JAMES RENNIE BEQUEST

REPORT ON EXPEDITION / PROJECT / CONFERENCE

Expedition/Project/ Conference Title: Global distribution of dinoflagellates abundance and biomass.

Travel Dates: 12th July– 31st August 2023

Location: ETH, Zürich, Switzerland

Group member(s): Ruby Bader

Aims:

Photography consent form attached:
(please refer to your award letter)

☐ Yes
☐ No

OUTCOME (a minimum of 500 words):-

Over the course of three months, I homogenised data from different past scientific projects and produced one Dinoflagellates data set that can be used to explore the plankton's global abundance pattern. In addition, I constructed a further data set that contains values to bio-geometric dimensions of over 150 unique Dinoflagellate species. This will allow for future calculations of the amounts of carbon that is being stored within this plankton group.

Alongside the production of the two data sets, I used my knowledge of marine science to assist the creation of an artistic outreach project. The project is a part of a larger art show called "Experimental Ecology" and currently on display at the Kulturstiftung Basel H. Geiger. The projects' objective is to educate the public about the contribution plankton ecosystems make towards life on our planet.

First and foremost, my project would not have been possible without the financial assistance of the "James Rennie Bequest" that I received. The scholarship made it possible for me to live in Switzerland whilst pursuing these two highly interesting and interlinked projects. Further acknowledgments go to the Kultutstiftung Basel H. Geiger for creating the opportunity for Meike Vogt, Riikka Tuariannian and me to produce an art installation art that is highlighting the importance of plankton. Acknowledgements also go to Meike Vogt, a senior scientist of the Enviornemntal Physics group at ETH, who gave me the opportunity for both projects and Rikka Tauriannian for taking me on-board the artistic team. Fabio Benedetti was also a key co-worker for me within the ETH research group, who always supported me when needing to reach decisions regarding the Dinoflagellates data.

Introduction

The project is split into two interlinked sub-projects. The first is to conduct research on the global biomass patterns of dinoflagellate phytoplankton. The main scientific objective of the research is too better understand the global ecological composition of the Class *Dinophycea*. The second project is to produce an art show for "Experimental Ecology" with the artist Riikka Taurianian that reflects on

the social imaginary aspect of plankton, beyond the scientific realm. The project aims to increase knowledge and understanding of plankton, and to challenge Anthropocene thinking through physical and multisensory interaction. My purpose was to assist the artist with my scientific knowledge of the organism, but also aid in the manual labour of producing the multiple artworks.

Methods

Research Project

This project is based on Noemy Cherniers work, a previous MSc student of the group, where she was investigating global biomass distribution of dinoflagellates. Thus, many of my methods and the extent of the work I could complete within the three months relied on her previous efforts in the project. The methods I used included loop-programming, data exploration through maps and plots and manually checking the sources that dimensions values were taken from Chernier. Furthermore, I explored the use of OpenAI for 'data wrangling' and was very surprised at how useful it was for my work. I noticed it reduced the time spent on debugging scripts and increased the amount of new code I was learning. This has been an important discovery for my forthcoming data science career.

Science-Art Collaboration

The methods used for this project included polyester textile dying, sewing of textiles during the installation, script writing for short-film, construction of wooden framework and lastly, the cutting, heating and moulding of recycled PET sheet. As the very experienced artist was choosing these methods, they were also very useful to the task that had to be achieved. The dying of textiles was the most challenging as we had to search for the suitable material, colour and trial multiple resist-dying techniques that would produce a fitting abstract image on the textiles.

Results

Research Project

The results that have been reached so far are very limited and superficial. We have been able to identify the species by the order of contribution to the total number of observations within the dataset. We came to the conclusion that there were no majorly dominate species being observed. More interestingly, I was able to evaluate the importance of the 75 different Genus we have data on based on the percentage of abundance they contribute to the total global abundance (Table 2). This is incredibly valuable as it aids us in understanding which Genus's and Species it is important to invest further hours in to find suitable geometric variables. Further leading us to a more robust global biomass calculation.

Table 1. Species that contribute to 95% of total concertation

ID	Genus	Mean Concentration (ind/m³)	Percent of Total Dinoflagellate Abundance(%)	Cumulative Percentage Contribution(%)
1	Ceratium	14274.850	27.946	27.946
2	Cladopyxis	8062.967	15.785	43.731
3	Actiniscus	5064.725	9.915	53.646

ID	Genus	Mean Concentration (ind/m³)	Percent of Total Dinoflagellate Abundance(%)	Cumulative Percentage Contribution(%)
4	Cystodinium	5000.000	9.788	63.434
5	Blepharocysta	5000.000	9.788	73.223
6	Tripos	3724.981	7.292	80.515
7	Pronoctiluca	3482.587	6.818	87.333
8	Protoperidinium	1385.857	2.713	90.046
9	Histioneis	1000.000	1.958	92.004
10	Dinophysis	902.796	1.767	93.771
11	Corythodinium	720.339	1.410	95.181

Science-Art Collaboration

The outcome of this work was the construction of an immersive installation aiding the audience into an experience which explore marine microorganisms. We created five sculptures, a short-movie and multisensory interactive walkway.

Discussion

The disorganisation and lack of homogeneity between the raw abundance data meant I invested much more time than expected into quality checking and then re-doing the master's student work as we identified multiple errors in the work. I was not able to arrive at calculating the biomasses, let alone model the data set. As a team, we decided it was more important to have a strong data set then rush a modelling exercise. Thus, my time was allocated to creating a clean abundance data set of global Dinoflagellate observations and a geometric traits database for Dinoflagellates. Currently, our conclusion is that the database is too limited to calculate, all observations we have gathered, with a high degree of confidence. I was, however, able to identify key Species and Genus's that we must invest more efforts in to finding suitable geometric trait values in order to calculate a carbon and biomass.

Personal Statement

Although the research project did not go as I predicted, I am able to see the valuable skills and experiences I did gain from it. Firstly, my professional communication has made a large step. Being the youngest and least experience team member in a group of mature academics made me more adept to communicating my ideas was based on a strong decision-making processes. The experience made more aware of what type of communicator I am, and where I aspire to go. Hence, another valuable skill I improved upon was self-reflecting and setting goals for personal development. Another skill I grew in was project planning. I learned the importance of setting goals, making timelines, and always keeping the aim of the task in the foreground. Sadly, I did not get to develop skills in working with a scientific model, however, through the meticulous cleaning of data my confidence in my programming skills grew as I feel like I solidified my data management skills.

The most rewarding insight I have found from my experience, are the exchanges I have had with many interesting people from very different career backgrounds. I had many conversations about

the importance of artistic communication of scientific knowledge. This has deeply inspired me to further pursue the topic of communicating technically scientific findings to a much wider audience. I plan on putting together my own art show with other final ear students to present our dissertation findings through creative means. Furthermore, the connections I have made with new people I have met throughout the project seem to be ones that I will yield to interesting future collaborations.