# Weekly surface water samples from Newport Pier, CA collected between 11 January 2012 and 3 November 2023

**Website**: https://www.bco-dmo.org/dataset/564351
**Data Type**: Other Field Results
**Version**: 3
**Version Date**: 2024-06-24

**Project**
» Biological Controls on the Ocean C:N:P ratios (Biological C:N:P ratios)

**Programs**
» Dimensions of Biodiversity (Dimensions of Biodiversity)
» Ocean Carbon and Biogeochemistry (OCB)


| Contributors | Affiliation | Role |
|---|---|---|
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**Abstract**
Weekly surface water samples from Newport Pier, CA, were collected between 11 January 2012 and 3 November 2023. This project is a continuation of a time series with weekly surface water sampling from the Microbes in the Coastal Region of Orange County (MICRO) time series station at Newport Pier (33°36.37'N, 117°55.87'W). We measured dissolved nitrate and phosphate in the water, as well as particulate organic carbon, nitrogen and phosphorus. These data were published in Fagan et al. (2019), Larkin et al. (2020), and a pending publication, Larkin et al. (in prep).


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## Coverage

**Location**: Newport Pier, CA
**Spatial Extent**: **Lat**:33.6062 **Lon**:-117.9312
**Temporal Extent**: 2012-01-11 - 2023-11-03

## Dataset Description

Associated sequence data will be made available at The National Center for Biotechnology Information (NCBI) under BioProject PRJNA624320 "Microbes In the Coastal Region of Orange County (MICRO) time series" on 06/18/2025.
This dataset includes column "NCBI_BioSample" accession numbers. The BioSample accession information and related SRA data will be accessible from the BioProject page https://www.ncbi.nlm.nih.gov/bioproject/PRJNA624320/ once released.

Additional metagenomic data across the entire time series is available from the DOE Joint Genome Institute under "Detecting nutrient limitation and coastal biogeochemical responses to El Nino using microbial eco-genomic biomarkers" (award DOI: 10.46936/10.25585/60001365) accessible from page https://genome.jgi.doe.gov/portal/Detnutbiomarkers/Detnutbiomarkers.info....

## Methods & Sampling

### Sampling and analytical procedures:

Surface water from the “Microbes in the Coastal Region of Orange County” (MICRO) time series station at Newport Pier (33 36.37’ N, -117 55.87’ W ) was collected weekly, in the morning, from 11 Jan 2012 to 26 December 2018. One liter polycarbonate bottles rinsed three times prior to sampling were filled for quantification of particulate organic matter and nutrient concentrations (three samples each from two bottles for a total of six replicates). Temperature salinity, and chlorophyll a were continuously monitored using an automated shore station mounted next to the sampling site (www.sccoos.org).

Triplicate 300 ml samples for POC/PON or POP from each bottle were filtered within an hour of collection through pre-combusted (500 C, 5 h) 25 mm GF/F filters (Whatman, MA). Each filter was rinsed with Milli-Q water before being fitted in order to remove potential P residues. The filtrate from the initial filtration was collected and used for macronutrient quantification. The filtrate was filtered through a 0.2 µm syringe filter into a 50 ml tube. Triplicates were collected for both macronutrient and stored at −20 C.

Nitrate and phosphate samples were collected in prewashed 50 mL Falcon tubes and filtered through a 0.2 µm syringe filter and stored at −20 C until further analysis. Soluble reactive phosphorus (SRP) concentrations were determined using the magnesium-induced co-precipitation (MAGIC) protocol and calculated against a potassium monobasic phosphate standard. (Karl and Tien, 1992; Lomas et al., 2010). Nitrate samples were treated with a solution of ethylenediaminetetraacetate and passed through a column of copperized cadmium fillings (Knap et al., 1993). Measurements were conducted using the same standards and protocols throughout the time series.

After thawing, POC/PON filters were allowed to dry overnight at 65◦C before being packed into a 30 mm tin capsule (CE Elantech, Lakewood, New Jersey). Samples were then analyzed for C and N content on the same FlashEA 1112 nitrogen and carbon analyzer (Thermo Scientific, Waltham, Massachusetts), following the Sharp (1974) protocol. POC and PON concentrations were calibrated using known quantities of atropine.

For published methodologies, see Allison et al. (2012), Fagan et al. (2019) and Martiny et al., (2016).

## Data Processing Description

Issue report:

SCCOOS salinity meter down between March - May 2016

Picoplankton columns are included in the dataset to maintain consistency with previously submitted data, but flow cytometry counts were not performed by our laboratory during the 2015-2018 time period.

## BCO-DMO Processing Description

Version 3:
[data from 2018 to 2023 appended to the dataset, some parameters were removed and some have new names, but the methods for the dataset are the same as prior versions]:

* submitted file "NewportPier_MicrobeEnviro_2012-2023.csv" was imported into the BCO-DMO data system for this dataset. Values "NaN" and "N/A" were imported as missing data values. Submitters confirmed they indicate the same thing.
* table filtered to remove columns that had "NaT" in the date column and all values except JGI_DOI blank. Submitters clarified these should be removed and were remnant information.
** Missing data values are displayed differently based on the file format you download.  They are blank in csv files, "NaN" in MatLab files, etc.
* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores.  Can not start with a number]
* Date converted to ISO 8601 format
* All the numeric decimal columns were rounded to three decimal places except the picoeuk_ml which was rounded to 2 places since the rest of the *_ml parameters.
* renamed column NCBI_SRA_Accession column name to NCBI_BioSample for clarity since it was BioSamples. The SRA accessions will be accessible from the BioProject Page.

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Version 2 (2020-08-20): [data from 2015 to 2018 appended to version 1]
* Extracted data submitted in Excel file BCODMO-Data_MICRO_NewportPier_CA-2015-2018.xlsx to csv with values as formatted in Excel (some numeric values had more precision than the set formatting).
* Columns Month, Day and Year were removed from the 2015-2018 data. They were not in v1 and are redundant with information in Date column.
* Added to data from version 1
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.
* converted Date format to ISO 8601 format YYYY-MM-DD
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Version 1 (2015-07-30):
- Generated from original file: "BCODMO_Newport.xlsx" contributed by Celine Mouginot
- Single column for Date inserted with combined Year,Month,Day formatted as YYYYMMDD
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name

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## Related Publications

Allison, S. D., Chao, Y., Farrara, J. D., Hatosy, S., & Martiny, A. C. (2012). Fine-Scale Temporal Variation in Marine Extracellular Enzymes of Coastal Southern California. Frontiers in Microbiology, 3. doi:10.3389/fmicb.2012.00301
*Methods*

Fagan, A. J., Moreno, A. R., & Martiny, A. C. (2019). Role of ENSO Conditions on Particulate Organic Matter Concentrations and Elemental Ratios in the Southern California Bight. Frontiers in Marine Science, 6. doi:10.3389/fmars.2019.00386
*Results*

Karl, D. M., & Tien, G. (1992). MAGIC: A sensitive and precise method for measuring dissolved phosphorus in aquatic environments. Limnology and Oceanography, 37(1), 105–116. doi:10.4319/lo.1992.37.1.0105
*Methods*

Knap, A., Michaels, R., Dow, R., Johnson, K., Gundersen, J., Sorensen, A., ... & Waterhouse, T. (1993). Bermuda Atlantic time-series study methods manual (Version 3). Bermuda Biological Station for Research, US JGOFS. https://www.researchgate.net/publication/245583966_Bermuda_Atlantic_Time-series_Study_Methods_Manual_Version_3
*Methods*

Larkin, A. A., Brock, M. L., Fagan, A., Moreno, A., Lees, L., Suarez Cham, S., Gerace, S. D., & Martiny, A. C. (in prep). Climate-driven succession in marine microbiome biodiversity and biogeochemical function.
*Results*

Larkin, A. A., Moreno, A. R., Fagan, A. J., Fowlds, A., Ruiz, A., & Martiny, A. C. (2020). Persistent El Niño driven shifts in marine cyanobacteria populations. PLOS ONE, 15(9), e0238405. https://doi.org/10.1371/journal.pone.0238405
*Results*

Lomas, M. W., Burke, A. L., Lomas, D. A., Bell, D. W., Shen, C., Dyhrman, S. T., & Ammerman, J. W. (2010). Sargasso Sea phosphorus biogeochemistry: an important role for dissolved organic phosphorus (DOP). Biogeosciences, 7(2), 695–710. doi:10.5194/bg-7-695-2010
*Methods*

Martiny, A. C., Talarmin, A., Mouginot, C., Lee, J. A., Huang, J. S., Gellene, A. G., & Caron, D. A. (2015). Biogeochemical interactions control a temporal succession in the elemental composition of marine communities. Limnology and Oceanography, 61(2), 531–542. doi:10.1002/lno.10233
*Methods*

SCCOOS (2024). A Science-Based Decision Support System. SOUTHERN CALIFORNIA COASTAL OCEAN OBSERVING SYSTEM. Retrieved June 24, 2024, from https://sccoos.org/ www.sccoos.org
*Methods*

Sharp, J. H. (1974). Improved analysis for “particulate” organic carbon and nitrogen from seawater1. Limnology and Oceanography, 19(6), 984–989. doi:10.4319/lo.1974.19.6.0984
*Methods*

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## Related Datasets

### IsRelatedTo

Swartout, A., Martiny, A. (2021). Detecting nutrient limitation and coastal biogeochemical responses to El Nino using microbial eco-genomic biomarkers. Joint Genome Insitute (JGI) Genome Portal version:8.18.177. The Regents of the University of California. Available from https://genome.jgi.doe.gov/portal/Detnutbiomarkers/Detnutbiomarkers.info.html

University of California - Irvine. Microbes In the Coastal Region of Orange County (MICRO) time series. (2020). In: NCBI:BioProject: PRJNA624320 [Internet]. Bethesda, MD: National Library of Medicine (US), National Center for Biotechnology Information; Available from: http://www.ncbi.nlm.nih.gov/bioproject/PRJNA624320.

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Date | Date (ISO 8601 format) | unitless |
| NO3_1 | Nitrate replicate 1 | micromolar (uM) |
| NO3_2 | Nitrate replicate 2 | micromolar (uM) |
| NO3_3 | Nitrate replicate 3 | micromolar (uM) |
| NO3_4 | Nitrate replicate 4 | micromolar (uM) |
| NO3_5 | Nitrate replicate 5 | micromolar (uM) |
| NO3_6 | Nitrate replicate 6 | micromolar (uM) |
| NO3_Avg | Average of nitrate replicates | micromolar (uM) |
| SRP_1 | Soluble reactive phosphorus replicate 1 | micromolar (uM) |

| | | |
|---|---|---|
| SRP_2 | Soluble reactive phosphorus replicate 2 | micromolar (uM) |
| SRP_3 | Soluble reactive phosphorus replicate 3 | micromolar (uM) |
| SRP_4 | Soluble reactive phosphorus replicate 4 | micromolar (uM) |
| SRP_5 | Soluble reactive phosphorus replicate 5 | micromolar (uM) |
| SRP_6 | Soluble reactive phosphorus replicate 6 | micromolar (uM) |
| SRP_Avg | Average of soluble reactive phosphorus replicates | micromolar (uM) |
| POP_1 | Particulate organic phosphorus replicate 1 | micromolar (uM) |
| POP_2 | Particulate organic phosphorus replicate 2 | micromolar (uM) |
| POP_3 | Particulate organic phosphorus replicate 3 | micromolar (uM) |
| POP_4 | Particulate organic phosphorus replicate 4 | micromolar (uM) |
| POP_5 | Particulate organic phosphorus replicate 5 | micromolar (uM) |
| POP_6 | Particulate organic phosphorus replicate 6 | micromolar (uM) |
| POP_Avg | Average of particulate organic phosphorus replicates | micromolar (uM) |
| PON_1 | Particulate organic nitrogen replicate 1 | micromolar (uM) |
| PON_2 | Particulate organic nitrogen replicate 2 | micromolar (uM) |
| PON_3 | Particulate organic nitrogen replicate 3 | micromolar (uM) |
| PON_4 | Particulate organic nitrogen replicate 4 | micromolar (uM) |
| PON_5 | Particulate organic nitrogen replicate 5 | micromolar (uM) |
| PON_6 | Particulate organic nitrogen replicate 6 | micromolar (uM) |
| PON_Avg | Average of particulate organic nitrogen replicates | micromolar (uM) |
| POC_1 | Particulate organic carbon replicate 1 | micromolar (uM) |
| POC_2 | Particulate organic carbon replicate 2 | micromolar (uM) |
| POC_3 | Particulate organic carbon replicate 3 | micromolar (uM) |
| POC_4 | Particulate organic carbon replicate 4 | micromolar (uM) |
| POC_5 | Particulate organic carbon replicate 5 | micromolar (uM) |

| | | |
|---|---|---|
| POC_6 | Particulate organic carbon replicate 6 | micromolar (uM) |
| POC_Avg | Average of particulate organic carbon replicates | micromolar (uM) |
| Temp | Sea temperature | Degrees Celcius (deg C) |
| Chlorophyll | Sea salinity | Practical Salinity Units (PSU) |
| Salinity | Chlorophyll-a concentration | micrograms per liter (ug/L) |
| picoeuk_ml | Picoeukaryote concentration | cells per milliliter (cells/ml) |
| PNEconc_ml | PNE, Pico/nano-eukaryotic phytoplankton concentration | cells per milliliter (cells/ml) |
| Proconc_ml | Prochlorococcus concentration | cells per milliliter (cells/ml) |
| Synconc_ml | Synechococcus concentration | cells per milliliter (cells/ml) |
| JGI_DOI | Joint Genome Institute (JGI) Award DOI for "Detecting nutrient limitation and coastal biogeochemical responses to El Nino using microbial eco-genomic biomarkers (Proposal ID: 507072)". Related sequence data in the JGI Genome Portal are accessible by clicking the "Site Award URL" on the JGI Award DOI page. | unitless |
| NCBI_BioSample | NCBI BioSample accession number | unitless |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | FlashEA 1112 Analyzer; Thermo Scientific, Waltham, Massachusetts |
| **Generic Instrument Name** | Elemental Analyzer |
| **Generic Instrument Description** | Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material. |

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## Deployments

**MICRO_NewportPier_CA**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/632387 |
| **Platform** | MICRO time series station at Newport Pier |
| **Start Date** | 2012-01-11 |
| **End Date** | 2015-04-30 |

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## Project Information

**Biological Controls on the Ocean C:N:P ratios (Biological C:N:P ratios)**

**Coverage**: western North Atlantic; 60N to 20N along 66W longitude; 20N to 15S in the tropical Pacific

One of the fundamental patterns of ocean biogeochemistry is the Redfield ratio, linking the stoichiometry of surface plankton with the chemistry of the deep ocean. There is no obvious mechanism for the globally consistent C:N:P ratio of 106:16:1 (Redfield ratio), especially as there is substantial elemental variation among plankton communities in different ocean regions. Thus, knowing how biodiversity regulates the elemental composition of the ocean is important for understanding the ocean and climate as a whole -- now and in the future.

The conceptual hypotheses for this study are as follows: 1. The C:N:P ratio of a cell is constrained by its broad taxonomic group, which determines, for example, whether it has an outer shell, its size, functional metabolism, membrane lipid composition. 2. Within a taxon, there is high genetic diversity. Some of this genetic diversity is potentially laterally transferred, or can be lost within taxa, and confers various functional abilities (organic phosphate assimilation, nitrate assimilation, photoheterotrophy, etc.). Functional diversity provides the cell with further flexibility, such as the ability to respond to varying nutrient supply rates/ratios, and affects a cell's C:N:P ratio within the range specified by the taxon. 3. Given these taxonomic and genetic constraints, a cell is physiologically plastic and modifies how it allocates cellular resources in response to nutrient supply rates/ratios in the environment. 4. The microbial diversity (taxonomic, genetic, and functional) of the surface ocean varies over time and space, driven by many factors in addition to nutrients. The sum of this mixture composes the ecosystem C:N:P, the ratio that Redfield described.

Based on this framework, the CoPIs will make field observations of taxon-specific stoichiometry and growth rates, genomic analyses, and conduct laboratory chemostat experiments to improve understanding of how ocean taxonomic, genetic, and functional biodiversity control the stoichiometry of the surface ocean plankton. Their analyses of these data would lead to a mechanistic understanding of variations in the Redfield ratio, both spatially and temporally.

This study will greatly expand knowledge of the genomic diversity among ocean microbes and how this diversity affects biogeochemistry. The stoichiometry of the ocean's microbes is a parameter that nearly every chemical or biological oceanographer uses, from converting measurements made in one element to another, to estimating regional and global nitrogen budgets. The research also has important implications for the global carbon budget and any changes that might result from climate change.

To understand mechanistically temporal and spatial variability of the plankton C:N:P ratio, biodiversity must be studied not only at the traditional taxonomic level, but at the genetic and functional levels which dictate organism response to their environment. Data will be integrated into a combined ocean ecological, evolutionary, and biogeochemical model, with flexible stoichiometry, including cellular biochemical allocations. Seeding a coupled physical-biological model of the oceans with multiple competing genotypes enables the exploration of ecological and evolutionary patterns of resource acquisition and C:N:P ratios. Developing a more mechanistic examination of the course of ecology and evolution, in which laboratory and field data define tradeoffs between different growth and nutrient acquisition strategies, would estabblish the framework of adaptive dynamics for determining "evolutionarily convergence". Finally, model outcomes will be evaluated against field data.

The field work planned for this project includes several cruises: BV46 (September/October 2011), BV48

(September 2012), a June 2013 cruise from Bermuda to the Labrador Sea, and a cruise from Hawaii to Tahiti (May 2014). Additionally, samples will be be acquired during cruises of opportunity.

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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.

**Ocean Carbon and Biogeochemistry (OCB)**

**Website**: http://us-ocb.org/

**Coverage**: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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## Funding


| Funding Source | Award |
|---|---|
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1046001 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1046297 |


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