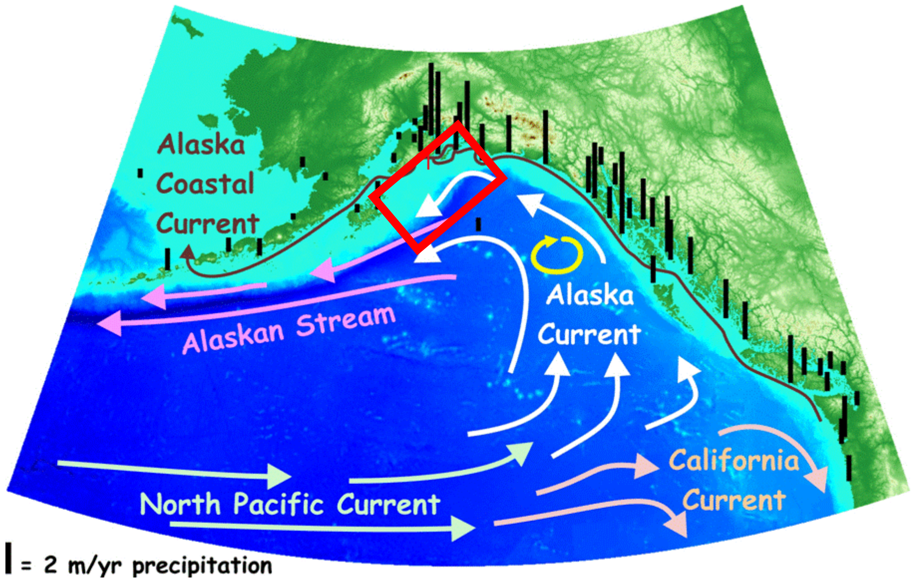
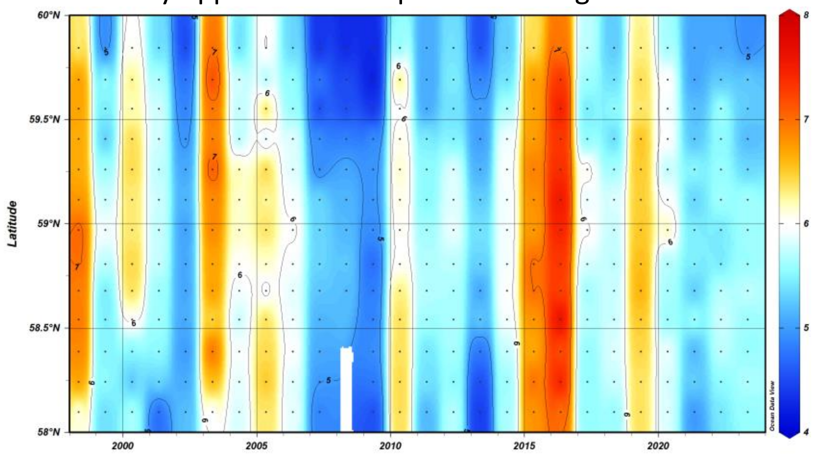
Northern Gulf of Alaska LTER

Russ Hopcroft for NGA Team

NGA LTER

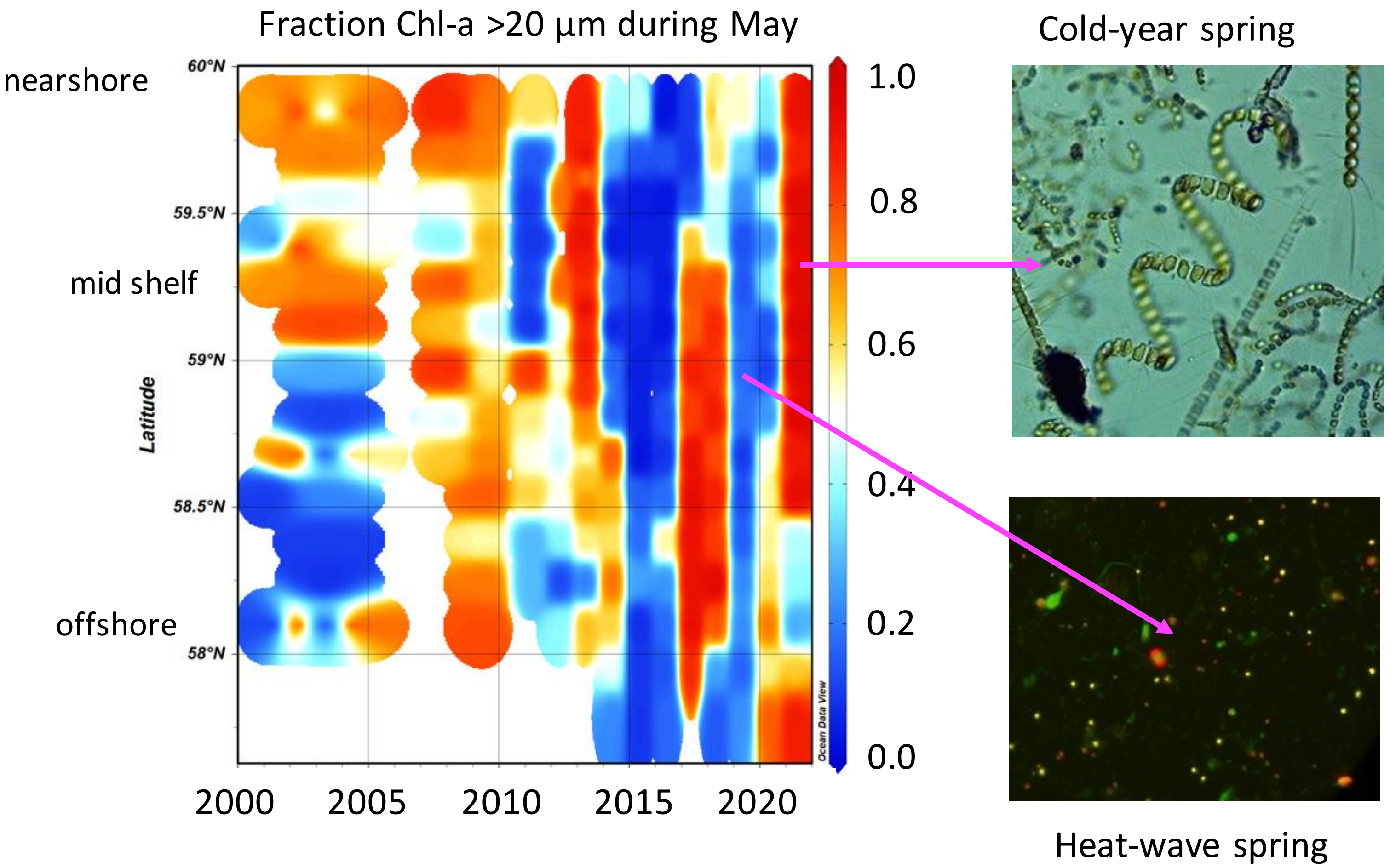
- Subarctic Pacific
- Highly seasonal
- Complex bathymetry & circulation
- Cruises at least twice per year for 25 years along a 250km cross-self transect
- Large interannual variation during spring “bloom” period





Science findings: Phytoplankton

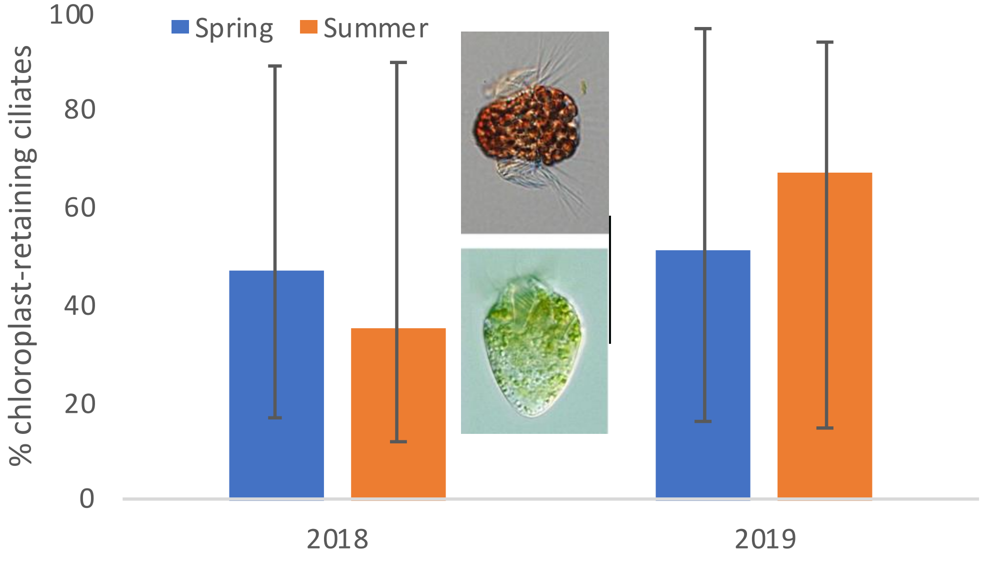
- The NGA alternates between a large cell phytoplankton community during spring and a small cell community during summer & fall
- Warm and cold years alter the prominence of each in the seasonal cycle



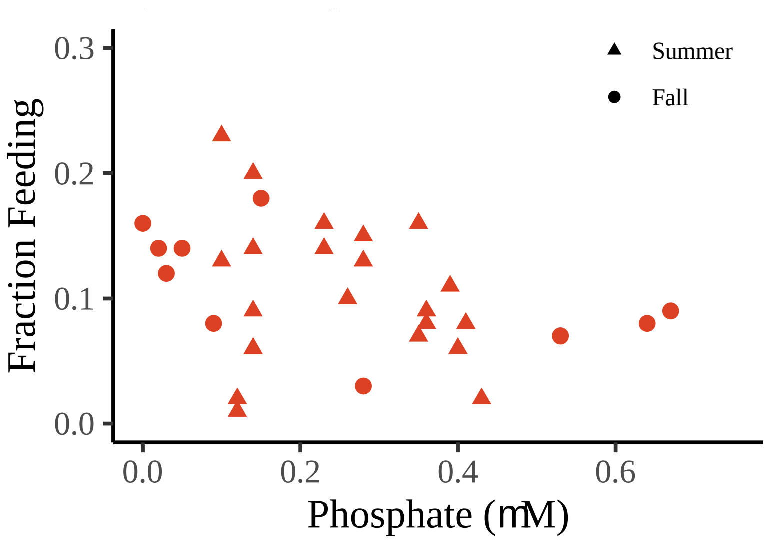
Mixotrophy in NGA protists

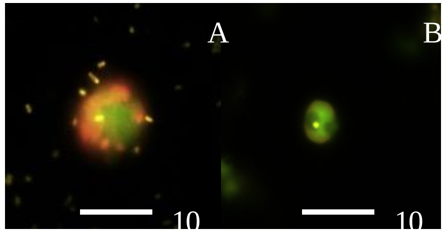
(Feeding and photosynthesis by the same organism)

Mixotrophy helps stabilize size spectra of prey for multicellular zooplankton after spring bloom



'Microzooplankton' mixotrophy is prevalent, more so during 2019 heatwave than 2018



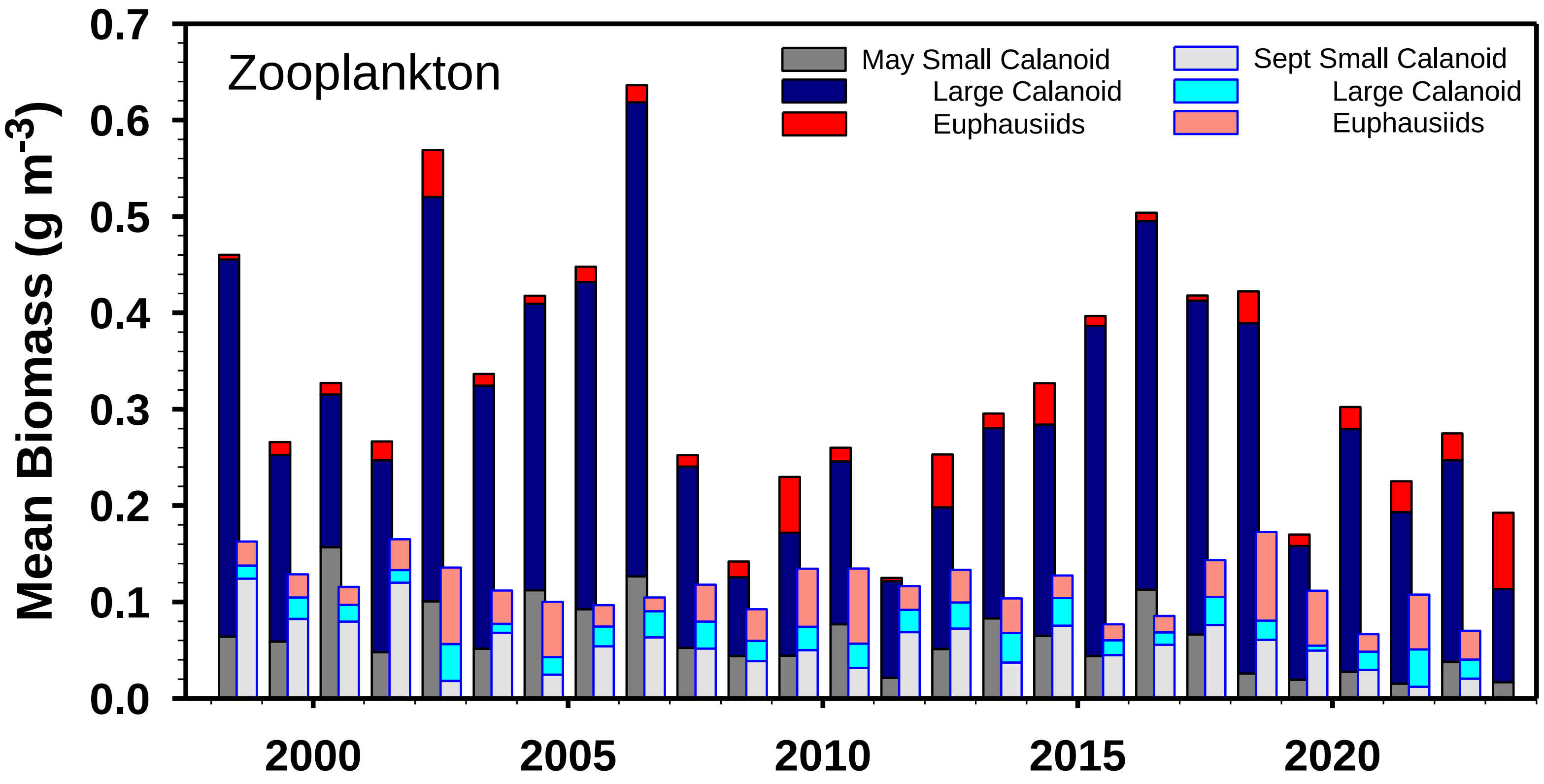


Busse (2021)

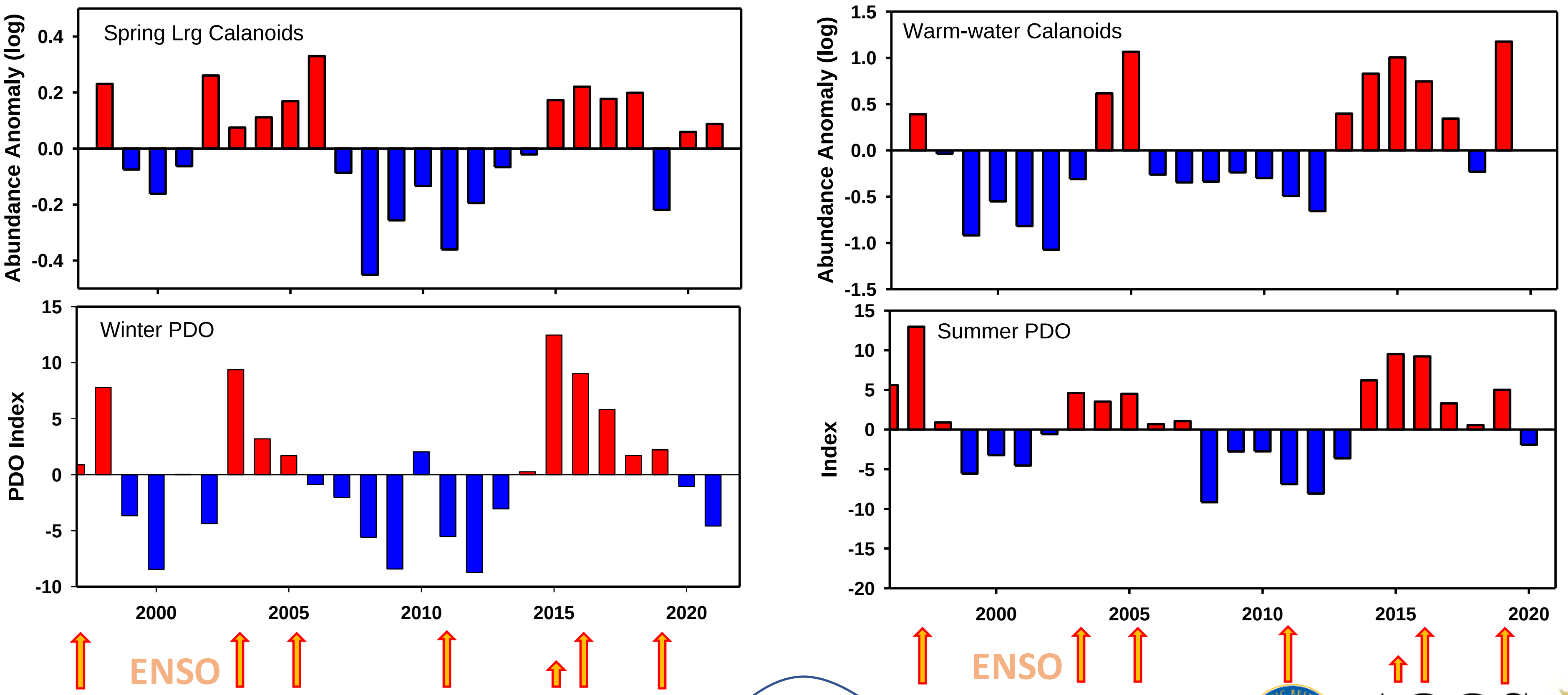
Feeding by phytoflagellates on picocyanobacteria tied to reduced inorganic nutrient availability (summer 2019)

Zooplankton: A resilient integrator of primary production

- Despite great variability in spring phytoplankton blooms, overall zooplankton biomass is surprisingly stable across years
- 4-fold range in spring, 2-fold in summer
- At species level, changes can be pronounced
- Functional redundancy and complementarity stabilize resources to higher trophic levels



Strong linkage to the Climate Indices that drive/reflect environmental variability



- Pacific Decadal Oscillation and El Nino Southern Oscillation can explain up to two-thirds of variability in biomass of key zooplankton groups

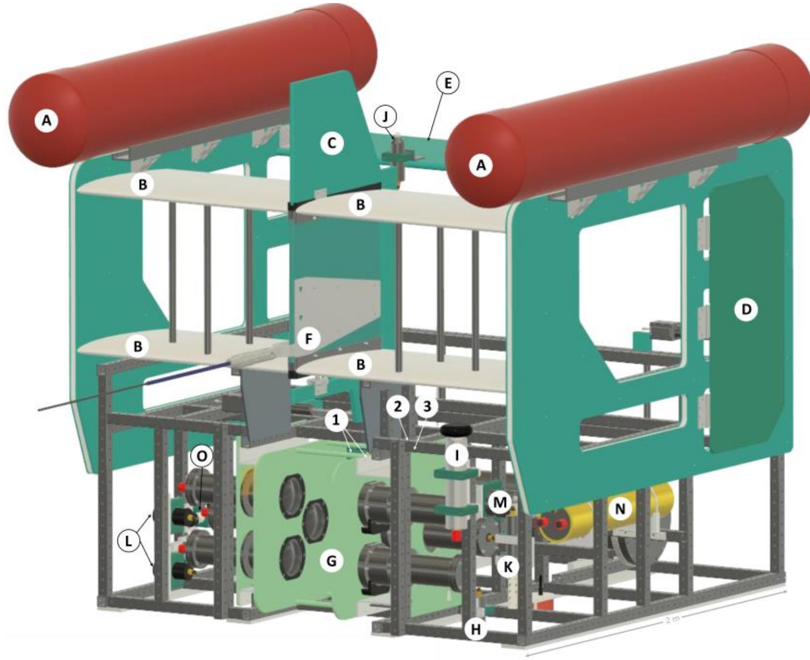
Challenges with observations programs

- Complexity of ecosystems require large multidisciplinary teams with large associated labor costs
- Tradeoffs between funding staff that maintain long-term data quality/consistency and student training/education
- Mission creep (doing more without funding for it)
- Consistency of infrastructure: all ships are not equal
- Shifting expectations from students and early career scientists

About half of the science team of a typical 2-3 week cruise

Challenges with data sharing

- Instrument-based measurements and basic chemistry are easy to QC and publish
- Data generated from species-level analysis requires considerable effort to create and QC – data evolves over time
- Experimental data is problematic to format and describe – it may take multiple years to make data complete and useful enough to publish
- Portability of large data sets/types (e.g. imaging, metagenomics & transciptomics)
- Variable commitment to simply publishing data vs making it truly useful to others

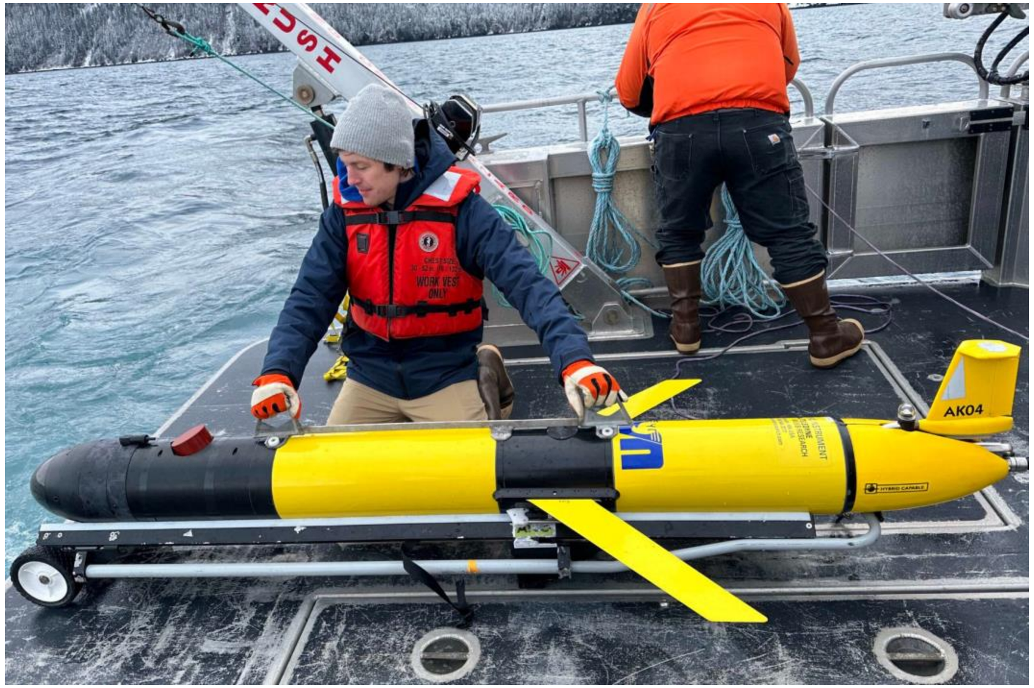


A. Floats
B. Wings
C. Roll Fin
D. Rudder
E. Elevator
F. Tow point
G. Imaging parcel
H. Altimeter (depth from bottom)
I. Flowmeter (speed thru water)
J. PAR (photosynthetically active radiation)
K. pH meter (pH)
L. ECO triplet x2 (fluorescence)
M. AC-S (spectrophotometer)
N. EK80 (acoustics)
O. Oxygen (dissolved oxygen)

(Obscured in image)
1. FastCat x2 (depth, temperature, salinity)
2. LISST (particle size)
3. SUNA (nitrate)

Future needs of LTER

- Budgets that keep up within increasing costs and adequately support true costs of multidisciplinary teams
- More generous/dedicated student support
- Technology/instrumentation consistently deployed across sites (e.g. gliders, moorings, in situ imaging, metagenomics) - as appropriate
- Better connections/partnering with other long-term observations programs/networks (BATS, HOTS, NOAA)
- Recognition that LTERs do **both** ecological research and are sentinel sites for monitoring global change
- Addition of missing biomes?



NSF Infrastructure: usage and needs

- Modern University Fleet (UNOLS): adequate access and capacity
- Shore-side infrastructure necessary for ships: many are near (or past) End of Life
- Better operational connection to OOI: shared sites?
- Robust infrastructure developed on site for sample archival: we can’t predict future value of samples

Questions?