Gross oxygen production and total daytime oxygen consumption derived from in vitro incubations deployed in situ at different depths at Station ALOHA during June 2019 (cruise ID KM1910)

Website: https://www.bco-dmo.org/dataset/868714
Data Type: Other Field Results
Version: 1
Version Date: 2022-05-25

Project
» EAGER Collaborative Research: Early career chief scientist training for biological and chemical oceanographers (Chief Sci KM1910)

Contributors	Affiliation	Role
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Abstract
Gross oxygen production and total daytime oxygen consumption derived from in vitro incubations deployed in situ at different depths at Station ALOHA during June 2019 (cruise ID KM1910)

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Coverage

Spatial Extent: **N**:22.81 **E**:-157.92 **S**:22.72 **W**:-157.95
Temporal Extent: 2019-06-19 - 2019-06-22

Dataset Description

Rates of gross oxygen production rates and total daytime oxygen consumption were measured using the ^{18}O-water in vitro method and membrane inlet mass spectrometry as described by Ferrón et al. (2016).

Methods & Sampling

Seawater samples for the incubations were collected in triplicate before dawn at six different depths (5, 25, 45, 75, 100, and 125m) with 12-L Niskin® bottles attached to a CTD rosette. Subsamples were taken from the Niskin bottles in acid-washed volume- calibrated 150-mLquartz glass bottles with ground-glass stoppers. The bottles were first rinsed with the seawater sample, and then filled from bottom to top using acid- washed silicon tubing, allowing the water to overflow at least twice the volume of the bottles. Before closing, the incubation bottles were spiked with 650 µL of ^{18}O-H_2O (97.2% ^{18}O, Medical Isotopes) for the surface samples (5-45 m)

and 1,000 µL for deeper samples (75-125 m). The samples were deployed in situ at the corresponding depths before dawn using a free-drifting array, and incubated until dawn. After recovery, the incubated samples were poisoned with saturated mercuric chloride solution to inhibit biological activity. Time-zero samples were also collected pre-dawn and poisoned at the time of the deployment.

Data Processing Description

Data is processed as described by Ferrón et al. (2016). Gross oxygen production is determined from the change in the 18O isotope ratio of dissolved oxygen over the incubation:

GOP = [R(O2)final - R(O2)initial / R(H2O) - R(O2)initial] x [O2]initial

where *R(O2)initia*l and *R(O2)final* are the initial and final isotope ratios (18O/16O) for dissolved oxygen, respectively, *[O2]initial* is the initial dissolved oxygen concentration, and *R(H2O)* is the 18O isotope ratio of the incubation water.

The net oxygen change during the incubation is simultaneously determined from the net change in oxygen to argon molar ratios:

NOC = [((O2/Ar)*final* / (O2/Ar)initial) - 1] x [O2]initial

where *(O2/Ar)final* and *(O2/Ar)initial* are the final and initial oxygen to argon molar ratios, respectively.

The total daytime oxygen consumption is derived as the difference between GOP and NOC and extrapolated to 24 hours (Ferrón et al., 2016).

BCO-DMO Processing Notes:
* Adjusted column names to comply with database requirements
* Added ISO8601 format of date and times

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Data Files

File
oxygen_production.csv (Comma Separated Values (.csv), 3.22 KB) MD5:b175a5d49dd9ef55bb4cbf035960bb70 Primary data file for dataset ID 868714

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Supplemental Files

File
Gross_oxygen_production_km1910 filename: Gross_oxygen_production_km1910.xlsx (Octet Stream, 12.57 KB) MD5:3ff67ba40dbc44a066292f0d5c00aa27 Gross oxygen production km1910: Data table with mean and standard deviation of three replicates of parameters GOP and R.

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Related Publications

Ferrón, S., del Valle, D. A., Björkman, K. M., Quay, P. D., Church, M. J., & Karl, D. M. (2016). Application of membrane inlet mass spectrometry to measure aquatic gross primary production by the 18 O in vitro method. Limnology and Oceanography: Methods, 14(9), 610–622. doi:10.1002/lom3.10116

Results

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Parameters

Parameter	Description	Units
Cruise_ID	Cruise identification number	unitless
Date	Date of the incubations	UTC
Latitude	Array deployment latitude, south is negative	decimal degrees
Longitude	Array deployment Longitude, west is negative	decimal degrees
Time_in	Local time of array deployment in HST (UTC-10h)	unitless
Time_out	Local time of array recovery in HST (UTC-10h)	unitless
Depth	Sampling and incubation depth	meters
GOP	Gross oxygen production	mmol O2 m-3 d-1
R	Total daytime O2 consumption in the light	mmol O2 m-3 d-1
ISO_DateTime_UTC_In	Sampling start date and time (UTC) in ISO8601 format: YYYY-MM-DDThh:mmz	unitless
ISO_DateTime_UTC_Out	Sampling start date and time (UTC) in ISO8601 format: YYYY-MM-DDThh:mmz	unitless

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Instruments

Dataset-specific Instrument Name	Membrane inlet mass spectrometer
Generic Instrument Name	Membrane Inlet Mass Spectrometer
Dataset-specific Description	Membrane inlet mass spectrometer consists of a Pfeiffer Vacuum HiCube 80 Eco turbo pumping station connected to a HiQuayTM quadrupole mass spectrometer (QMG700), with a Balzers radio frequency generator (QMH 400-5) and a Balzers analyzer (QMA 430). The membrane inlet design is from Bay Instruments (Easton, Maryland).
Generic Instrument Description	Membrane-introduction mass spectrometry (MIMS) is a method of introducing analytes into the mass spectrometer's vacuum chamber via a semipermeable membrane.

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Deployments

KM1910

Website	https://www.bco-dmo.org/deployment/841636
Platform	R/V Kilo Moana
Report	https://datadocs.bco-dmo.org/docs/305/Chief_Sci_KM1910/data_docs/matt_church_EAGER_cruise_plan_06_17_2019.pdf
Start Date	2019-06-15
End Date	2019-06-24
Description	NSF Chief Scientist Training Cruise. For more information, see Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/KM1910 (cruise DOI: 10.7284/908380)

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Project Information

EAGER Collaborative Research: Early career chief scientist training for biological and chemical oceanographers (Chief Sci KM1910)

Coverage: Station ALOHA (22.75N, 158W), North Pacific Ocean

NSF Award Abstract:

Intellectual Merit
The PIs request funds to provide training in leading and organizing research cruises to early career researchers in the areas of Biological and Chemical Oceanography. Participants in this training program would be introduced to pre-cruise planning and logistics, receive training in commonly used oceanographic sampling equipment, and conduct shipboard measurements during a 10-day oceanographic cruise to the North Pacific Subtropical Gyre (NPSG). The goal of this training program is to prepare early career scientists for leading and participating in interdisciplinary oceanographic research at sea.

Broader Impacts
The proposed program addresses the broader impacts criteria successfully. The research cruise and follow-up reports and publications focus on interdisciplinary questions important for advancing the field. Given the rapid changes that oceanic systems are undergoing, it is important to have a cadre of junior scientists who are adept at managing interdisciplinary collaborations and conducting research at sea. The PIs are considering ways to connect with diverse audiences in recruiting participants. The impact on early career oceanographers will be very strong. This will create an experience that will be a major impact on the careers of the trainees, especially if they stay in the oceanography field.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1911990

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