Nutrient concentrations and biogeochemical rate data collected in the eastern tropical North Pacific Ocean in 2017 on R/V Oceanus cruise 1704A

Website: https://www.bco-dmo.org/dataset/969971
Data Type: Cruise Results
Version: 1
Version Date: 2025-07-29

Project
» CAREER: Oxygen sensitivity of aerobic respiration and nitrification in oxygen minimum zones and biogeochemical feedbacks to deoxygenation (RANDOM)

Contributors	Affiliation	Role
Beman, John Michael	University of California-Merced (UC Merced)	Principal Investigator
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Abstract
This dataset contains nutrient concentrations and biogeochemical rate data collected in the eastern tropical North Pacific Ocean in 2017 on R/V Oceanus cruise 1704A.

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Coverage

Location: Eastern Tropical North Pacific Ocean
Spatial Extent: **N**:27.4 **E**:-106.5 **S**:16 **W**:-117.5
Temporal Extent: 2017-04-07 - 2017-04-27

Methods & Sampling

Samples were collected in April 2017 aboard the *R/V Oceanus* using Niskin bottles. Nutrient samples were analyzed for NH_4^+ and NO_2^- aboard the ship, with additional shore-based analyses of combined NO_3^-+NO_2^- and PO_4^{3-} at the University of California Santa Barbara Marine Science Institute Analytical Lab (see Beman et al. 2020). Water column profiles of oxygen consumption rates (OCR) were measured using 5 replicates at each depth, including one each with tracer level (5-10% *in situ* concentration measured at sea) addition of $^{15}NH_4^+$ or $^{15}NO_2^-$ to measure ammonia/nitrite oxidation. OCR was measured based on starting and ending DO values, and samples for nitrite and ammonia oxidation were collected from labeled bottles at the end of the experiments. Nitrite and ammonia oxidation rates followed Beman et al. (2012) and Beman et al. (2013). See Beman et al. (preprint) for additional detail.

Data Processing Description

Data were processed and analyzed in Microsoft Excel and R.

BCO-DMO Processing Description

- Imported original file "BCODMO_BEMAN_ETNP17.xlsx" into the BCO-DMO system.
- Flagged "nd" as a missing data value (missing data are empty/blank in the final CSV file).
- Converted Date column to YYYY-MM-DD format.
- Converted Time column to hh:mm format and renamed to "Time_Local".
- Renamed fields to comply with BCO-DMO naming conventions.
- Saved final file as "969971_v1_etnp17_nutrients_and_rates.csv".

Problem Description

Some samples were lost/compromised during transport, leading to missing values.

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Data Files

File	
969971_v1_etnp17_nutrients_and_rates.csv	(Comma Separated Values (.csv), 5.07 KB) MD5:4a9e055dad6b7055404409f0428d7058
Primary data file for dataset ID 969971, version 1	

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Related Publications

Beman, J. M., Leilei Shih, J., & Popp, B. N. (2013). Nitrite oxidation in the upper water column and oxygen minimum zone of the eastern tropical North Pacific Ocean. The ISME Journal, 7(11), 2192–2205. https://doi.org/10.1038/ismej.2013.96
Methods

Beman, J. M., Vargas, S. M., Vazquez, S., Wilson, J. M., Yu, A., Cairo, A., & Perez-Coronel, E. (2020). Biogeochemistry and hydrography shape microbial community assembly and activity in the eastern tropical North Pacific Ocean oxygen minimum zone. Environmental Microbiology, 23(6), 2765–2781. Portico. https://doi.org/10.1111/1462-2920.15215
Methods

Beman, J. M., Vargas, S. M., Wilson, J. M., Perez-Coronel, E., Karolewski, J. S., Vazquez, S., Yu, A., Cairo, A. E., White, M. E., Koester, I., Aluwihare, L. I., & Wankel, S. D. (2021). Substantial oxygen consumption by aerobic nitrite oxidation in oceanic oxygen minimum zones. Nature Communications, 12(1). https://doi.org/10.1038/s41467-021-27381-7
Results

Genco, B. M., White, M. E., Koester, I., Vargas, S. M., Saunders, J. K., Petras, D., Saito, M. A., García-Maldonado, J. Q., Dorrestein, P. C., Aluwihare, L. I., & Beman, J. M. (2025). Tropical cyclones drive oxygen minimum zone shoaling and simultaneously alter organic matter production. Science Advances, 11(23). https://doi.org/10.1126/sciadv.ado8335
Results

Michael Beman, J., Popp, B. N., & Alford, S. E. (2012). Quantification of ammonia oxidation rates and ammonia-oxidizing archaea and bacteria at high resolution in the Gulf of California and eastern tropical North Pacific

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Parameters

Parameter	Description	Units
Latitude	Latitude of sample collection	decimal degrees North
Longitude	Longitude of sample collection	decimal degrees East
Date	Date of sample collection (local time zone)	unitless
Time_Local	Time of sample collection (local time zone). Stations 1-5 are Mountain time and Station 6 is Pacific time.	unitless
Station	Station number	unitless
Depth	Sample depth	meters (m)
OCR	Oxygen consumption rate	micromoles per liter per day
Nitrate	Dissolved nitrate concentration	micromolar
Nitrite	Dissolved nitrite concentration	micromolar
Ammonium	Dissolved ammonium concentration	micromolar
Ammonia_oxidation	Ammonia oxidation rate	nanomoles per liter per day
Nitrite_oxidation	Nitrite oxidation rate	nanomoles per liter per day

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Instruments

Dataset-specific Instrument Name	IsoPrime 100 isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	IsoPrime 100 isotope ratio mass spectrometer normalized to international reference materials (USGS 32, USGS 34, USGS 35).
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Lachat QuikChem 8500 Series 2 Flow Injection Analyzer
Generic Instrument Name	Lachat QuikChem 8500 flow injection analysis system
Generic Instrument Description	The Lachat QuikChem 8500 Series 2 Flow Injection Analysis System features high sample throughput and simple, but rapid, method changeover. The QuikChem 8500 Series 2 system maximises productivity in determining ionic species in a variety of sample types, from sub-ppb to percent concentrations. Analysis takes 20 to 60 seconds, with a sample throughput of 60 to 120 samples per hour.

Dataset-specific Instrument Name	Loligo Systems Fibox
Generic Instrument Name	Oxygen Sensor
Dataset-specific Description	The Loligo Systems Fibox is a fiber optic oxygen meter.
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O2) in the gas or liquid being analyzed

Dataset-specific Instrument Name	Turner Trilogy Fluorometer
Generic Instrument Name	Turner Designs Trilogy fluorometer
Generic Instrument Description	The Trilogy Laboratory Fluorometer is a compact laboratory instrument for making fluorescence, absorbance, and turbidity measurements using the appropriate snap-in application module. Fluorescence modules are available for discrete sample measurements of various fluorescent materials including chlorophyll (in vivo and extracted), rhodamine, fluorescein, cyanobacteria pigments, ammonium, CDOM, optical brighteners, and other fluorescent compounds.

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Deployments

OC1704A

Website	https://www.bco-dmo.org/deployment/970009
Platform	R/V Oceanus
Start Date	2017-04-01
End Date	2017-04-29
Description	See more information at R2R: https://www.rvdata.us/search/cruise/OC1704A

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Project Information

CAREER: Oxygen sensitivity of aerobic respiration and nitrification in oxygen minimum zones and biogeochemical feedbacks to deoxygenation (RANDOM)

Website: https://bemanlab.org/about/research/research-etnp-and-goc/

Coverage: Eastern Tropical North Pacific Ocean

NSF Award Abstract:
Aerobic microorganisms in the ocean help regulate biogeochemical nutrient cycles through the linked production and consumption of dissolved oxygen (DO) and organic matter. Concentrations of DO have been shown to be steadily decreasing in deeper ocean waters and the resulting areas of critically low DO content, known as oxygen minimum zones (OMZs), are expanding. While this phenomenon is recognized as having potentially serious impacts on biogeochemical cycles where OMZs are growing, surprisingly little research has been done to identify the mechanisms and quantify the specific processes that will affect these changes. This project will study the connection between changing DO concentrations and nutrient cycling in the interior of the ocean. The oxidation of nitrogen compounds (ammonia and nitrite in particular) is strongly influenced by DO concentrations. Because of the complex and connected nature of marine biogeochemical reactions that involve DO, each one potentially altered by concentration changes, this research is critical for a complete understanding of how ocean chemistry will change in the near future. The project will incorporate education into the research by developing materials to teach high school students about the nitrogen cycle, by developing a marine chemistry based course for undergraduates that will give them both field and computational experience, and by building on past efforts to include traditionally underrepresented groups in science. One of the graduate students funded by this project will translate lectures into Spanish and make these available on the internet for increased accessibility for minority students.

The world's largest oxygen minimum zone (OMZ), located in the Eastern Tropical North Pacific (ETNP), is an ideal study site for research into the effects of varying dissolved oxygen (DO) concentrations on nutrient cycling in the interior ocean. Throughout this OMZ, the extent of anoxia exhibits a range that allows for study of the effect of changing DO content on the rates and mechanisms that control consumption of DO and organic matter by aerobic microorganisms in a 'real world' setting. In particular, ammonia and nitrite oxidation, reactions that play a critical role in the nitrogen cycle, are likely to be significantly affected by varying DO concentration. This project will evaluate aerobic respiration, ammonia, and nitrite oxidation rates at various stations in the ETNP, examine carefully controlled incubations, and develop primers to target active microorganisms in the OMZ; all to quantify the connections between DO and these biogeochemical nutrient cycles. The research will also examine the hypothesis that more organic carbon is respired in waters with low DO and a shallow OMZ than previously thought and evaluate the possibility that nitrogen cycling in low DO regions could push OMZs to anoxia due to nitrite oxidation coupled with nitrate reduction, which could potentially accelerate DO consumption. With the expansion of OMZ's in a changing ocean, it is crucial to more fully understand the connections between these various, complex, components.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1555375

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