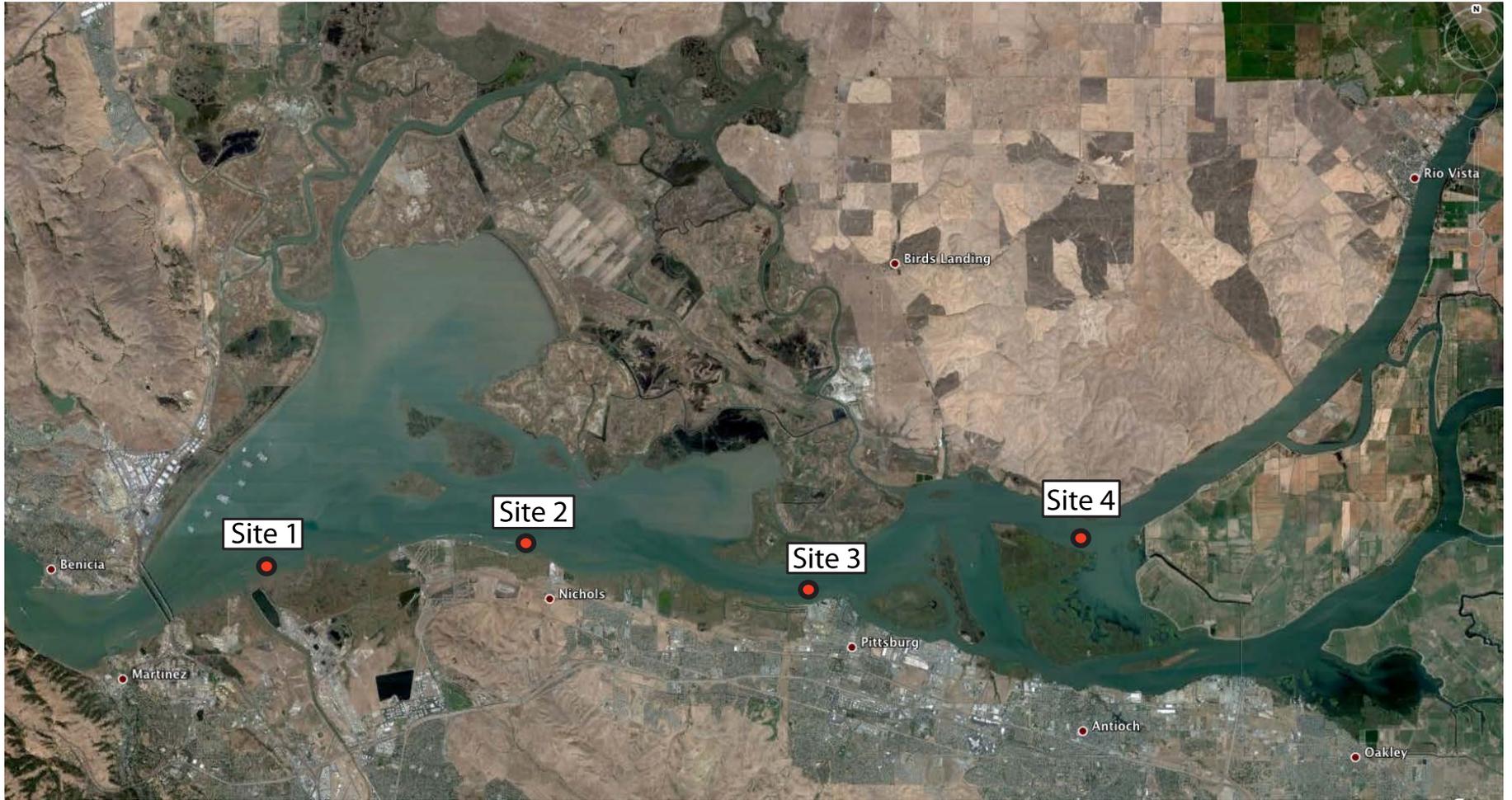


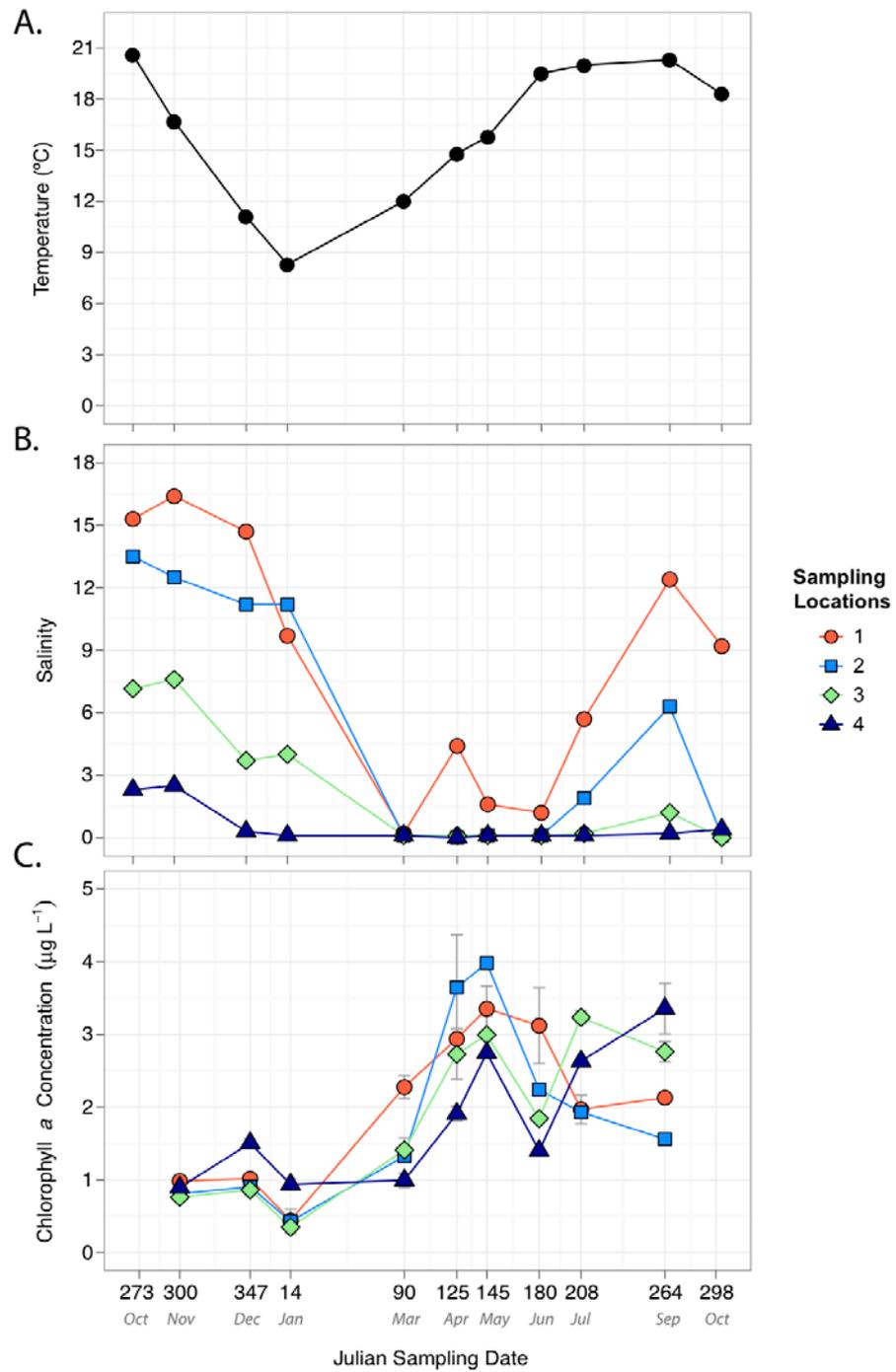
Seasonal and spatial variation in the energetics of the invasive clam, *Corbula amurensis*, in the upper San Francisco Estuary

Nathan A. Miller
Jonathon H. Stillman

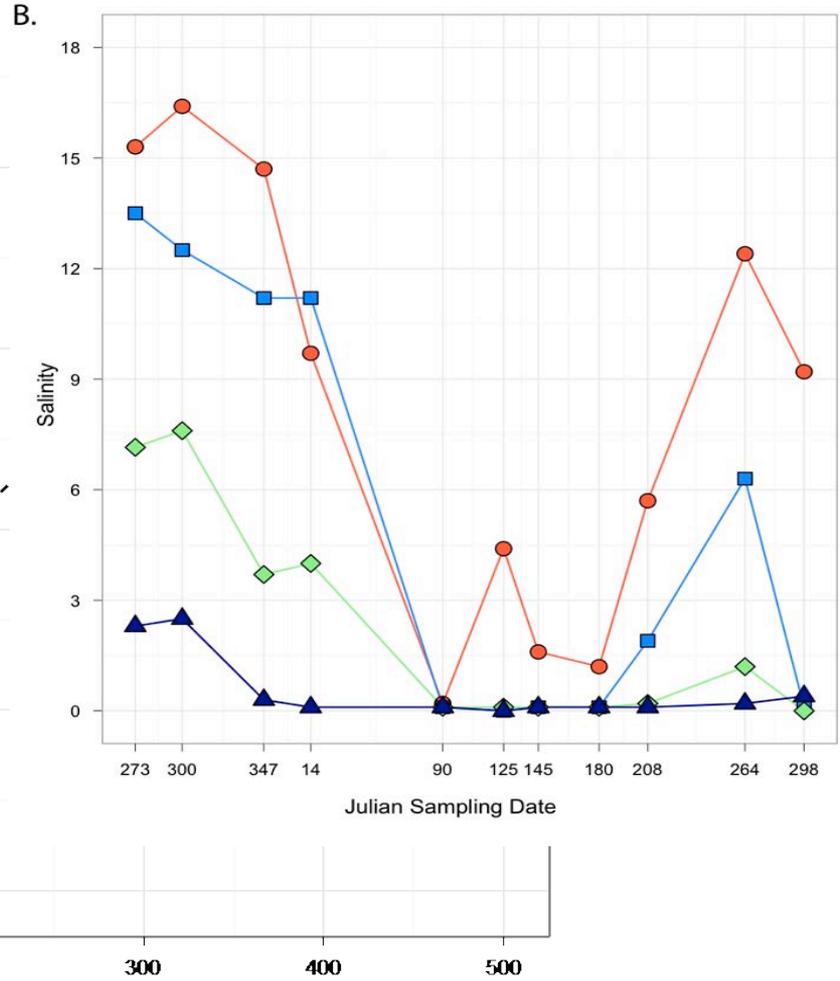
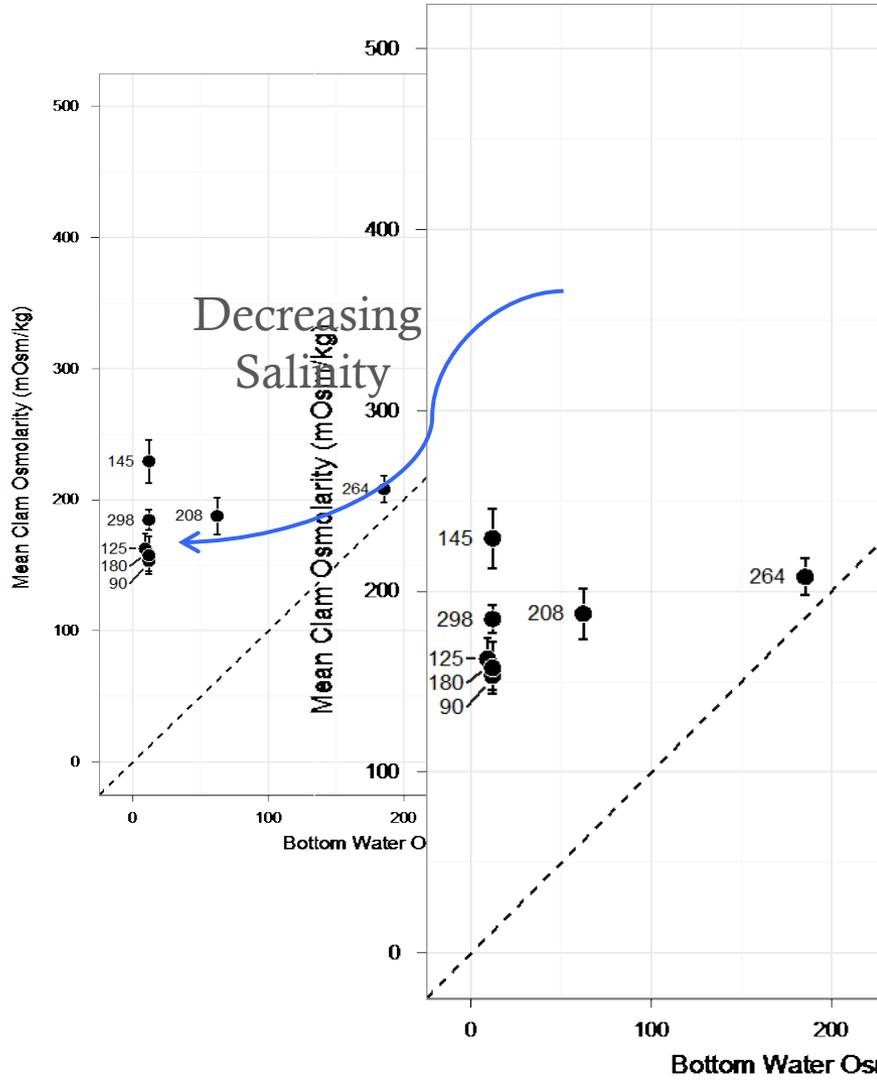
San Francisco State University
Romberg Tiburon Center

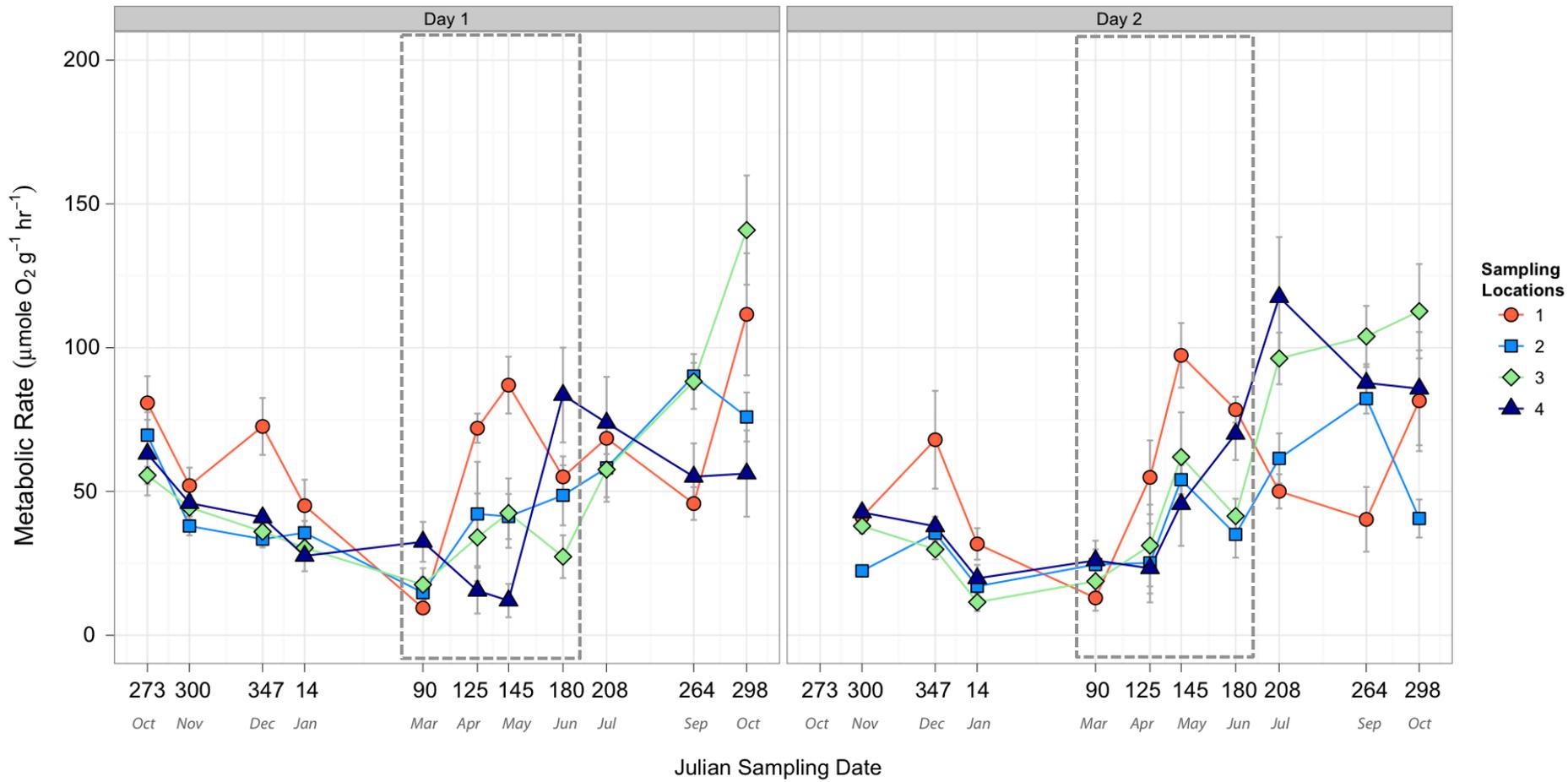




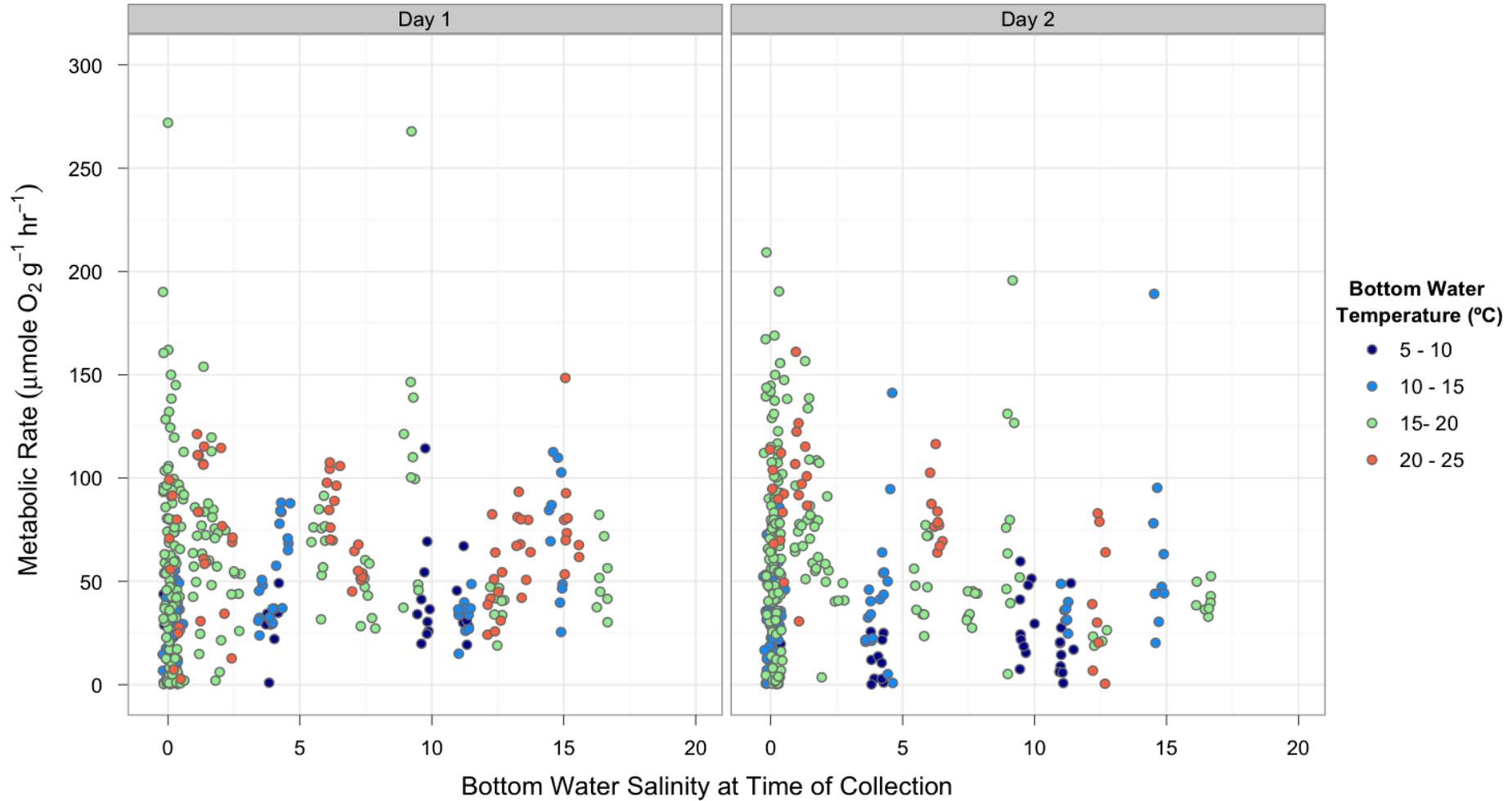


Site 2 Clams



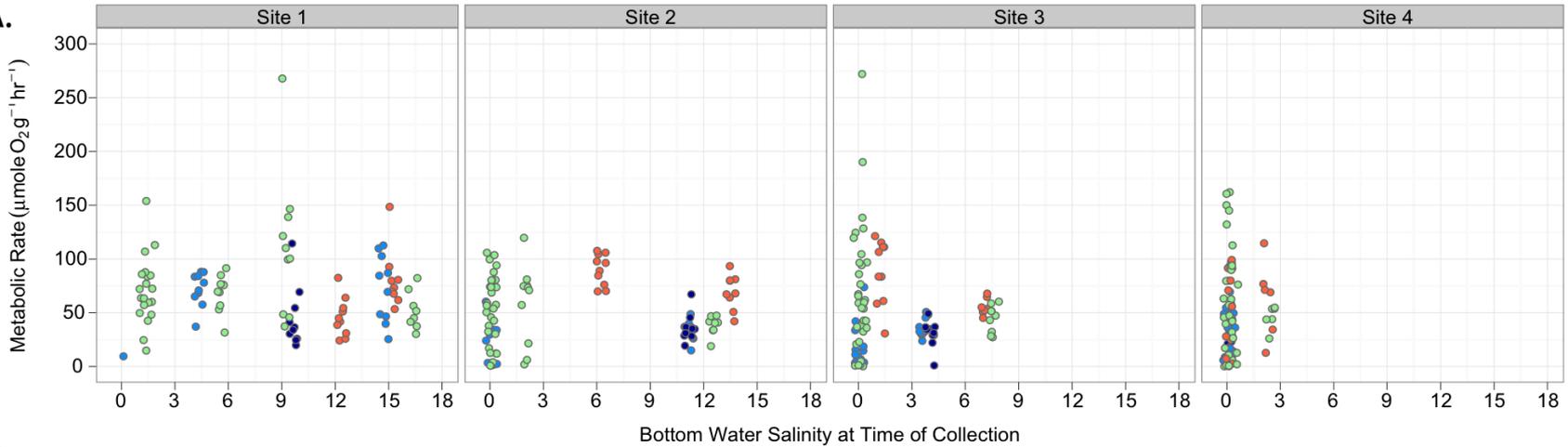


No strong effect of Salinity on clam metabolic rates



No strong effect of Salinity on clam metabolic rates

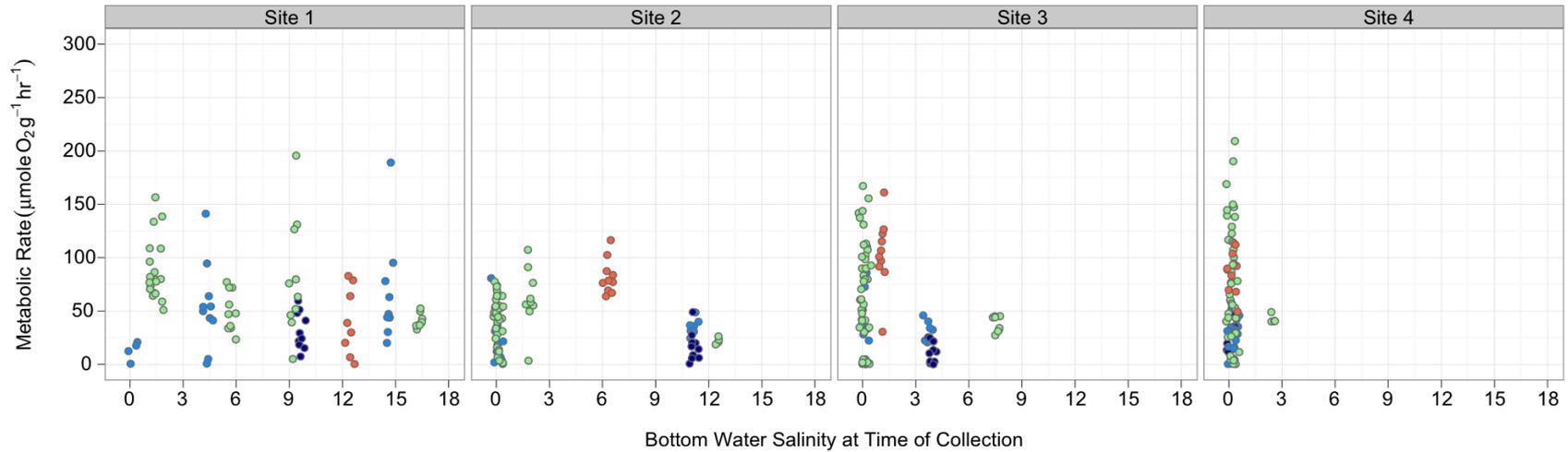
A.



Bottom Water Temperature

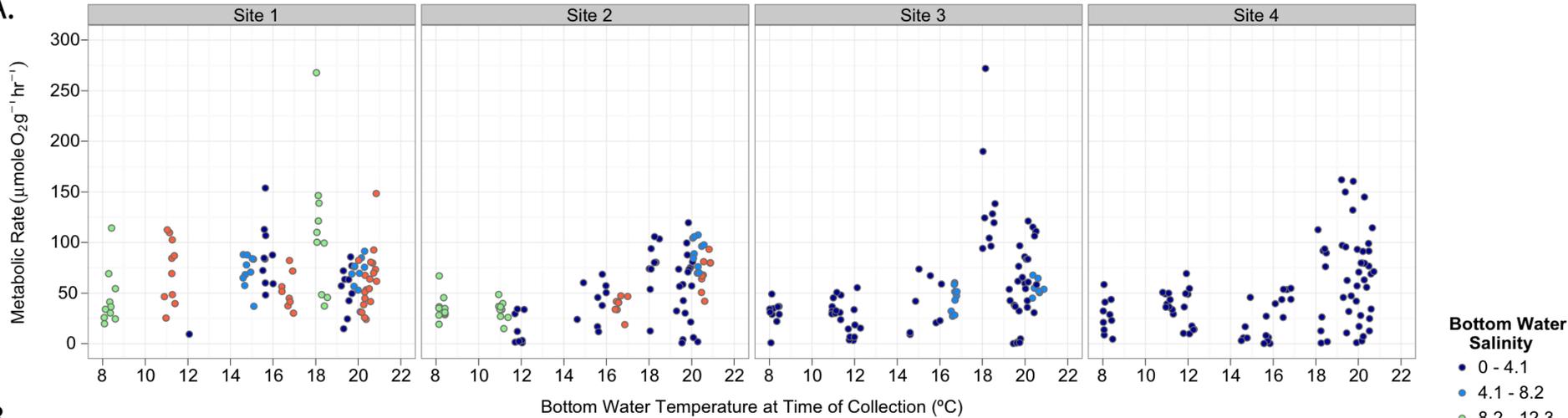
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

B.

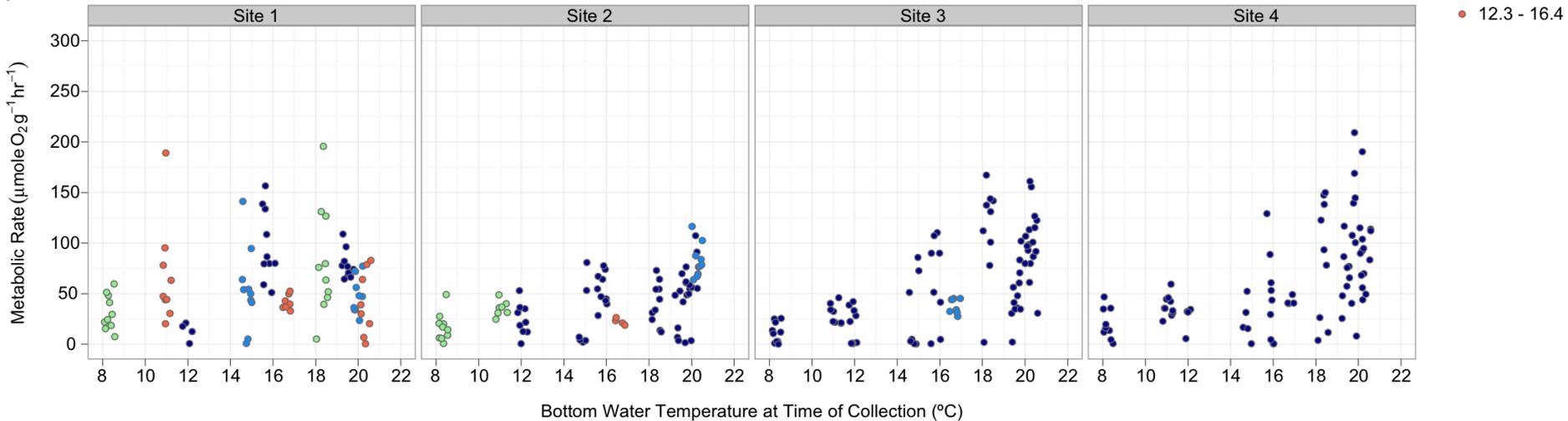


No strong effect of Temperature on clam metabolic rates

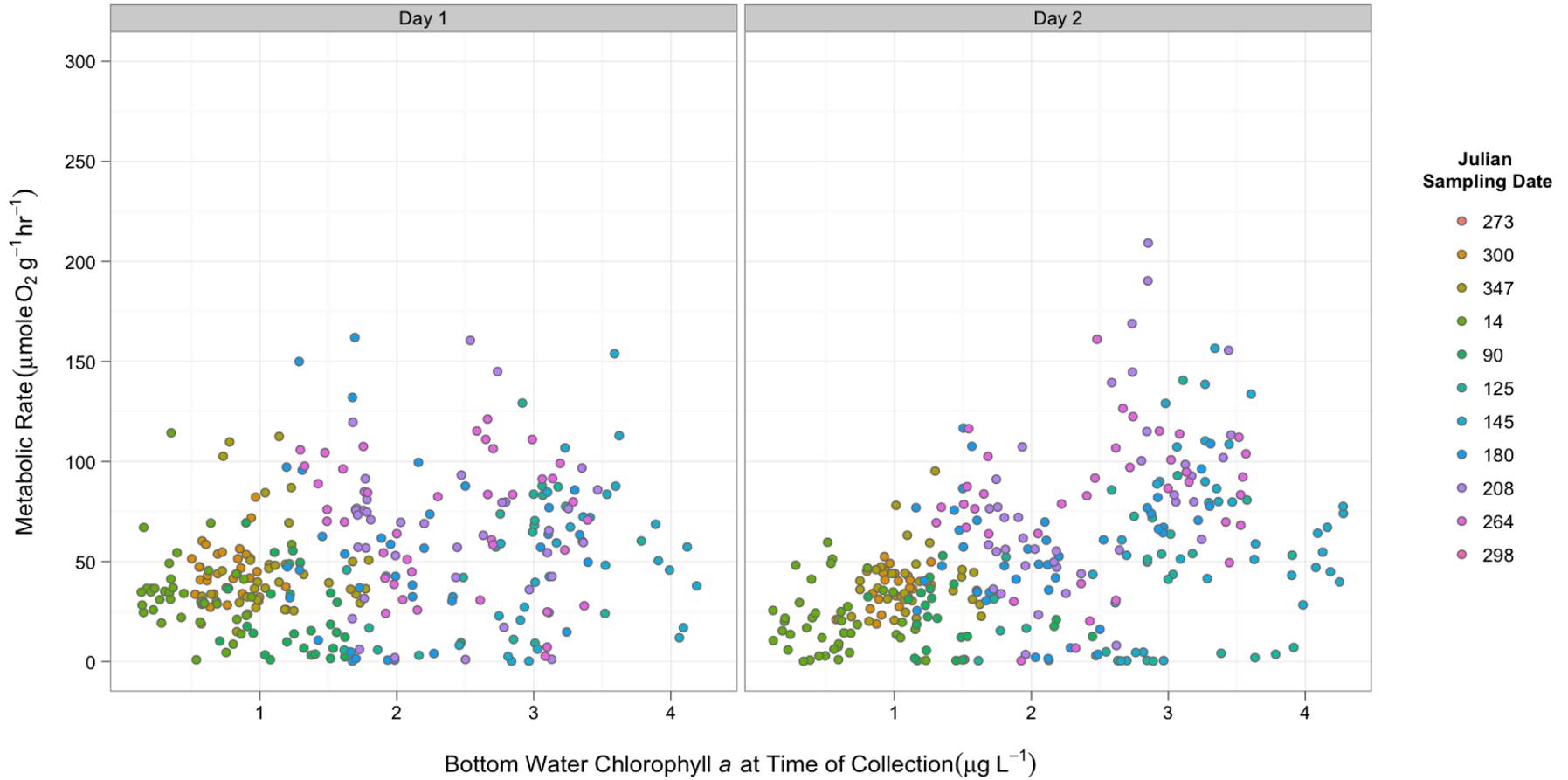
A.

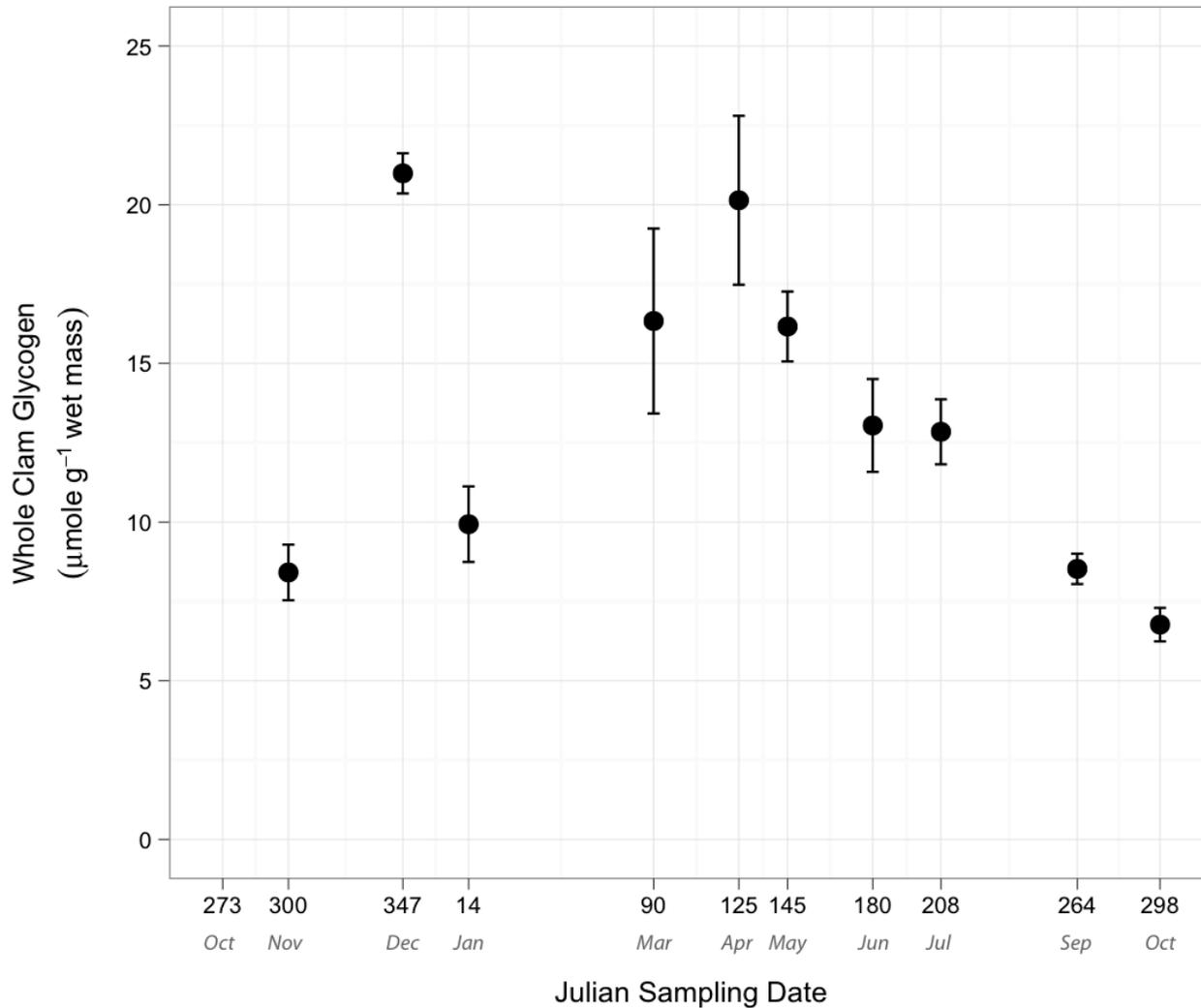


B.

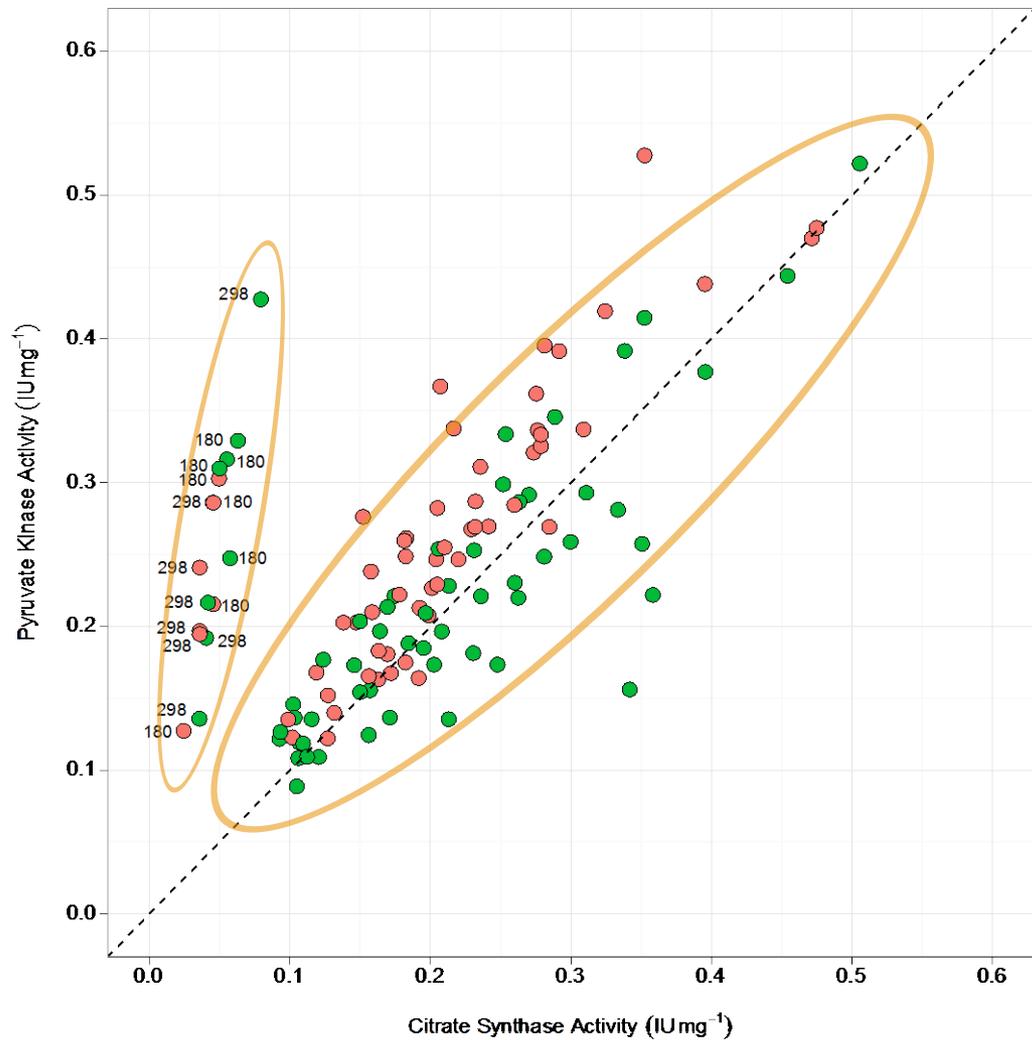


No strong effect of Chlorophyll on clam metabolic rates





Seasonal pattern in **Glycogen**, but unrelated to osmoregulation



Food Energy



Glycolysis
(Pyruvate Kinase)

No O_2
Needed



ATP

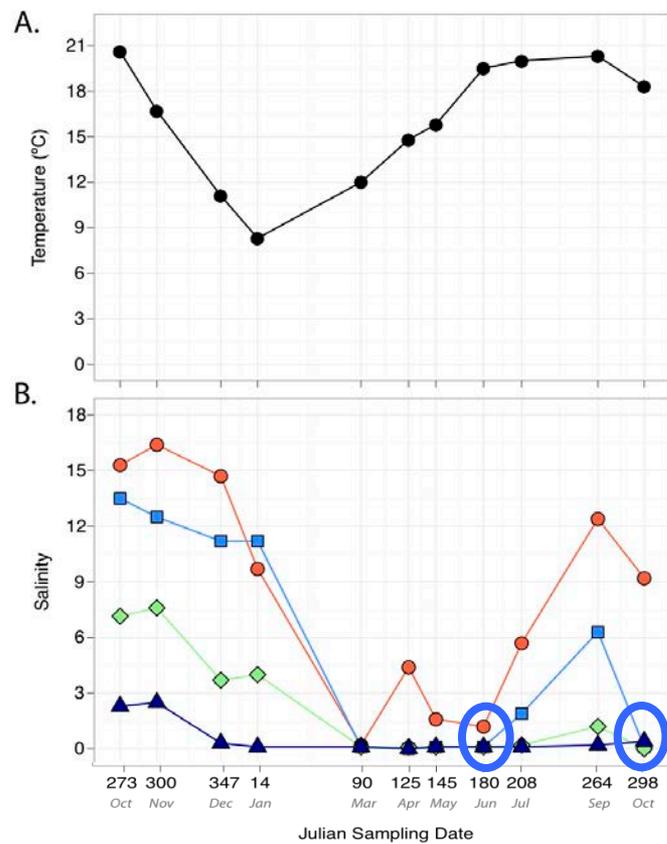
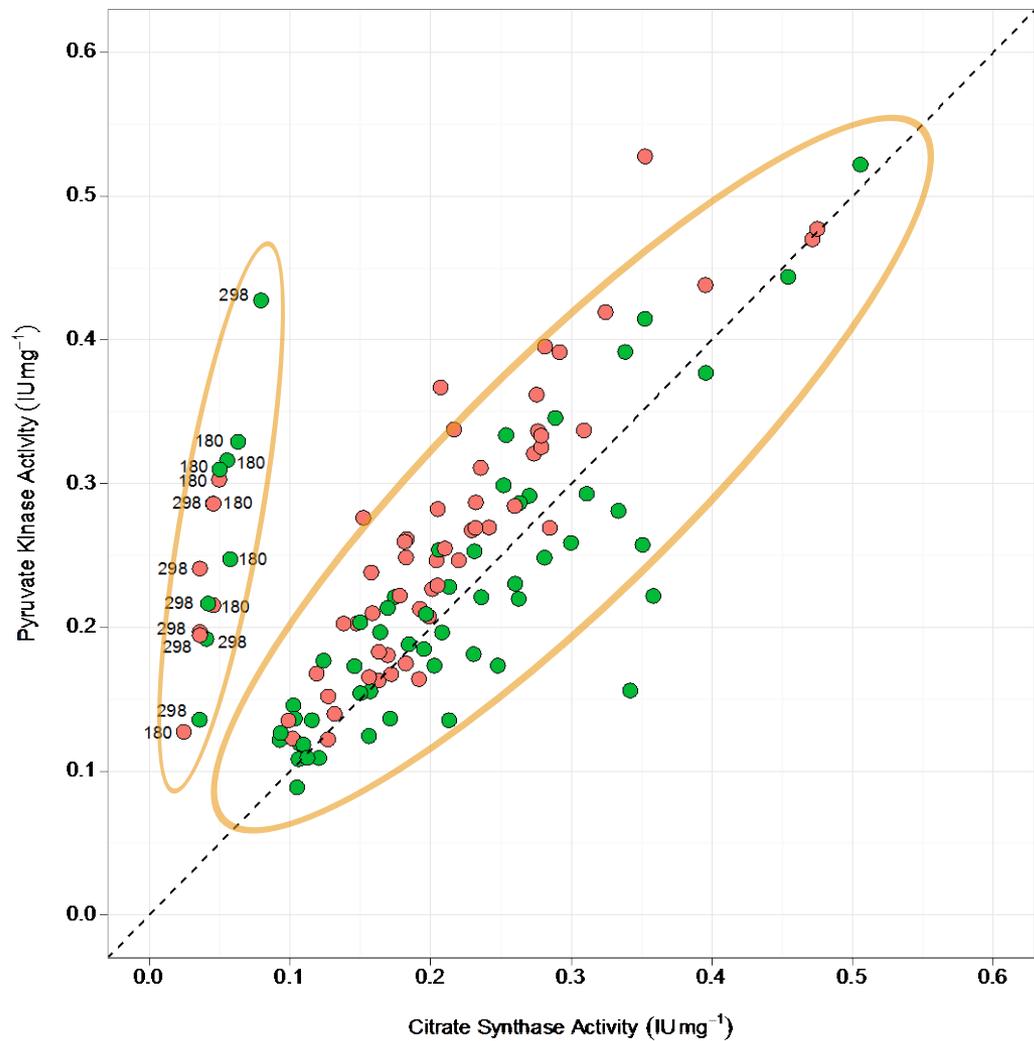


Krebs Cycle
(Citrate Synthase)

O_2
Needed



ATP





C. amurensis energy use in the field is not strongly driven by temperature, salinity, or food availability

We do now have energetics numbers across seasons (at least for one year)

Interactive effects still only explain ~16% variability

Osmoregulation... but unassociated with metabolic rate or energy storage

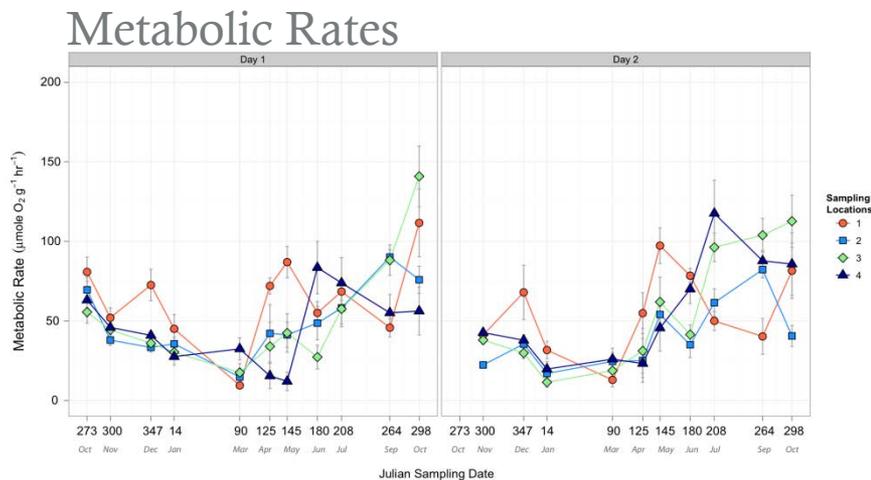
Less efficient energy use at times, though not clearly associated with salinity



Suggests...

a need to re-evaluate the importance of salinity in determining the distribution of adult *C. amurensis* in the SFE.

How do the energy requirements of these clams translate into additional ecologically relevant impacts?



Clam
Filtration Rates

Oxygen respiration rate
($\mu\text{moles O}_2 \text{ gDW}^{-1} \text{ day}^{-1}$)

Assume $RQ = 1$

Carbon consumption rate
($\mu\text{g C gDW}^{-1} \text{ day}^{-1}$)

Assume $C:\text{Chl } a = 20$
(Kimmerer *et al.* 2012)

Chlorophyll consumption rate
($\mu\text{g Chl } a \text{ gDW}^{-1} \text{ day}^{-1}$)

Using our data ($\mu\text{g Chl } a \text{ L}^{-1}$)

Clam filtration rate
($\text{L gDW}^{-1} \text{ day}^{-1}$)

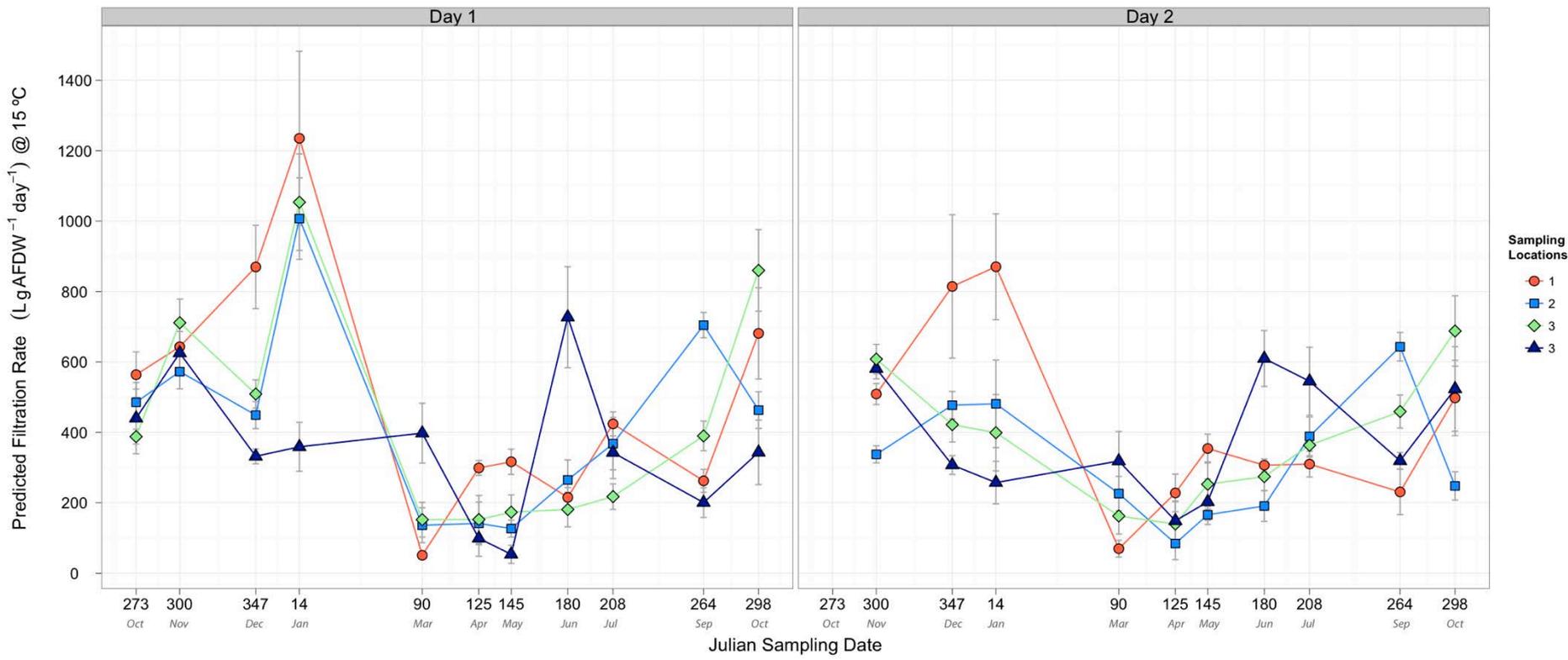
Clam filtration rate
($\text{L gDW}^{-1} \text{ day}^{-1}$)

Assume $DW:\text{AFDW} = 0.83$
(Ricciardi and Bourget 1998)

Clam filtration rate (AFDW)
($\text{L gAFDW}^{-1} \text{ day}^{-1}$)

Using our data
 $Q_{10} = 2.0$

Clam filtration rate (@ 15 °C)
($\text{L gAFDW}^{-1} \text{ day}^{-1} @ 15^\circ\text{C}$)



Note: Does not consider biomass/abundance changes

Take Home:

These clams are not following our rules

- Expend more energy dealing with low salinity

Nope

- Distribution patterns driven by salinity patterns

Maybe, but not due to

energetic/osmoregulatory constraints

- Greatest impact on phytoplankton population when it is warm/metabolism high **Potentially no**



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