Nutrient and chlorophyll analyses from surface samples collected underway on board container ships during basin-wide transects of the North Pacific Ocean from Hong Kong to Long Beach, CA from 2009-2012

Website: https://www.bco-dmo.org/dataset/829141
Data Type: Cruise Results
Version: 1
Version Date: 2020-11-16

Project
» North Pacific Surface Carbon, Oxygen and Isotope Measurements from Container Ships (2008-) (NPac Cont Ship)

Contributors	Affiliation	Role
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Abstract
Surface nutrient and chlorophyll analyses were performed on samples collected on board commercial container ships from April 2009 through December 2012. Samples were collected from the underway seawater system during basin-wide transects of the North Pacific Ocean while traversing from Hong Kong to Long Beach, California.

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Coverage

Spatial Extent: **N**:49.67 **E**:-119.283 **S**:22.133 **W**:114.9
Temporal Extent: 2009-04-01 - 2012-12-11

Methods & Sampling

Samples were collected from shipboard seawater intake (10 m depth) on basin-wide transects of the North Pacific between Hong Kong and Long Beach, California onboard the M/V OOCL Tianjin and the M/V OOCL Tokyo (each individual transect has a unique Cruise ID). Sea surface temperature and salinity at the time of sample collection were determined using a Sea-Bird Electronics SBE45 thermosalinograph installed in the ship's seawater intake. To prevent biofouling that could cause respiration in the ship's seawater lines [Juranek et al., 2010], intake lines between the anticorrosive sea chest and the sampling port were purged with bleach and freshwater between every cruise. Since the samples were collected underway on a vessel moving ~24 knots

and samples for all parameters were collected by a single shiprider, ship transit from the time that the location coordinates were recorded to the time of actual sampling could reflect a transit distance offset from the recorded location of up to 40 kilometers.

Details of collection event issues (dataset Notes field):

- **Missing info on duplicate:** A number of data entries are missing timestamp and location information for duplicates because separate times were not recorded at the time of collection. Since the ship moves at ~24 knots, differences between the duplicate samples may represent real spatial variations between the times the duplicate samples were collected.
- **Intake temp issue:** The intake temperature was not working until 2010-02-17 on the TJ9 cruise, so 23 of the reported temperatures are derived from TSG -0.3 (approximate correction for inline warming)
- **Missing TSG data and/or GPS signal:** On the Tokyo_0 cruise, 7 entries are missing TSG data and 2 additional are missing GPS information as well as TSG data.
- **No GPS data:** On the Tianjin_1 cruise, six entries did not have GPS available.

Data Processing Description

Methods are described in detail in Clayton et al. (in preparation for JGR: Oceans). Discrete samples were collected from the underway seawater system (10 m depth). Chlorophyll samples were filtered onto Whatman GF/F. Both chlorophyll and nutrient samples were frozen for later analysis in a shore-based laboratory. Samples were measured in the Marine Chemistry Laboratory at the University of Washington. For nutrients, analyses and calibration follow the protocols of the WOCE Hydrographic Program using a Seal Analytical AA3. For chlorophyll, analysis is acetone extraction and fluorometric detection on a Turner Designs TD-700 fluorometer.

BCO-DMO Processing:

- Converted datetimes to ISO Date UTC format
- Converted Longitudes to 0 to 180 scale
- Rounded fields to 4 decimal places
- Shortened Notes column (for better display) and listed details above in Acquisition description
- Adjusted parameter names to comply with database requirements.
- Removed units from field names and added to Parameter Description metadata section.
- Added a conventional header with dataset name, PI names, version date.
- Missing data identifier of 'nd' used ('nd' is BCO-DMO system default missing data identifier).

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Data Files

File
npac_discrete_nut_chl.csv (Comma Separated Values (.csv), 71.83 KB) MD5:6d5a98fa8a89f85a2447ece5aa07ba55 Primary data file for dataset ID 829141

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Related Publications

Clayton, S., Palevsky, H. I., Thompson, L., & Quay, P. D. (2021). Synoptic Mesoscale to Basin Scale Variability in Biological Productivity and Chlorophyll in the Kuroshio Extension Region. Journal of Geophysical Research: Oceans, 126(11). Portico. https://doi.org/10.1029/2021jc017782 https://doi.org/10.1029/2021JC017782

Methods

Gordon, L. I., J. C. Jennings, JR, A. A. Ross, and J. M. Krest. (1994). A suggested protocol for continuous flow analysis of seawater nutrients (phosphate, nitrate, nitrite, and silicic acid) in the WOCE Hydrographic Program and the Joint Global Ocean Fluxes Study. WHP Office Report 91-1. Revision 1, Nov. 1994. WOCE Hydrographic

Program Office, Woods Hole, MA.
Methods

Juranek, L. W., Hamme, R. C., Kaiser, J., Wanninkhof, R., & Quay, P. D. (2010). Evidence of O2 consumption in underway seawater lines: Implications for air-sea O2 and CO2 fluxes. Geophysical Research Letters, 37(1), n/a–n/a. doi:10.1029/2009gl040423 https://doi.org/10.1029/2009GL040423
Methods

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Parameters

Parameter	Description	Units
ISO_DateTime_UTC	Timestamp (mean GMT time for each time interval) in ISO format (yyyy-mm-dd hh:mm) with UTC time zone	unitless
Cruise	Cruise ID	unitless
Station	Station number	unitless
Salinity	Sea surface Salinity as measured by shipboard thermosalinograph	psu
Temperature	Sea surface Temperature as measured by shipboard thermosalinograph	degrees Celsius
Latitude	Latitude of sample collection, South is negative	decimal degrees
Longitude	Longitude of sample collection, West is negative	decimal degrees
Lon360	Longitude on 360 degree scale with 180 at the Date Line	decimal degrees
PO4	Phosphate concentration	micromoles (umols)
SiO4	Silicate concentration	micromoles (umols)
NO3	Nitrate concentration	micromoles (umols)
NO2	Nitrite concentration	micromoles (umols)
NH4	Ammonium concentration	micromoles (umols)
Chlorophyll	Chlorophyll	micrograms per Liter (ug/L)
Phaeopigment	Phaeopigment	micrograms per Liter (ug/L)
Fo_to_Fa	Fo/Fa, ratio of unacidified to acidified chlorophyll a	unitless
Notes	Comments about collection events	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 45 MicroTSG Thermosalinograph
Generic Instrument Description	A small externally powered, high-accuracy instrument, designed for shipboard determination of sea surface (pumped-water) conductivity and temperature. It is constructed of plastic and titanium to ensure long life with minimum maintenance. It may optionally be interfaced to an external SBE 38 hull temperature sensor. Sea Bird SBE 45 MicroTSG (Thermosalinograph)

Dataset-specific Instrument Name	Seal Analytical AA3
Generic Instrument Name	Seal Analytical AutoAnalyser 3HR
Generic Instrument Description	A fully automated Segmented Flow Analysis (SFA) system, ideal for water and seawater analysis. It comprises a modular system which integrates an autosampler, peristaltic pump, chemistry manifold and detector. The sample and reagents are pumped continuously through the chemistry manifold, and air bubbles are introduced at regular intervals forming reaction segments which are mixed using glass coils. The AA3 uses segmented flow analysis principles to reduce inter-sample dispersion, and can analyse up to 100 samples per hour using stable LED light sources.

Dataset-specific Instrument Name	Turner Designs TD-700 fluorometer
Generic Instrument Name	Turner Designs 700 Laboratory Fluorometer
Generic Instrument Description	The TD-700 Laboratory Fluorometer is a benchtop fluorometer designed to detect fluorescence over the UV to red range. The instrument can measure concentrations of a variety of compounds, including chlorophyll-a and fluorescent dyes, and is thus suitable for a range of applications, including chlorophyll, water quality monitoring and fluorescent tracer studies. Data can be output as concentrations or raw fluorescence measurements.

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Deployments

Tokyo_0

Website	https://www.bco-dmo.org/deployment/626906
Platform	OOCL Tokyo
Start Date	2011-02-23
End Date	2011-03-07
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_1

Website	https://www.bco-dmo.org/deployment/626908
Platform	OOCL Tokyo
Start Date	2011-05-16
End Date	2011-05-29
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_2

Website	https://www.bco-dmo.org/deployment/626910
Platform	OOCL Tokyo
Start Date	2011-06-27
End Date	2011-07-10
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_4

Website	https://www.bco-dmo.org/deployment/626914
Platform	OOCL Tokyo
Start Date	2012-01-25
End Date	2012-02-06
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TJ5

Website	https://www.bco-dmo.org/deployment/626897
Platform	OOCL Tianjin
Start Date	2009-04-01
End Date	2009-04-10
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TJ8

Website	https://www.bco-dmo.org/deployment/626902
Platform	OOCL Tianjin
Start Date	2009-12-03
End Date	2009-12-12
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

TJ9

Website	https://www.bco-dmo.org/deployment/626904
Platform	OOCL Tianjin
Start Date	2010-02-13
End Date	2012-02-21
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tianjin_1

Website	https://www.bco-dmo.org/deployment/626918
Platform	OOCL Tianjin
Start Date	2012-04-30
End Date	2012-05-13
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tianjin_2

Website	https://www.bco-dmo.org/deployment/626920
Platform	OOCL Tianjin
Start Date	2012-07-24
End Date	2012-08-06
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tianjin_3

Website	https://www.bco-dmo.org/deployment/626922
Platform	OOCL Tianjin
Start Date	2012-11-28
End Date	2012-12-11
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

Tokyo_3

Website	https://www.bco-dmo.org/deployment/626912
Platform	OOCL Tokyo
Start Date	2011-09-20
End Date	2011-10-02
Description	Container ship collected surface salinity, temperature and water samples for carbon and oxygen isotopes measurements.

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Project Information

North Pacific Surface Carbon, Oxygen and Isotope Measurements from Container Ships (2008-) (NPac Cont Ship)

Coverage: Transects across the North Pacific from Hong Kong to Long Beach, California, USA; ~25-50N, 115E-120W

This project is an ongoing time-series beginning in 2008 of measurements relevant to ocean carbon cycling and productivity on basin-wide container ship transects across the North Pacific from Hong Kong to Long Beach, California, with transects made throughout the seasonal cycle beginning in October 2008. The goal of this project is to improve our understanding of the rates and mechanisms of ocean carbon uptake from the atmosphere throughout the seasonal cycle and across spatial gradients across the basin. Sampling includes both discrete samples and continuous underway measurements. Tracers sampled in this program include triple oxygen isotopes (δ17O and δ18O), a tracer of gross primary production, oxygen/argon dissolved gas ratios, a tracer of net community production or carbon export, and carbonate system parameters (pCO2, total alkalinity, DIC, and 13C-DIC) as tracers of ocean carbon uptake and carbon cycling.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0628663
NSF Division of Ocean Sciences (NSF OCE)	OCE-1259055
NOAA Oceanic and Atmospheric Research (OAR) Climate Program Office (NOAA OAR Climate Program)	A10OAR4310088

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