CTD data from R/V Kilo Moana KM1314 in the The North Pacific Ocean (Seattle to Honolulu, including Line P, Station ALOHA), Aug - Sept 2013 (Nitrification and Marine Planktonic Biodiversity project)

Website: https://www.bco-dmo.org/dataset/539810
Version: 2014-11-24

Project
» Significance of nitrification in shaping planktonic biodiversity in the ocean (Nitrification and Marine Planktonic Biodiversity)

Program
» Dimensions of Biodiversity (Dimensions of Biodiversity)

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Dataset Description

Water property data from the North Pacific Ocean, including CTD, dissolved oxygen, chlorophyll fluorescence, PAR, turbidity, beam transmission.

Related Dataset: KM1314 bottle

Methods & Sampling

Samples were collected onboard the R/V Kilo Moana between 8/7 and 9/5 2013. Water property data were collected using a Niskin rosette equipped with a Seabird CTD package and auxiliary sensors, specifically: Seabird 911 CTD, SBE 43 Dissolved Oxygen Sensor, Biospherical/Licor PAR/Irradiance Sensor, WETLabs ECO Chlorophyll Fluorometer, WETLabs C-Star Transmissometer, Seapoint Chlorophyll Fluorometer. Discrete samples for nutrients, oxygen, and prokaryotic cells were collected using a Niskin rosette attached to the sensor package. All CTD sensors were factory calibrated within 1 year of deployment. Nutrient samples were filtered onboard, frozen immediately at -80 degrees C, and subsequently processed at the University of Washington Marine Chemistry Lab using the US-JGOFS protocols. Discrete oxygen samples were analyzed on

board using the Carpenter modification of the Winkler method.

Data Processing Description

Data were processed using Seabird proprietary data conversion software and factory calibration coefficients; dissolved oxygen voltage was aligned using a time advance of 3.75 seconds for both Oxygen 1 and Oxygen 2; downcast data were averaged into 1 meter bins.

BCO-DMO Data Processing Notes:

added conventional header with dataset name, PI name, version date, reference information
renamed parameters to BCO-DMO standard; renamed Station to event; StationName to station
reduced number of significant digits for lat and lon
version 2 (24 Nov. 2014) replaces version 1 (21 Nov. 2014)

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Data Files

File
ctd_KM1314.csv (Comma Separated Values (.csv), 5.35 MB) MD5:6bb9321244ecd30f867ba507cbda3040 Primary data file for dataset ID 539810

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Parameters

Parameter	Description	Units
station	Station number (sequential based on location).	unitless
event	Event number	unitless
month_utc	2-digit month of year, UTC, at start of cast.	mm (01 to 12)
day_utc	2-digit day of month, UTC, at start of cast.	dd (01 to 31)
year	4-digit year at start of cast.	YYYY
time_start	Time (UTC) at start of CTD cast, 24-hour clock.	HHMM
lat_start	Latitude at start of CTD cast. Positive = North.	decimal degrees
lon_start	Longitude at start of CTD cast. Positive = East.	decimal degrees
depth_w	Depth of the water (bottom depth).	meters
ISO_DateTime_UTC	Date/Time (UTC) ISO8601 formatted. T indicates start of time string; Z indicates UTC.	YYYY-mm-ddTHH:MM:SS.ssZ
press	Pressure, Digiquartz.	decibars
temp	Temperature from primary sensor, ITS-68, measured in degrees Celsius.	degrees C
temp2	Temperature from secondary sensor, ITS-68, measured in degrees Celsius.	degrees C
cond	Conductivity from primary sensor measured in Siemens per meter.	S/m
cond2	Conductivity from secondary sensor measured in Siemens per meter.	S/m

O2_umol_kg	Oxygen measured by primary SBE 43 sensor in micromoles per kilogram.	umol/kg
O2_umol_kg2	Oxygen measured by secondary SBE 43 sensor in micromoles per kilogram.	umol/kg
fluor	Fluorescence measured by WET Labs ECO-AFL/FL in milligrams per cubic meter.	mg/m^3
fluor_spt	Fluorescence, Seapoint.	?
sal	Salinity from primary sensor in practical salinity units.	PSU
sal2	Salinity from secondary sensor in practical salinity units.	PSU
sigma_theta	Sigma theta density from primary sensor in kilograms per cubic meter.	kg/m^3
sigma_theta_2	Sigma theta density from secondary sensor in kilograms per cubic meter.	kg/m^3
potemp	Potential temperature from primary sensor, ITS-90, measured in degrees Celsius.	degrees C
potemp2	Potential temperature from secondary sensor, ITS-90, measured in degrees Celsius.	degrees C
beam_c	Beam attenuation measured by the WET Labs C-Star transmissometer.	1/m
PAR	PAR/Irradiance, Biospherical/Licor	
cruise_id	Cruise identification	unitless
turbidity	Turbidity	NTU
trans	Beam transmission	percent
O2sat	Oxygen saturation measured by primary SBE 43 sensor	percent
O2sat_2	Oxygen saturation measured by secondary SBE 43 sensor	percent
yrday_gmt	UTC day and decimal time, as 326.5 for the 326th day of the year, or November 22 at 1200 hours (noon).	unitless

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Instruments

Dataset-specific Instrument Name	CTD SBE 911plus
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	CTD-fluorometer
Generic Instrument Name	CTD-fluorometer
Dataset-specific Description	WETLabs ECO Chlorophyll Fluorometer
Generic Instrument Description	A CTD-fluorometer is an instrument package designed to measure hydrographic information (pressure, temperature and conductivity) and chlorophyll fluorescence.

Dataset-specific Instrument Name	Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	Seapoint Chlorophyll Fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	PAR sensor
Generic Instrument Name	Photosynthetically Available Radiation Sensor
Dataset-specific Description	Biospherical/Licor PAR/Irradiance Sensor
Generic Instrument Description	A PAR sensor measures photosynthetically available (or active) radiation. The sensor measures photon flux density (photons per second per square meter) within the visible wavelength range (typically 400 to 700 nanometers). PAR gives an indication of the total energy available to plants for photosynthesis. This instrument name is used when specific type, make and model are not known.

Dataset-specific Instrument Name	SBE-43 DO
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Transmissometer
Generic Instrument Name	Transmissometer
Dataset-specific Description	WETLabs C-Star Transmissometer
Generic Instrument Description	A transmissometer measures the beam attenuation coefficient of the lightsource over the instrument's path-length. This instrument designation is used when specific manufacturer, make and model are not known.

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Deployments

KM1314

Website	https://www.bco-dmo.org/deployment/536050
Platform	R/V Kilo Moana
Start Date	2013-08-07
End Date	2013-09-05

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Project Information

Significance of nitrification in shaping planktonic biodiversity in the ocean (Nitrification and Marine Planktonic Biodiversity)

Microorganisms sustain the biogeochemical cycling of nitrogen, one of the most important nutrient cycles on earth. A key step in this cycle, the oxidation of ammonia to nitrite by autotrophic microorganisms, was for a century thought mediated by a few restricted bacterial genera. Significant ammonia oxidation, perhaps most, is now attributed to a previously enigmatic group of Archaea - the ammonia-oxidizing archaea (AOA) - of high abundance in both marine and terrestrial environments. The investigators prior physiological and environmental analyses, the foundation for this proposal, have shown that AOA are active within the marine photic zone and that their competitive fitness in the marine environment is at least in part attributable to an extremely high affinity for ammonia, growing at near maximum growth rates at concentrations of ammonia that would not sustain known bacterial ammonia oxidizers, and an unusual copper-based respiratory system that may render them more competitive in iron limited environments. The compelling inference from these prior analyses is that AOA alter and possibly control the forms of fixed nitrogen available to other microbial assemblages within the

photic zone by converting ammonia, a nearly universally available form of nitrogen, into nitrite, a form only available to nitrite oxidizing bacteria and some phytoplankton. If correct, this has a significant impact on biodiversity.

The PIs will use the most recent technological advances in protein and high throughput sequencing to evaluate the significance of nitrification in shaping biodiversity (genomic and metagenomics), activity (transcriptome, proteome and stable isotope probing), and in controlling availability of an important trace element (copper). In turn, by resolving the environmental and biotic variables that influence the diversity, distribution and activity of AOA, they will advance general understanding of their taxonomy. More directly, functional knowledge of the contribution of AOA to regenerated nitrate will improve estimates of new ocean production ("biological pump") based on nitrate assimilation, which in the past has mostly neglected the importance of nitrification as a major source of nitrate. Together these studies will transform understanding of the marine nitrogen cycle, estimates of new production, and will ultimately provide a better understanding of the impact of human activity on this critical nutrient cycle.

The nitrogen cycle has been profoundly affected by anthropogenic inputs of reactive nitrogen into terrestrial, marine, and atmospheric systems having, or predicted to have, major impacts on marine biological production, increased N20 emissions, nitrogen pollution, and eutrophication. Likewise, there is a poor understanding of the relationship between nitrogen cycling and productivity in marine ecosystems. Marine systems are increasingly affected by ocean acidification and by atmospheric inputs of reactive nitrogen. Since both changes greatly alter nitrogen available to microorganisms, the characterization of the response of these environmentally relevant AOA is of tremendous relevance to understanding the affect of acidification and anthropogenic nitrogen inputs on major ocean processes.

The proposed project encompasses and integrates the three dimensions (functional genetic, and taxonomic) of biodiversity. First, the project is framed by function: microbial control of one of the most important nutrient cycles on earth, the nitrogen-cycle. Second, it is motivated by recent genetic analyses that associate activities of a novel clade of Archaea (provisionally assigned to a new kingdom within the Archaea, the Thaumarchaeota) with control of ammonia oxidation in the ocean. Third, it is built upon a compelling synthesis of physiological and environmental data that lead to its central hypothesis that by altering and possibly controlling the form of nitrogen, the AOA also alter biodiversity and ecological function in one of the most productive environments on earth. It identifies a specific taxonomic imperative. The tremendous genetic diversity among the globally abundant AOA catalogued almost exclusively by gene sequencing surveys and therefore lacking formal description makes it essential to resolve membership into ecologically relevant groups or clades as a prelude to developing a formal taxonomy. The investigators have assembled a group of researchers with specific expertise in each of dimension and uniquely qualified to address the research objectives outlined in an integrative way.

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Program Information

Dimensions of Biodiversity (Dimensions of Biodiversity)

Website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503446

Coverage: global

(adapted from the NSF Synopsis of Program)
Dimensions of Biodiversity is a program solicitation from the NSF Directorate for Biological Sciences. FY 2010 was year one of the program. [MORE from NSF]

The NSF Dimensions of Biodiversity program seeks to characterize biodiversity on Earth by using integrative, innovative approaches to fill rapidly the most substantial gaps in our understanding. The program will take a broad view of biodiversity, and in its initial phase will focus on the integration of genetic, taxonomic, and functional dimensions of biodiversity. Project investigators are encouraged to integrate these three dimensions to understand the interactions and feedbacks among them. While this focus complements several core NSF programs, it differs by requiring that multiple dimensions of biodiversity be addressed simultaneously, to understand the roles of biodiversity in critical ecological and evolutionary processes.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1046017

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