Size Fractionated Chlorophyll Measurements from R/V Tangaroa TAN1810 in the Chatham Rise (Subtropical and Sub-Antarctic waters off of New Zealand) from October to November 2018 (Salp Food Web Ecology project)

Website: https://www.bco-dmo.org/dataset/905404
Data Type: Cruise Results
Version: 1
Version Date: 2023-08-01

Project
» Collaborative Research: Quantifying trophic roles and food web ecology of salp blooms of the Chatham Rise (Salp Food Web Ecology)

Contributors	Affiliation	Role
Gutierrez Rodriguez, Andres	New Zealand National Institute of Water and Atmospheric Research (NIWA)	Principal Investigator
Stukel, Michael R.	Florida State University (FSU)	Co-Principal Investigator
Yingling, Natalia	Florida State University (FSU)	Co-Principal Investigator
Newman, Sawyer	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset provides size-fractionated (SF) chlorophyll measurements taken across the subtropical front east of New Zealand in October and November 2018. The dataset provides depth-resolved measurements of SF chlorophyll for 0.2 µm, 2 µm and 20 µm sized cells for locations in the subtropical and subantarctic-influenced locations of the subtropical front. Samples for size fractionated chlorophyll a (SF Chla) were analyzed by first gravity filtering a sample (250 mL) through a 20 µm 47-mm polycarbonate filter, then with low vacuum pressure, filtering sequentially through a 2 µm and a 0.2 µm filter. Filters were then folded, placed in 1.5 mL cryovials and frozen (-80 °C) until analysis (Gutiérrez-Rodríguez et al., 2020). Chla and acidified phaeopigment-a concentrations were measured (within 3 months) using ice-cold 90% acetone extraction by spectrofluorometric methods (APHA 10200 H) on a Varian Cary Eclipse fluorescence spectrophotometer (Rice et al., 2012). In addition to serving as the chlorophyll measurements for size specific C:Chl ratios, size fractionated chlorophyll measurements are crucial in estimating chlorophyll concentrations for various sized autotroph cells. The summed SF chlorophyll is also provided in this dataset as comparison to total chlorophyll sampled in this region. Andrés Gutierrez Rodriguez and his lab were responsible for collection and analysis of this dataset.

Table of Contents

Coverage

Spatial Extent: **N**:180 **E**:-42.6547 **S**:174.095 **W**:-45.5557
Temporal Extent: 2018-10-25 - 2018-11-19

Methods & Sampling

Field Collection

Data was collected in the Chatham Rise section of the Southern Ocean, located east of Aotearoa New Zealand, as part of the SALPOOP ('Salp Particle expOrt and Ocean Production') voyage during October to November 2018.). We conducted five Lagrangian experiments (hereafter referred to as "cycles") that lasted four to eight days (Décima et al., 2023). There were three cycles that were sampled in SA waters (1, 2 and 5) and two cycles in ST waters (3 and 4) while salps were only present in three cycles (1, 2 and 4). Six depths were chosen to span the euphotic zone (based on chlorophyll fluorescence measured during the conductivity-temperature-depth (CTD) downcast profiles).

Size Fractionated Chlorophyll *a* Measurements

Samples for size fractionated chlorophyll *a* (SF Chl*a*) were analyzed by first gravity filtering a sample (250 mL) through a 20 µm 47-mm polycarbonate filter, then with low vacuum pressure, filtering sequentially through a 2 µm and a 0.2 µm filter. Filters were then folded, placed in 1.5 mL cryovials and frozen (-80 °C) until analysis (Gutiérrez-Rodríguez et al., 2020). Chl*a* and acidified phaeopigment-a concentrations were measured (within 3 months) using ice-cold 90% acetone extraction by spectrofluorometric methods (APHA 10200 H) on a Varian Cary Eclipse fluorescence spectrophotometer (Rice et al., 2012).

Data Processing Description

Chl and acidified phaeopigment-a concentrations were measured in the lab (within 3 months) using an ice-cold 90% acetone extraction by spectrofluorometric methods (APHA 10200 H) on a Varian Cary Eclipse fluorescence spectrophotometer (Rice et al., 2012).

BCO-DMO Processing Description

Removed units from column headers.

Percent sign (%) replaced by "_percent" in column headers to remove special characters. Periods removed from float numeric values in column names; see parameter details for full information.

Dates converted from %m/%d/%y format to %Y-%m-%d format.

Latitude and longitude coordinates rounded to 6 decimal places.

[table of contents | back to top]

Related Publications

Gutiérrez-Rodríguez, A., Latasa, M., Selph, K. E., Safi, K., Yingling, N., Lopes dos Santos, A., Kelly, T. B., Gorbunov, M. Y., Decima, M., Stukel, M. R., and Nodder, S. D. (In Preparation). Phytoplankton taxon-specific production and microzooplankton consumption in subtropical and subantarctic waters of contrasting productivity
Results

Gutiérrez-Rodríguez, A., Safi, K., Fernández, D., Forcén-Vázquez, A., Gourvil, P., Hoffmann, L., Pinkerton, M., Sutton, P., & Nodder, S. D. (2020). Decoupling Between Phytoplankton Growth and Microzooplankton Grazing Enhances Productivity in Subantarctic Waters on Campbell Plateau, Southeast of New Zealand. Journal of Geophysical Research: Oceans, 125(2). Portico. https://doi.org/10.1029/2019jc015550
https://doi.org/10.1029/2019JC015550
Methods

Standard Methods for the Examination of Water and Wastewater. ALPHA-AWWA-WEF. Standard Methods Online. https://www.standardmethods.org/
Methods

Yingling, N., Selph, K. E., Décima, M., Safi, K., Gutiérrez-Rodríguez, A., Fender, C. K., & Stukel, M. R. (In Preparation). Autotrophic Plankton Size Spectra, Biomass, Abundance, and Community Composition in the Subtropical Convergence Zone in the Southern Ocean. Deep Sea Res. Part I.
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
Cycle	Lagrangian experiment number	unitless
Cast	CTD deployment number	unitless
Depth	Depth the sample originated in meters	meters
Lat	Latitude in decimal degrees; a positive value indicates an Eastern coordinate	decimal degrees
Lon	Longitude in decimal degrees; a negative value indicates a Northern coordinate	decimal degrees
Date	Date in New Zealand Standard time	unitless
Chl_a_02	Chlorophyll concentration for the 0.2 µm filter	mg/m^3
Chl_a_2	Chlorophyll concentration for the 2 µm filter	mg/m^3
Chl_a_20	Chlorophyll concentration for the 20 µm filter	mg/m^3
Summed_SF_Chl	Total or summed chlorophyll concentration for the 0.2, 2 and 20 µm filter	mg/m^3
Chl_a_02_percentage	Percentage of total summed chlorophyll represented by 0.2 µm cells	unitless
Chl_a_2_percentage	Percentage of total summed chlorophyll represented by 2 µm cells	unitless
Chl_a_20_percentage	Percentage of total summed chlorophyll represented by 20 µm cells	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Varian Cary Eclipse fluorescence spectrophotometer
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Chl and acidified phaeopigment-a concentrations were measured in the lab (within 3 months) using an ice-cold 90% acetone extraction by spectrofluorometric methods (APHA 10200 H) on a Varian Cary Eclipse fluorescence spectrophotometer (Rice et al., 2012).
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

[table of contents | back to top]

Deployments

TAN1810

Website	https://www.bco-dmo.org/deployment/757070
Platform	R/V Tangaroa
Start Date	2018-10-23
End Date	2018-11-21

[table of contents | back to top]

Project Information

Collaborative Research: Quantifying trophic roles and food web ecology of salp blooms of the Chatham Rise (Salp Food Web Ecology)

Coverage: East of New Zealand, Chatham Rise area

NSF Award Abstract:
Salps are unique open-ocean animals that range in size from a few millimeters to greater than twenty centimeters, have a gelatinous (jelly-like) body, and can form long chains of many connected individuals. These oceanic organisms act as oceanic vacuum cleaners, having incredibly high feeding rates on phytoplankton and, unusual for consumers of their size, smaller bacteria-sized prey. This rapid feeding and the salps' tendency to form dense blooms, allows them move substantial amounts of prey carbon from the surface into the deep ocean, leading to carbon dioxide removal from the atmosphere. However, salps are often considered a trophic dead-end, rather than a link, in the food web due to the assumption that they themselves are not consumed, since their gelatinous bodies are less nutritious than co-occurring crustacean prey. Along with this, salp populations are hypothesized to be increasing due to climate change. This proposal addresses these questions: 1) Do salps compete primarily with crustaceans (as in the prevailing paradigm) or are they competitors of single-celled protists, which are the dominant grazers of small phytoplankton? 2) Do salp blooms increase the efficiency of food-web pathways from tiny phytoplankton to fisheries production in nutrient-poor ocean regions?

This project will support the interdisciplinary education of a graduate student who will learn modeling and laboratory techniques in the fields of biological and chemical oceanography and stimulate international

collaborations between scientists in the United States and New Zealand. Additionally, several Education and Outreach initiatives are planned, including development of a week-long immersive high school class in biological oceanography, and education modules that will serve the "scientists-in-the schools" program in Tallahassee, FL.

It is commonly assumed that salps are a trophic sink. However, this idea was developed before the discovery that protists (rather than crustaceans) are the dominant grazers in the open ocean and was biased by the difficulty of recognizing gelatinous salps in fish guts. More recent studies show that salps are found in guts of a diverse group of fish and seabirds and are a readily available prey source when crustacean abundance is low. This proposal seeks to quantify food web flows through contrasting salp-dominated and salp-absent water parcels near the Chatham Rise off western New Zealand where salp blooms are a predictable phenomenon. The proposal will leverage previously obtained data on salp abundance, bulk grazing impact, and biogeochemical significance during Lagrangian experiments conducted by New Zealand-based collaborators. The proposal will determine 1) taxon- and size-specific phytoplankton growth rate measurements, 2) taxon- and size-specific protozoan and salp grazing rate measurements, 3) compound specific isotopic analysis of the amino acids of mesozooplankton to quantify the trophic position of salps, hyperiid amphipods, and other crustaceans, 4) sediment traps to quantify zooplankton carcass sinking rates, and 5) linear inverse ecosystem modeling syntheses. Secondary production and trophic flows from this well-constrained ecosystem model will be compared to crustacean-dominated and microbial loop-dominated ecosystems in similarly characterized regions (California Current, Costa Rica Dome, and Gulf of Mexico).

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756465
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756610

[table of contents | back to top]