Annual cycle of lipid dynamics in zooplankton from the Beaufort Sea shelf, Canadian Arctic

Tara Connelly, Tara Businski, Don Deibel, Chris Parrish, Piotr Trela

Memorial University of Newfoundland

Special Thanks

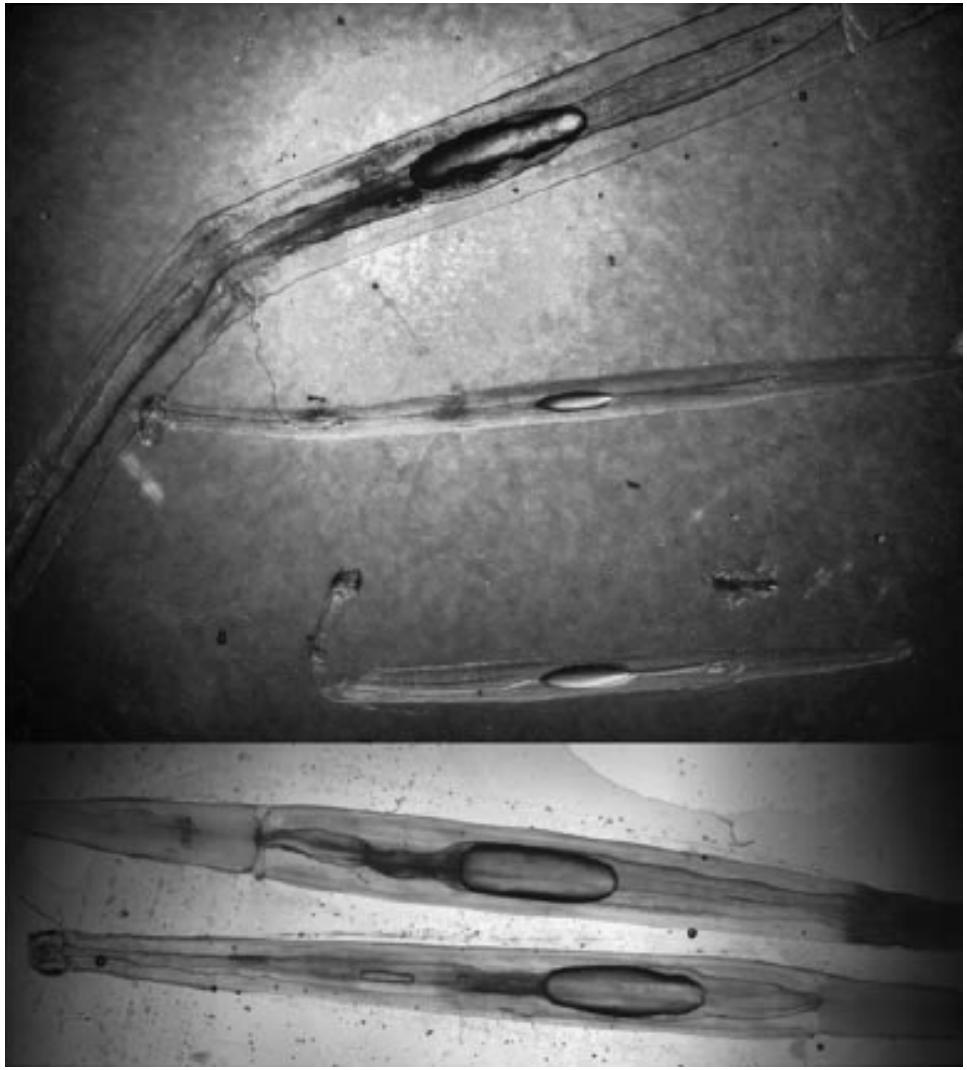
- Jeanette Wells
- Christine Vickers
- Sing-Hoi Lee
- Members of L. Fortier lab

NSERC, Sigma-Xi, Memorial University


NOAA

Calanus hyperboreus

Calanus glacialis



Eukrohnia hamata

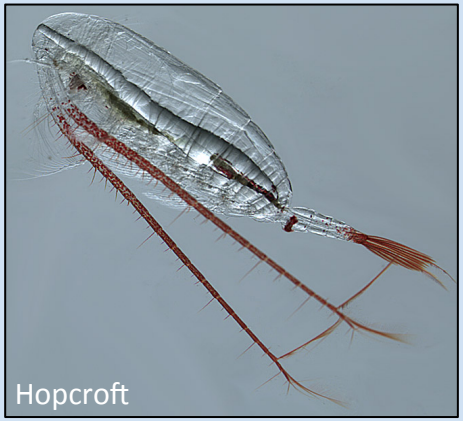
Pond 2012

Central Questions

How does lipid content and lipid composition of 7 zooplankton taxa vary throughout the year?

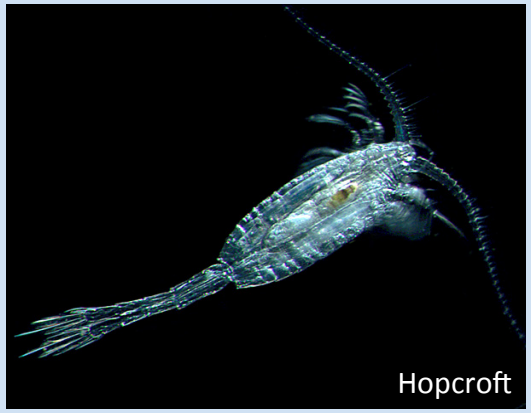
What time periods and which taxa are of optimum lipid quantity and quality for higher trophic levels?

C. hyperboreus



C. glacialis

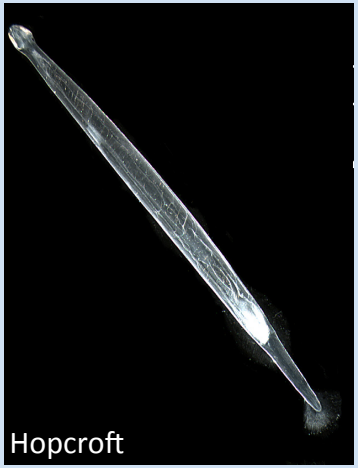
M. longa



P. glacialis

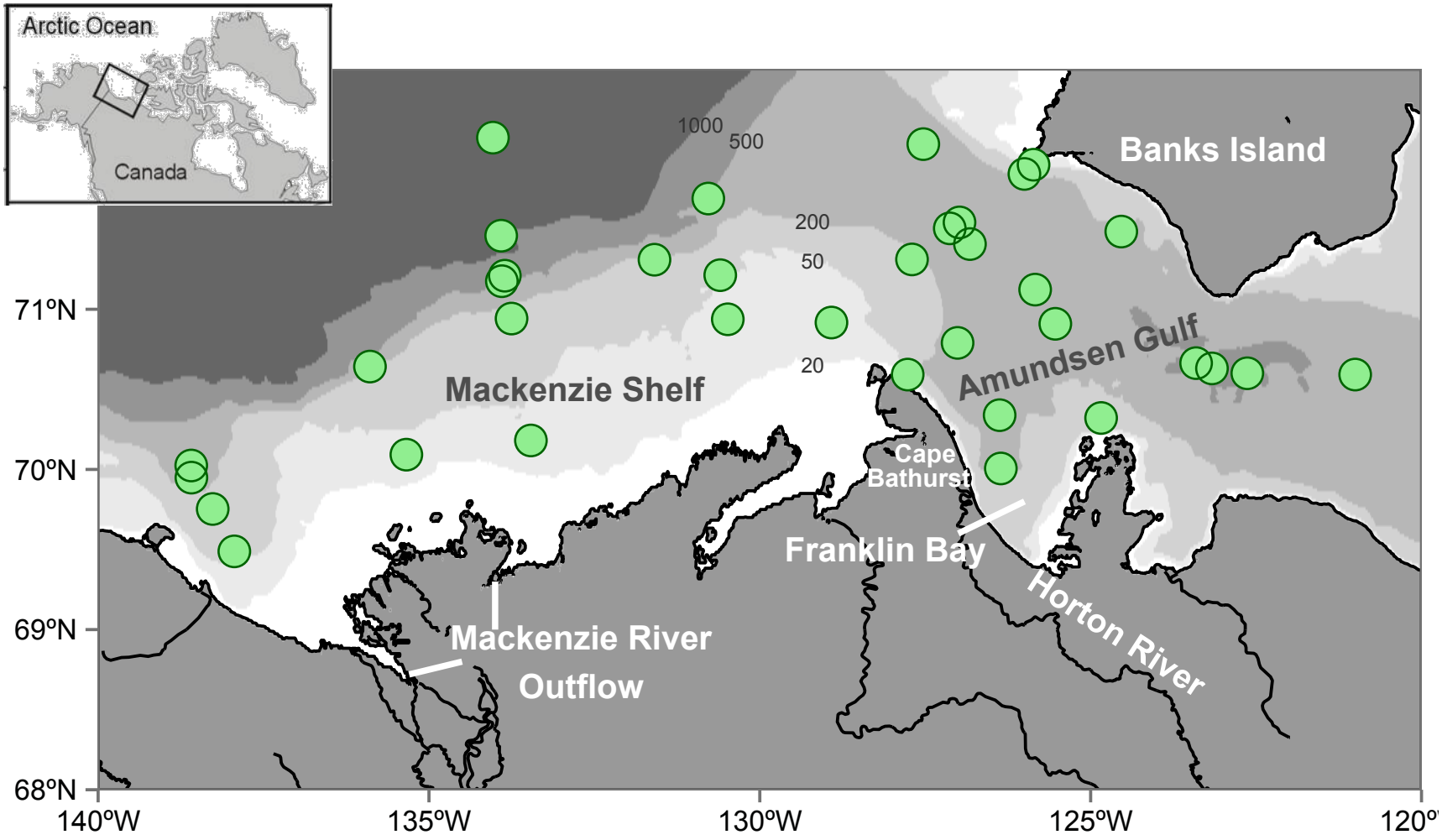
P. elegans

E. hamata

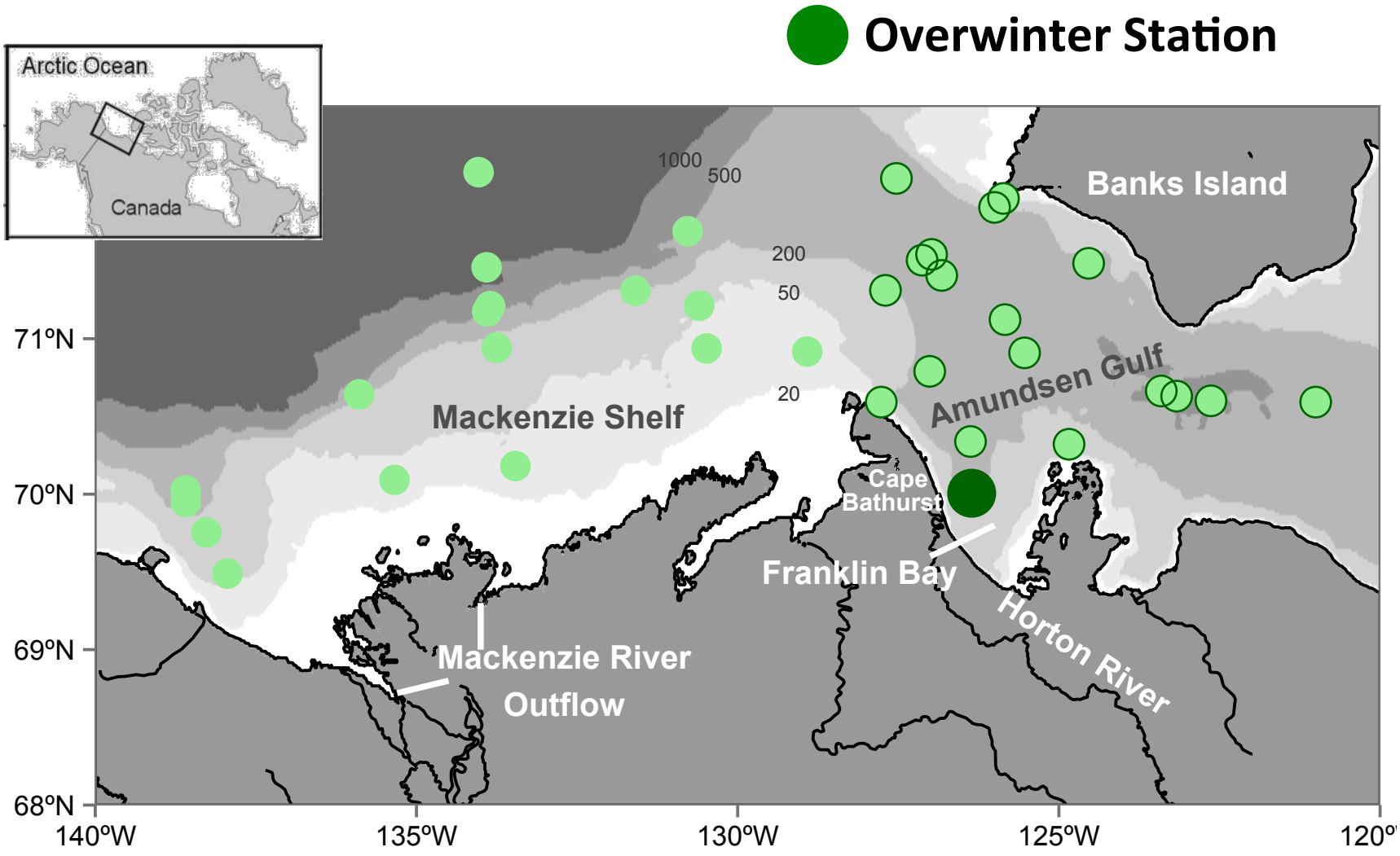


Oikopleura

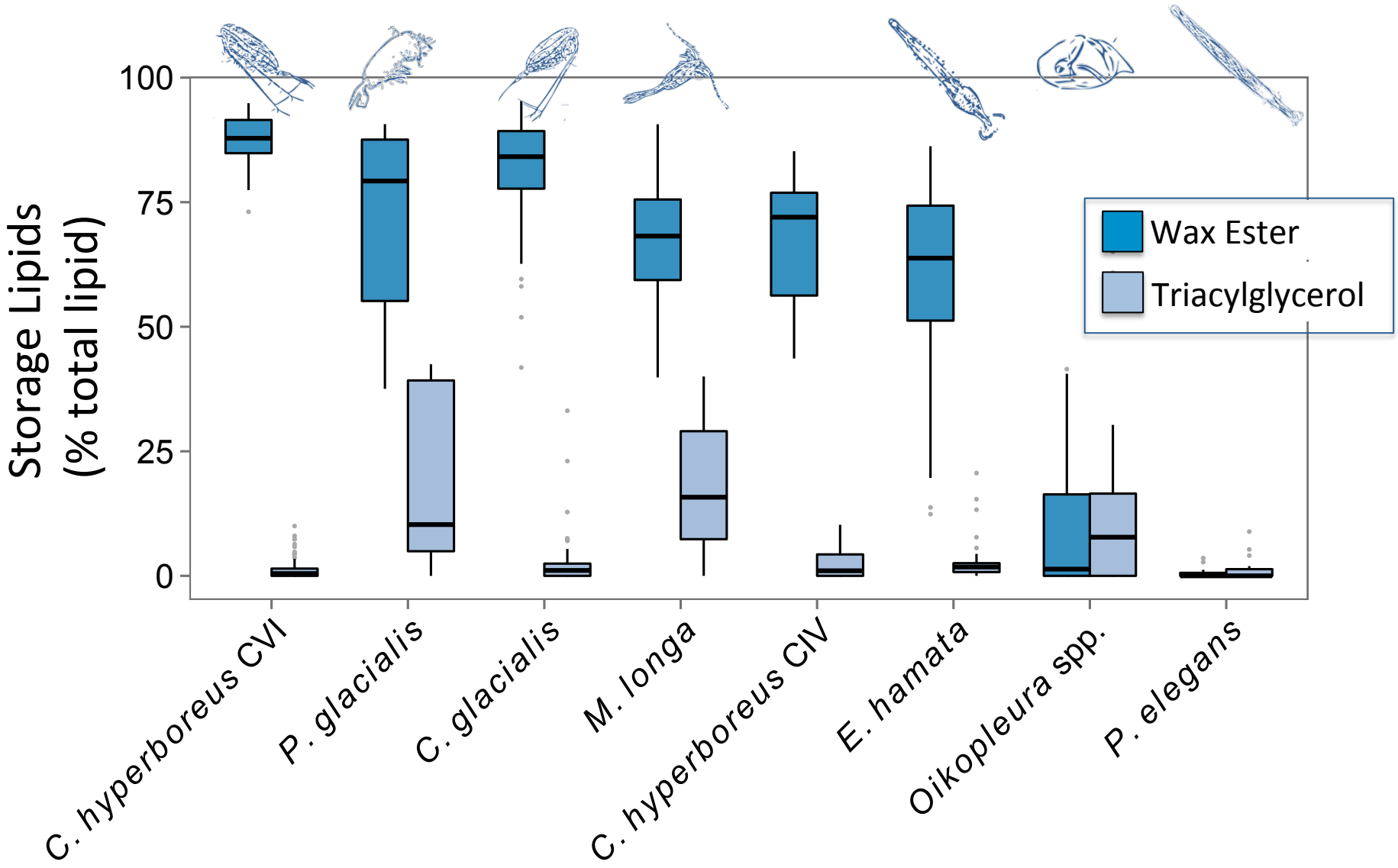
Beaufort Sea Shelf



Beaufort Sea Shelf

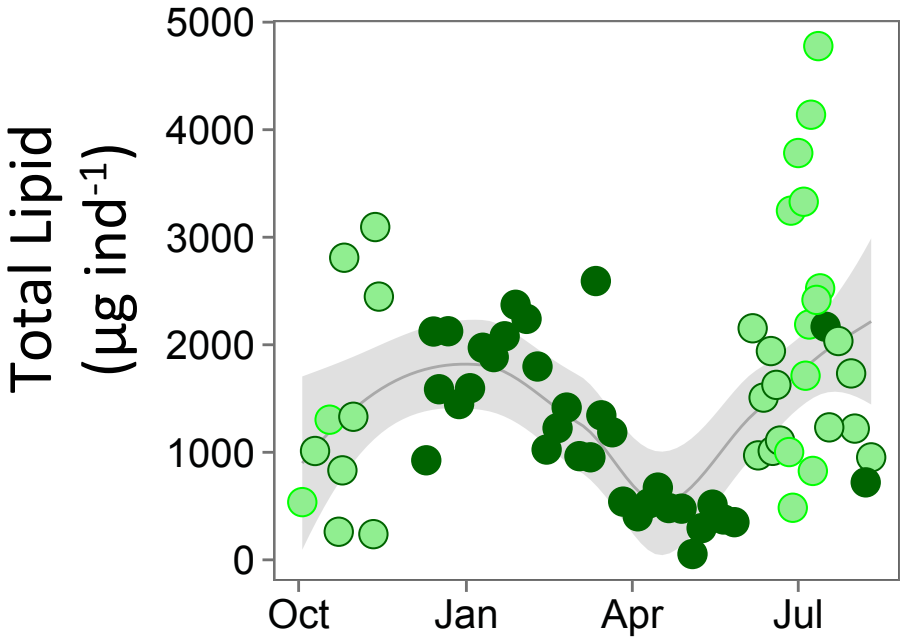


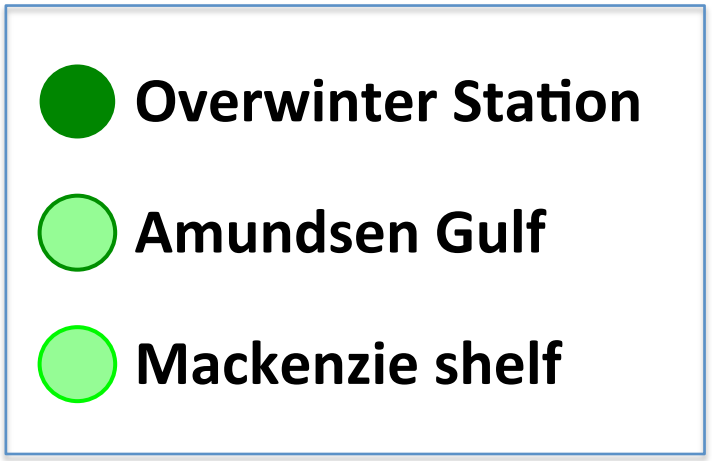
Storage Lipids



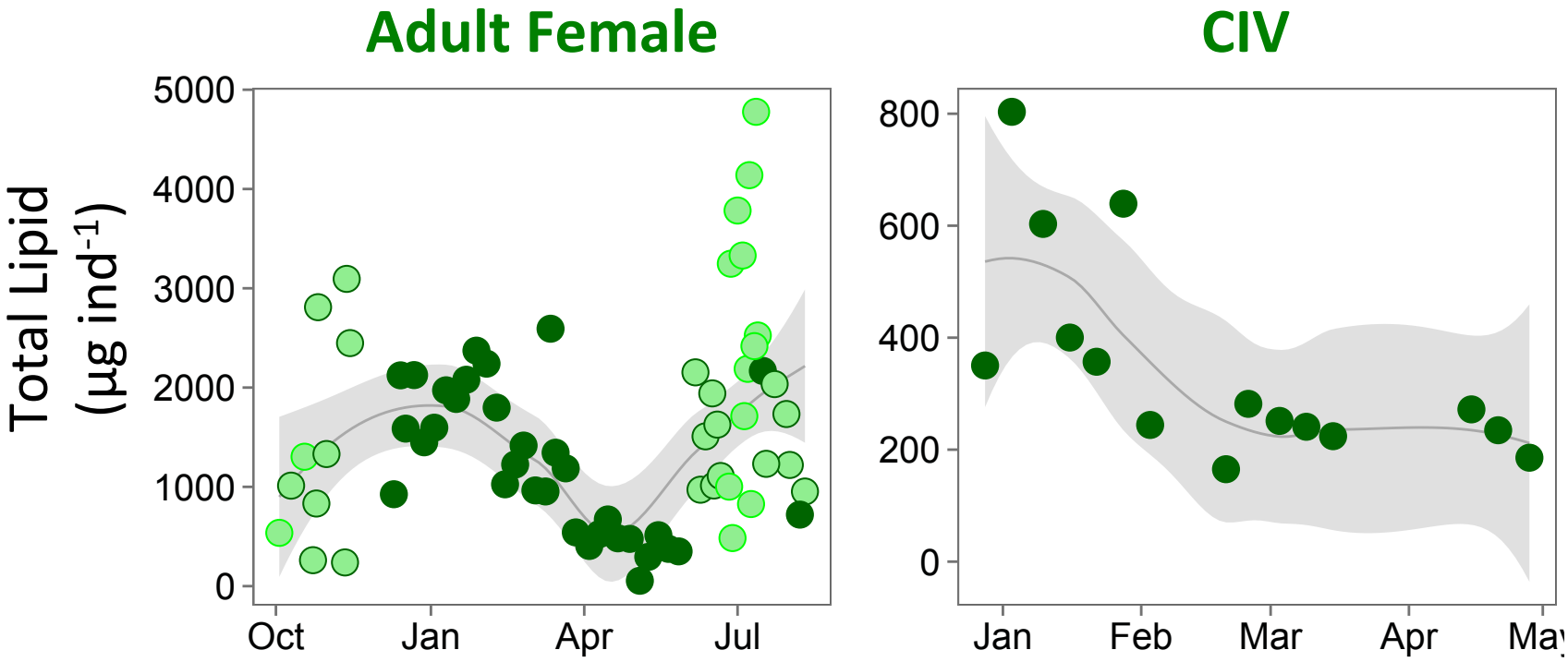
Calanus hyperboreus

Adult Female



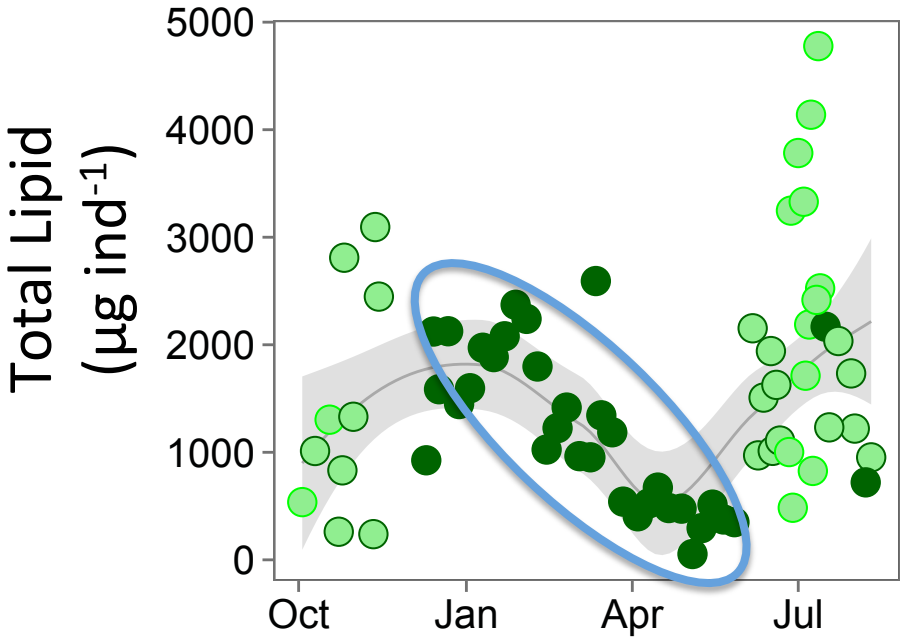


Calanus hyperboreus



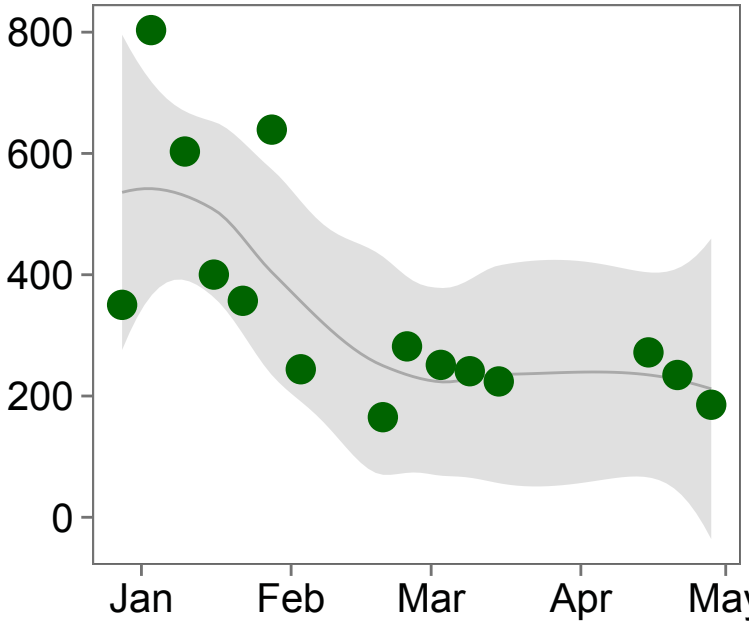
Calanus hyperboreus

Adult Female



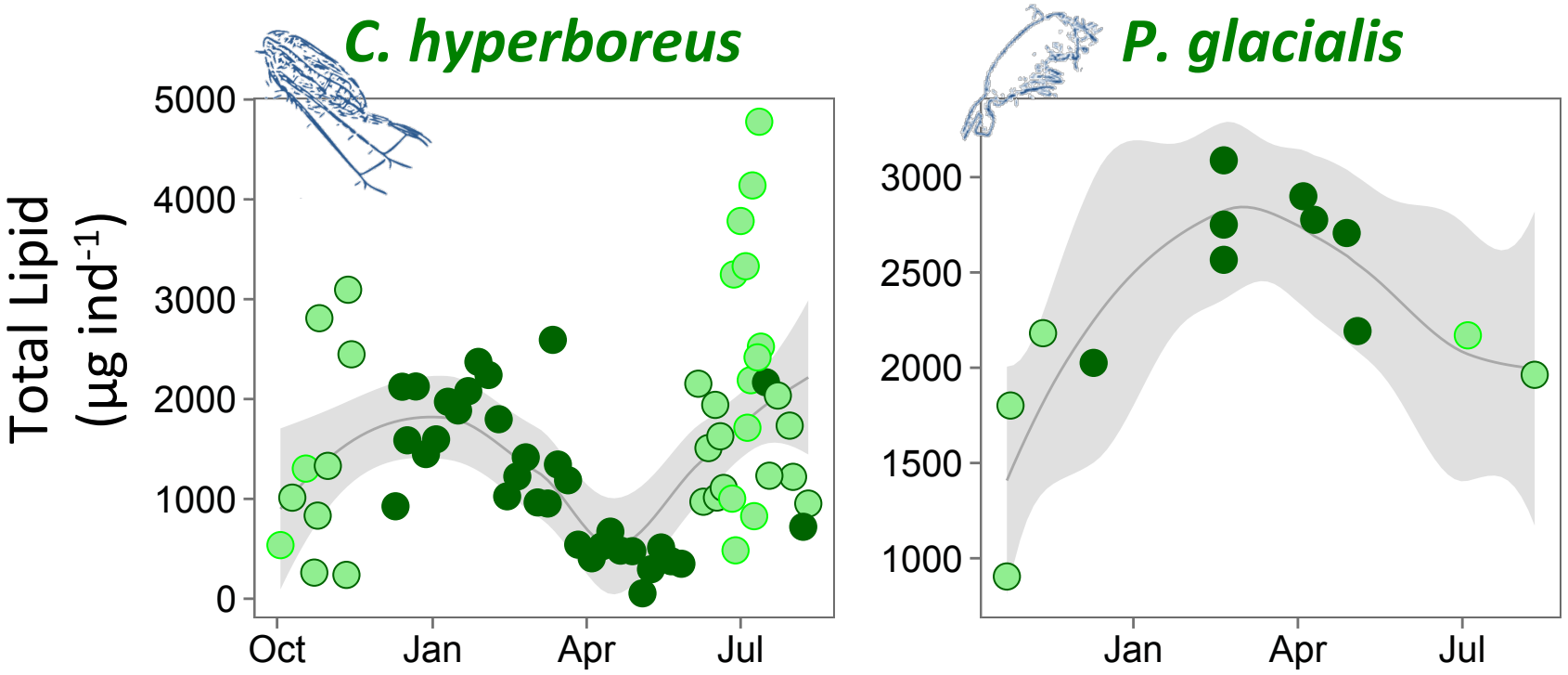
450 *µ*g month^{-1} ind^{-1}
80-85% loss

CIV



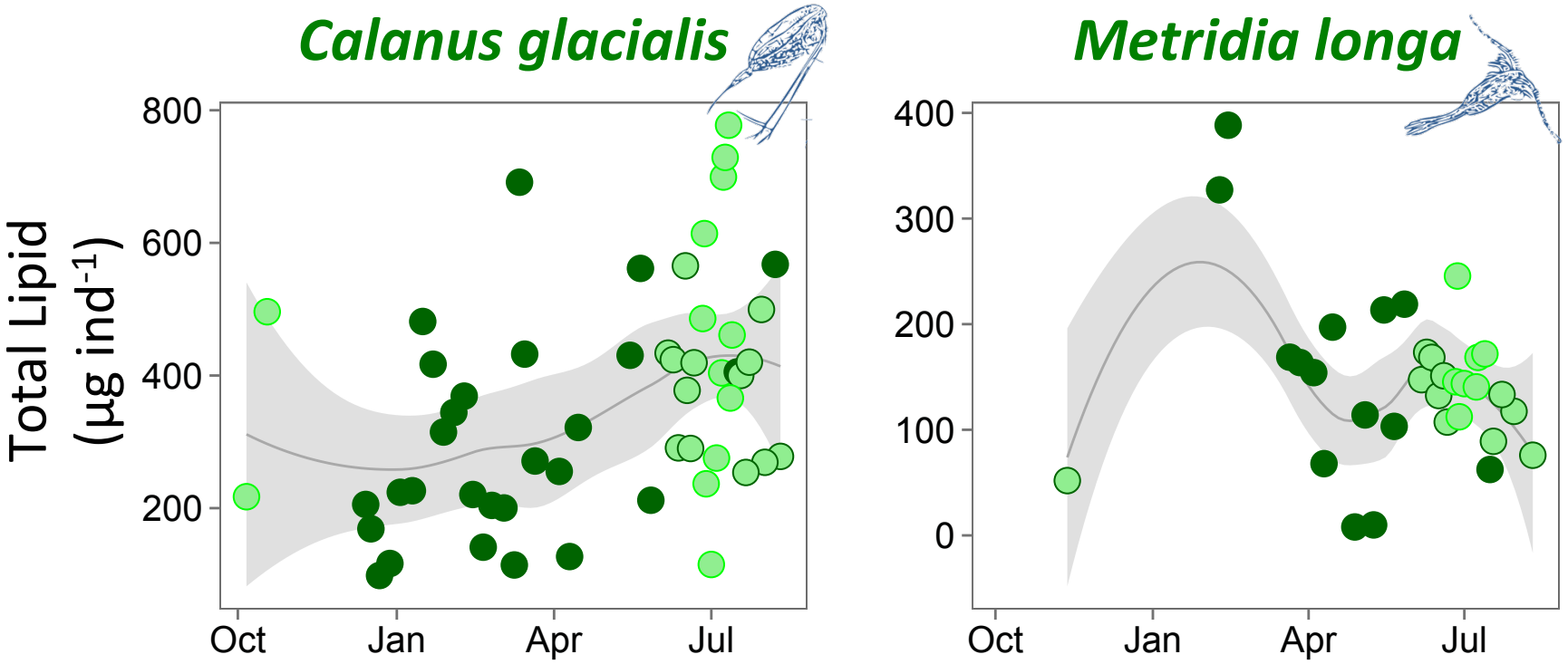
100 *µ*g month^{-1} ind^{-1}
70-75% loss

Paraeuchaeta glacialis



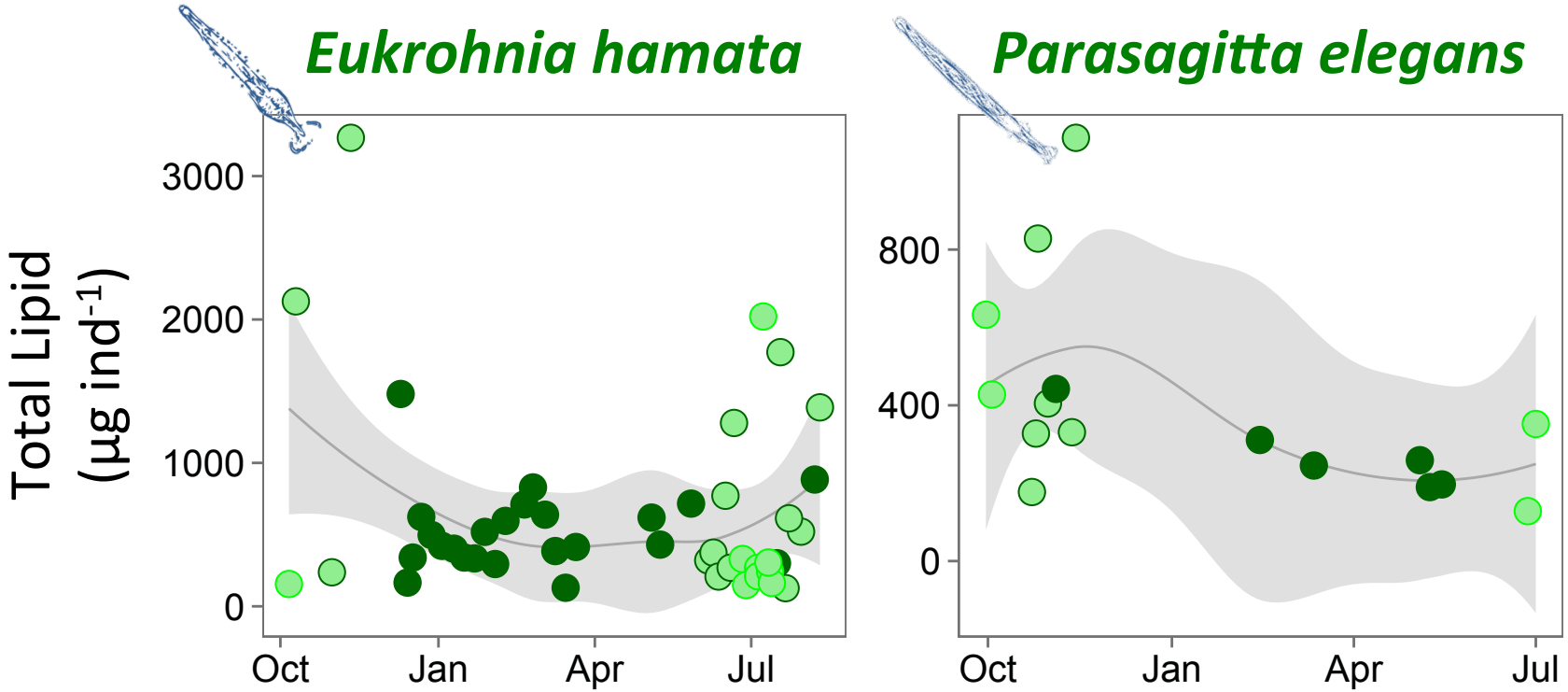
C. hyperboreus		***P. glacialis***
timing of **min** lipids	≈	timing of **max** lipids

Calanus glacialis & Metridia longa



Variable lipid content

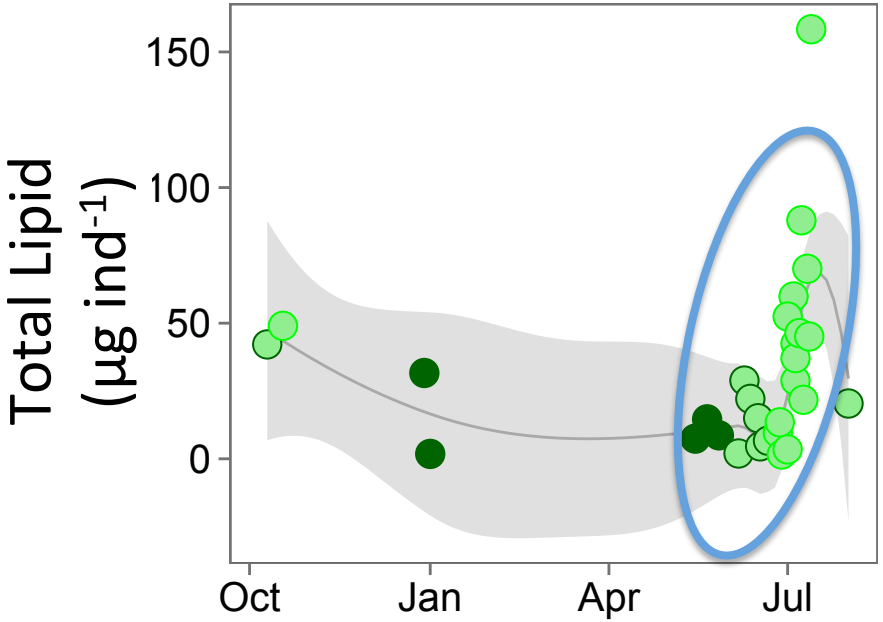
Cheatognaths

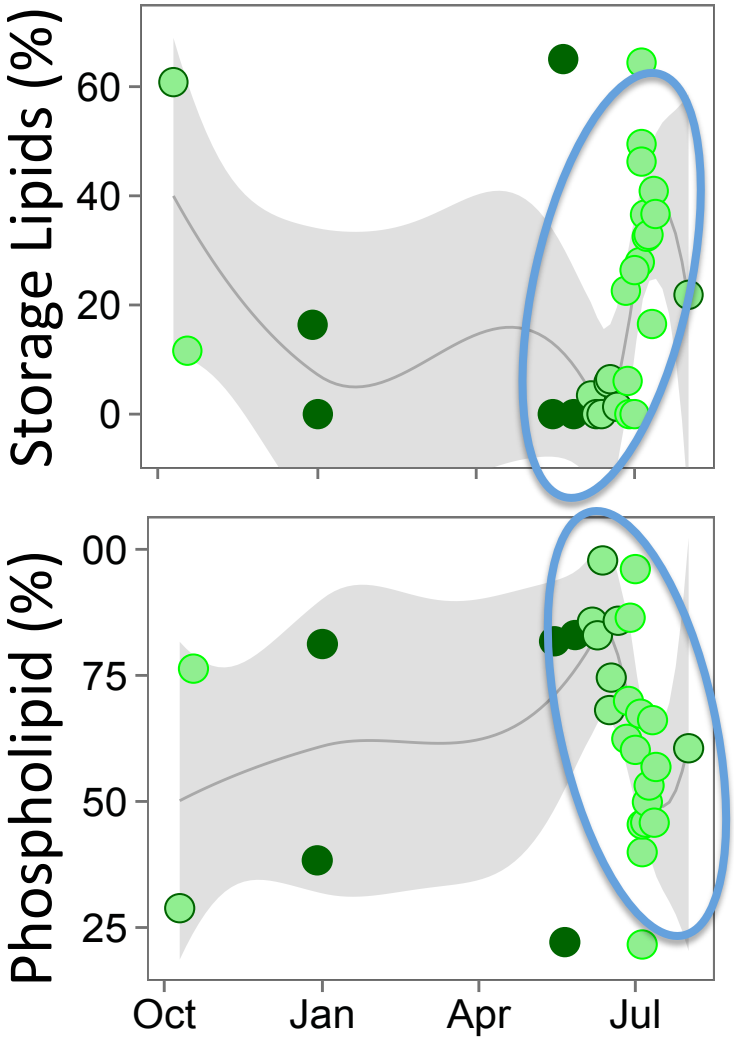


	E. hamata	*P. elegans*
Storage lipids	**> 50%**	**<10%**

No obvious temporal trends

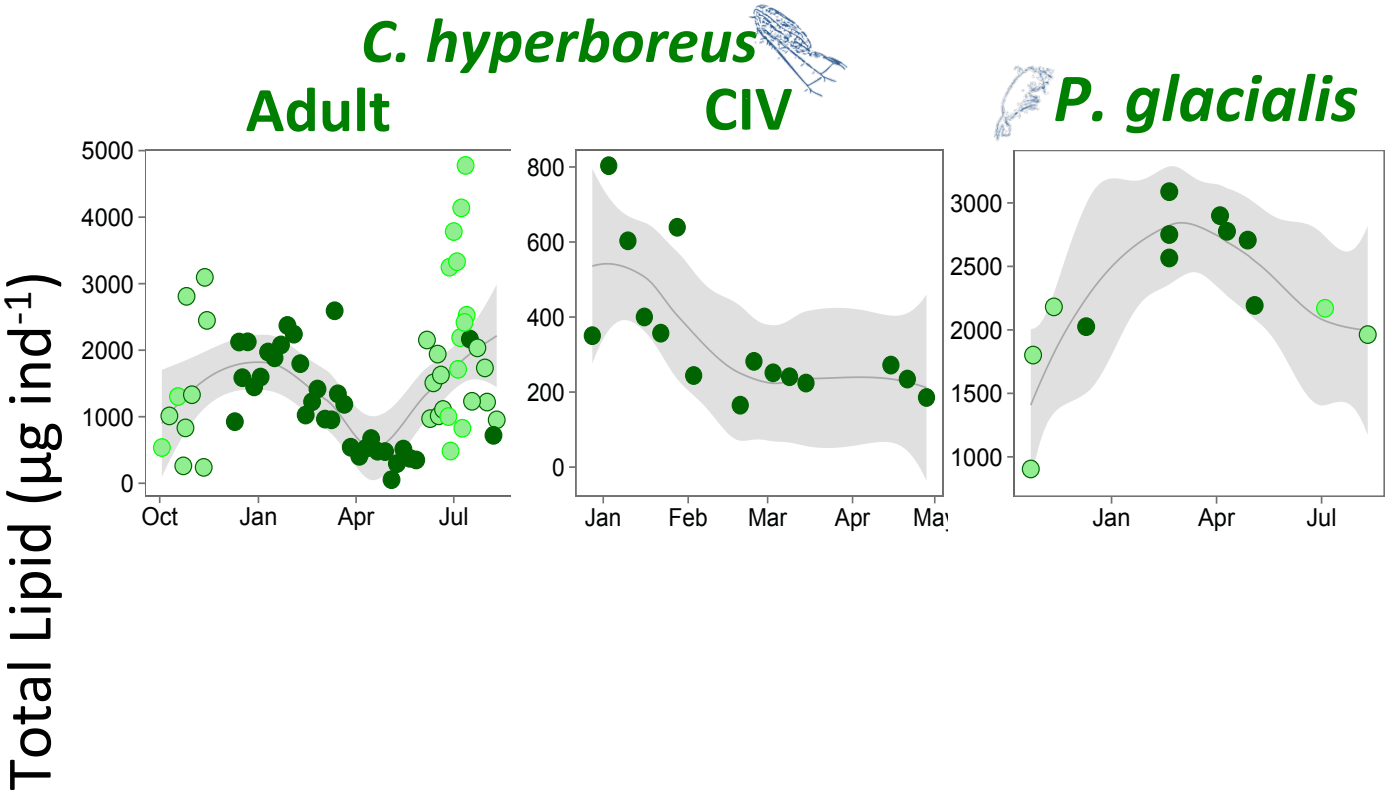
Oikopleura



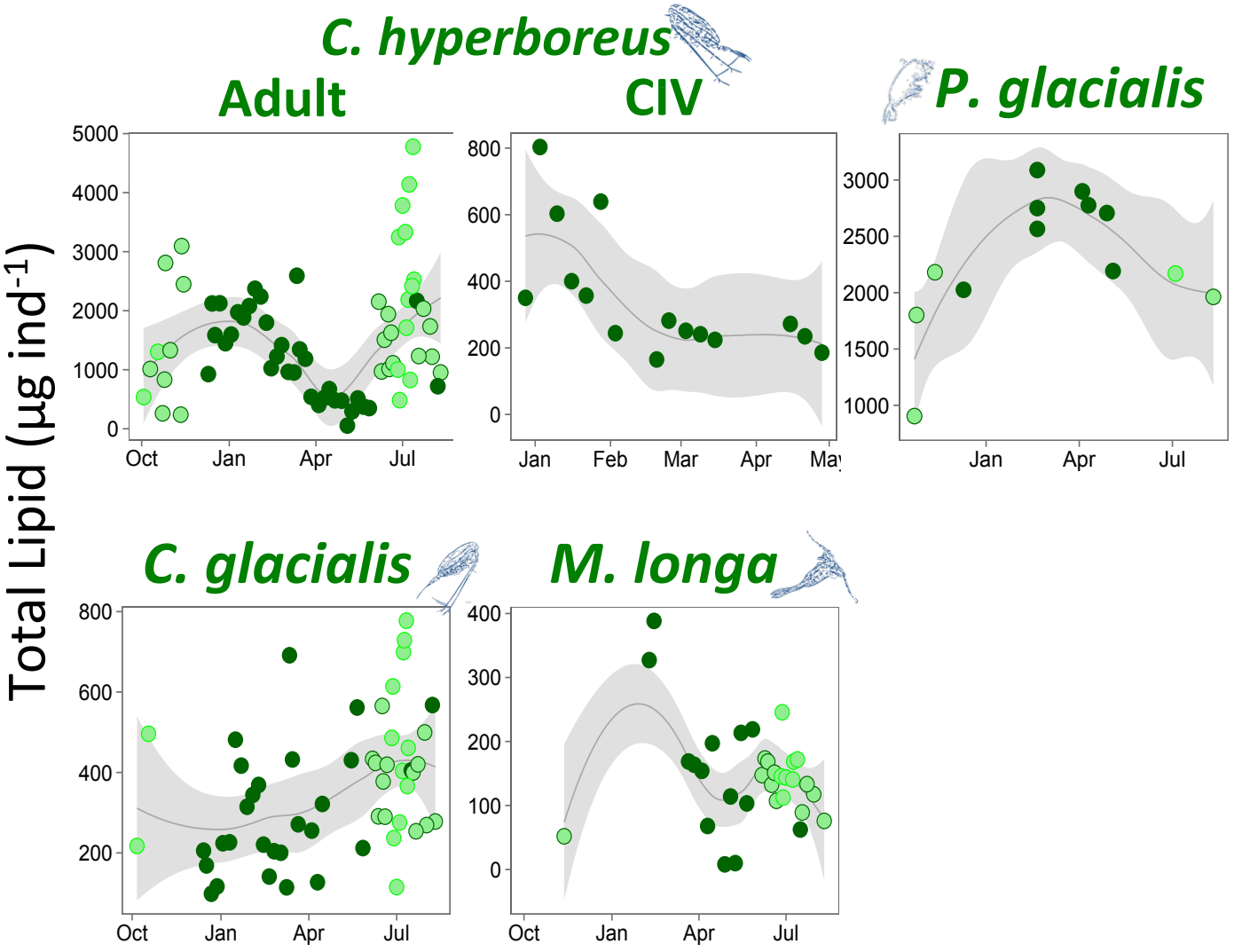


Increase in storage lipids during summer

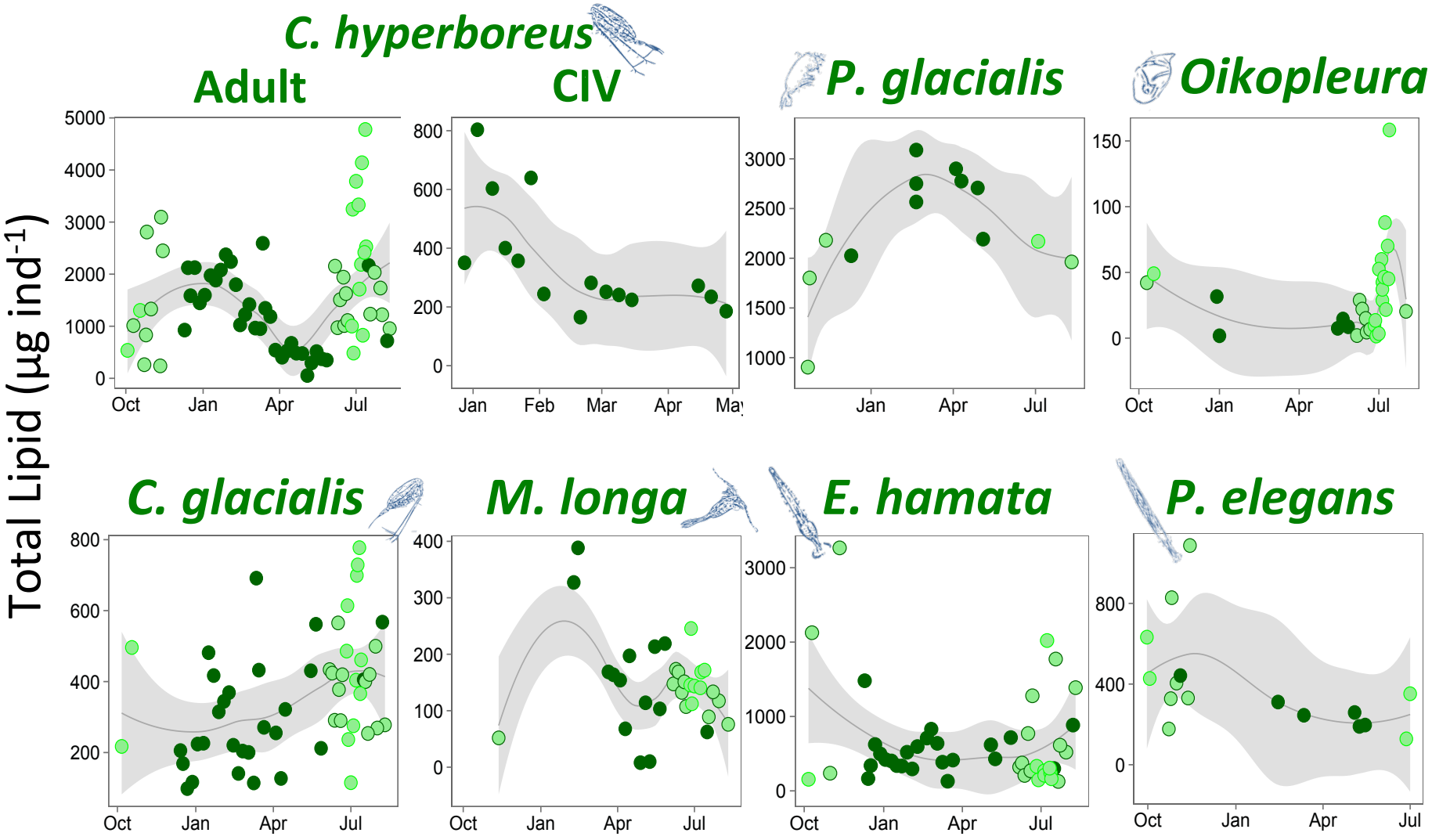
Lipid Content



Lipid Content

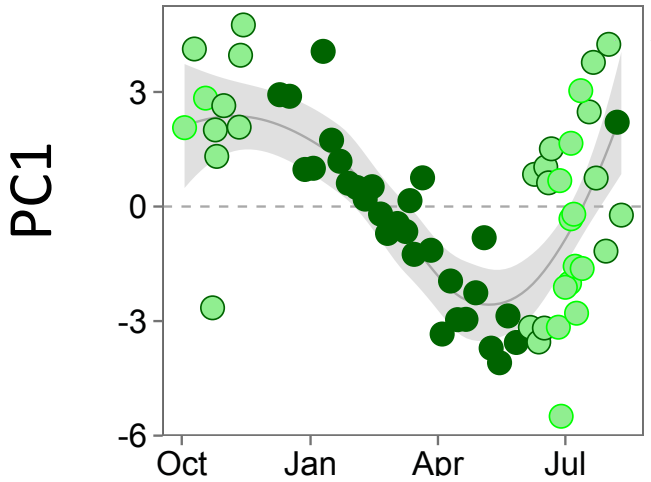


Lipid Content



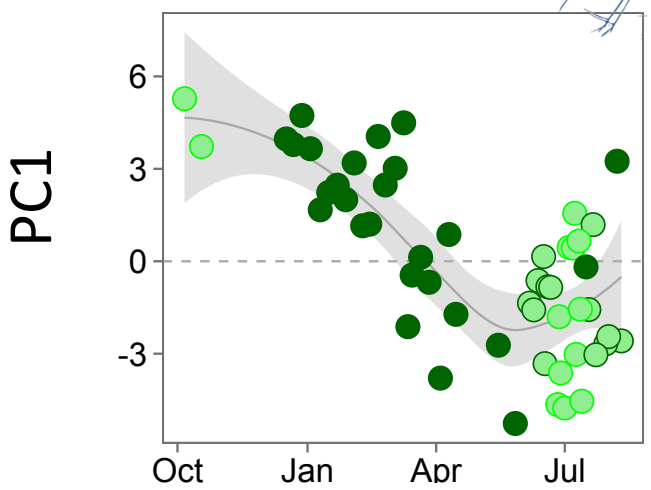
Fatty Acids

C. hyperboreus

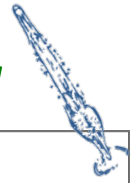


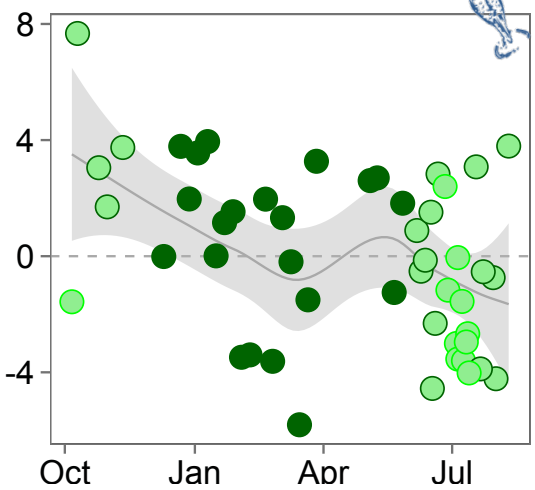
Strong seasonal patterns in fatty acid profiles for all taxa except *E. hamata*

C. glacialis



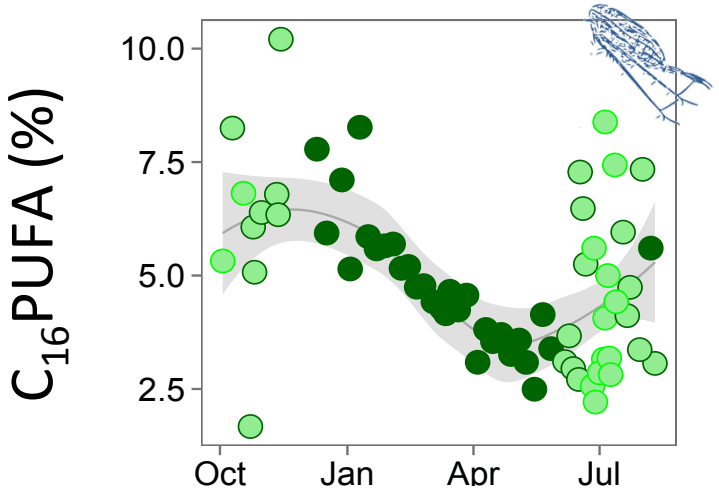
E. hamata

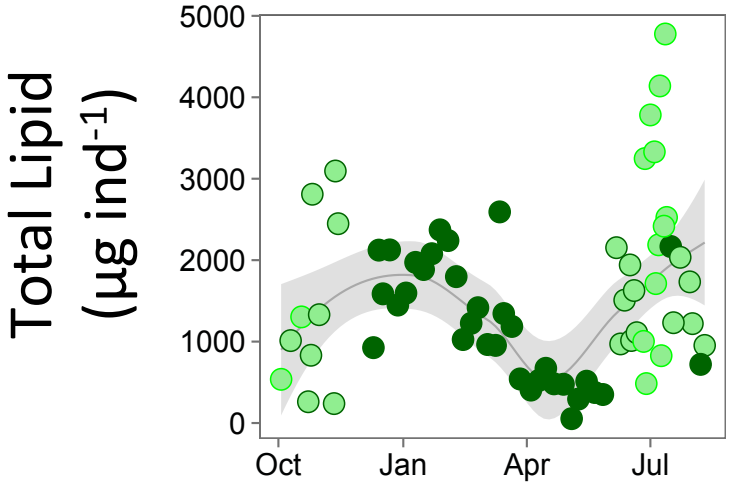




C_{16} PUFA

C. hyperboreus

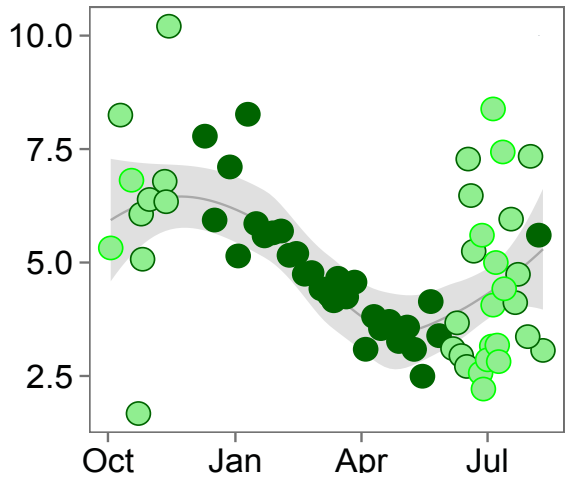




Similar temporal trend between total lipid content and C_{16} PUFA

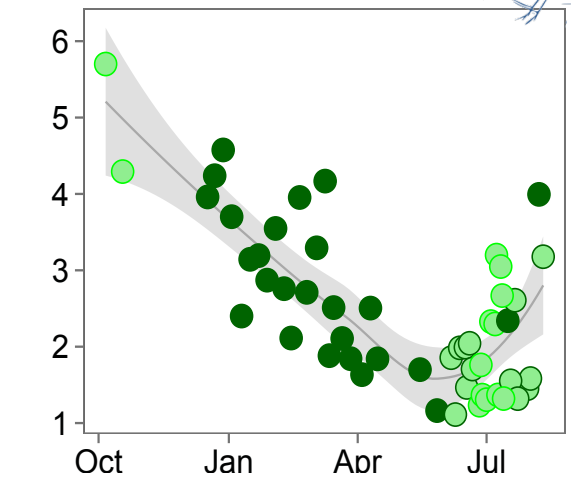
C_{16} PUFA

C. hyperboreus

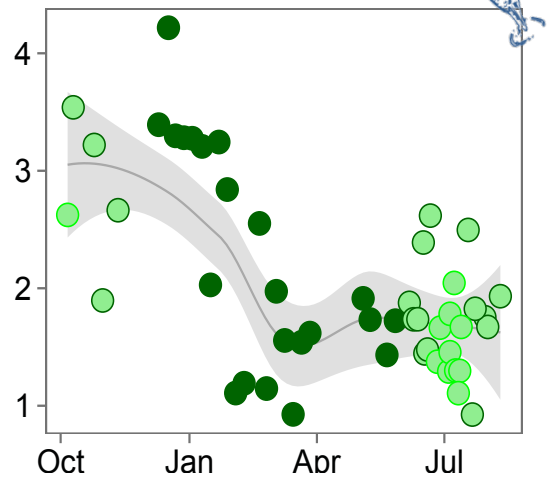


Decrease in C_{16} PUFA through winter

C. glacialis

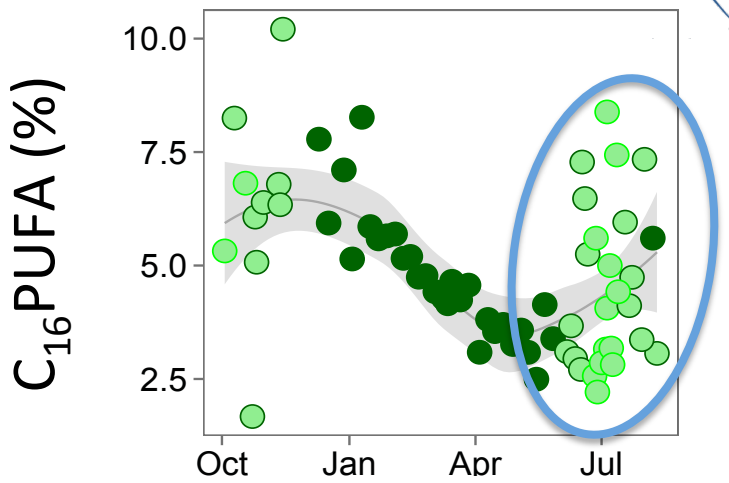


E. hamata



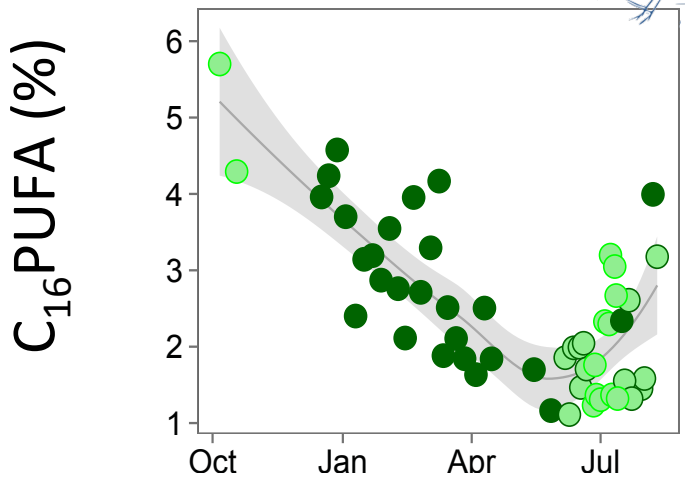
C_{16} PUFA

C. hyperboreus

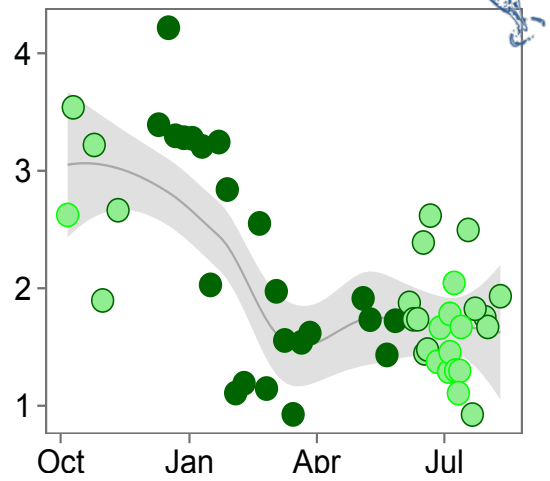


Decrease in C_{16} PUFA through winter

C. glacialis

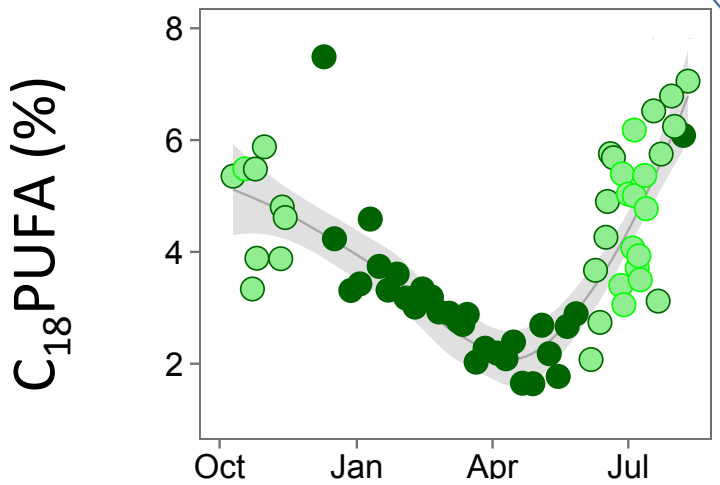


E. hamata



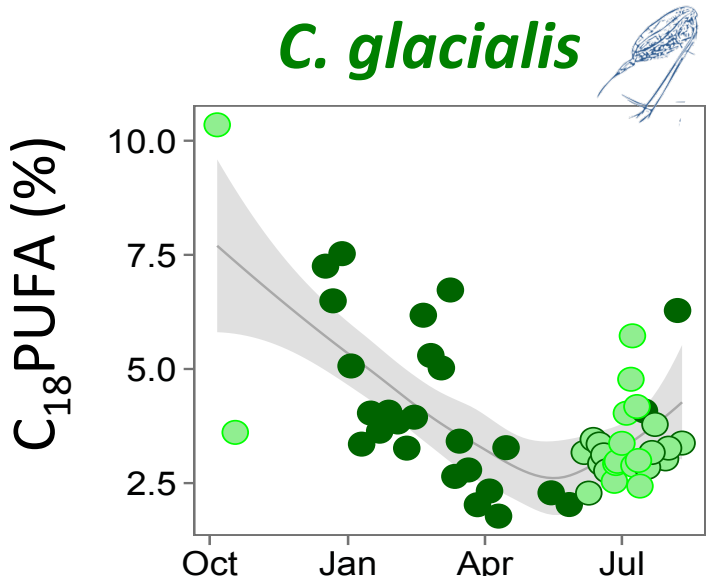
C_{18} PUFA

C. hyperboreus

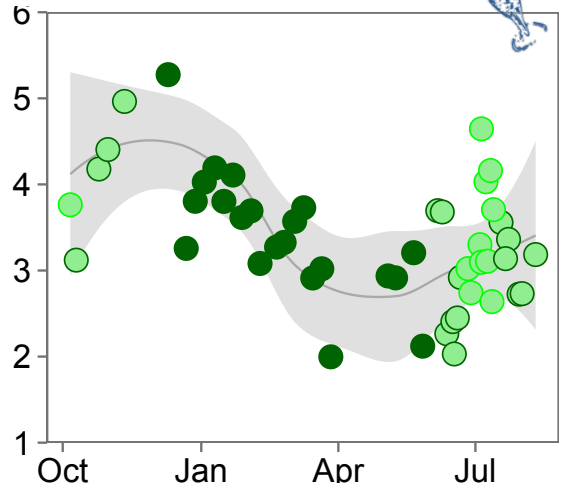


Clear increase in C_{18} PUFA in *C. hyperboreus* during summer

C. glacialis

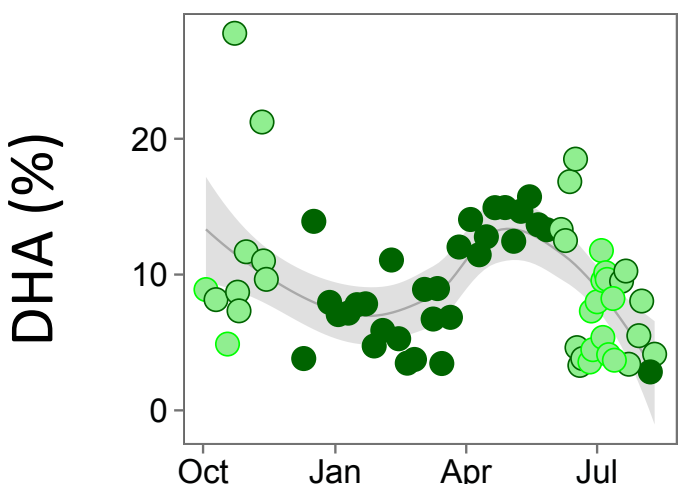


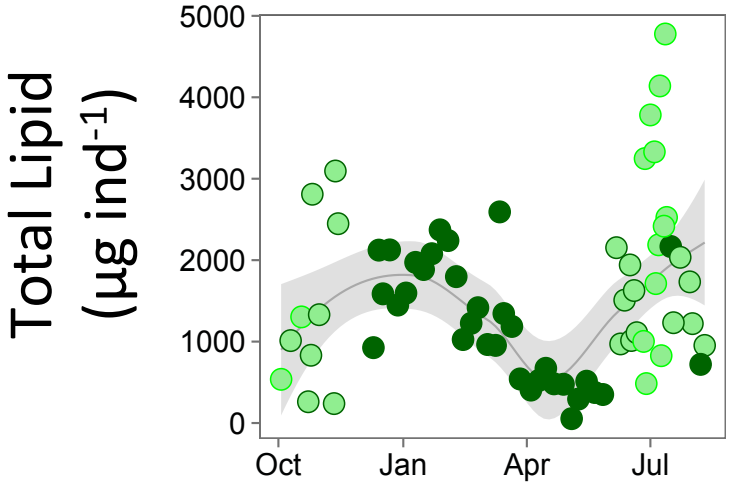
E. hamata



DHA (22:6n-3)

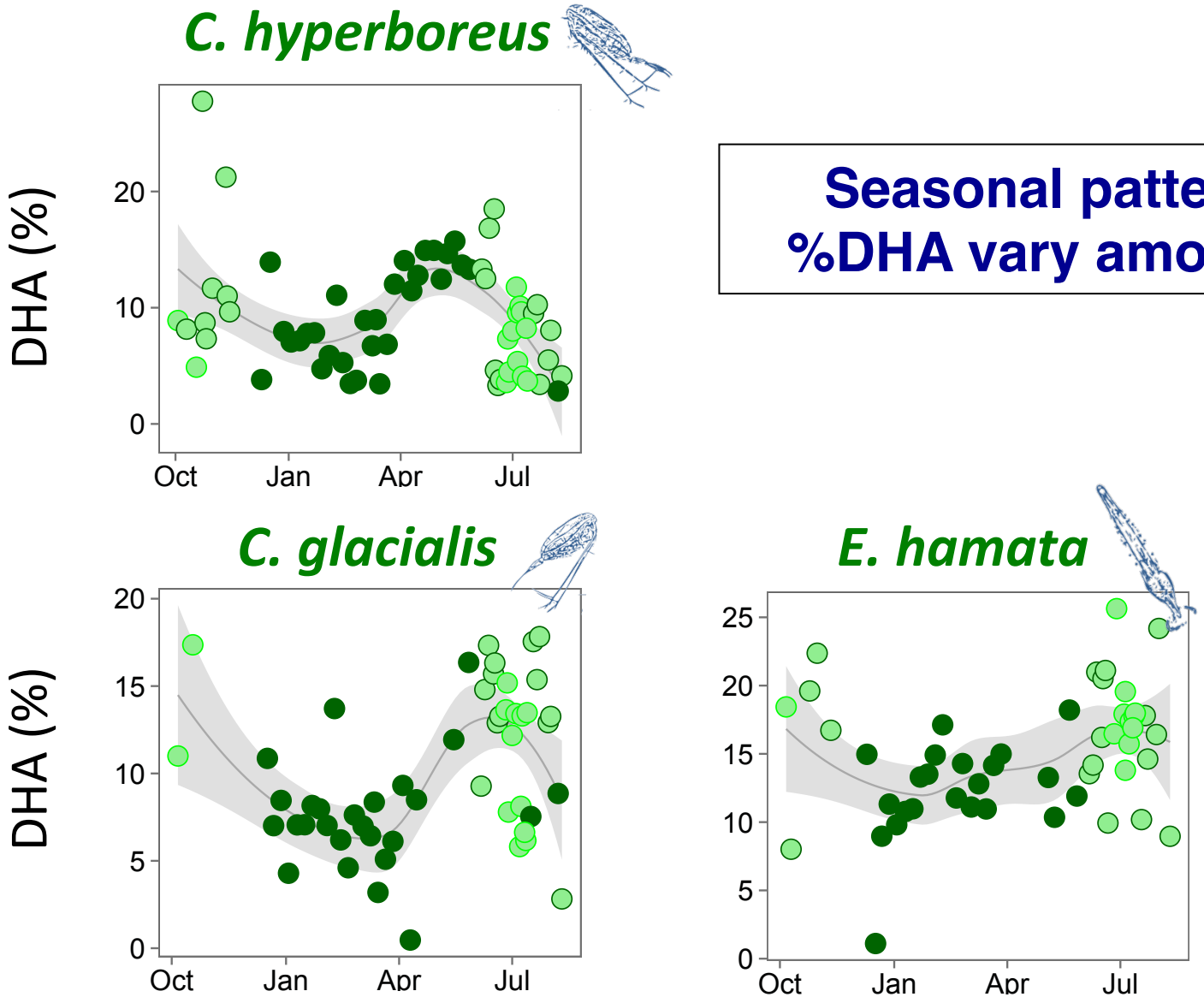
C. hyperboreus





Inverse temporal trend between total lipid content and %DHA

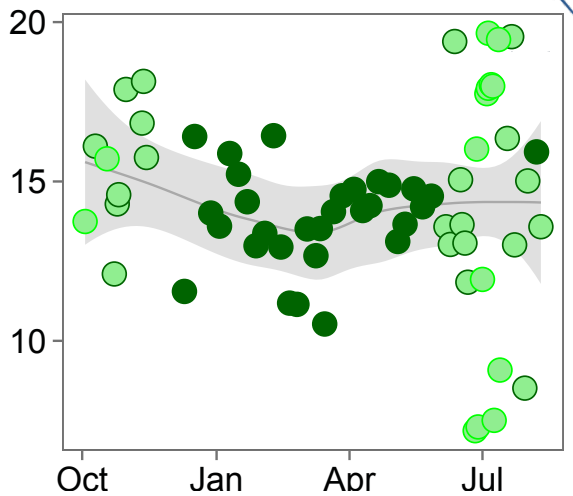
DHA (22:6n-3)



Seasonal patterns of %DHA vary among taxa

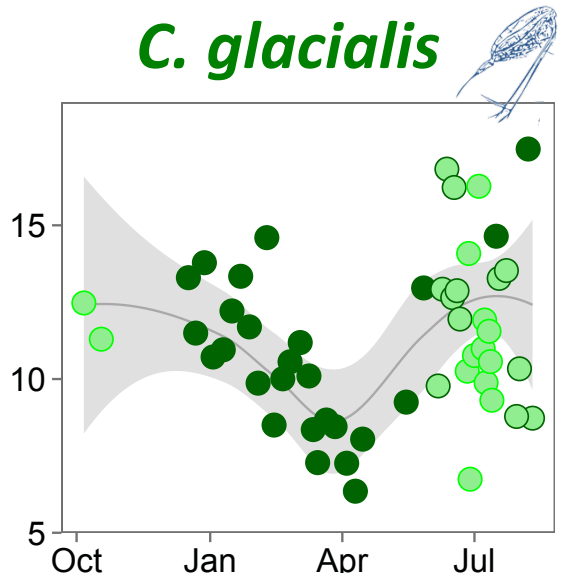
EPA (20:5n-3)

C. hyperboreus

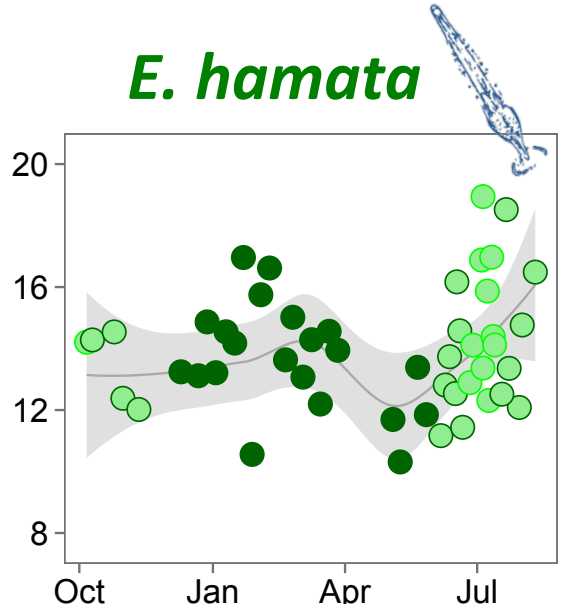


No seasonal variation in %EPA of *C. hyperboreus*

C. glacialis



E. hamata



Fatty Acid Summary

- Fatty acid profiles showed distinct seasonal trends for all taxa except *E. hamata*
- Seasonality of C_{16} PUFA and C_{18} PUFA in zooplankton followed availability in POM
- Seasonality of DHA in *C. hyperboreus* did not follow availability in POM and was opposite to seasonality of lipid content
- *C. glacialis* had distinct seasonality in EPA and DHA, which followed availability in POM

Conclusions

- Seasonality in lipid content and/or composition for all taxa
- Temporal patterns of PUFA vary among PUFA and taxa
- Even if feeding behavior of predators invariant thru the year, energy density and nutritional value of their prey varies
- Future: quantify the standing stock of lipid and DHA and EPA in *C. hyperboreus*, *C. glacialis*, and *M. longa*