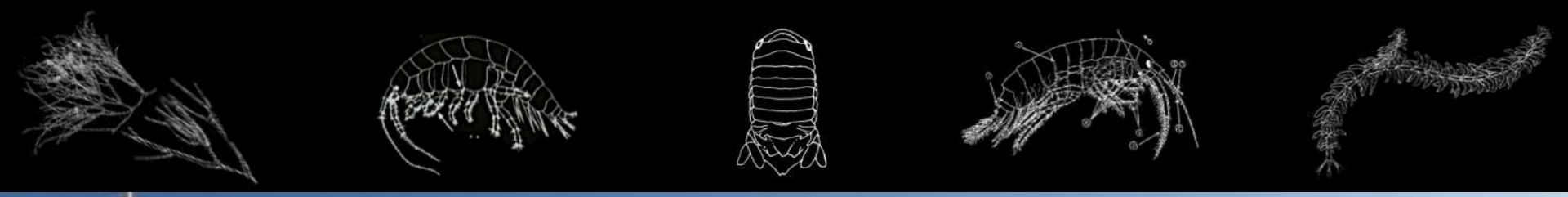

Elemental and isotopic composition of Submerged Aquatic Vegetation in Suisun Bay and the Delta: spatio-temporal patterns and food web support

Julien Moderan, Jen Miller,

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Romberg Tiburon Center for Environmental Studies

Bay Delta Science Conference, Sacramento, Oct 2014

CONTEXT

Not much known about native SAV other than eelgrass

Extent of *Stuckenia* beds (Sago pondweed) assumed minimal until recently

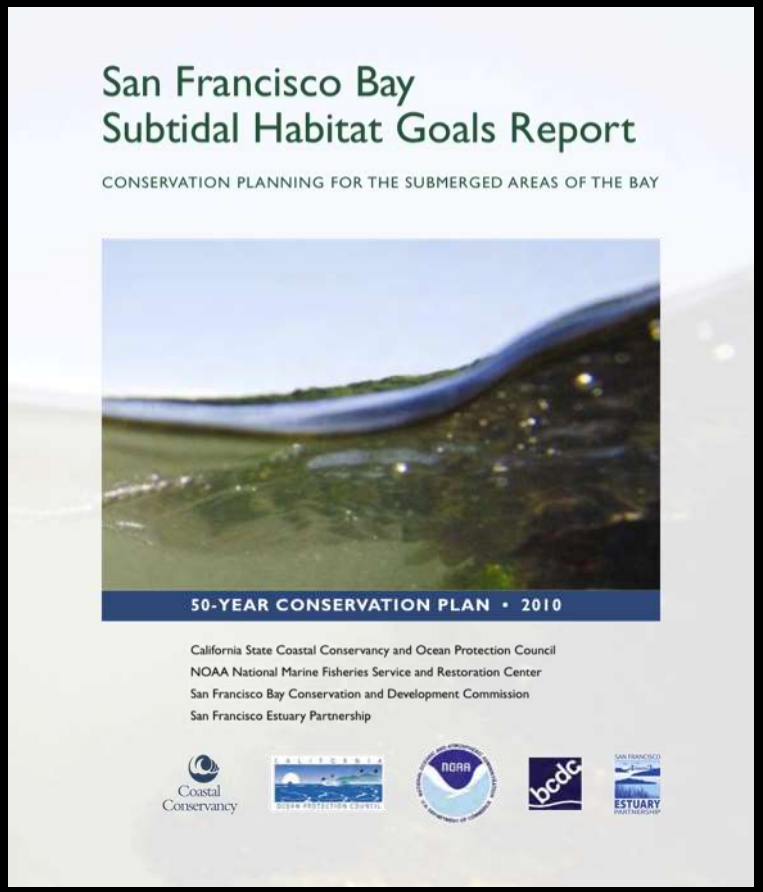
SUBMERGED AQUATIC VEGETATION SCIENCE GOAL 4

Assess the status and distribution of other SAV.

Question A. What is the distribution and abundance of each of the native SAV species other than eelgrass?

SUBMERGED AQUATIC VEGETATION PROTECTION GOAL 5

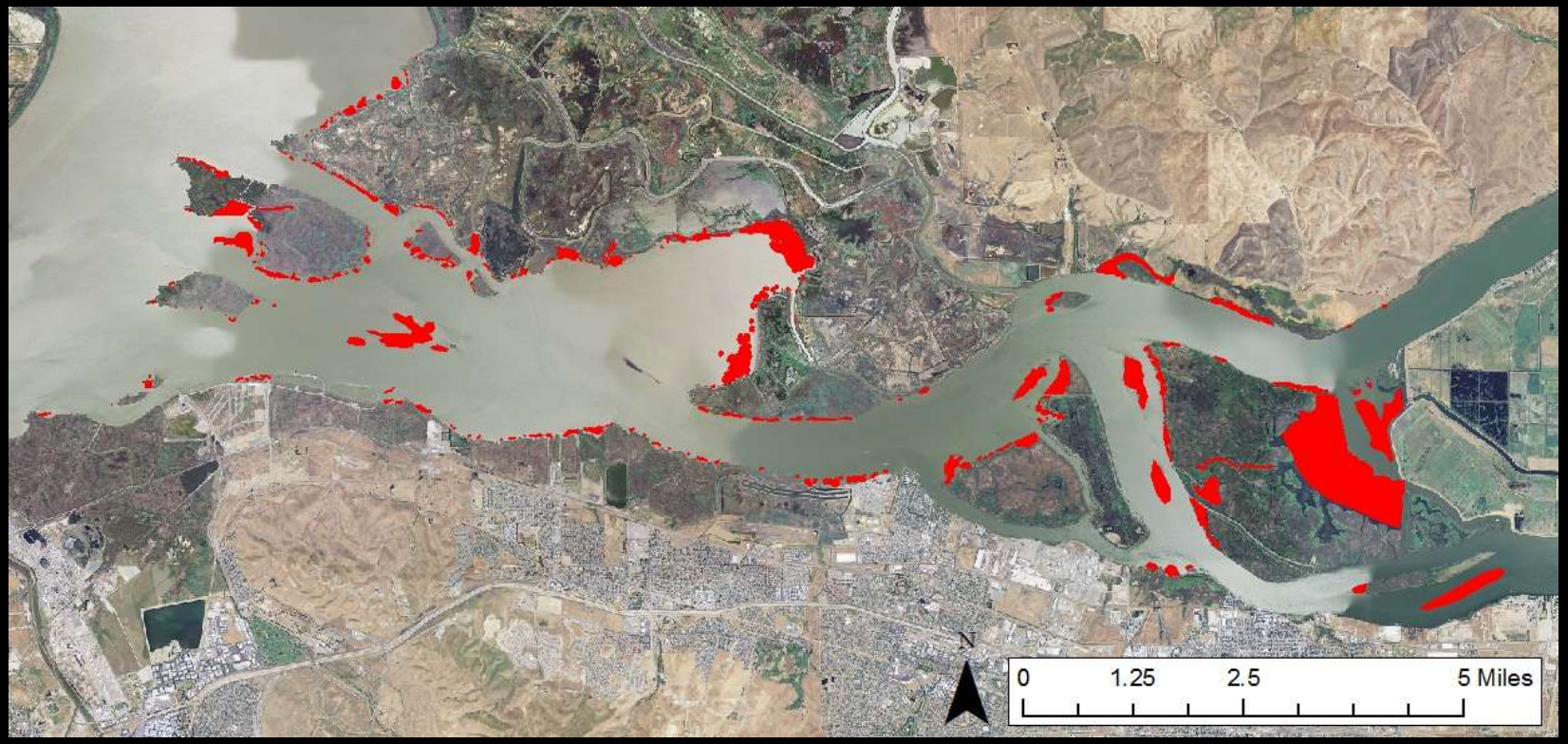
Protect existing sago pondweed habitat in San Francisco Bay.



CONTEXT

But… >1200 acres of *Stuckenia* spp. recently discovered and mapped

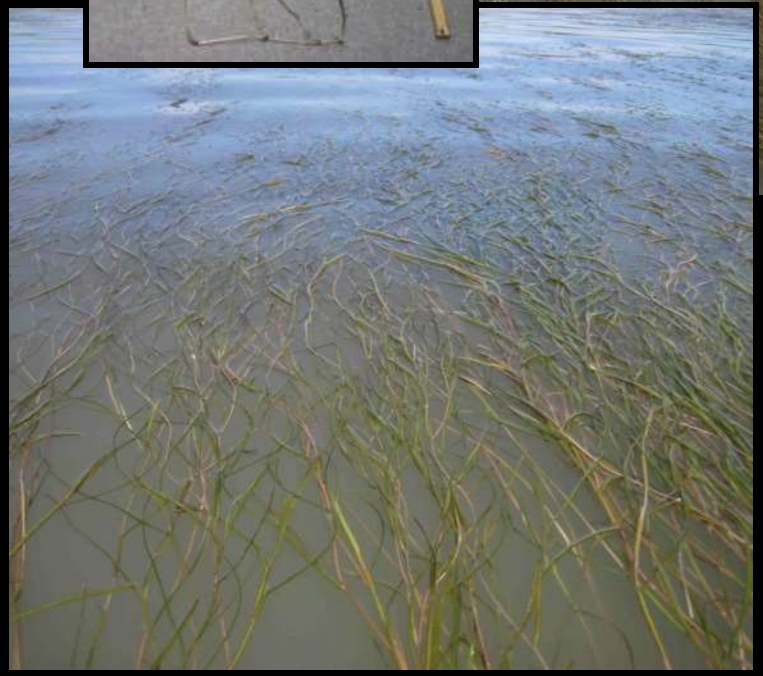
See Melissa Patten's poster



Context

Stuckenia spp.

- Native
- Foundation species
- Potential habitat and food source for native fish



Context: Native *vs* Invasive SAV

Native *Stuckenia spp*.

Open canopy, turbidity, refuge for native fish, proximity to tidal marsh resources and open water, along migratory pathways

Non-native *Egeria densa*

Dense, reduced turbidity, refuge for non-native predator fish (shade / dark hiding places)

See Kathy Boyer's talk

Context: Native *vs* Invasive SAV

Native *Stuckenia spp*.

- Dominates in Suisun Bay
- Invertebrates communities characterized by amphipods and isopods (*G. Daiberi, A. valida and G. oregonensis*)

Non native *Egeria densa*

- Dominates in west Delta (freshwater)
- Invertebrates communities characterized by gastropods and insects larvae (*Physa sp., Helisoma anceps…)*

See Jen Miller's poster

Questions

How do the elemental / stable isotope composition of SAV vary between species, location and season?

Contribution to the food web?

Methods – Sampling strategy

8 sites: 4 in Suisun *Stuckenia*-dominated; 4 in west Delta *Egeria*-dominated + higher plant diversity

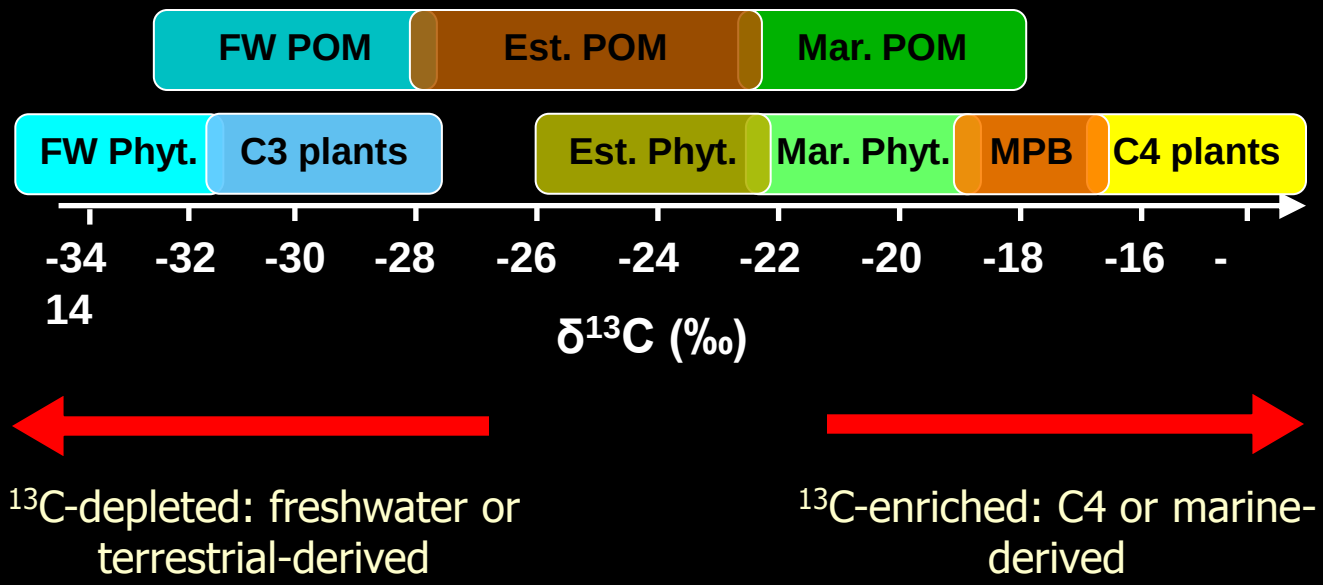
Quarterly from Fall 2011 to Fall 2012

Top 30cm of each SAV species with invertebrates and epiphytes + other potential OM sources when present (algae, POM…)

Methods – Stable Isotopes Analysis

- $\delta^{13}C$: Organic matter origin

Fry & Sherr (1984), but see Cloern et al. (2002)

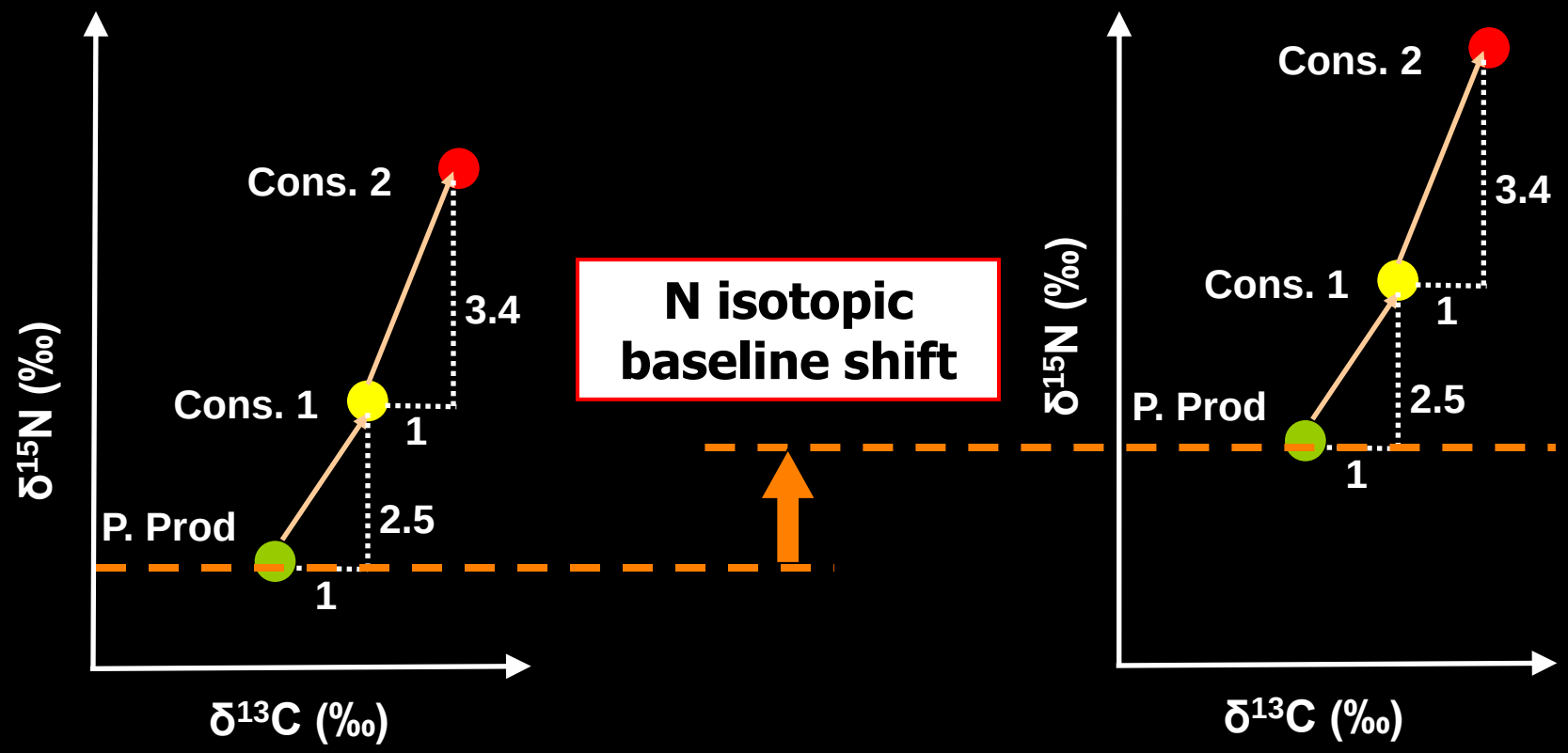


^{13}C-depleted: freshwater or terrestrial-derived

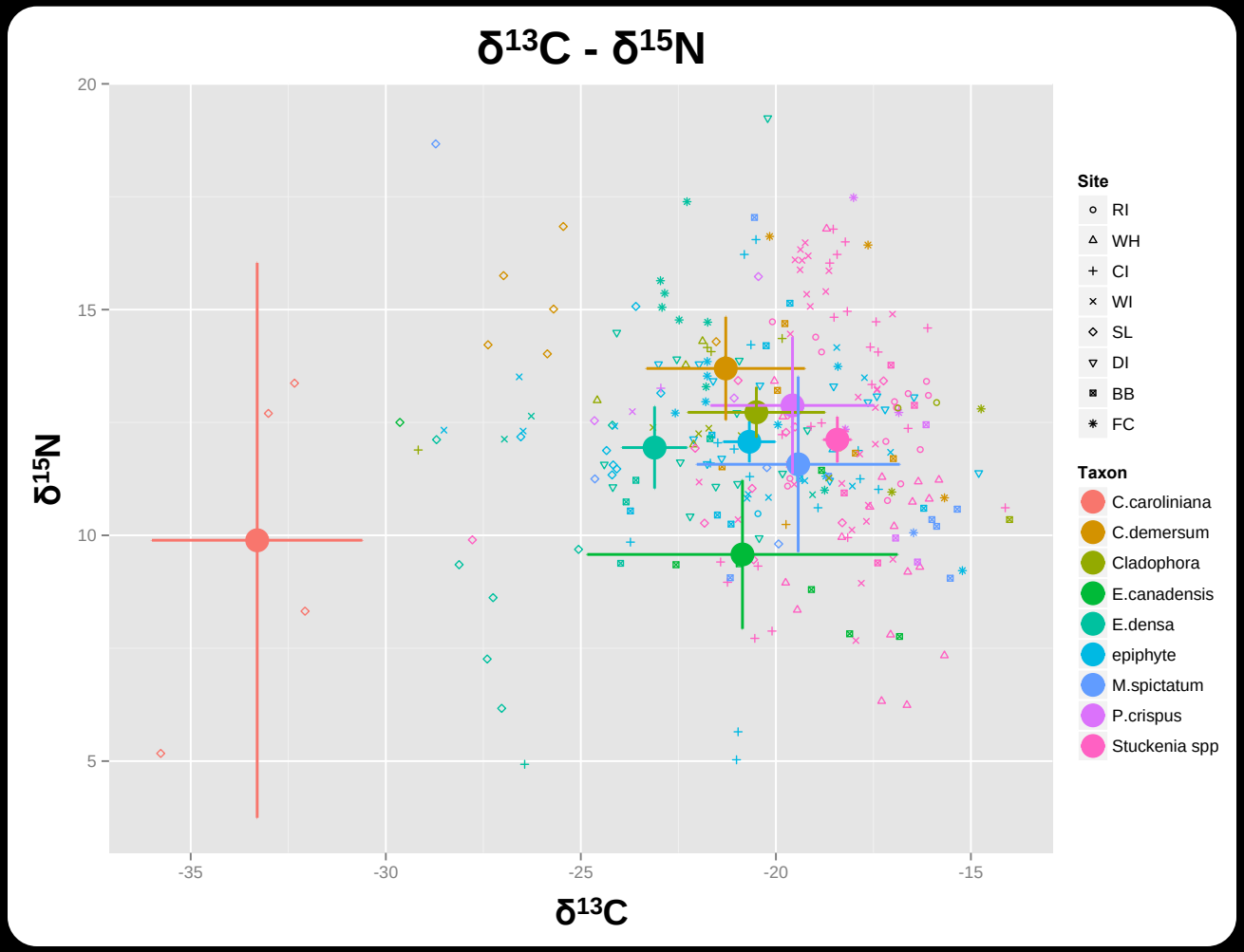
^{13}C-enriched: C4 or marine-derived

Methods – Stable Isotopes Analysis

- $\delta^{13}C$: Organic matter origin — *Fry & Sherr (1984), but see Cloern et al. (2002)*
- $\delta^{15}N$: Trophic level — *Post (2002)*
  Anthropogenic N inputs — *Riera et al. (2000)*



Interspecific differences

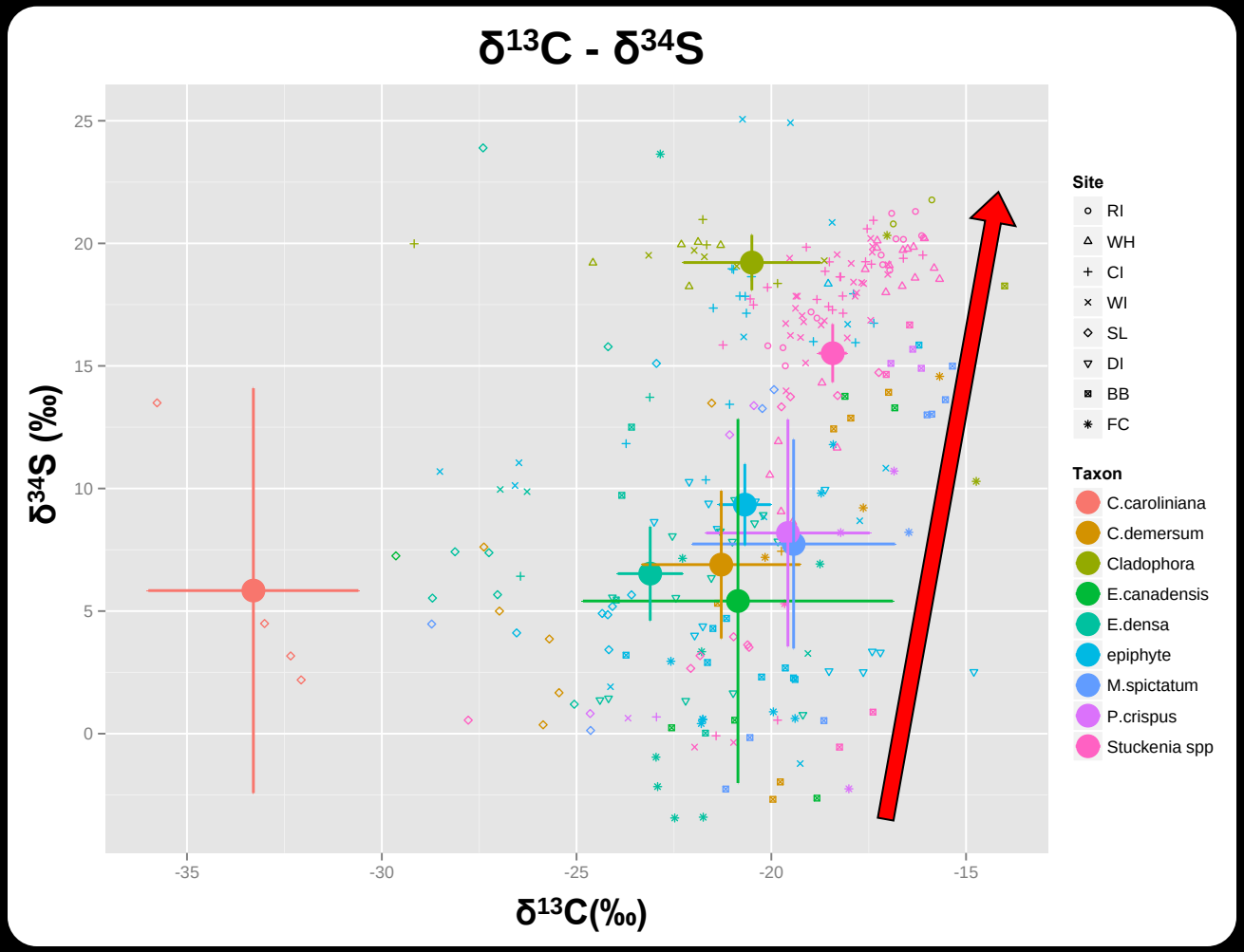


High variablility in both C and N stable isotope composition (-35 to -15‰ and 5 to 20‰)

$\delta^{15}N$ poorly discriminant (expected)

Cabomba caroliniana extremely ^{13}C-depleted

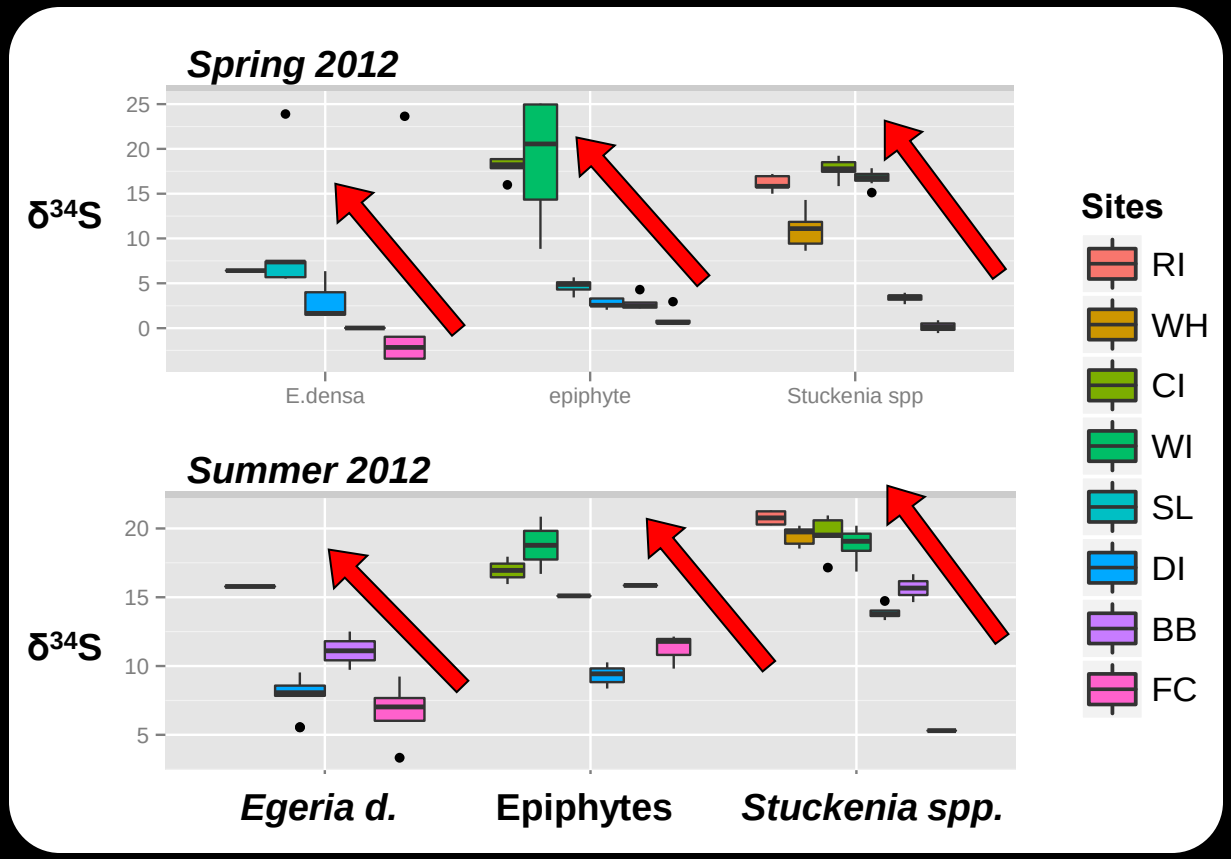
Interspecific differences



$\delta^{34}S$ discriminates further *Cladophora* and *Stuckenia* spp.

East-West (fresh to brackish water) gradient in $\delta^{34}S$ probably reflects ambient sulphate signature

Spatio-Seasonal Patterns: $\delta^{34}S$

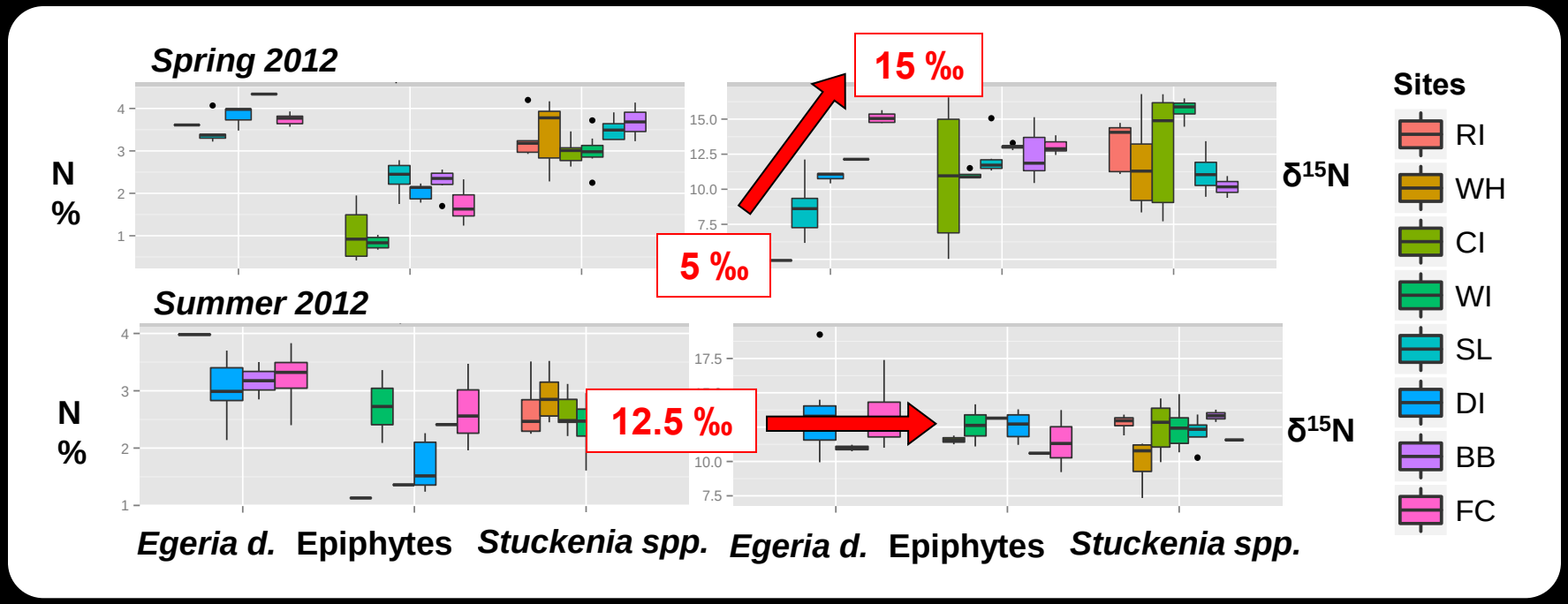


East-West (fresh to brackish water) gradient in $\delta^{34}S$ probably reflect ambient sulphate signature

Plants known to synthesize organic S from inorganic sulphate with no or little fractionation

Concurrent sampling of sources and consumers essential for valuable use of $\delta^{34}S$ as a supplementary tracer in the low salinity zone

Spatio-Seasonal Patterns: $\delta^{15}N$

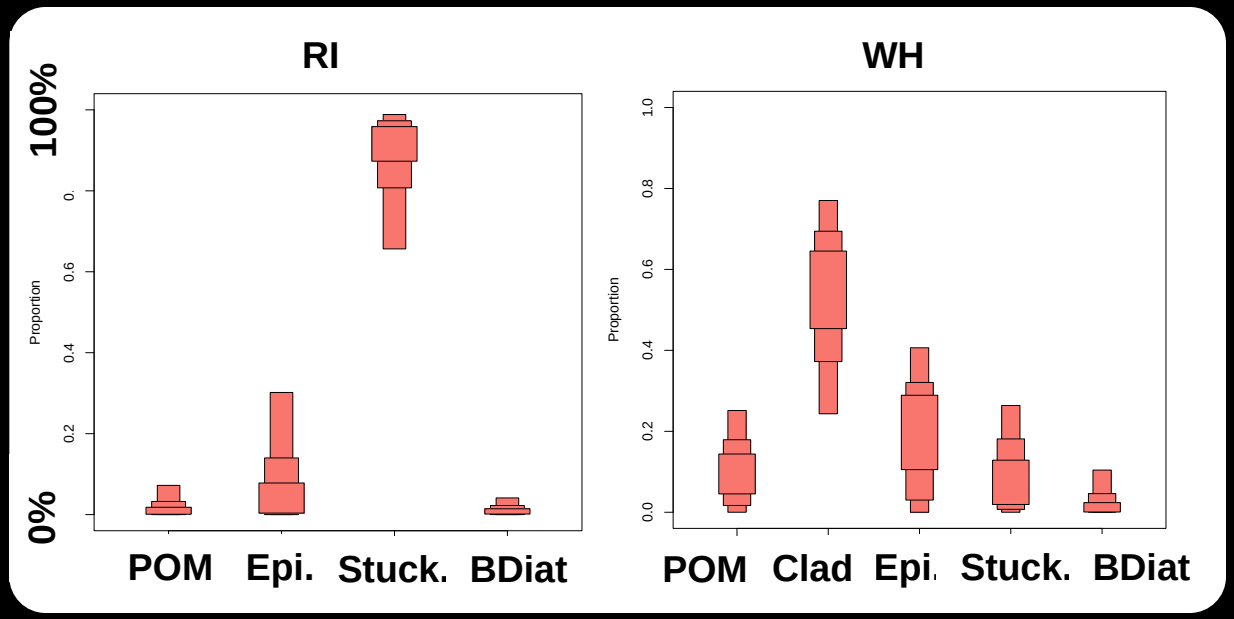


Strong $\delta^{15}N$ gradient in spring (only) for *Egeria*, not *Stuckenia*.

Egeria known to efficiently absorb NH_4^+ from water, poor N uptake from root system

Reflects short scale variations in the sources of DIN – strong gradient in high flow conditions

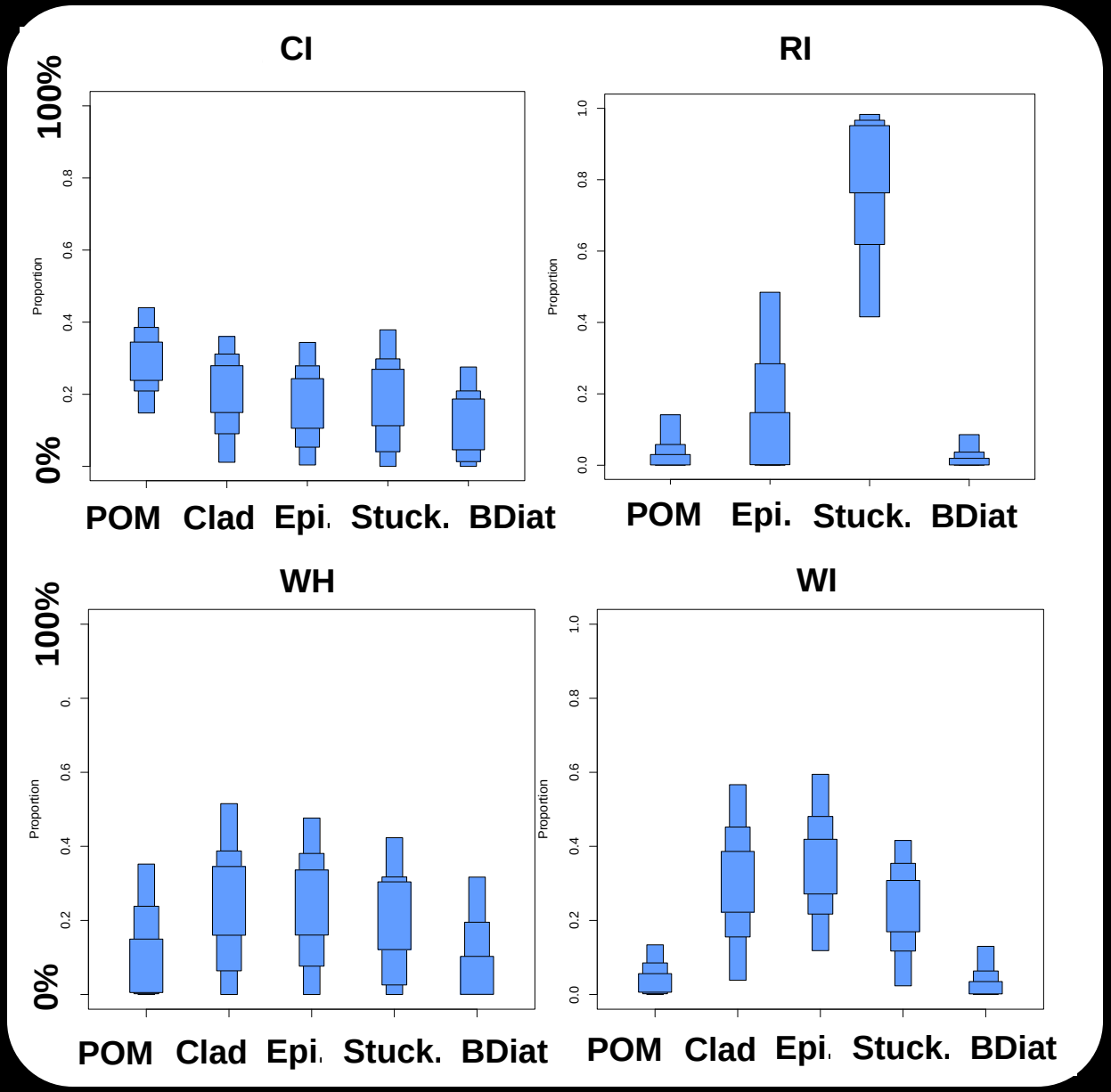
Invertebrates diet – *A. valida*

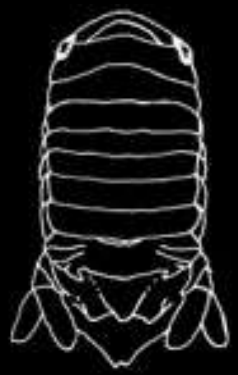


Cladophora = 30 to 80% of *A. valida*'s diet when present

If absent, diet almost exclusively composed of *Stuckenia*

Invertebrates diet – *G. oregonensis*

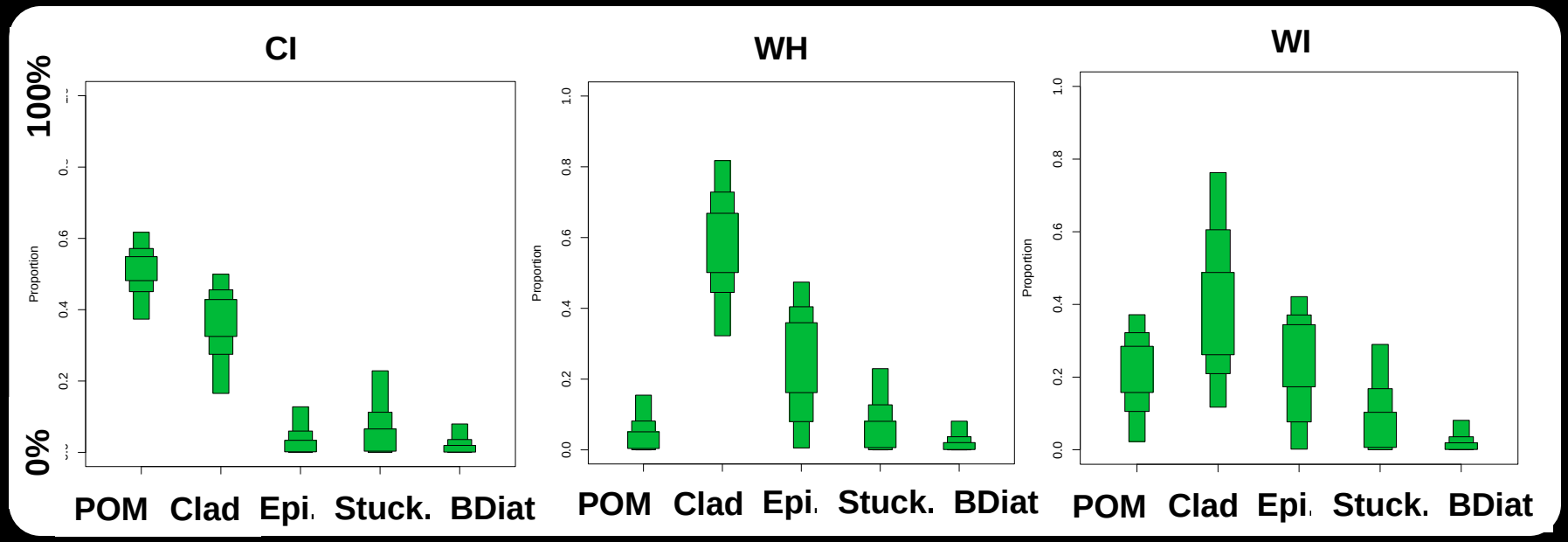




At RI, without *Cladophora*, diet >50% *Stuckenia*

Significant contribution of POM at CI, or more likely detritus with a similar signature

Invertebrates diet – *G. daiberi*



Cladophora = main item in *G. daiberi's* diet

Complemented with a ^{13}C-depleted source (POM?) at CI and/or epiphytes at WH

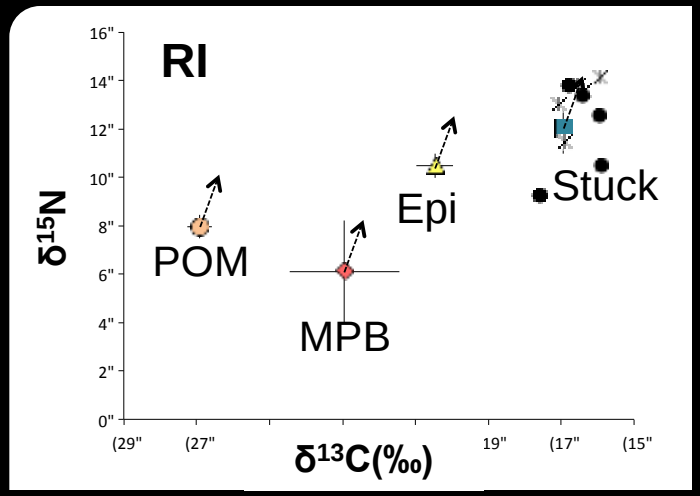
Conclusion

- High spatio-temporal variations in the SAV stable isotope composition: need appropriate sampling strategies in food web studies
- *Egeria* could be a good bioindicator for short scale variations in nutrient sources, while *Stuckenia* would more likely integrate the signal over longer time scale
- *Stuckenia* do directly contribute to the foodweb, but trophic plasticity in some invertebrate species (*Cladophora* often a major food item when present)

Thank you for your attention

The Boyer lab
RTC community
Ecosystem Restoration Program
Delta Science Program
NOAA Fisheries

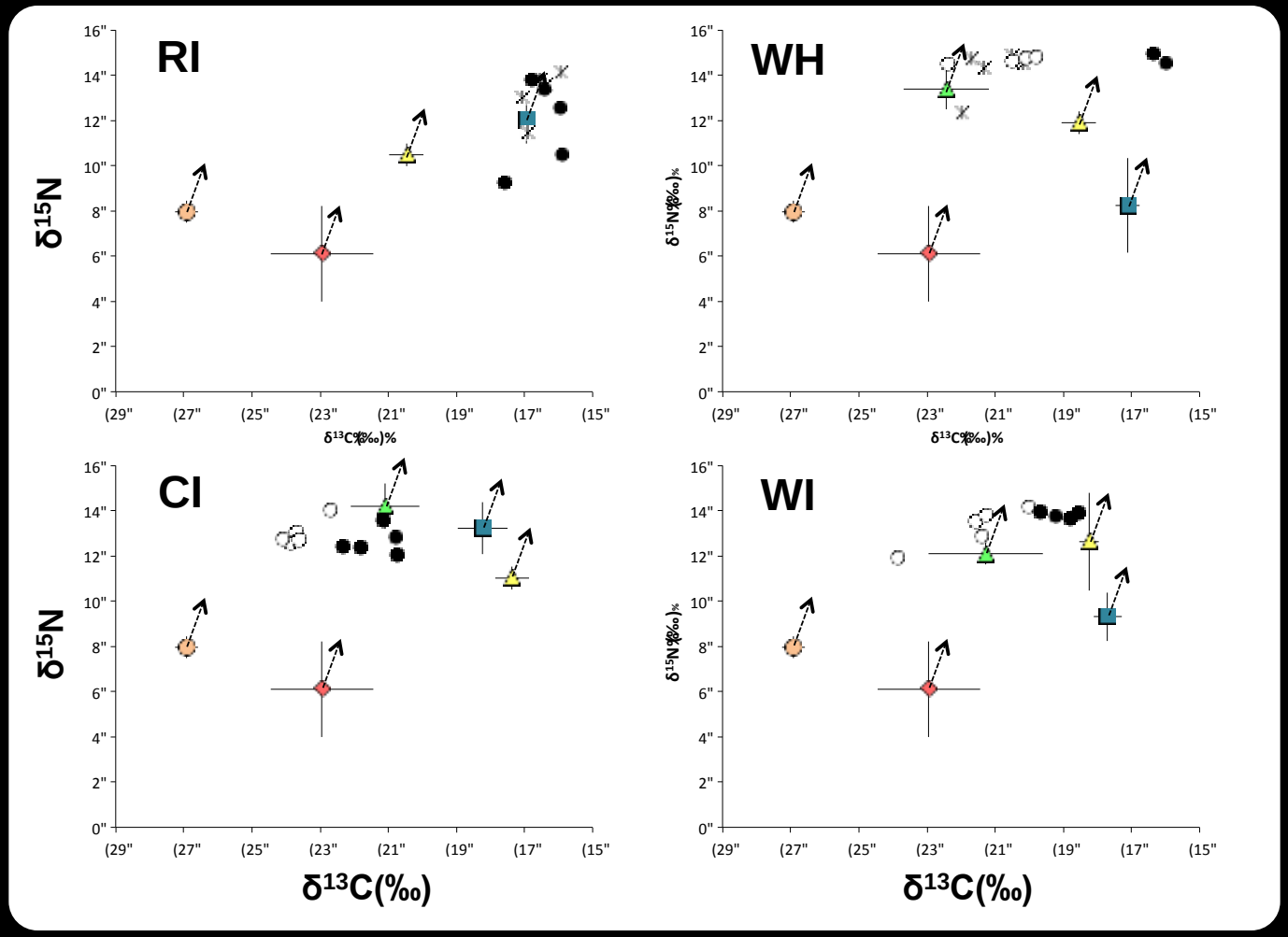
Invertebrates diet



POM"
Cladophora"
epiphyte"
Stuckenia"
BDiatoms"

A.valida"
G.daiberi"
G.oregonensis

Invertebrates diet



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