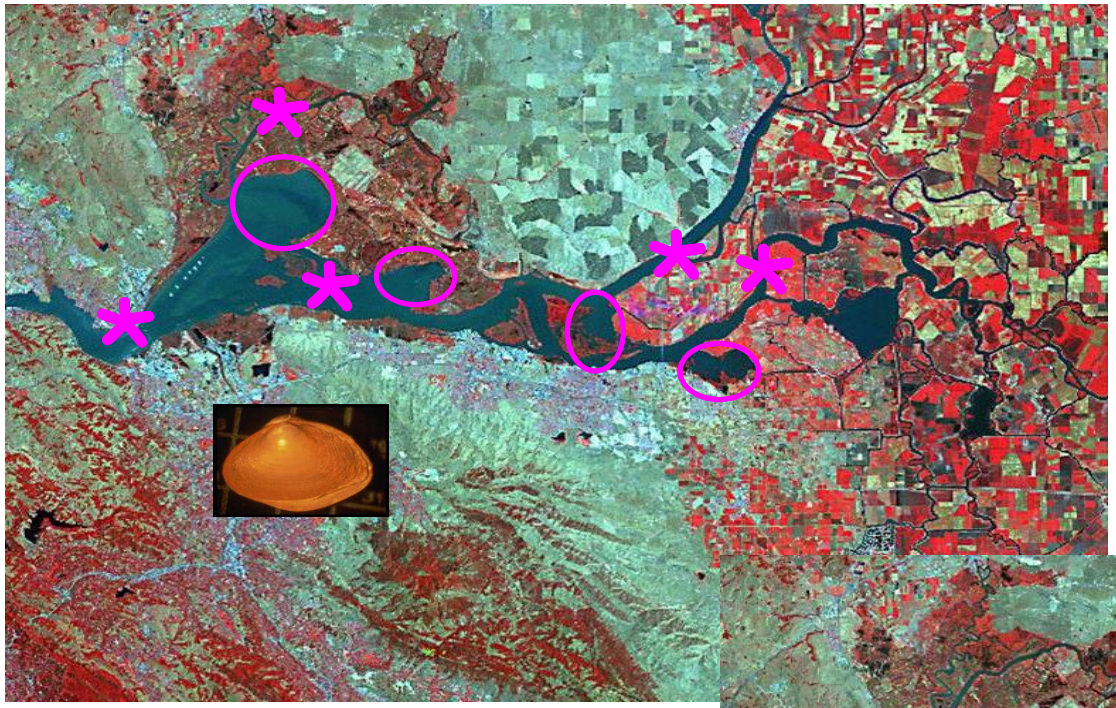
Potamocorbula distribution range 1986-2012.

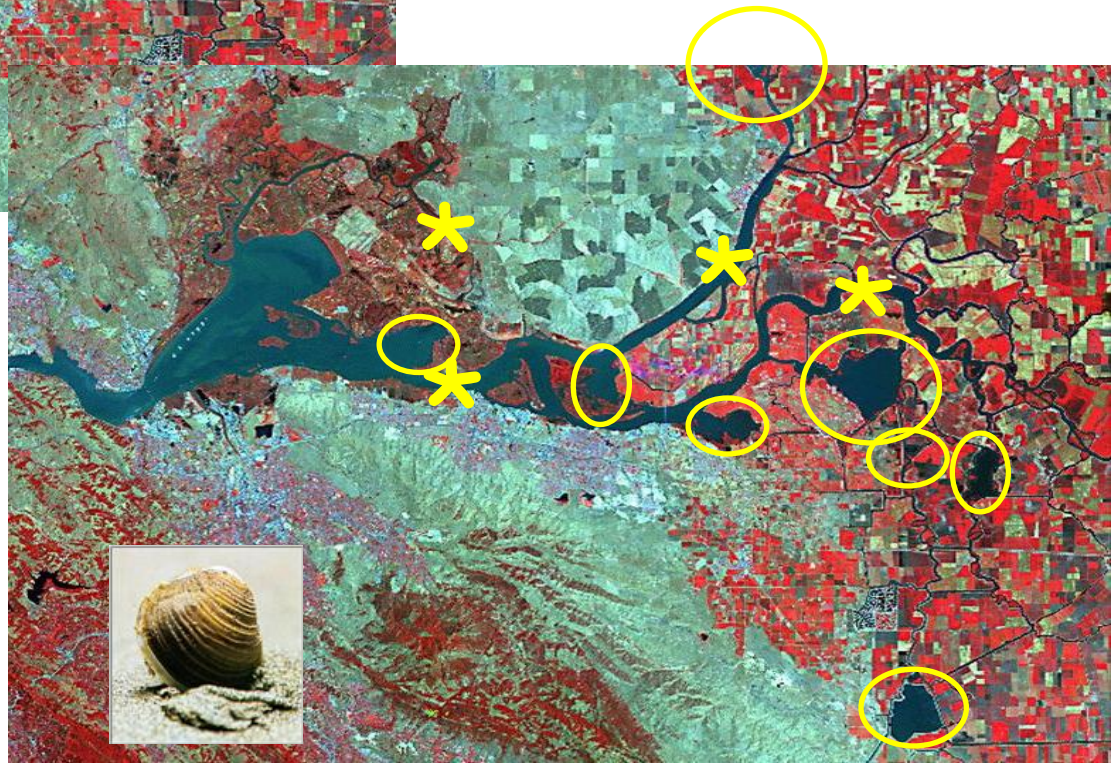


Corbicula distribution range 1977-2012.



Both species can inhabit channels, sloughs, lakes and rivers <u>but neither do well with frequent and prolonged exposure</u>





Restoration Options May be Limited

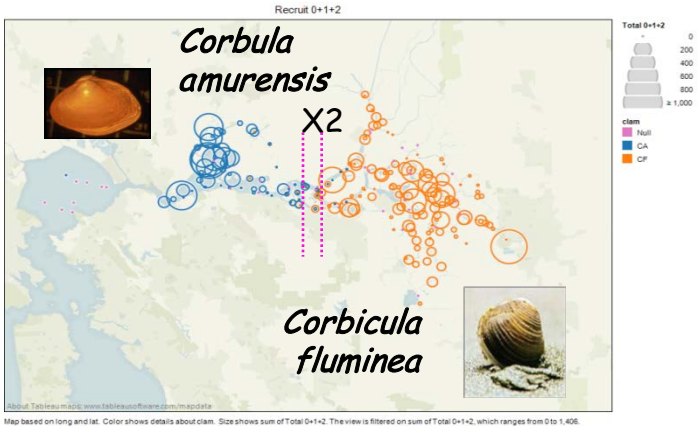
Shallow water habitat and/or its connecting waterways are good clam habitat.

Small sloughs may not be good habitat but the larger sloughs that they empty into may be excellent bivalve habitat. Contribution of primary producers relative to grazer consumption in connecting areas needs to be modeled.

Seasonal flood plains will not be good for either bivalve

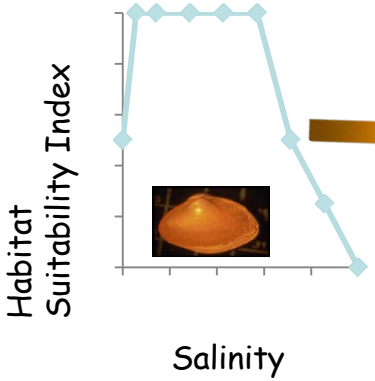
CASCADE

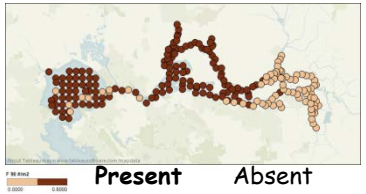
J. Thompson, F. Parchaso



Q: How will grazing rates change? (←→phytoplankton model)
Q: How will distributions and biomass change? (→contaminant model)

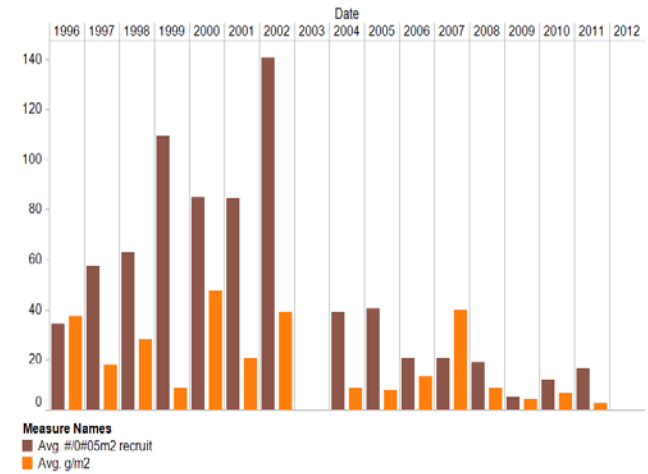
Bivalve distribution established with HABITAT, using response curves and water quality data from DFLOW-FM – for example

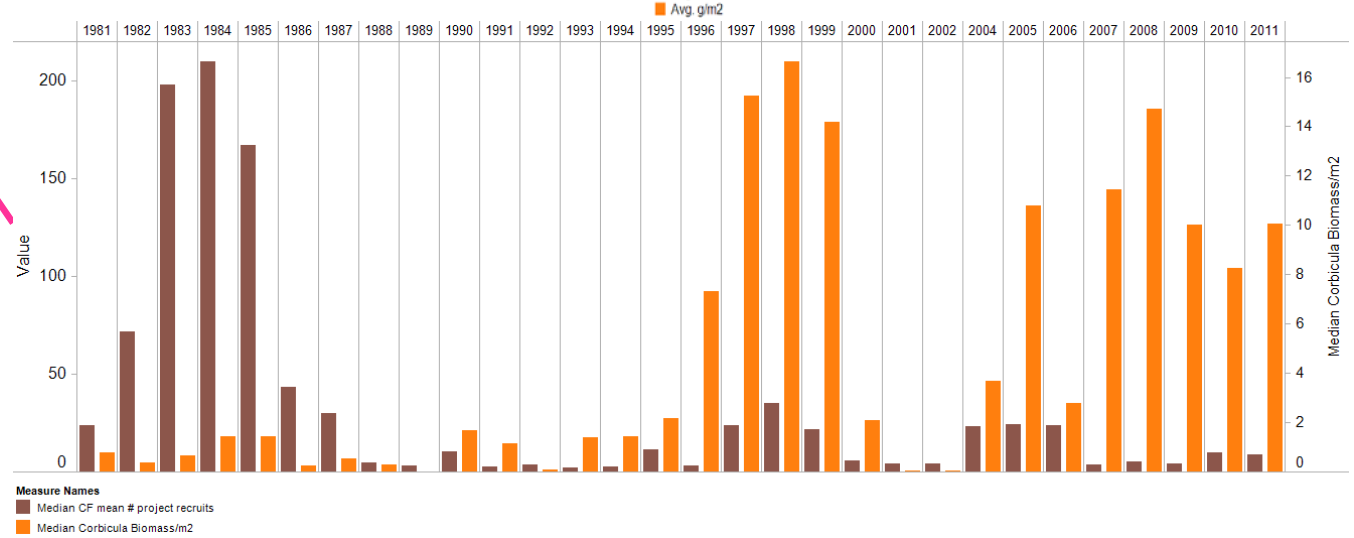




Phytoplankton Model

An energetics model grows the bivalves and a population model estimates bivalve biomass distribution



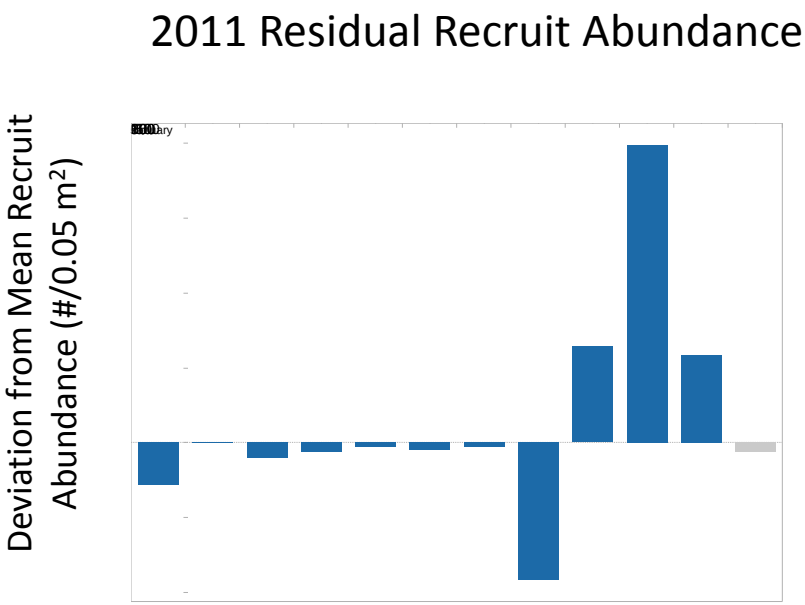


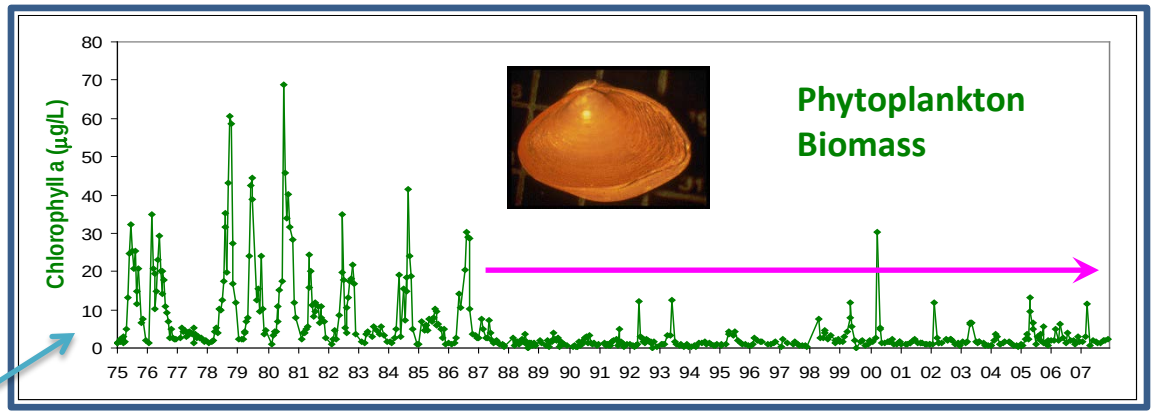
Recruits

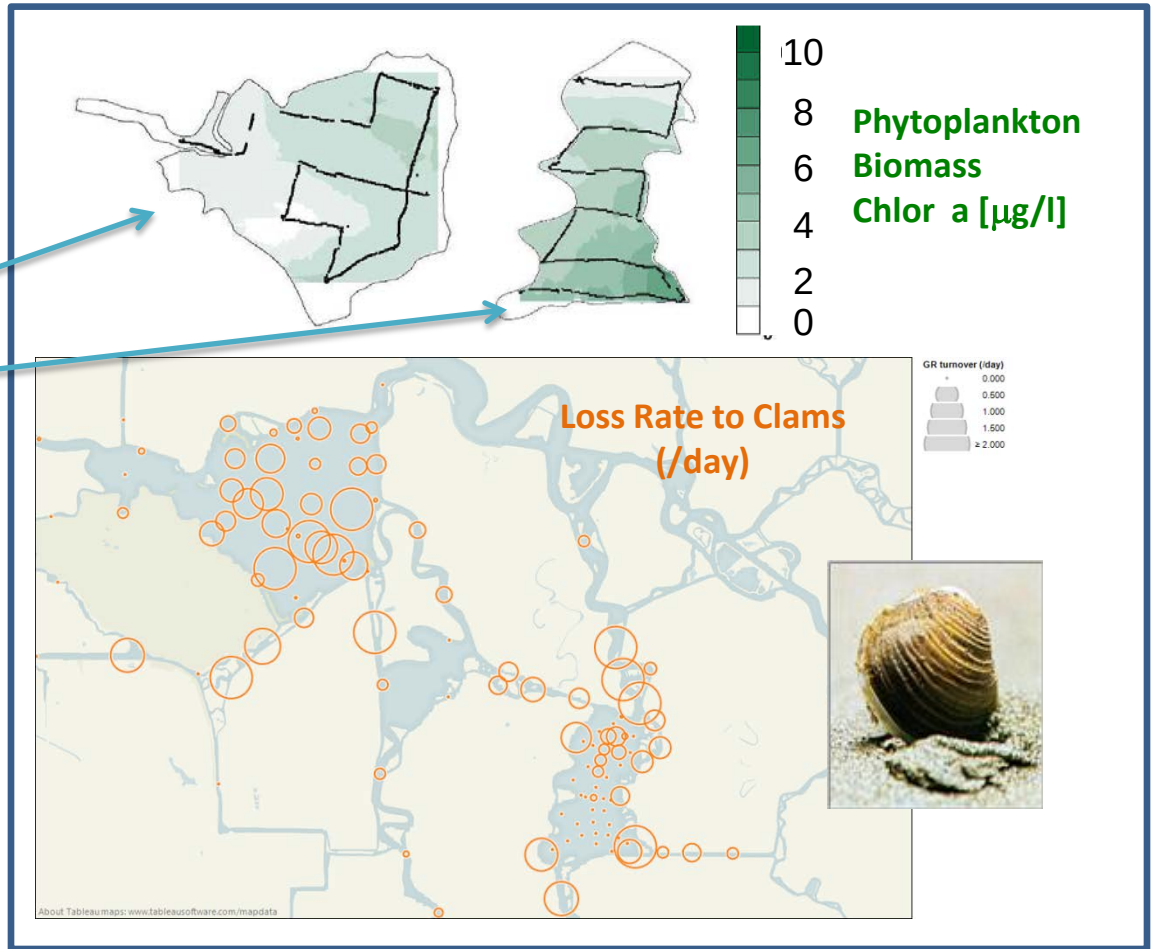
Biomass

Why? Recruits have declined at both locations. Has food increased at confluence and decreased at Rio Vista?

Recruitment at D7 in 2011 was a bit below average in spring 2011, started a month later than the average in fall, and then was way above average in mid fall.





Both clams can limit phytoplankton biomass through grazing

Both clams can limit phytoplankton biomass through grazing