ANALYSIS AND METHOD DEVELOPMENT OF BED SEDIMENTS CONTAINING CHLOROPHYLL

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Introduction

Marine ecosystems are unique because they are comprised of a diversity different species. The food sources supplying these organisms, such as phytoplankton. Since they are primary producers they play a vital role in the marine ecosystem and are consumed by zooplankton, small fish, and even humpback whales. Phytoplankton are an important indicator how much food is available for consumers and it can be potentially utilized to help detect damaging factors to the ecosystem. This research is unique because there is a direct, and testable correlation that can be tested based on a variety of factors whether it be location or a given season of the year. Through research, we devised a method to confirm the presence of chlorophyll in sediment samples collected from various locations throughout the Puget Sound.

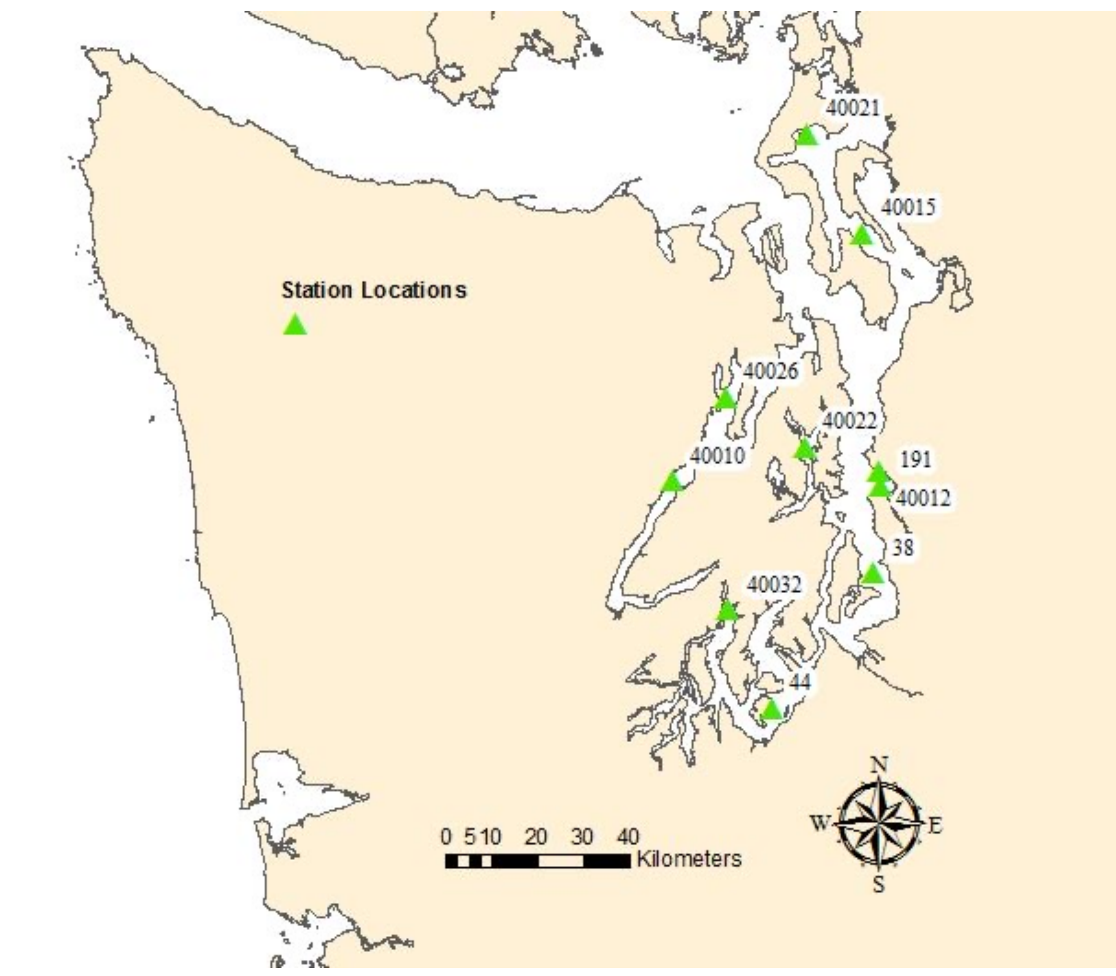

Figure 1. Analysis of sediment samples collected throughout the Pacific Northwest. The map was produced using Geographic Information Systems (GIS). The green triangles are representative of the various locations where these sediment samples where collected.

What are phytoplankton?

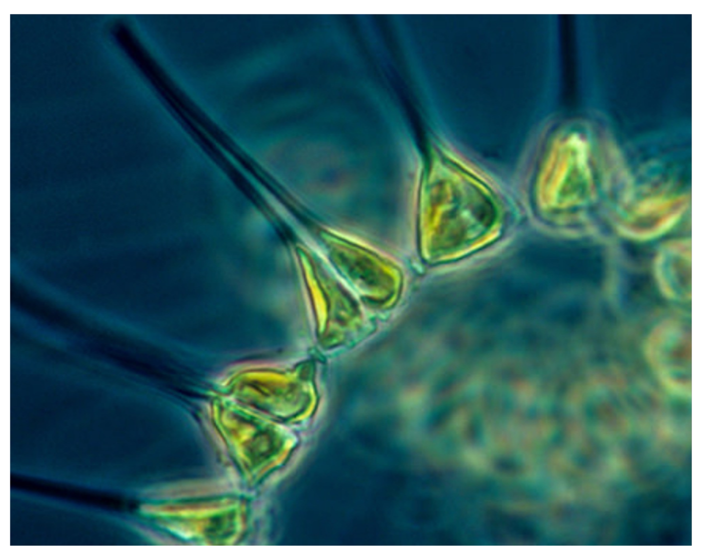

Image: National Oceanic and Atmospheric Administration, 2023 oceanservice.noaa.gov

Figure 2: Zoomed in image of phytoplankton.

Phytoplankton is a type of terrestrial plant and is considered one of the primary food sources for many organisms that inhabit marine ecosystems. Identically to land plants, phytoplankton also utilize chlorophyll, to capture sunlight, and produce energy. Although an ideal environment is one where they can easily obtain sunlight, phytoplankton can survive during winter seasons, and in water that is deeper and dark, compared to their ideal environment. However, some phytoplankton will die with little to no light, the other phytoplankton will rest until there are better light conditions.

Methods

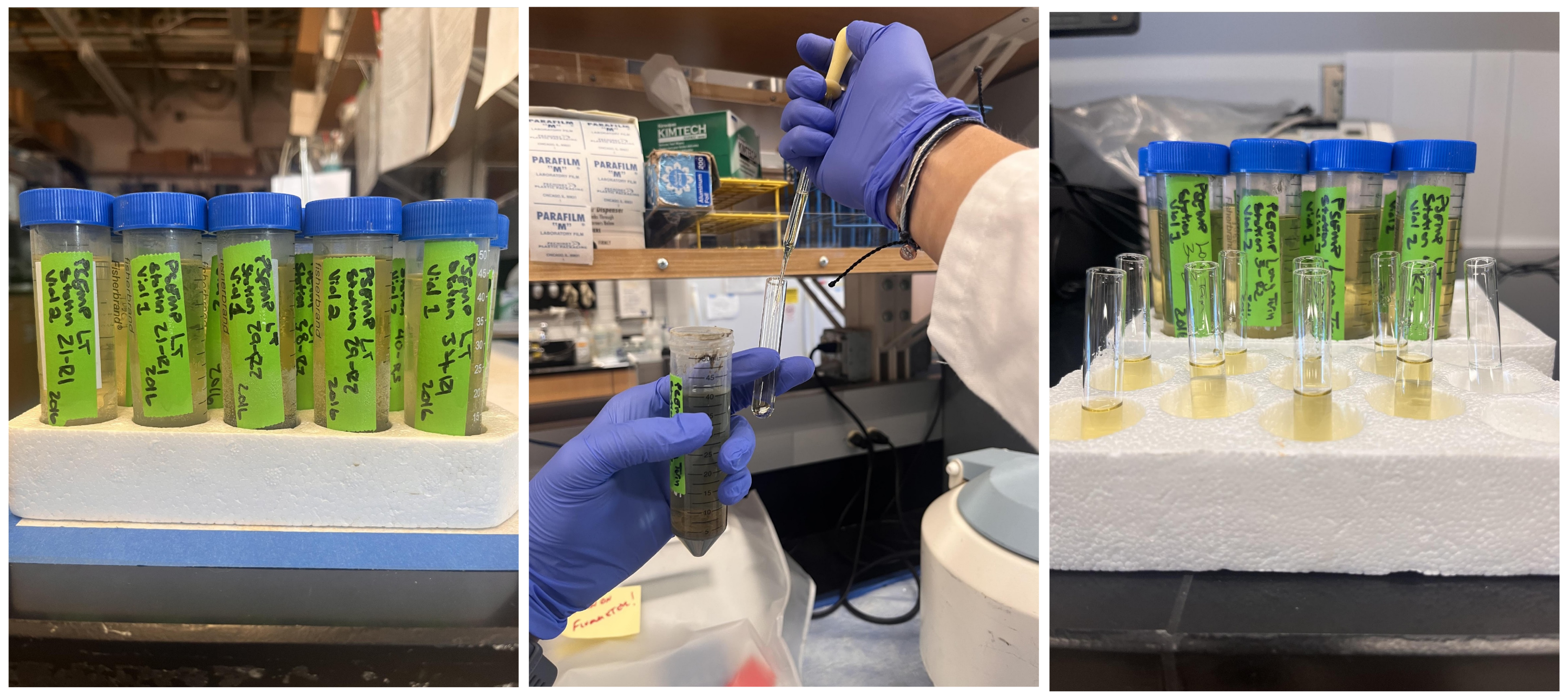

Figure 3: Initial sample preparation

Preparing Sediment Samples for Fluorometry Analysis

- To prepare samples, the first step was to compact 5mL of selected sediment into 50mL conical centrifuge tubes, ensuring that all content was evenly distributed at the bottom of the tube.
- The 5mL of sediment was then mixed with 40mL of acetone and then stored in a freezer for 12-18 hours. After the freezing period, the samples were then left to reach room temperature, and then centrifuged for 25 minutes at 3000 RPM.
- After the incubation period, we then proceeded to extract sample liquid from each of the tubes using a glass pipette and bulb and transferred them to sample tubes to be processed through the fluorometer.

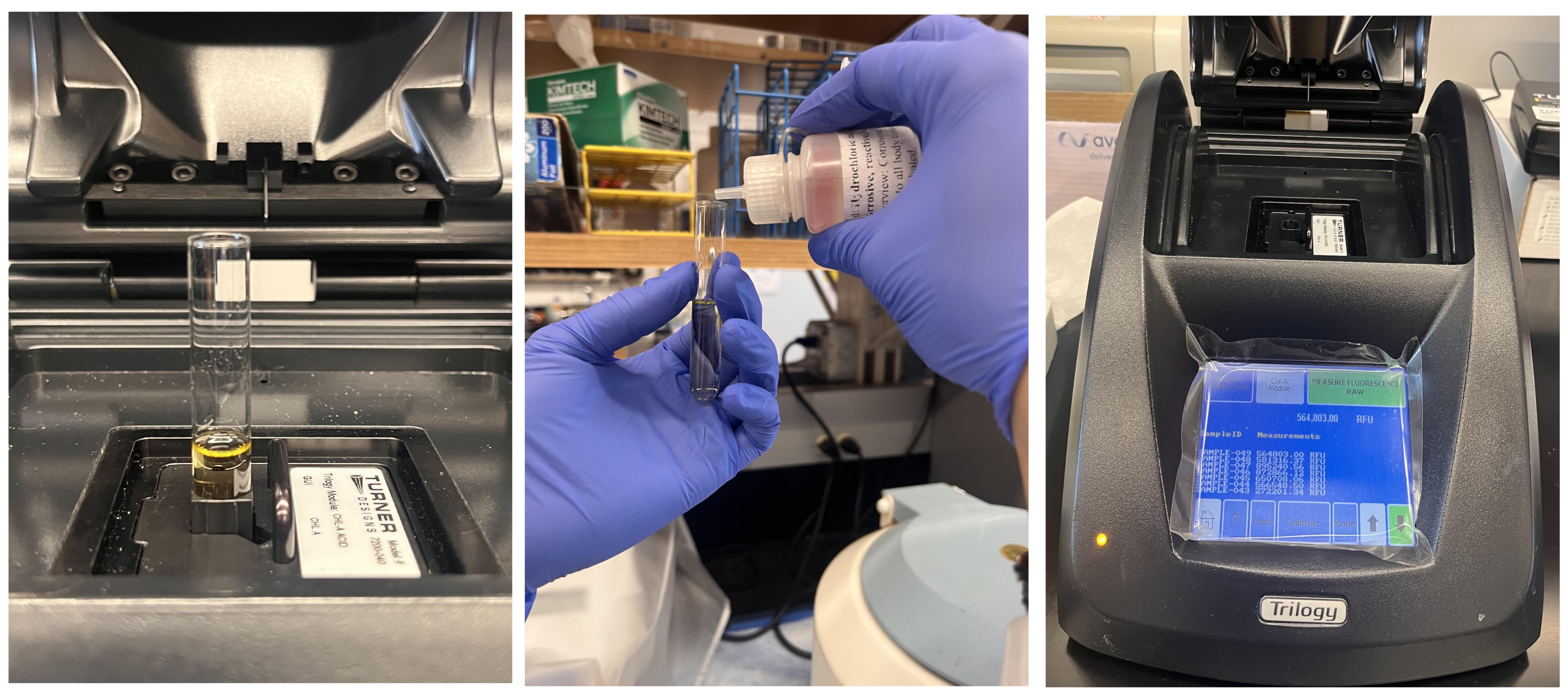

Figure 4: Sample processing using Trilogy Laboratory Fluorometer.

Data Recording Utilizing Fluorometry Techniques

- Once the samples were prepared, each sample tube was inserted into the fluorometer that contained a specific module calibrated to measure raw fluorescence units (RFU).
- HCl acid was added to the samples in order to facilitate a digest process which results in the emergence of phaeopigment. These sets were also recorded.
- After the samples were processed through the fluorometer, the data was then organized into spreadsheets which were then used to generate maps for further analysis.

Results

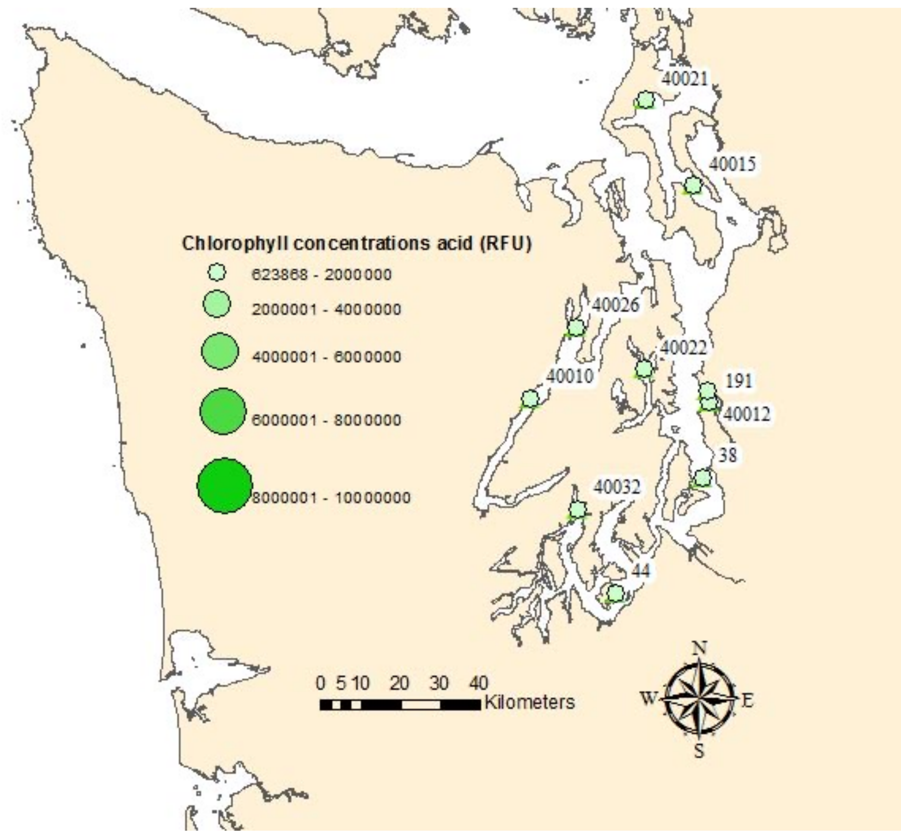

Figure 5. GIS map denoting chlorophyll concentration levels in Raw Fluorescence Units (RFU) from various stations.

- Chlorophyl was successfully recorded in sediment samples based on data provided by fluorometer readings.
- Confirmation of chlorophyll within these sediment samples has shown this isolation method we devised in lab, is functional.

What's Next?

Confirmation of chlorophyll within these sediment samples has shown that the methodology we devised in lab is functional. We will now be able to observe the presence of chlorophyll for organisms, within sediment samples, more specifically the benthic organism. Future research can potentially include how environmental factors affect the presence of phytoplankton based on seasonal shifts or during specific years. The method presented will not only provide the University of Washington with a standard protocol, but it could also inspire the development of future research experiments within this field. Ultimately, our goal is to contribute our knowledge to the surrounding communities by providing knowledge and awareness of our neighboring ecosystems. In 2014, Washington State experienced a significant heatwave. Based on our preliminary results, we can now apply this method to analyze samples collected from 2013, 2014, and 2016 to observe any changes in productivity that may have resulted from the heatwave.

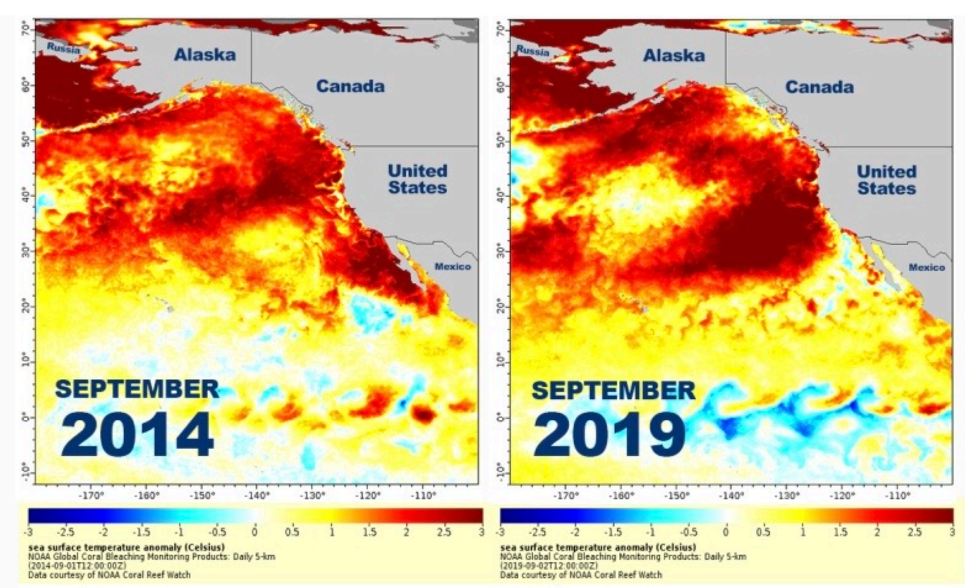

Image from NOAA fisheries, 2019, www.fisheries.noaa.gov

References