2016 Columbia River Estuary Conference

Macroinvertebrate structure and availability in reed canarygrass and Lyngbye's sedge habitats, Lower Columbia River & estuary

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Photo by L. Stamatiou

PLANT INVASIONS & MACROINVERTEBRATES

- Decreased abundance
- Lower taxonomic richness
- Shifts in community composition

Native *Carex lyngbyei*
(**CALY**) = Lyngbye's sedge
April 2014

Diptera
Chironomidae

Invasive *Phalaris arundinacea*
(**PHAR**) = reed canarygrass
May 2014

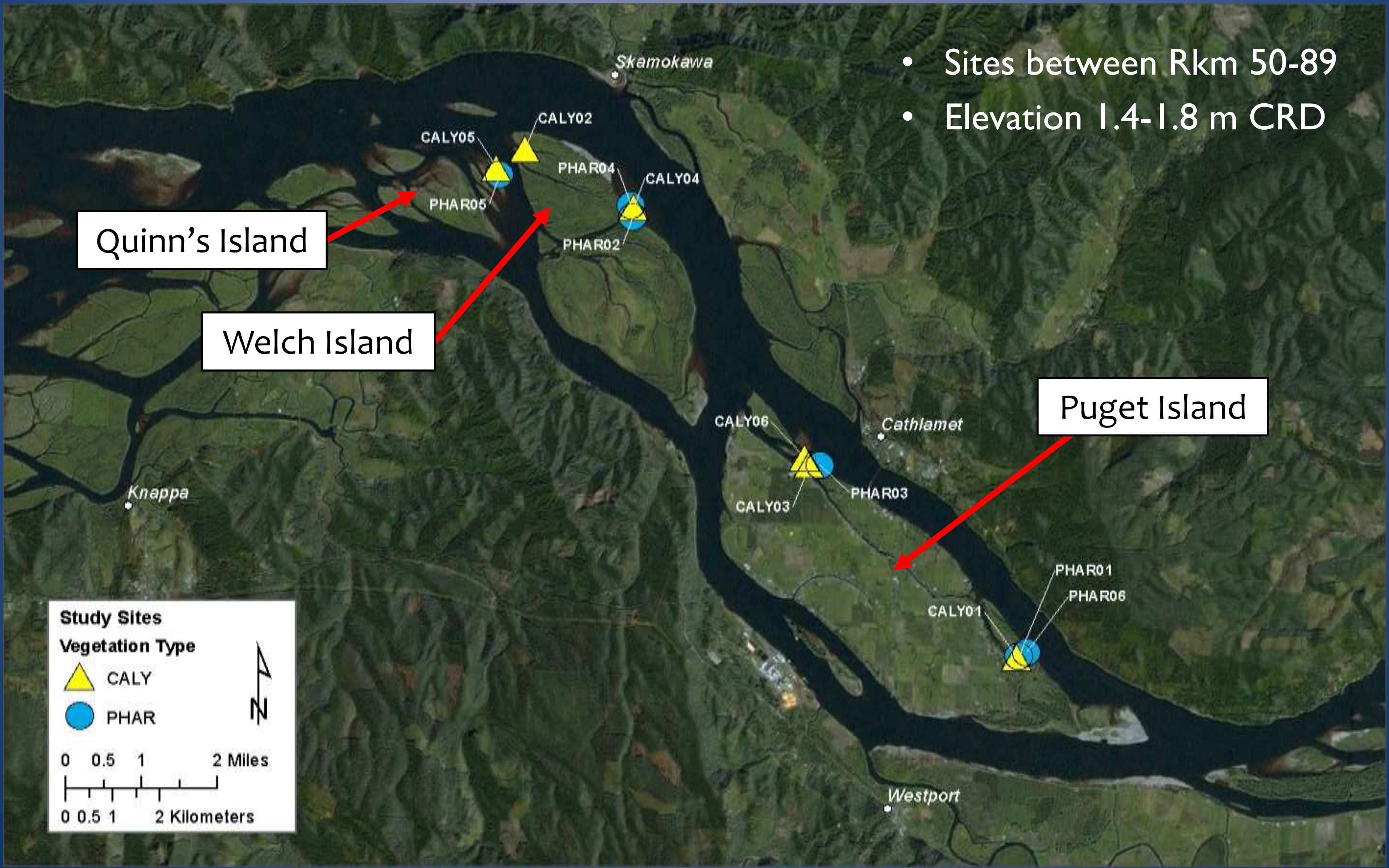
STUDY QUESTION & APPROACH

Q. What are the differences in macroinvertebrate community structure & availability in marshes dominated by PHAR vs. CALY?

- Limit study to location with similar environmental characteristics
  - Freshwater emergent tidal marshes
  - Similar tidal cycles/inundation periods
  - Mixed presence of large-ish CALY & PHAR patches
- 6 CALY sites & 6 PHAR sites
  - homogenous (>50%) vegetation
  - sample macroinverts within patch center in April, May, & June 2014

Vegetation & soil metrics were assessed concurrently by PNNL

STUDY SITES



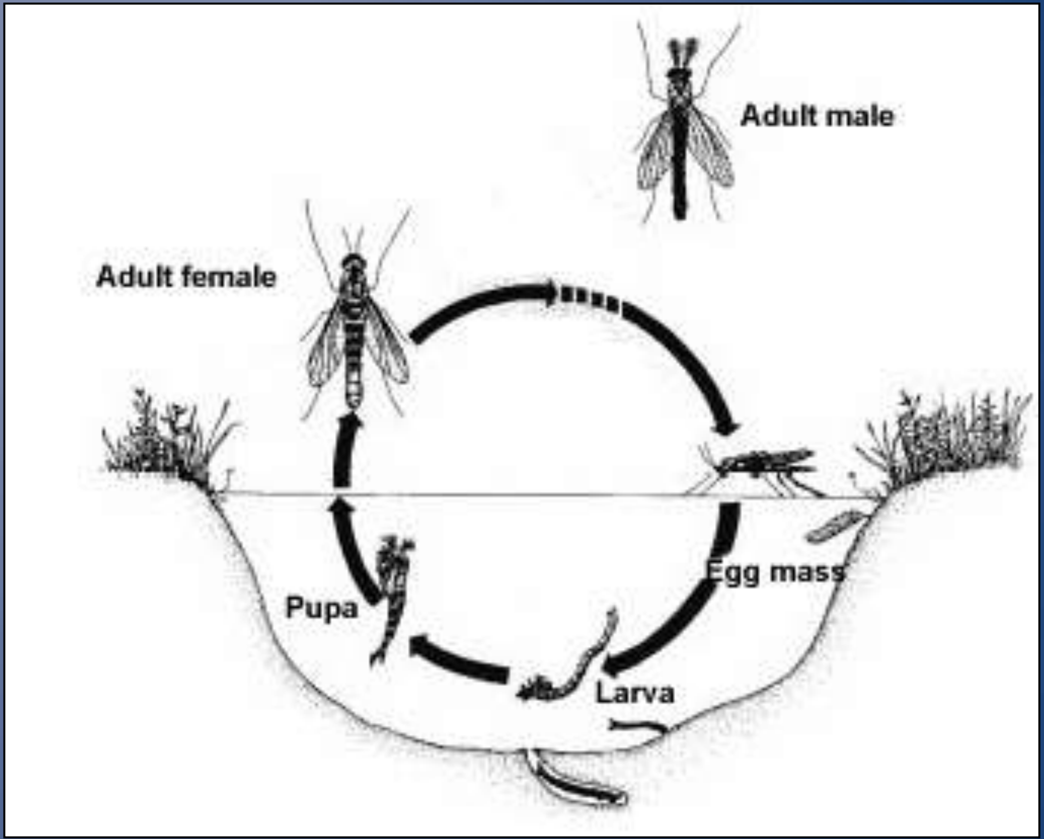
- Sites between Rkm 50-89
- Elevation 1.4-1.8 m CRD

METHODS

Many macroinvertebrates (including Chironomids) use both aquatic & terrestrial habitats during their life cycle.

Used three different sampling techniques to capture all life cycle stages:

- Fallout traps
  - Terrestrial adults
- Emergence traps
  - Pupae metamorphosing to adults
- Benthic cores
  - Larvae



Life cycle diagram for a Chironomid fly (midge). Larvae are present in the sediment, then emerge and make their way through the water column as a pupa, before beginning the terrestrial adult stage.

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DENSITY & BIOMASS

Univariate ANOVA with main effects of

Month & Vegetation Type

to examine the abundance & biomass

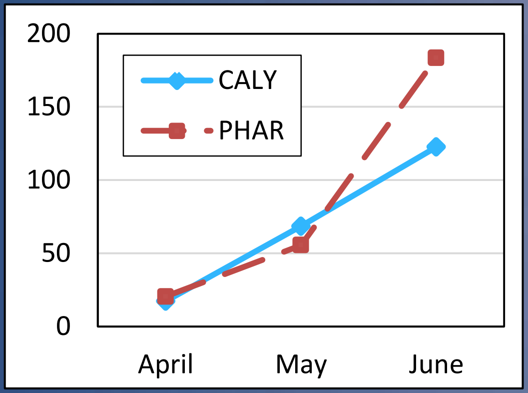
of macroinvertebrates between PHAR & CALY

ALL TAXA – DENSITY & BIOMASS

DENSITY

Fallout traps

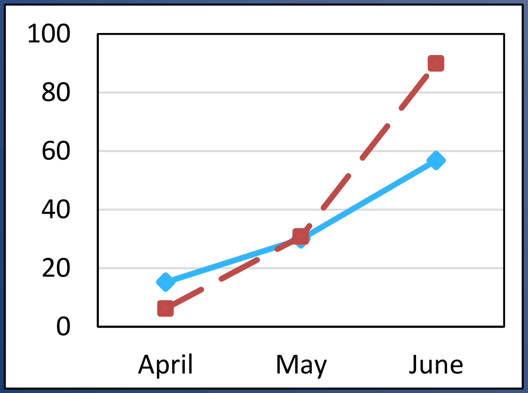
/ m² / hr



BIOMASS

Fallout traps

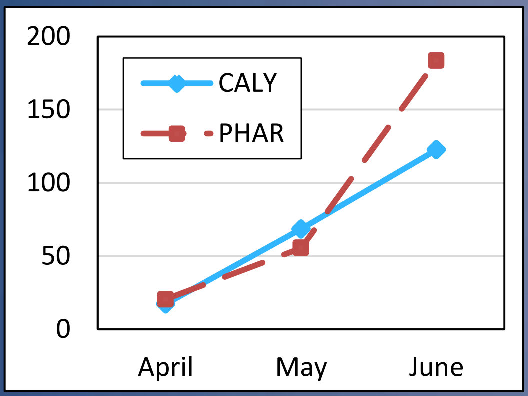
mg / m² / hr



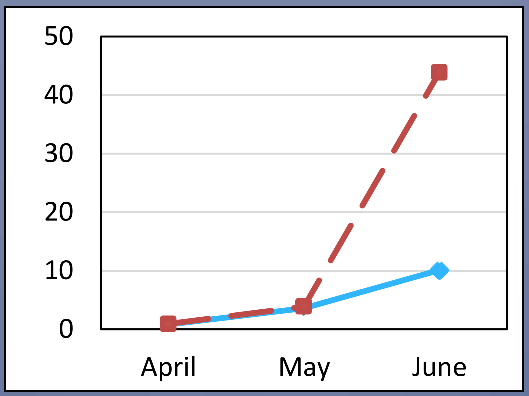
ALL TAXA – DENSITY & BIOMASS

DENSITY

Fallout traps
/ m² / hr

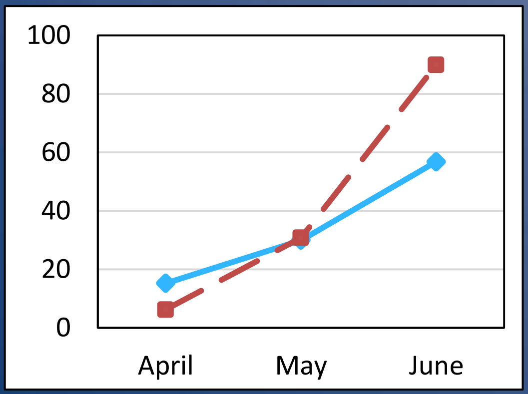


Emergence traps
/ m² / hr

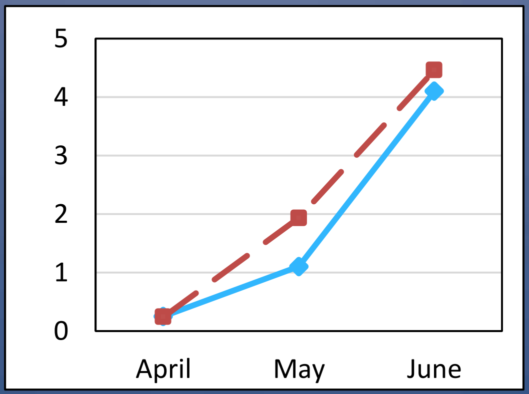


BIOMASS

Fallout traps
mg / m² / hr



Emergence traps
mg / m² / hr



ALL TAXA – DENSITY & BIOMASS

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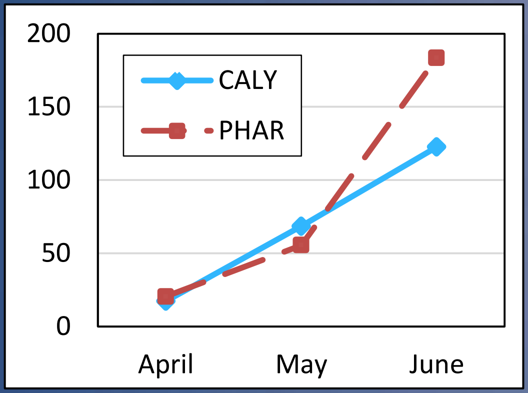
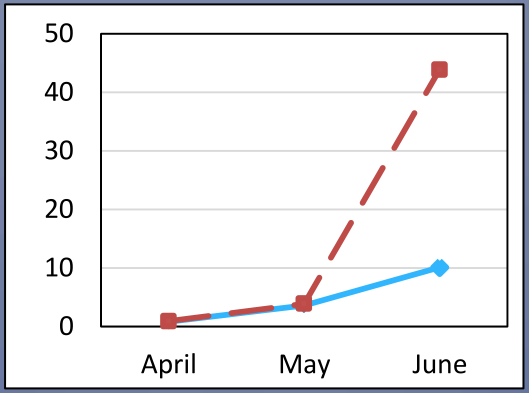
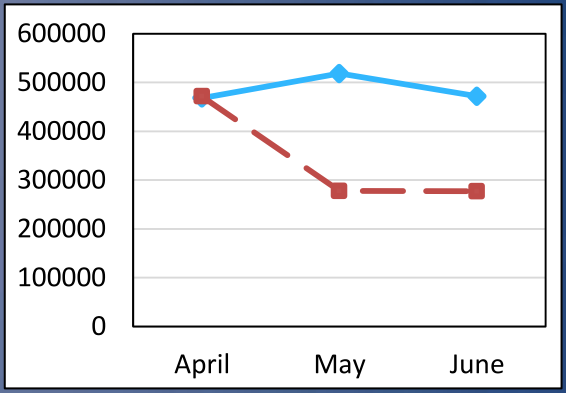


Emergence traps
/ m² / hr

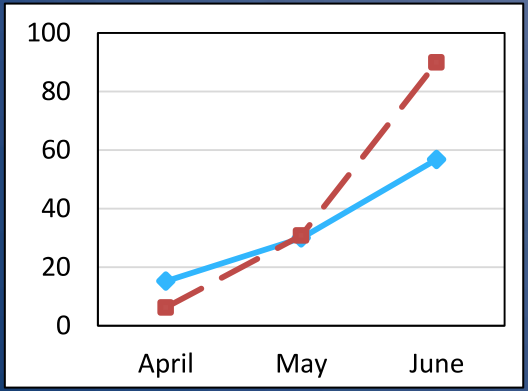


Benthic cores
/ m³

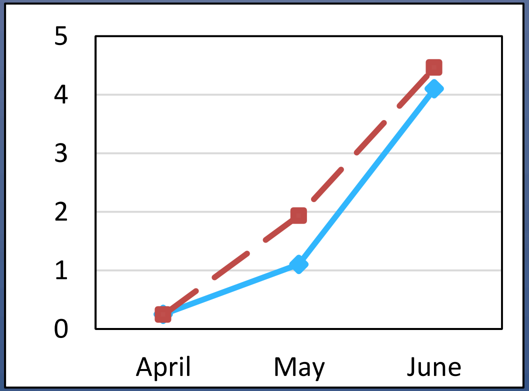


BIOMASS

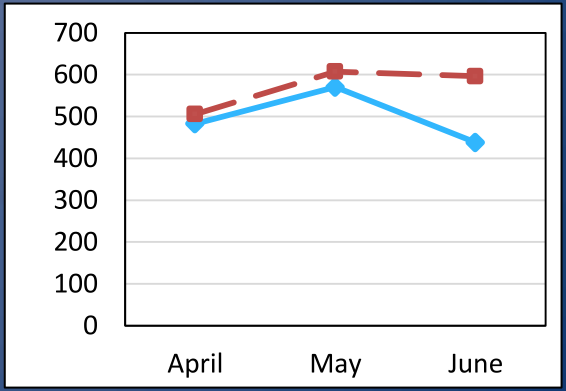
Fallout traps
mg / m² / hr



Emergence traps
mg / m² / hr



Benthic cores
g / m³



RESULTS

Trends

All Taxa

- Density and biomass increase over time (fallout & emergence)
- Density and biomass in PHAR and CALY sites were similar
- Main effect of Plant Type was significant for benthic taxa abundance (CALY > PHAR)

Results

ANOVA (p value) test for main effect of **Plant Type** on taxa abundance (density) and biomass

density	**All Taxa**	
Fallout	0.820	
Emergence	--	
Benthic	0.003	
biomass		
Fallout	0.236	
Emergence	0.161	
Benthic	0.694	

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Fallout	0.820	
Emergence	*no sig. effect*	
Benthic	0.003	
biomass		
Fallout	0.236	
Emergence	0.161	
Benthic	0.694	

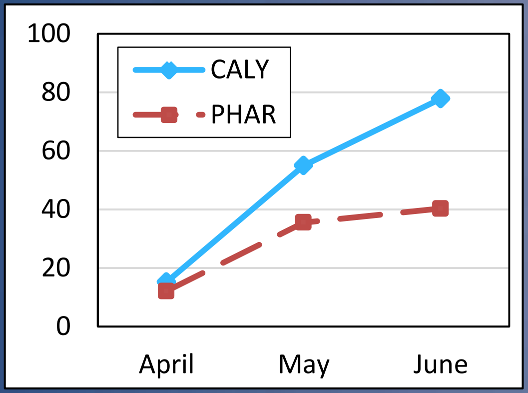
Significant Month x Plant Interaction

CHIRONOMID – DENSITY & BIOMASS

DENSITY

Fallout traps

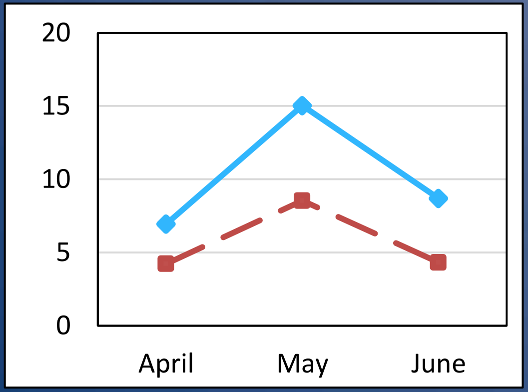
/ m² / hr



BIOMASS

Fallout traps

mg / m² / hr

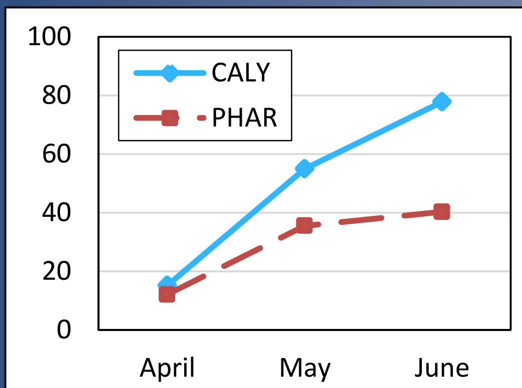


CHIRONOMID – DENSITY & BIOMASS

DENSITY

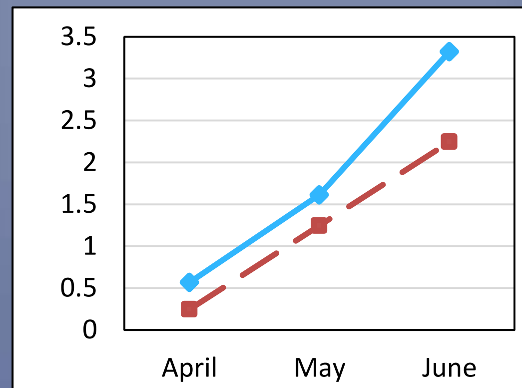
Fallout traps

/ m^2 / hr



Emergence traps

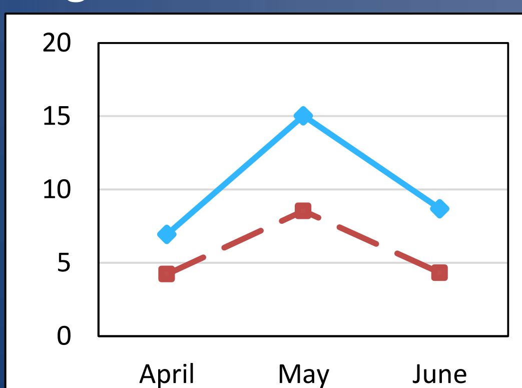
/ m^2 / hr



BIOMASS

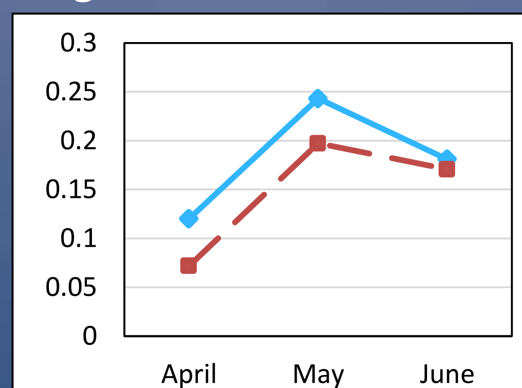
Fallout traps

mg / m^2 / hr



Emergence traps

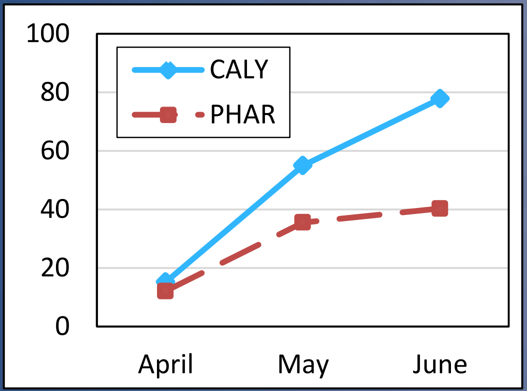
mg / m^2 / hr



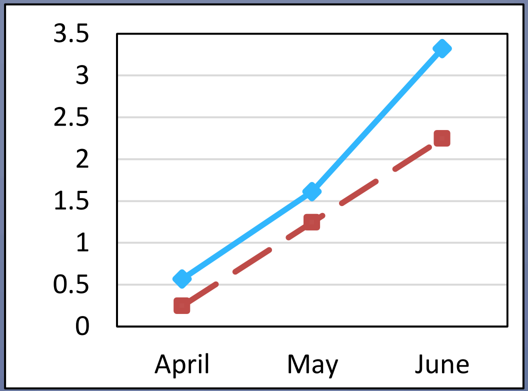
CHIRONOMID – DENSITY & BIOMASS

DENSITY

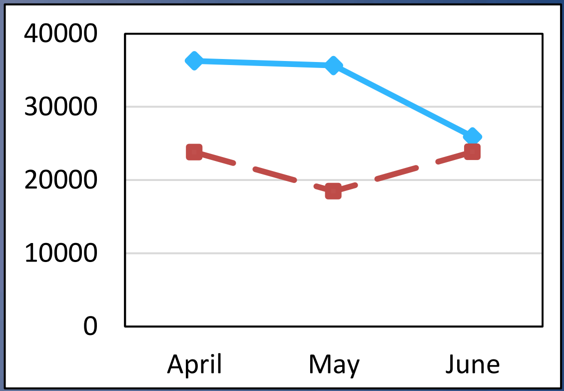
Fallout traps
/ m² / hr



Emergence traps
/ m² / hr

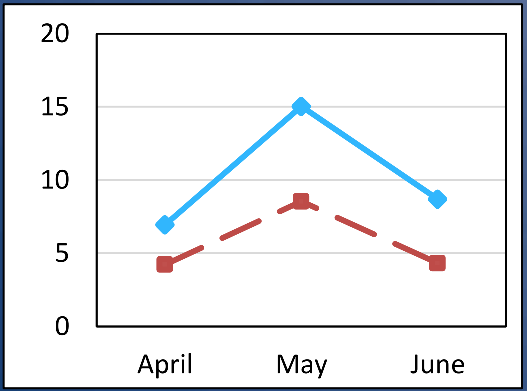


Benthic cores
/ m³

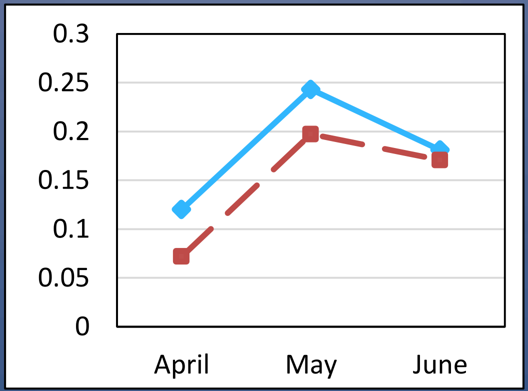


BIOMASS

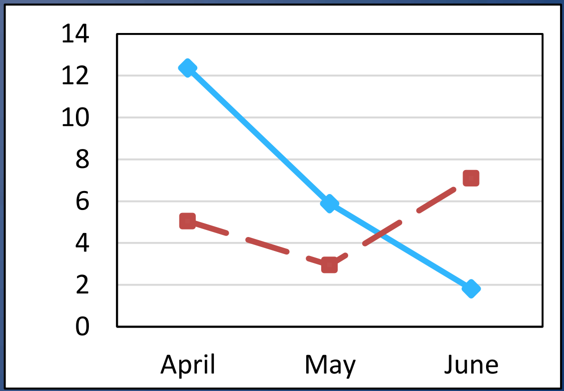
Fallout traps
mg / m² / hr



Emergence traps
mg / m² / hr



Benthic cores
g / m³



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- Main effect of Plant Type was significant for benthic taxa abundance (CALY > PHAR)

Chironomid

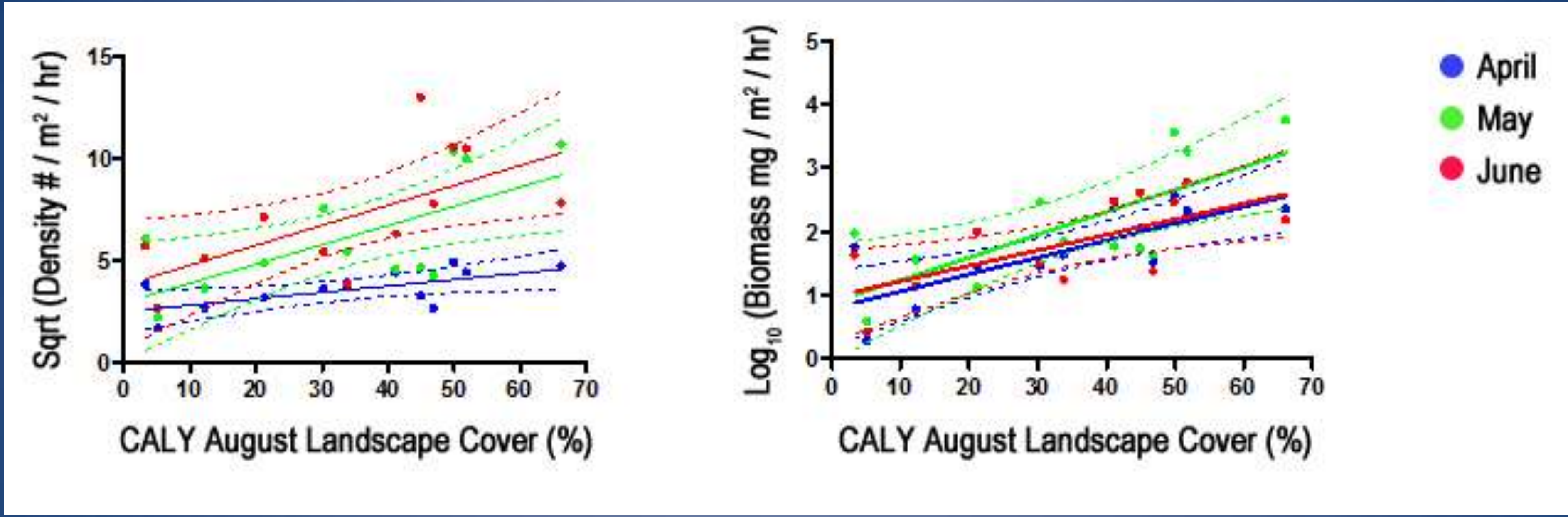
- Density increases over time; biomass peaks in May (fallout & emergence)
- CALY > PHAR in all sample methods

Results

ANOVA (p value) test for main effect of **Plant Type** on taxa abundance (density) and biomass

density	All Taxa	Chironomid
Fallout	0.820	0.027
Emergence	--	0.268
Benthic	0.003	0.045
biomass		
Fallout	0.236	0.002
Emergence	0.161	0.468
Benthic	0.694	0.382

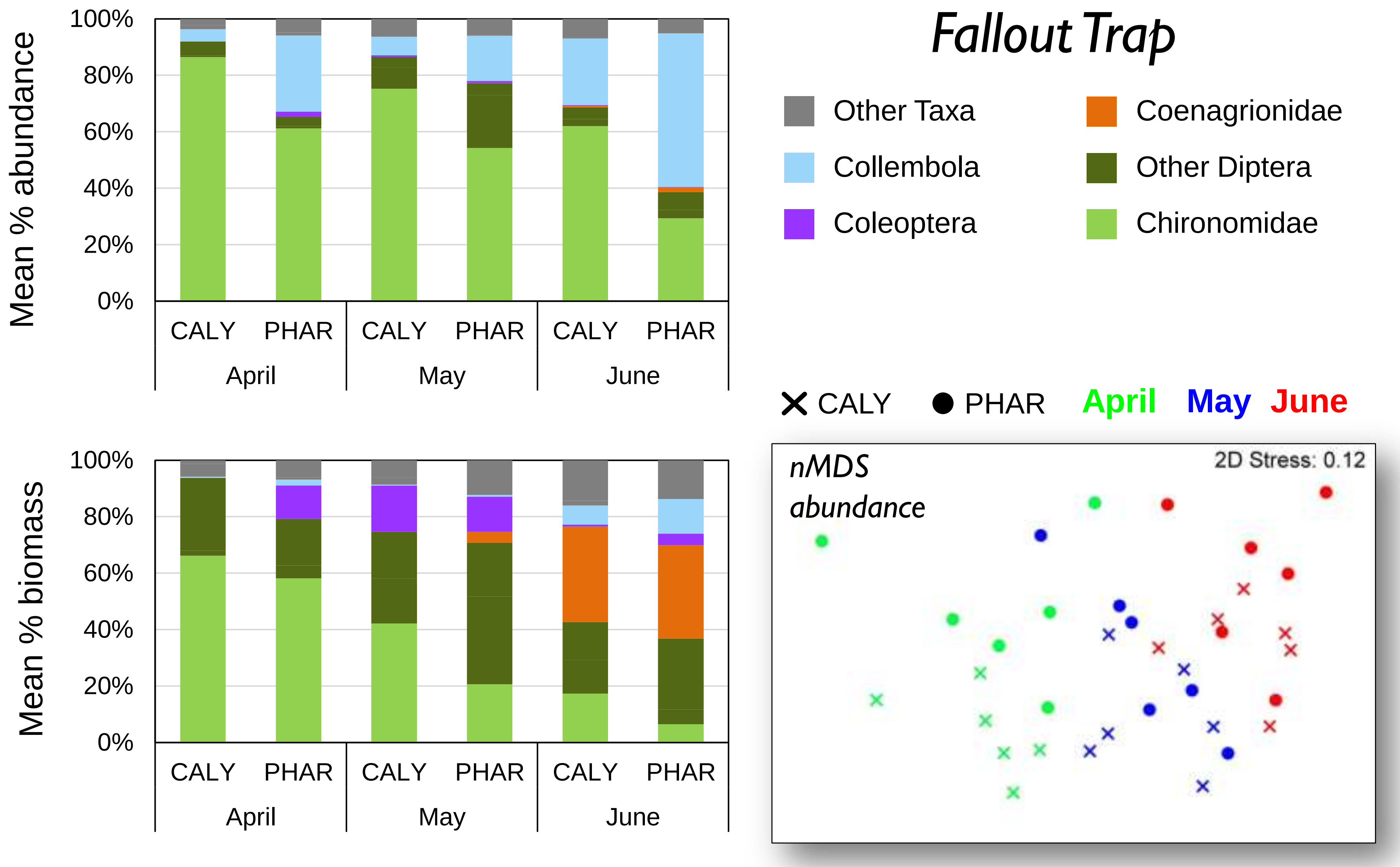
CHIRONOMID – LANDSCAPE VEGETATION



Trends

- Significant positive relationship between Chironomid (density and biomass) and CALY cover in all months
- Reductions in CALY cover will likely reduce the availability of Chironomids as juvenile salmon prey

COMMUNITY COMPOSITION



CONCLUSIONS

1. We did not see much of an effect of plant type on <u>overall</u> abundance or composition
   - When all taxa are considered, density and biomass tends to be similar in CALY (native) and PHAR (invasive) sites
2. CALY sites did appear to support more <u>Chironomids</u>
   - CALY dominated sites contain a higher average density and biomass of flies (including Chironomids – a dominant Chinook prey item)
   - Significant positive relationship between Chironomid density and biomass and CALY cover
   - The CALY community contains a proportionally higher number and biomass of flies, compared to PHAR

Photo by Si Simenstad

LESSONS LEARNED

We might have expected more definitive results from our study, however:

1. We sampled largely monotypic stands of 2 herbaceous species
   - Loss of arthropod diversity is generally associated with loss of plant species richness
2. Small marsh patches with other species within close proximity may have homogenized the communities to some degree
   - Mixing of detrital material throughout study area
3. Our samples were largely dominated by detritivores (larval Chironomidae and other Diptera, Collembola, and Oligochaeta)
   - Detritivores less likely to be negatively affected by invasive plants likely in response to increased litter and decaying vegetation

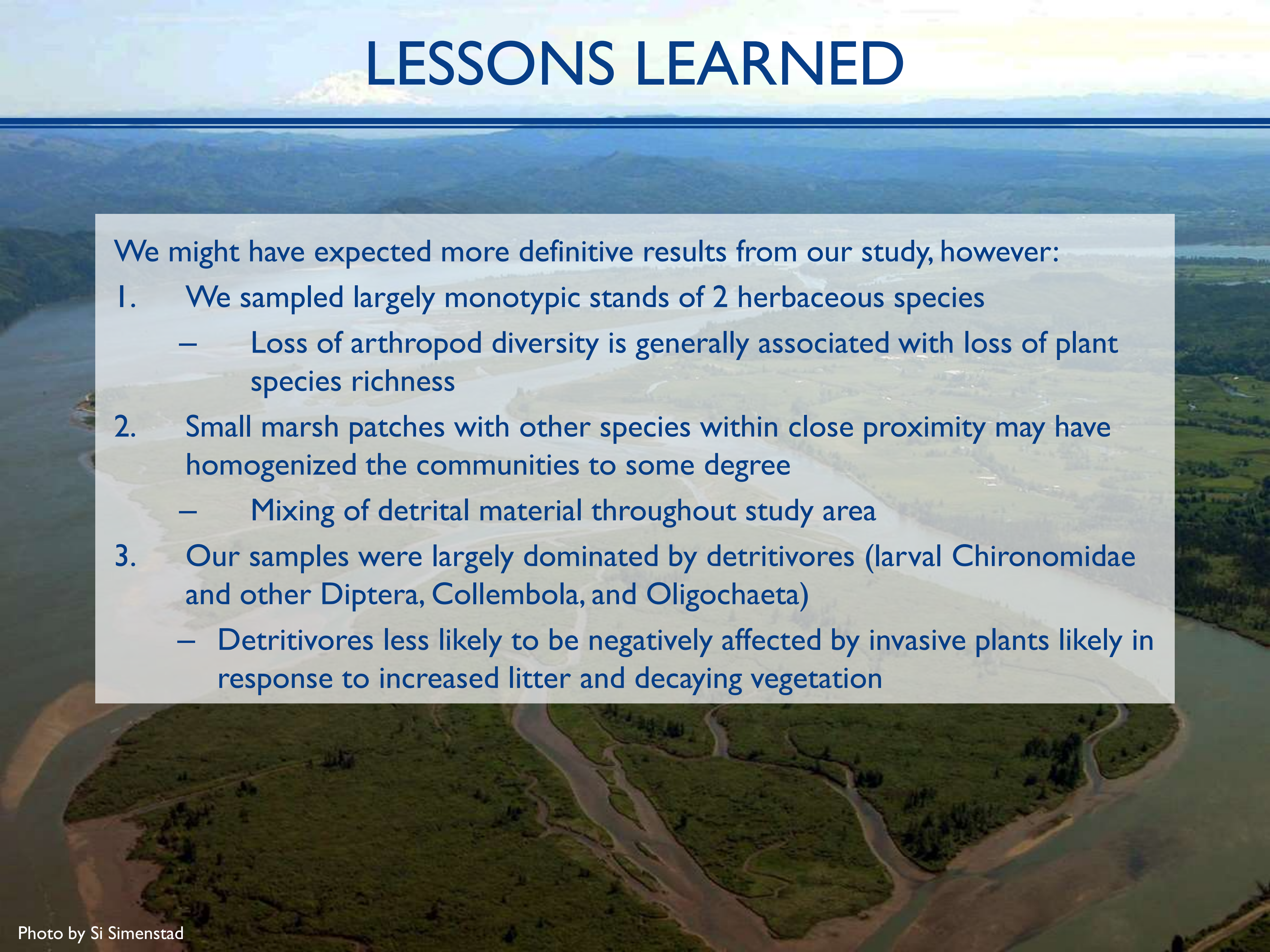


Photo by Si Simenstad

Acknowledgements

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- Special thanks to Valerie Cullinan and Erin Morgan

Photo by L. Stamatiou