

Introduction:

Pseudo-Nitzschia (P/N) is a species of naturally occurring phytoplankton that contributes to harmful algal blooms (HABs) in the California Current System (CCS). P/N can produce domoic acid (DA), a toxin which accumulates in organisms that consume phytoplankton, leading to amnesiac shellfish poisoning in higher trophic levels. Thus DA can negatively impact ecologically important species such as seabirds, whales, and sea lions, but it also poses a significant risk to human health. DA has been detected in shellfish species along the Washington, Oregon, and California coast causing fisheries to shut down for several weeks or even a season, resulting in a loss of millions of dollars in revenue.

Importantly, P/N is not always toxic; theories suggest that toxicity is induced by nutrient limitation, mixing events such as riverine inputs and upwelling, or in response to grazing. Understanding the factors that affect *Pseudo-Nitzschia* distribution and toxin production is critical to support management of healthy ecosystems, seafood, and coastal communities.

Questions:

- What are the spatial patterns of *Pseudo-Nitzschia* abundances?
- What are infestation rates of choanoflagellates on *Pseudo-Nitzschia*?
- What are the relationships between *Pseudo-Nitzschia*, choanoflagellate infestation, and domoic acid concentration?

Methods:



Imaging FlowCytobot From McLane Lab



FSV Bell Shimada

Samples were collected aboard the FSV Bell M Shimada September 2018 through the IFCB via ships flow through system. The IFCB takes microscopic images (μm in size) of phytoplankton and particles that fluoresce. All samples taken were 5ml, and the amount of images per sample ranged from 0-10,000 images.

- Images were visually analyzed from the IFCB
- phytoplankton species were identified
- *Pseudo-Nitzschia* colonies and infestation were counted and cataloged
- Once all the data was analyzed, distribution and infestation rates were evaluated and plotted through MatLab.
- IFCB images were co-located with nearest station in space for comparison with domoic acid data.

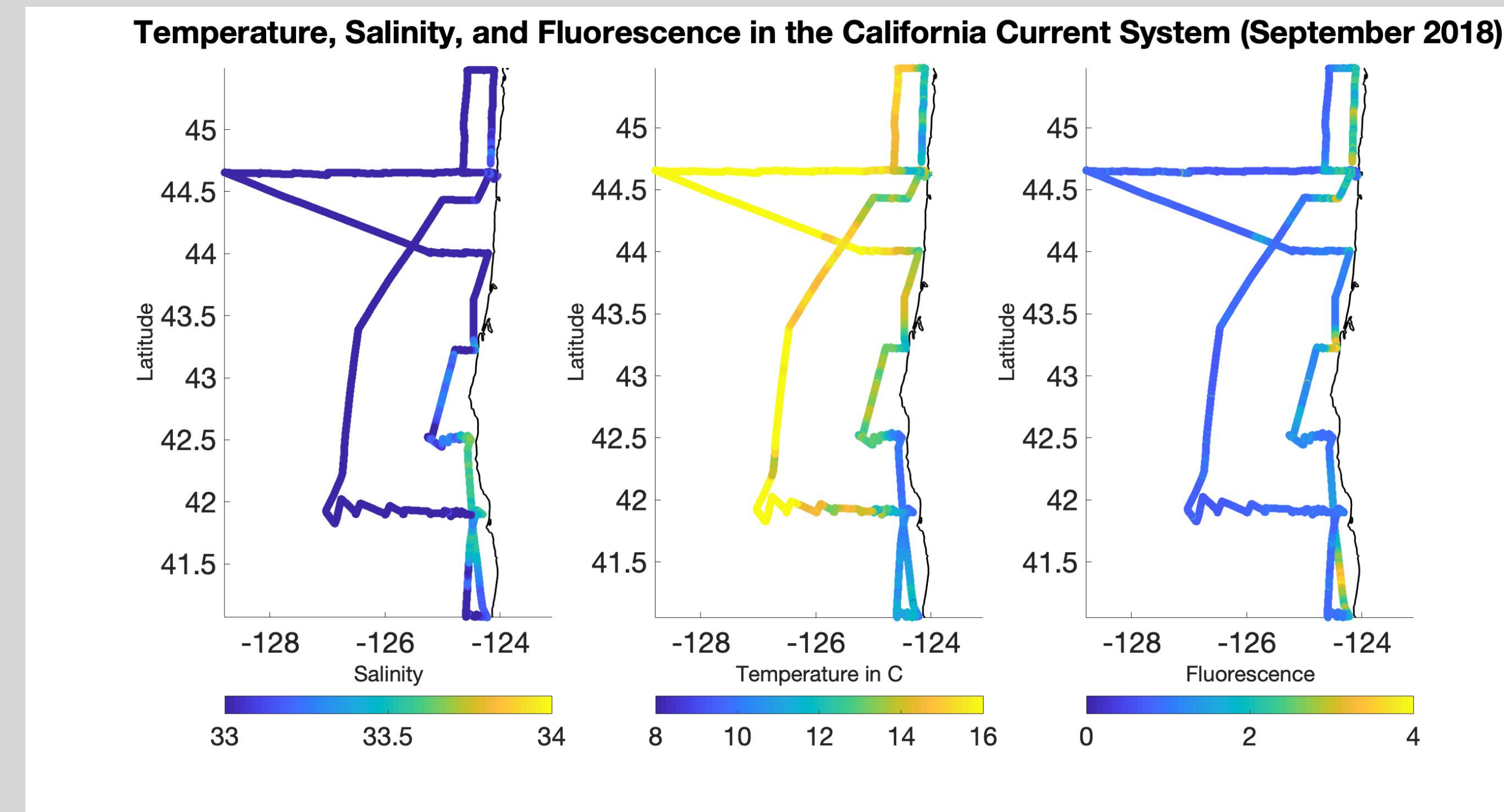
Images of healthy colonies of *Pseudo-Nitzschia*



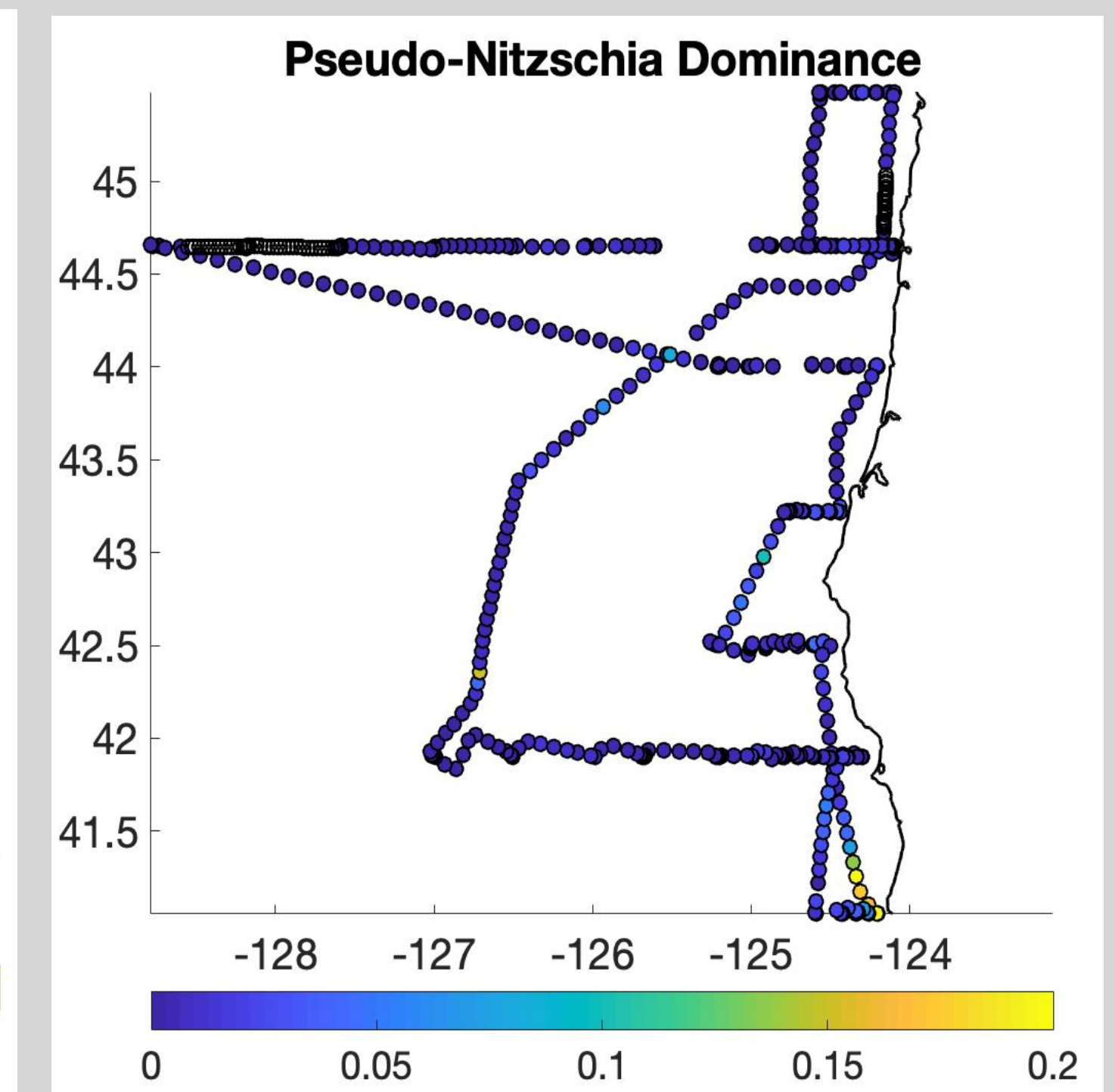
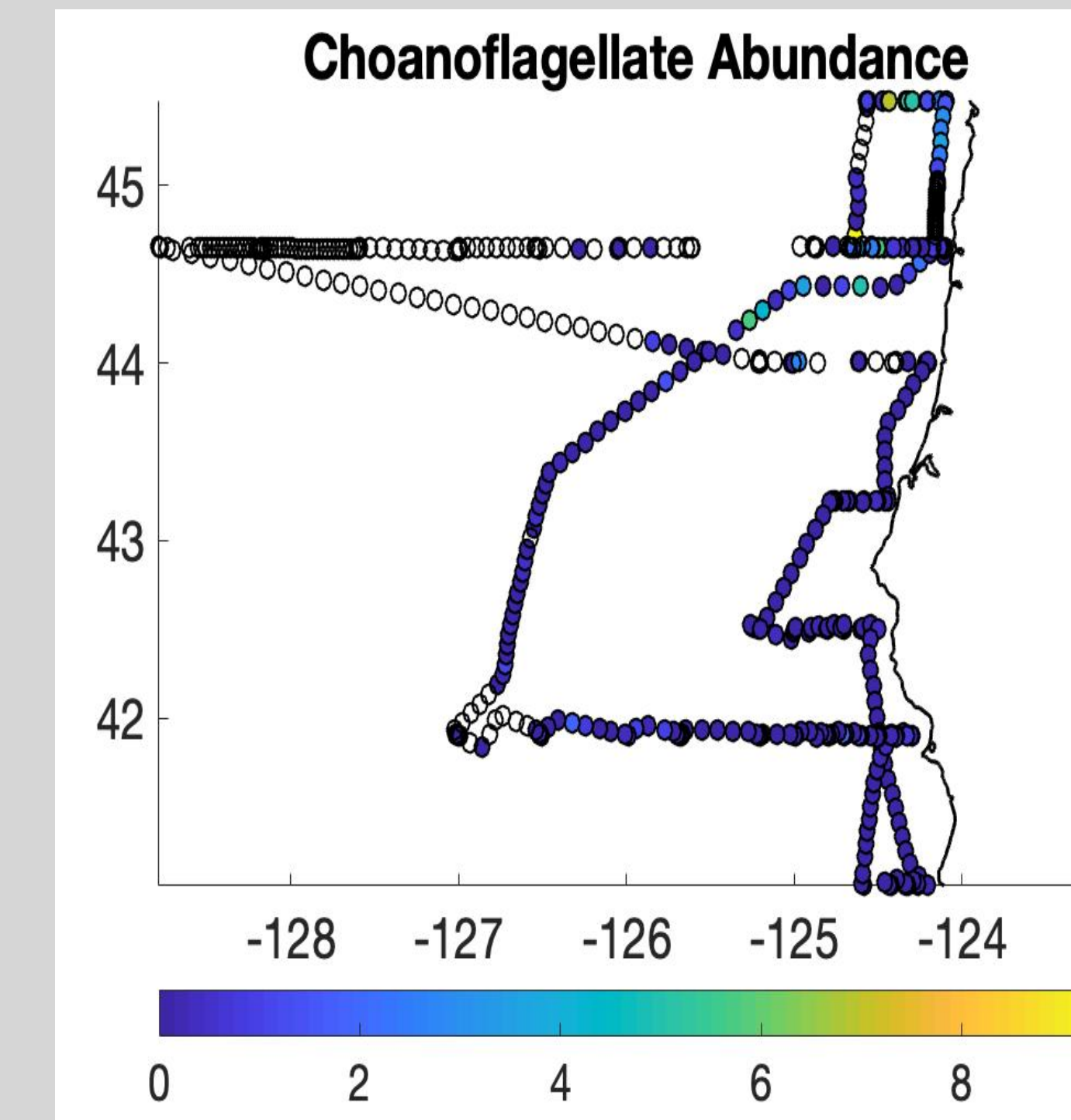
Image of an infested colony of *Pseudo-Nitzschia*



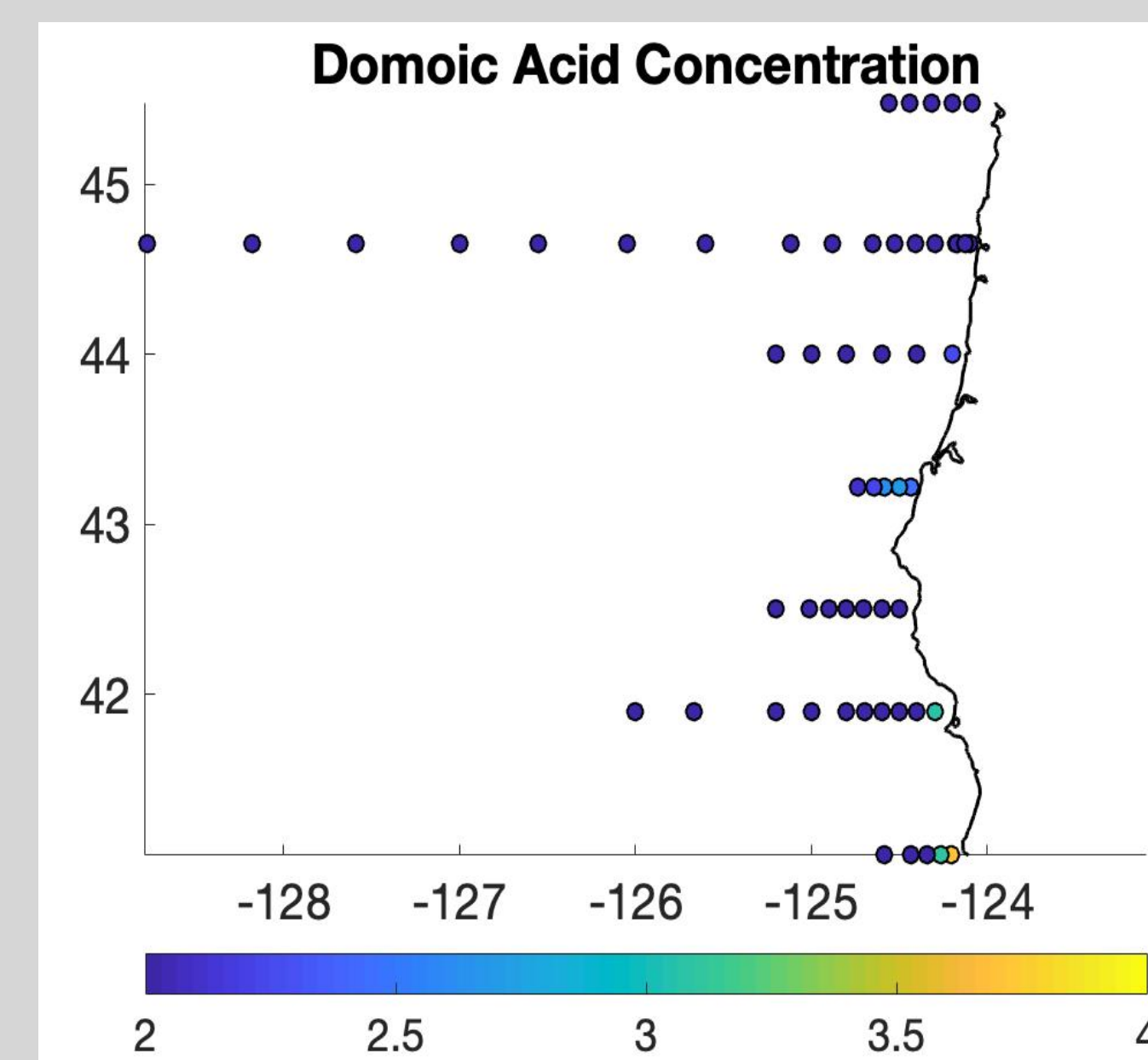
Results:



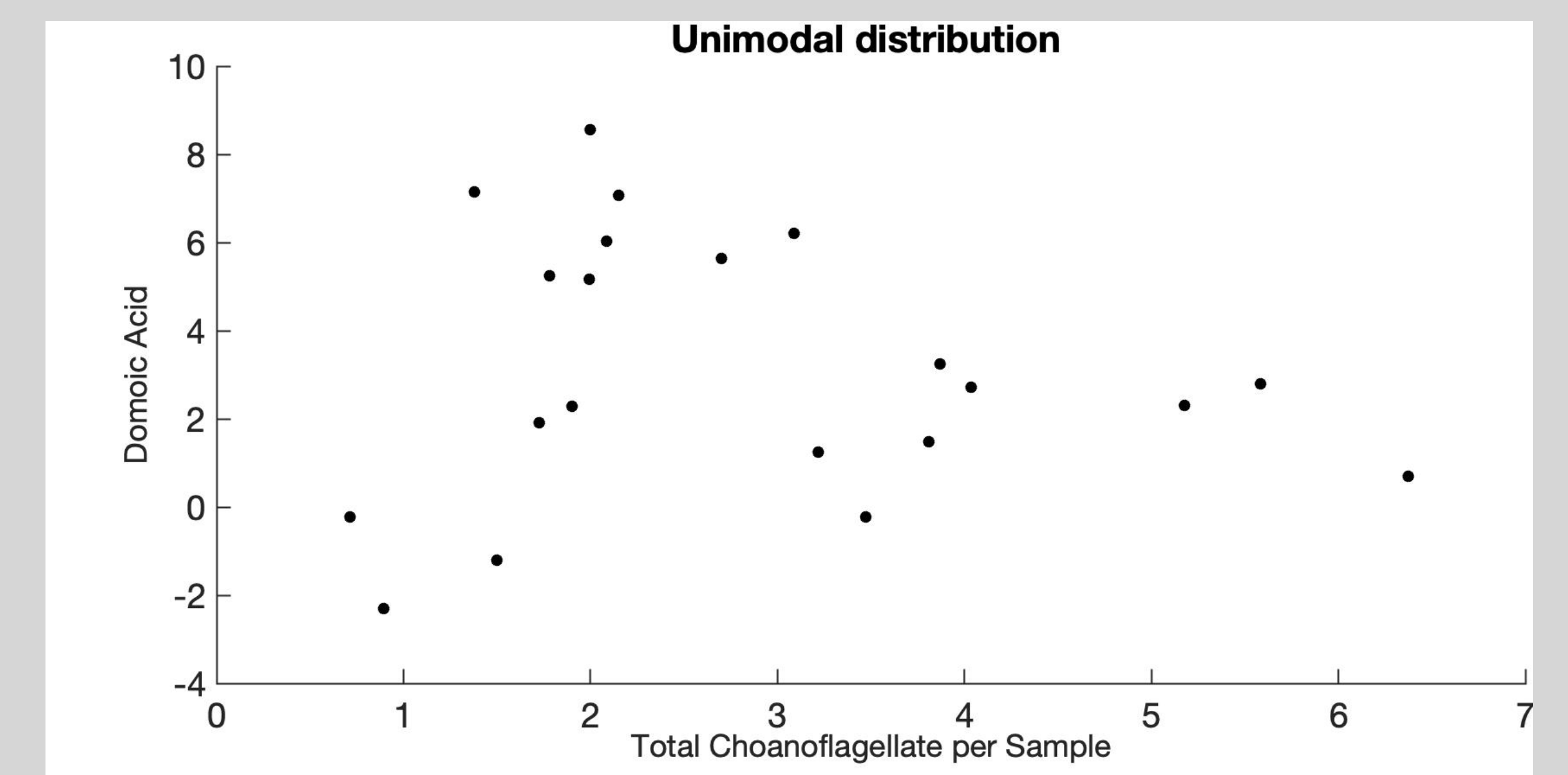
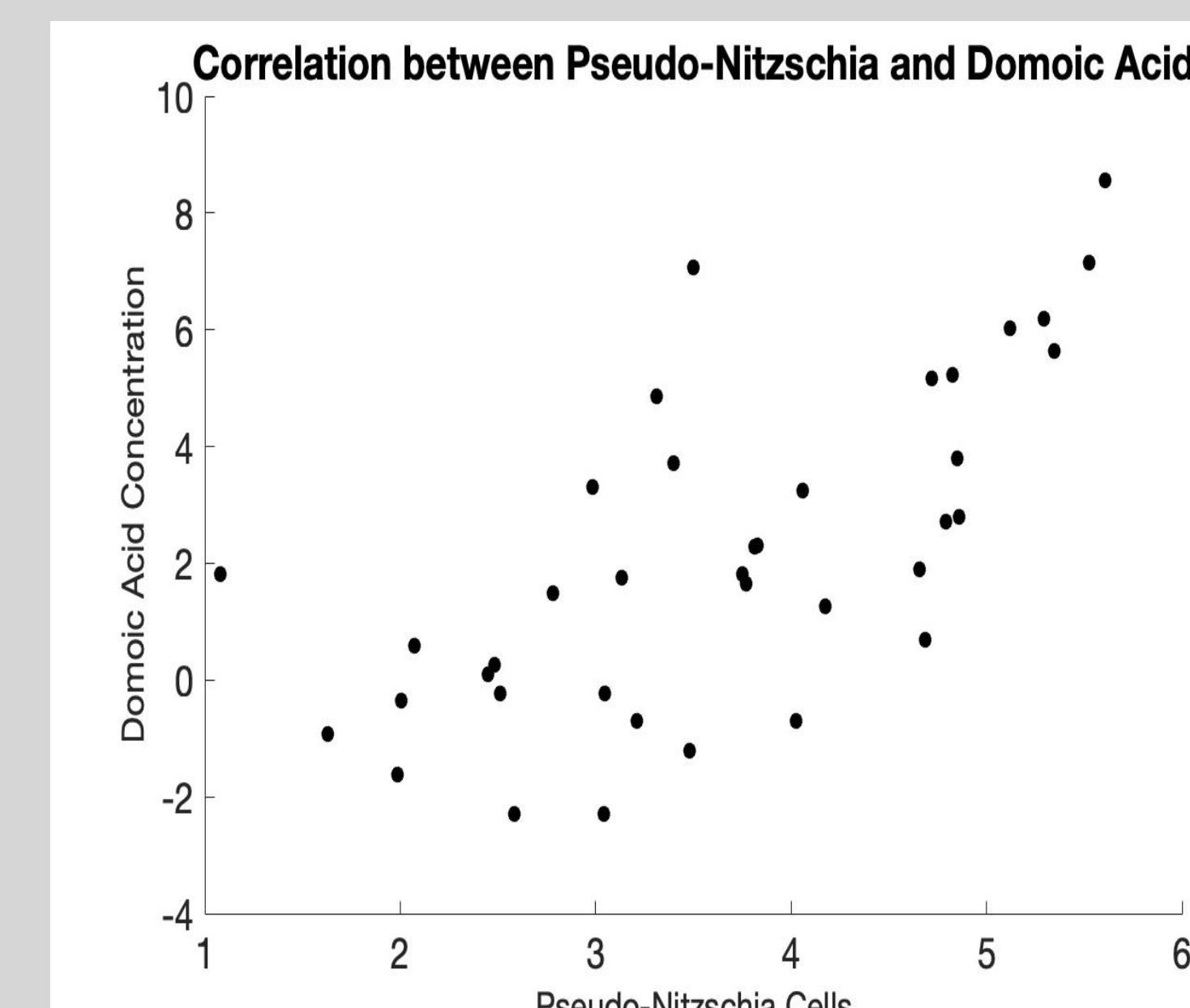
Pseudo-Nitzschia was present throughout the California Current System during September, but patchy, and highest in Northern California. Choanoflagellate infestation rates were highest in Northern Oregon.



Spatial distribution of choanoflagellates as well as *Pseudo-Nitzschia* dominant regions



Domoic acid concentrations were strongly correlated with *Pseudo-Nitzschia* abundances but weakly correlated with choanoflagellate infestation..



The rate of infestation followed a unimodal distribution favoring 2-3 celled colonies

Conclusion:

- *Pseudo-Nitzschia* was located mostly inshore, with high abundances off of Northern California.
- High concentrations of *Pseudo-Nitzschia* were associated with high salinity.
- Particulate domoic acid concentrations were correlated with PN abundance.
- For infestation rates, we observed a unimodal pattern that shows choanoflagellates favor *Pseudo-Nitzschia* colonies of 2-3 cells. Choanoflagellates are less likely to be found on single cells or colonies with 3 or more cells in length.

Further Questions:

- Why are choanoflagellates favoring smaller colony sizes?
- What are choanoflagellates spatial pattern?

References:

Trainer, V. L., Bates, S. S., Lundholm, N., Thessen, A. E., Cochlan, W. P., Adams, N. G., & Trick, C. G. (2012). *Pseudo-nitzschia* physiological ecology, phylogeny, toxicity, monitoring and impacts on ecosystem health. *Harmful Algae*, 14, 271-300.

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- Domoic acid data was provided by NOAA's Northwest Fisheries Science Center Vera Trainer, Nick Adams

