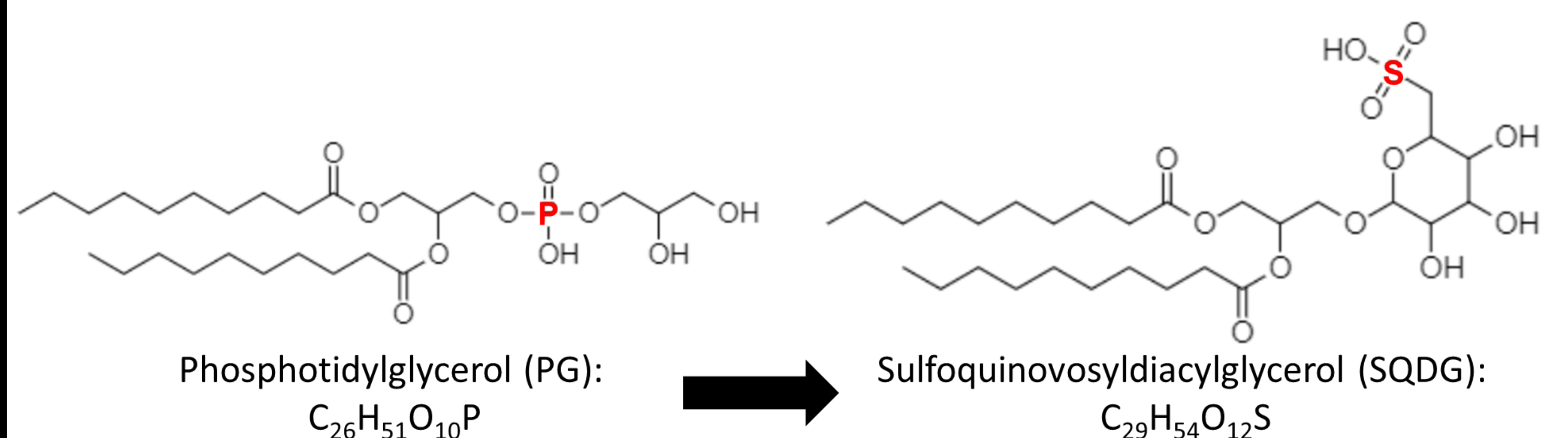
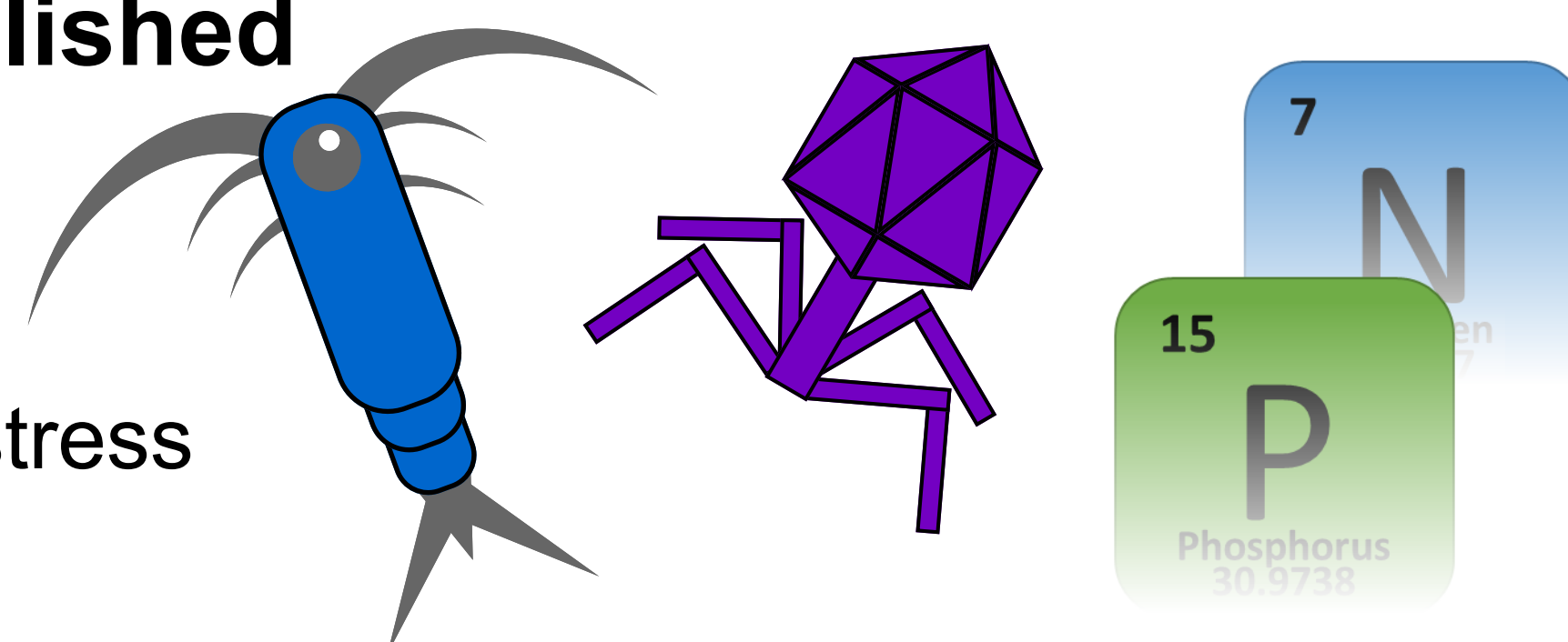
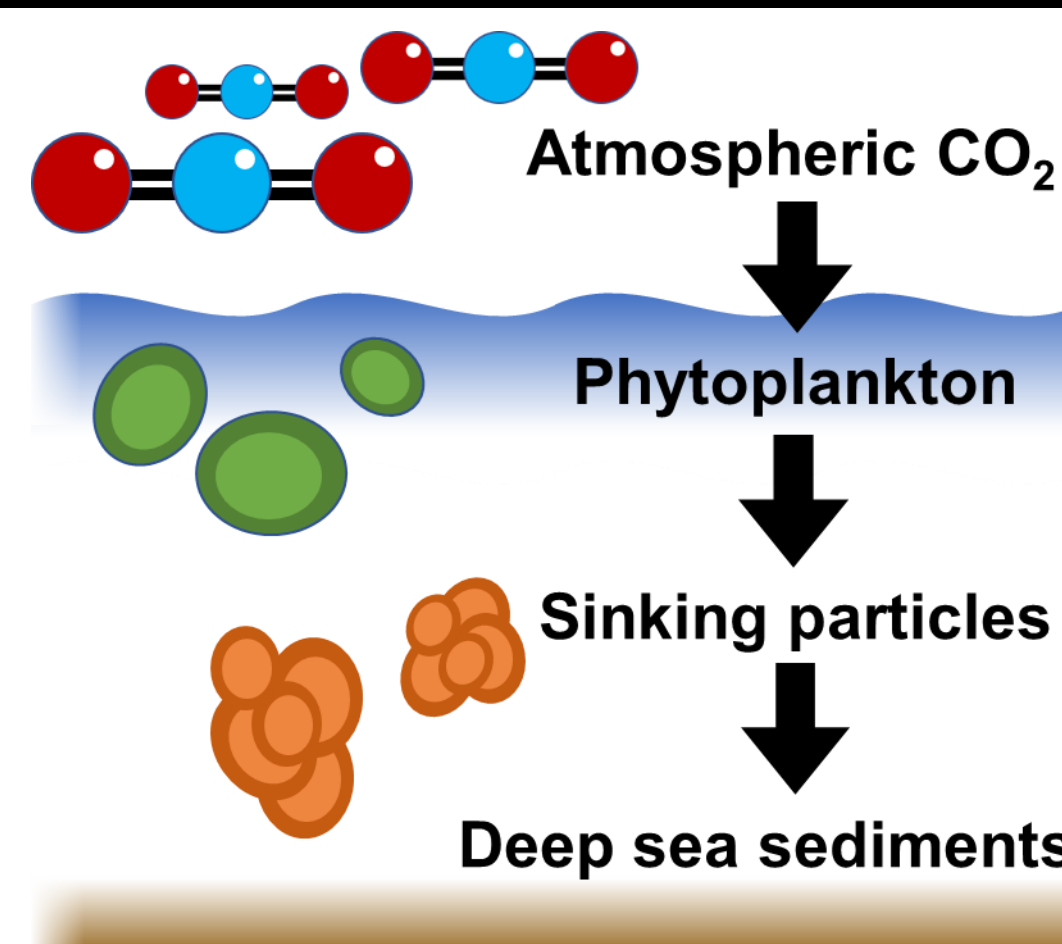


Background

- Phytoplankton are a vital part of marine ecosystems**
 - Sequester carbon into sediments
 - Serve as the foundation of the food web
 - Cycle nutrients through environment
- Phytoplankton “bloom” intensely when conditions are right...**
 - Triggered by the addition of nutrients to the environment
 - Large scale events — hundreds or thousands of km²
- ...then collapse abruptly when population controls are re-established**
 - Grazing pressure
 - Viral infection and lysis
 - Nutrient depletion and stress
- Lipidomics can be used to elucidate proxies for bloom decline**
- Membrane lipids (IP-DAGs) are excellent biomarkers for environmental conditions**
- In oligotrophic environments, lipid swapping can be used as a biomarker for nutrient stress**
 - P-containing lipids are replaced with betaine lipids^[1]
 - N-containing lipids are replaced with glycolipids^[2]

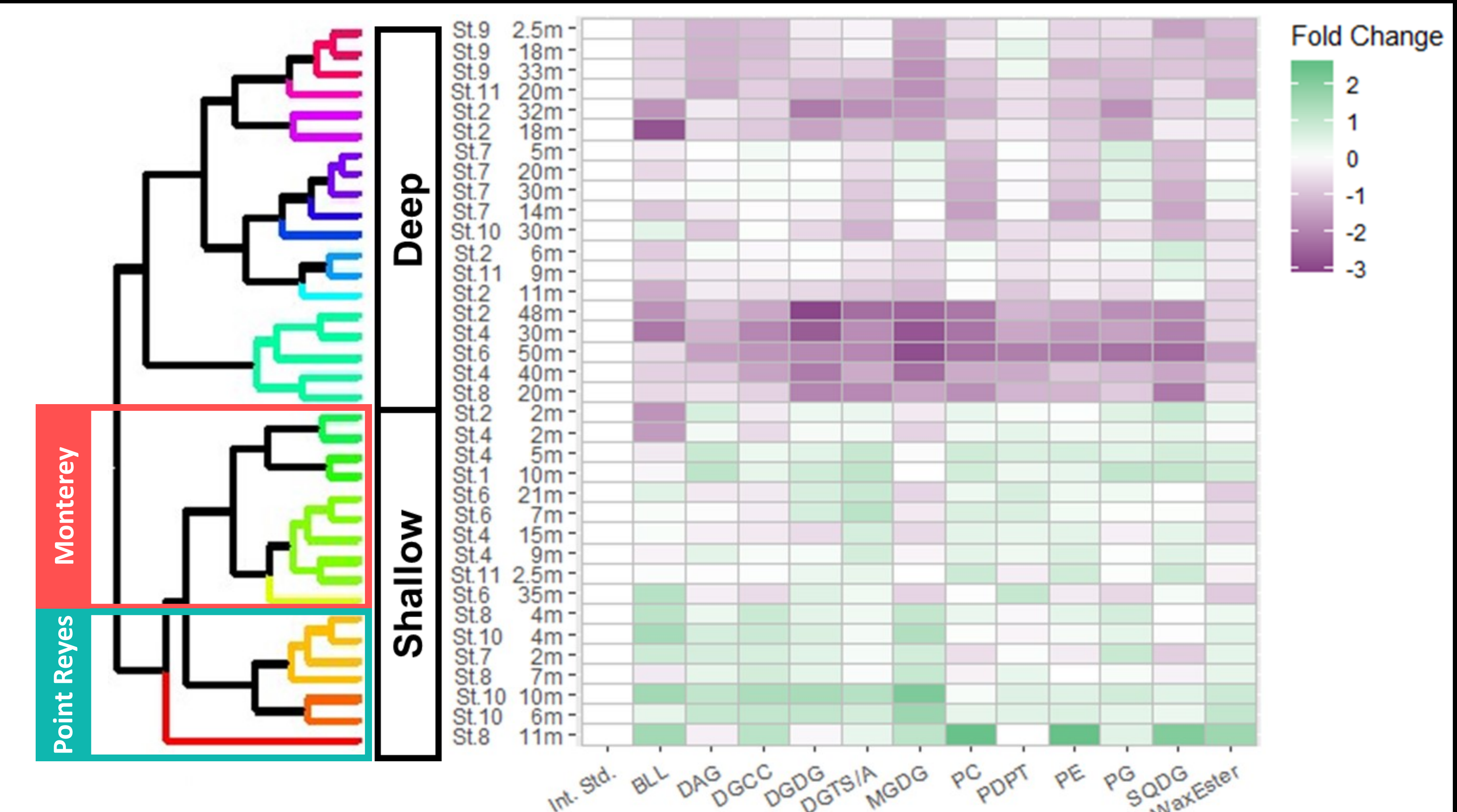


Questions addressed

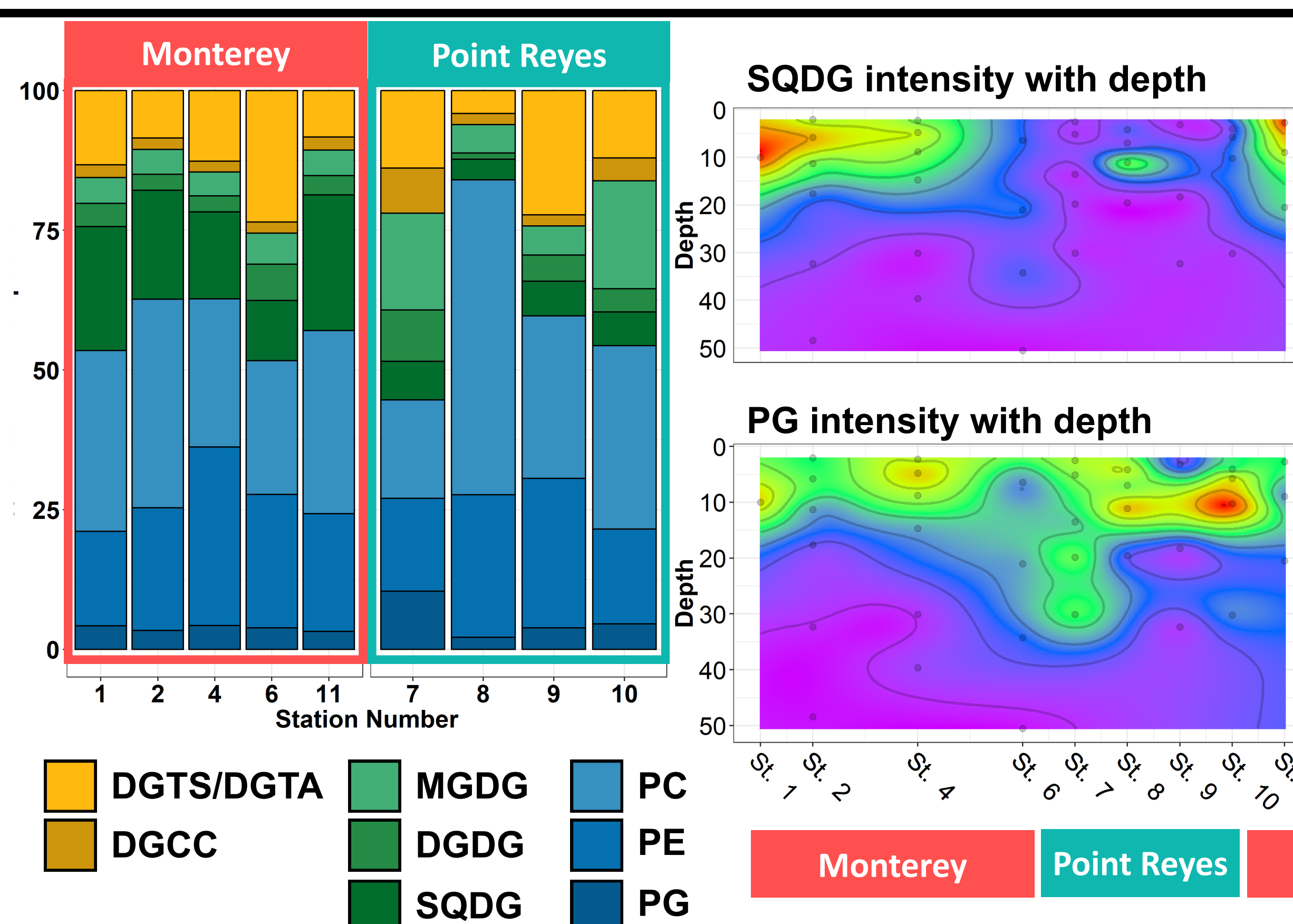
- Can we use lipidomics to describe membrane lipid distribution off the coast of California?
- Can we use oligotrophic biomarkers in eutrophic ecosystems?

Results

- Heatmap data shows the fold-change of each lipid sub-class relative to the mean across stations
- Dendrogram group colors denote that the lipidome structure is significantly similar between those samples^[6]
- Deep samples have a different lipid signature from shallow samples
- Among the shallow samples, Point Reyes samples are significantly different from Monterey samples

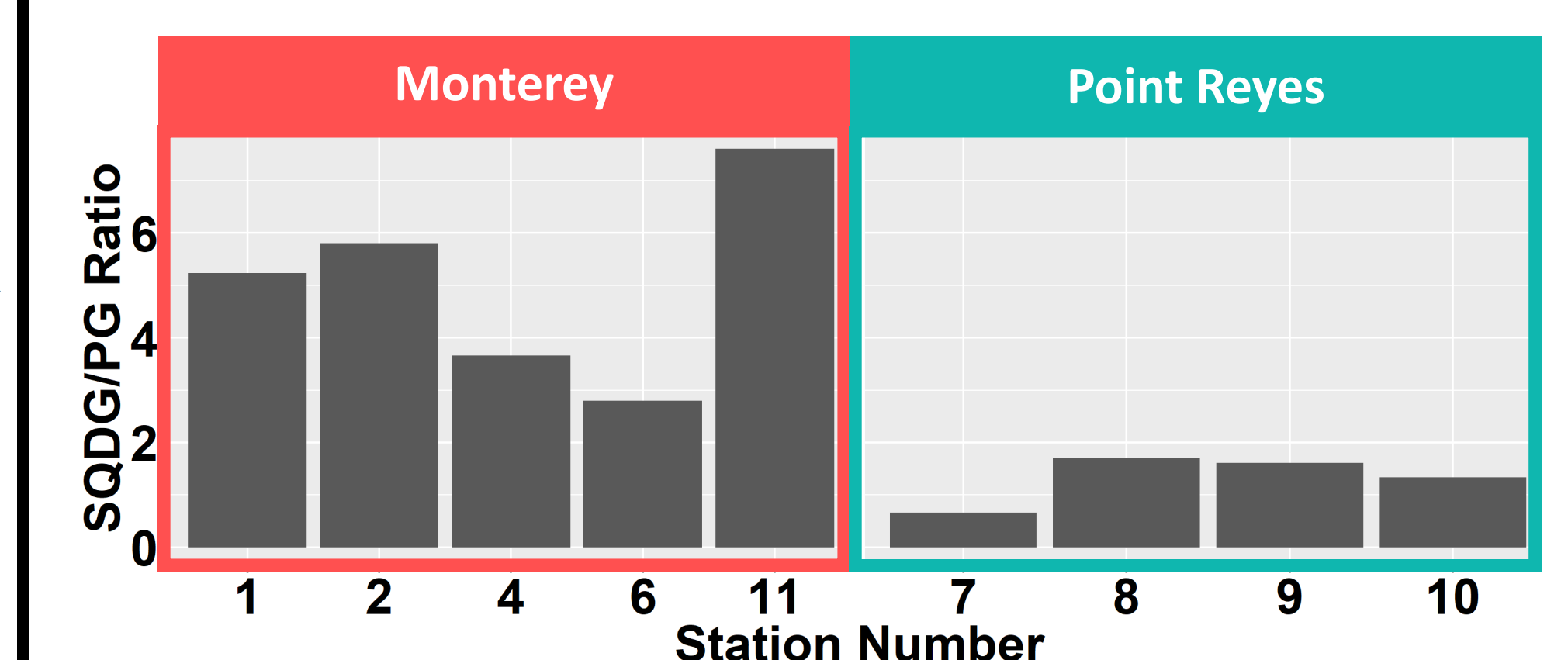


- Common intact membrane lipids (IP-DAGs) identified at every station
- Variation in relative abundance implies either nutrient stress lipid swapping or community composition shift
- Plots of intensity vs. depth highlight key locations of high lipid abundance

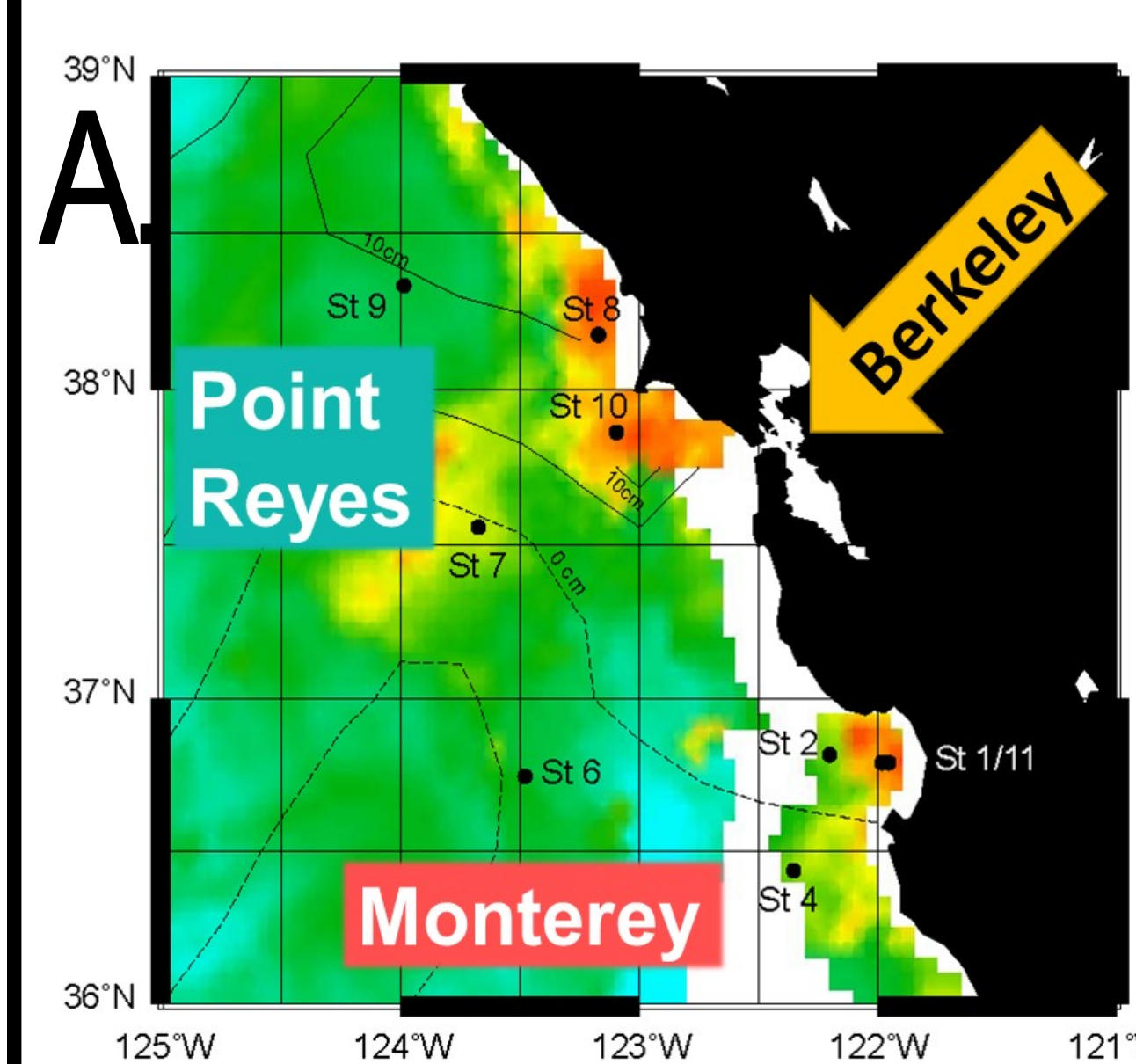


DGTS = diacylglyceroltrimethylhomoserine
DGTSA = diacylglycerol hydroxymethyltrimethyl-β-alanine
DGCC = diacylglycerol carboxyhydroxymethylcholine
MGDG = monogalactosyldiacylglycerol
DGDG = digalactosyldiacylglycerol
SQDG = sulfoquinovosyldiacylglycerol
PC = phosphatidylcholine
PE = phosphatidylethanolamine
PG = phosphatidylglycerol

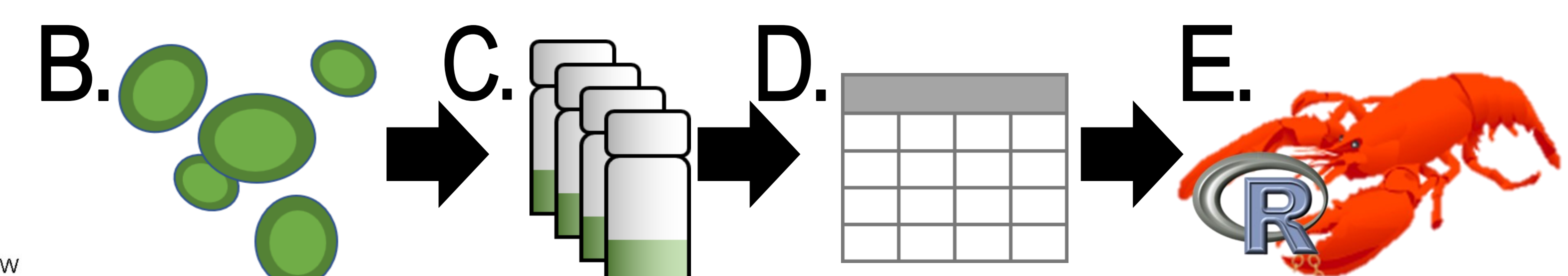
- Monterey stations have statistically significant SQDG:PG ratios from Point Reyes stations (Mann-Whitney U, p-value <0.001, n = 36)
- High SQDG:PG ratio in Monterey stations implies biomarker for healthy bloom biomass, not nutrient stress



Methods



Samples were processed via lipidomics pipeline. **A.** Environmental samples were collected from 9 stations in the California Current Ecosystem then **B.** filtered onto 0.2 μm Durapore filters and **C.** extracted via a modified Bligh & Dyer.^[3] These extracts were then **D.** analyzed via HPLC-MS^[4] and **E.** annotated via the R package LOBSTAHS.^[5]



Credits

Enormous thanks to the entire Van Mooy lab for sample preparation and data collection

Thank you also to the captain and crew of the R/V Point Sur for enabling the research cruise