Creatively tracking short-term variability and long-term trends in Kachemak Bay

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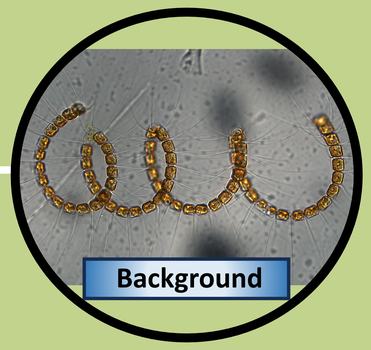


Kachemak Bay National Estuarine Research Reserve (KBNERR) tracks short-term variability and long-term trends in saltmarsh vegetation, nutrients, weather, and water quality as a part of a nationally standardized monitoring program, known as the System-wide Monitoring Program (SWMP). Concurrently, KBNERR leads a monitoring effort that collects phytoplankton samples from across Kachemak Bay through trained members of the community. Initially established out of interest from local oyster farmers and later as a way to detect harmful algal blooms, a rich dataset has emerged for phytoplankton community composition. Here, we pair phytoplankton composition and SWMP parameters to track broad ecological changes in changing environmental conditions. This project **investigates the seasonal and interannual environmental influences on phytoplankton communities in Kachemak Bay, Alaska.**

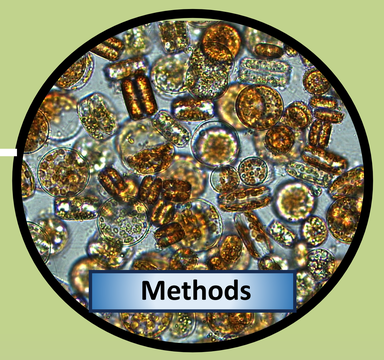
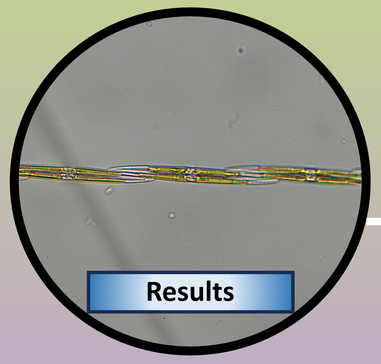


Figure 1: Site map of Kachemak Bay. Red sites are phytoplankton monitoring and blue are sites of both phytoplankton and SWMP monitoring

Phytoplankton Monitoring

- Samples are taken by KBNERR staff and community member volunteers.
- Phytoplankton collection methods were established by the National Phytoplankton Monitoring Network, housed within the National Center for Coastal Ocean Science (NCCOS).
- KBNERR staff identified phytoplankton to the lowest possible taxon for samples collected across Kachemak Bay.
- Phytoplankton communities from Seldovia Harbor, Kasitsna Bay, Jakolof Bay and Homer Harbor were included in this analysis, although effort spans a large area (Figure 1).



SWMP protocols and long-term trends

- NERR System-Wide Monitoring Program (SWMP) provide publicly available abiotic indicators of water quality.
- KBNERR has water quality sites in Seldovia and Homer Harbors, representing a more saline-influenced site and a more freshwater-influenced site (Figure 2).
- SWMP data were compared to phytoplankton communities via a step-wise model selection using a canonical correspondence analysis (CCA) with all SWMP parameters initially included in the model.

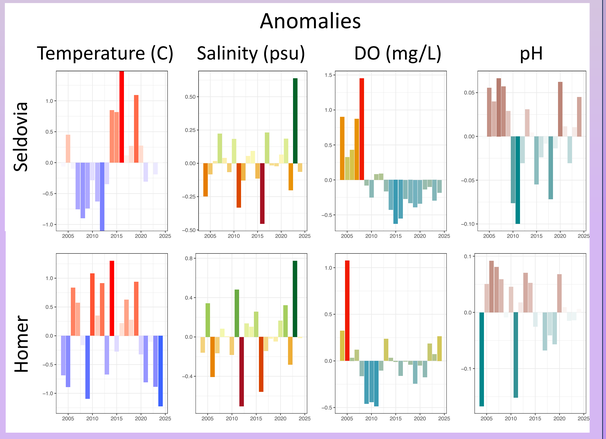
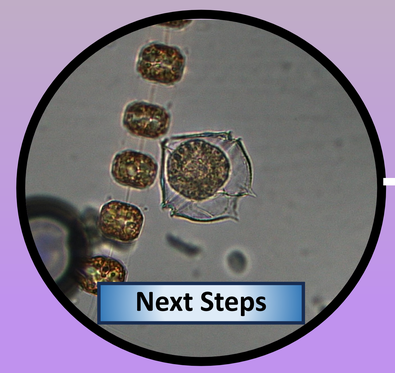
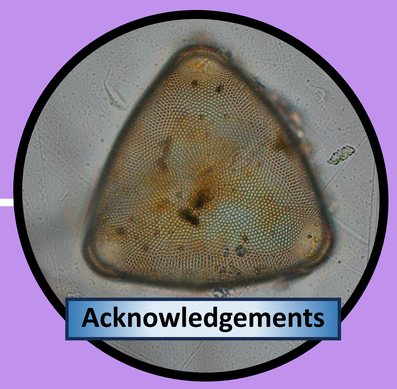


Figure 2: Long-term trends in four water quality parameters are shown for Seldovia (top) and Homer (bottom). Anomalies represent the difference from the running average value for each parameter.





Acknowledgements:
Thank you to all of our amazing community monitors past and present, the NOAA Kasitsna Bay Labs, the Alaska Ocean Observing System (AOOS), the Alaska Harmful Algal Bloom Network for making this work possible. Phytoplankton photos were taken by Kim Powell Schuster.

The phytoplankton community

Three genera of diatom are the major players in the phytoplankton community (Figure 3):

- *Chaetoceros* spp. ("Background" figure), the most common genus, is an important food component for shellfish but can clog gills of fish if they cannot swim away from a bloom. These species tend to bloom in Summer months.
- *Thalassiosira* spp. ("Methods" figure) is the favorite food of oysters and is the main contributor to the Spring bloom.
- *Pseudo-nitzchia* spp. ("Results" figure) is a potentially harmful species that produces toxins in other parts of the West Coast when it blooms. While KBNERR monitors for potentially harmful species, we are *NOT* a regulatory agency.

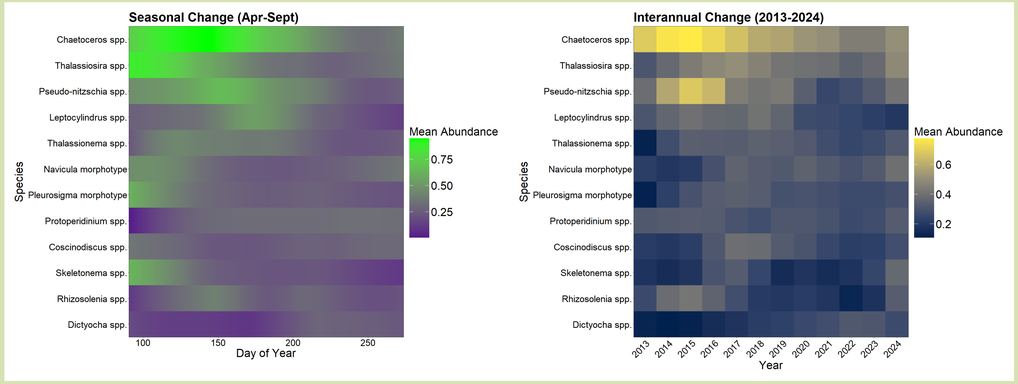


Figure 3. Average abundance by day of year (left) and year (right) for 12 common phytoplankton taxa smoothed with local polynomial regression. Abundance is measured by 0=absent, 1= present, 2=abundant, and 3=bloom.

Environmental and temporal influence

- Taxa varied across seasons (Figure 3a) and across years (Figure 3b)
- Seasonal changes were driven by temperature, dissolved oxygen and salinity (Figure 3a)
- While phytoplankton communities changed over time, our results suggest additional environmental influences (e.g., SWMP weather parameters) likely account for interannual patterns (Figure 3b).

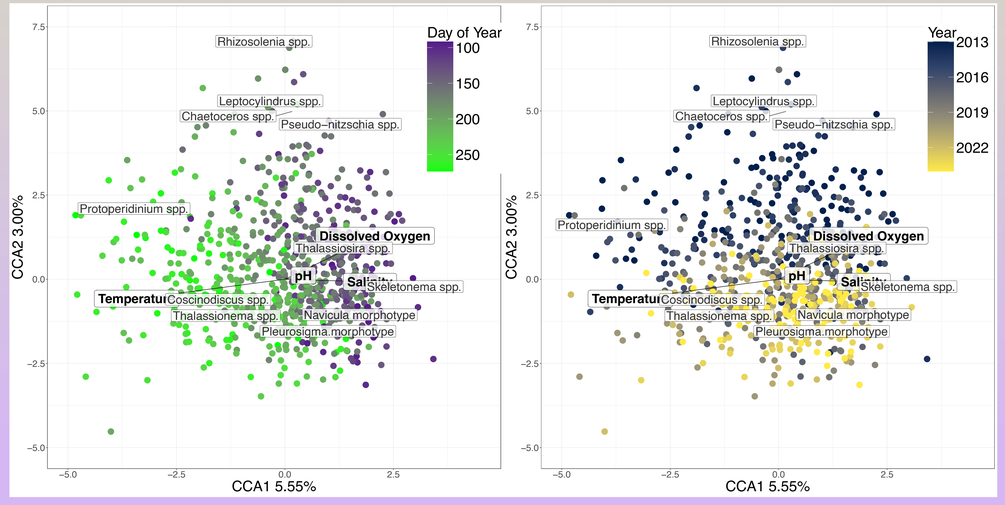


Figure 4. Canonical correspondence analysis (CCA) of common phytoplankton taxa presence/absence from April – Sept using Bray-Curtis dissimilarities. Points are colored by day of year (left) and year (right). The environmental variables from a step-wise model selection are shown in bold.

Moving forward:

- Investigate phytoplankton community variability in all sub-bays across Kachemak Bay.
- Investigate the early Spring Bloom of *Thalassiosira spp*. (an important food for oysters) and how it moves throughout the Kachemak Bay system. Stay tuned for "Has Spring Sprung? Investigating spring phytoplankton blooms using multiple monitoring tools ", funded through EPSCoR's Interface of Change Seed Grant.
- Continue collecting long-term monitoring data and perform retrospective analyses using KBNERR SWMP data

Get involved with KBNERR! Check our weekly phytoplankton updates! Access SWMP data