

Thorium-234 data from SalpPOOP cruise on the R/V Tangaroa to the Chatham Rise (subtropical and subantarctic waters) in October and November 2018

Website: <https://www.bco-dmo.org/dataset/883989>

Data Type: Cruise Results

Version: 1

Version Date: 2022-12-16

Project

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

Contributors	Affiliation	Role
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Abstract

This dataset represents Thorium-234 data from samples in the water column at the Chatham Rise (subtropical and subantarctic waters) on the Tangaroa Cruise 1810 (aka SalpPOOP cruise) in October and November 2018.

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Coverage

Spatial Extent: N:-42.7082 E:-179.849167 S:-45.5503 W:179.851

Temporal Extent: 2018-10-24 - 2018-11-17

Methods & Sampling

This dataset represents water column Thorium-234 data from the SalpPOOP, Tangaroa Cruise 1810 (aka SalpPOOP cruise). Salinity and density were measured using a CTD. 4-liter (L) samples for total water-column ²³⁴Th activity were collected using CTD bottles at approximately 12 depths from the surface to approximately 300 meters. Samples were acidified with nitric acid to a pH < 2, and a Th-230 tracer spike was added. Samples were shaken and allowed to equilibrate for 4 to 9 hours. Samples were then re-basified with ammonium hydroxide to a pH of 8-9, shaken, and allowed to equilibrate for more than 8 hours. Samples were then vacuum filtered at high vacuum pressure through a quartz (QMA) filter. Filters were mounted in RISO planchets and counted on a RISO low-level beta multi-counter at Palmer Station, Antarctica. Following a background count > 6 months later, samples were dissolved in 8M nitric acid / 10% hydrogen peroxide solution and a Th-229 tracer spike was added. Samples were then analyzed on an ICP-MS to quantify the Th-229:Th-230 ratio, which was used to calculate the initial precipitation and filtration yield of Th-234. Protocols

from Pike et al. (2005) were followed.

For additional sampling details see Decima et al. (in review, Nat. Comm.).

Data Processing Description

BCO-DMO Processing description:

- Converted collection date column and added column for ISO date format (YYYY-MM-DDThh:mmZ)
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Added a conventional header with dataset name, PI names, version date
- Added a column for Cruise ID
- Added columns for "Latitude" and "Longitude"
- Rounded columns: "Latitude", "Longitude", "Depth", "U238_activity", "Th234_activity", and "Th234_measurement_uncertainty" to 3 decimal places (or to the thousandth place)

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Data Files

File
thorium234.csv (Comma Separated Values (.csv), 11.44 KB) MD5:9e5deea1f7386ace969290858c093eb7
Primary data file for dataset ID 883989

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Related Publications

Décima, M., Stukel, M. R., Nodder, S. D., Gutiérrez-Rodríguez, A., Selph, K. E., dos Santos, A. L., Safi, K., Kelly, T. B., Deans, F., Morales, S. E., Baltar, F., Latasa, M., Gorbunov, M. Y., & Pinkerton, M. (2022). Salp blooms increase carbon export 5-fold in the Southern Ocean. <https://doi.org/10.1101/2022.02.07.479467>

Methods

Pike, S. M., Buesseler, K. O., Andrews, J., & Savoye, N. (2005). Quantification of ²³⁴Th recovery in small volume sea water samples by inductively coupled plasma-mass spectrometry. *Journal of Radioanalytical and Nuclear Chemistry*, 263(2), 355–360. doi:10.1007/s10967-005-0062-9 <https://doi.org/10.1007/s10967-005-0594-z>

Methods

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Parameters

Parameter	Description	Units
Cruise_ID	Cruise Identification	unitless
Collection_Datetime	Local date of collection (New Zealand ST) in format: YYYY-MM-DDThh:mmZ	unitless
ISO_DateTime_UTC	Date of collection in ISO 8601 format	unitless
Cast_Number	Cast number on the cruise	unitless
Cycle	Lagrangian experiment number	unitless
Latitude	Latitude of sample collection North	decimal degrees
Longitude	Longitude of sample collection East (West is negative)	decimal degrees
Depth	Depth of sample collection	meters
U238_activity	Activity of Uranium-238	decays per minute per liter
Th234_activity	Activity of Thorium-234	decays per minute per liter
Th234_measurement_uncertainty	Uncertainty in Th234 activity	decays per minute per liter

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD - fixed
Generic Instrument Description	A reusable instrument that always simultaneously measures conductivity and temperature (for salinity) and pressure (for depth). This term applies to CTDs that are fixed and do not measure by profiling through the water column. For profiling CTDs, see https://www.bco-dmo.org/instrument/417 .

Dataset-specific Instrument Name	ICP-MS (Inductively coupled plasma mass spectrometer)
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

Dataset-specific Instrument Name	RISO low-level beta multi-counter
Generic Instrument Name	Riso Laboratory Anti-coincidence Beta Counters
Generic Instrument Description	Low-level beta detectors manufactured by Riso (now Nutech) in Denmark. These instruments accept samples that can be mounted on a 25mm filter holder. These detectors have very low backgrounds, 0.17 counts per minute, and can have counting efficiencies as high as 55%.

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Deployments

TAN1810

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

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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.

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Funding

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

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