

CISESS ANNUAL REPORT ON RESEARCH FOR THE

GLOBAL OCEAN MONITORING AND OBSERVING PROGRAM

April 1, 2022 to March 31, 2023

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CISESS: UCI BIO-GO-SHIP - A GLOBAL ANALYSIS OF LARGE-SCALE CHANGES TO OCEAN PLANKTON SYSTEMS

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RESEARCH TOPIC: Surface Observation Networks

TASK CODE: AMAM_NOPP_21 Yr 2

HIGHLIGHT: A varying oxygen-to-carbon remineralization ratio is important for connecting ocean biogeochemical cycles. This year:

- We analyzed hydrographic, plankton genomic diversity, and particulate organic matter data from 1970 stations sampled during a global ocean observation program (Bio-GO-SHIP) to investigate the biogeography of surface ocean particulate organic matter stoichiometry.
- We developed a new ocean biogeochemistry database for ocean POM measurements (GO-POPCORN). This new database can help validate and calibrate the next generation of global ocean biogeochemical models with flexible elemental stoichiometry

ACCOMPLISHMENTS

Our accomplishments span across three main areas: (1) participating in a major research cruise that covered the entire Pacific Ocean (section P02), (2) publishing research on the biological regulation of ocean oxygen levels and the regulation of ecosystem carbon to nutrient stoichiometry, and (3) collaborating with the wider research community to develop operating procedures and standards for ocean biological sampling. This summary aims to highlight these remarkable achievements and their implications for the field of marine biology.

1. PACIFIC OCEAN RESEARCH CRUISE

Our research team participated in a groundbreaking research cruise that traversed the entire Pacific Ocean. During this expedition, we collected and analyzed metagenomic, flow cytometry, imaging, and optical samples from various depths and locations across the vast oceanic expanse. These samples were critical in providing us with an unprecedented understanding of the Pacific's diverse marine ecosystems and their complex interactions.

The metagenomic analyses allowed us to identify and characterize the microbial communities inhabiting different marine environments. Flow cytometry data provided insights into the abundance and distribution of phytoplankton and other microscopic organisms essential to marine food webs. High-resolution imaging enabled the visualization of various marine species, while optical sampling helped us understand the role of light in regulating oceanic processes.

By integrating data from these complementary techniques, our research team was able to develop a comprehensive picture of the Pacific Ocean's ecological dynamics. These findings have the potential to inform future conservation efforts, resource management strategies, and climate change mitigation plans.

2. BIOLOGICAL REGULATION OF OCEAN OXYGEN LEVELS AND ECOSYSTEM CARBON TO NUTRIENT STOICHIOMETRY

In addition to the research cruise, our team published groundbreaking research on the biological regulation of ocean oxygen levels and the regulation of ecosystem carbon to nutrient stoichiometry. Our findings revealed that marine microorganisms play a crucial role in maintaining the delicate balance of oxygen and nutrient availability in the ocean.

By examining the interactions between marine bacteria, phytoplankton, and other microscopic organisms, we uncovered the mechanisms that govern the conversion of nutrients into organic matter and the consumption of dissolved oxygen. These processes are vital for maintaining a healthy marine ecosystem and preventing the formation of oxygen-depleted "dead zones" that can harm marine life.

Furthermore, our research shed light on the complex relationship between carbon, nitrogen, and phosphorus in marine ecosystems. We demonstrated that changes in the availability of these key nutrients can significantly impact the overall stoichiometry of marine communities, with potential cascading effects on ecosystem structure and function. This information is crucial for predicting and managing the effects of climate change and other anthropogenic impacts on ocean ecosystems.

3. DEVELOPING OPERATING PROCEDURES AND STANDARDS FOR OCEAN BIOLOGICAL SAMPLING

Recognizing the need for standardized methodologies and best practices in ocean biological sampling, our team collaborated with a wide community group comprising researchers, industry professionals, and government agencies. Together, we developed a set of operating procedures and standards to ensure the accuracy, consistency, and reliability of biological sample collection and analysis.

These guidelines cover various aspects of ocean sampling, including proper equipment handling, sample preservation, and data management. By promoting the adoption of these standardized practices, our team aims to facilitate more robust and reproducible research findings in marine biology, ultimately advancing our understanding of the world's oceans.

PUBLICATIONS

1. Tanioka, Tatsuro, et al (including **Adam Martiny**), 2022: "Global Ocean Particulate Organic Phosphorus, Carbon, Oxygen for Respiration, and Nitrogen (GO-POPCORN)." *Scientific Data* 9.1 (2022): 688.
2. Tanioka, Tatsuro, et al. (including **Adam Martiny**), 2022: "Global patterns and predictors of C: N: P in marine ecosystems." *Communications Earth & Environment* 3.1 (2022): 271.
3. Moreno, Allison R., et al. (including **Adam Martiny**), 2022: "Regulation of the respiration quotient across ocean basins." *AGU Advances* 3.5 (2022): e2022AV000679.

PRODUCTS

1. GO-POPCORN, <https://doi.org/10.5061/dryad.05qftf5h>

EDUCATION, OUTREACH, AND TRAINING

STUDENT NAMES

1. **Adam Fagan** (UC Irvine Graduate Student)
2. **Skylar Gerace** (UC Irvine Graduate Student)