Pigment concentrations derived from High-Performance Liquid Chromatography (HPLC) analysis from samples collected during the Tara Pacific expedition from 2016-2018

Website: https://www.bco-dmo.org/dataset/889930
Data Type: Cruise Results
Version: 1
Version Date: 2023-02-24

Project
» Island mass effects on planktonic communities in the open ocean (Island Mass Effect)

Contributors	Affiliation	Role
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Abstract
The Tara Pacific expedition (2016-2018) sampled coral ecosystems around 32 islands in the Pacific Ocean. Here we provide pigment concentration data originating from 545 stations that were sampled during the expedition in the Pacific and during transit across the Atlantic. Pigment concentrations were derived from High-Performance Liquid Chromatography (HPLC) analysis. This data set provides high-quality measurements of major pigments including chlorophylls a, b, and c, peridinin, 19'-butanoyloxyfucoxanthin, fucoxanthin, neoxanthin, prasinoxanthin, violaxanthin, 19'-hexanoyloxyfucoxanthin, diadinoxanthin, antheraxanthin, alloxanthin, diatoxanthin, zeaxanthin, lutein, divinyl chlorophyll b, chlorophyll b, divinyl chlorophyll a, chlorophyll a, carotene, and bacteriochlorophyll a, which can be used to estimate phytoplankton community composition. More details on the Tara Pacific expedition and its sampling program can be found in Lombard et al., 2022 (doi: 10.1101/2022.05.25.493210).

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Coverage

Spatial Extent: **N**:51.5538 **E**:179.384 **S**:-35.6093 **W**:-179.101
Temporal Extent: 2016-05-30 - 2018-10-26

Methods & Sampling

Water samples (volume: 5 liters) for High-Performance Liquid Chromatography (HPLC) analysis were collected from surface water using a custom-made, underway pumping system (nicknamed "Dolphin"; Lombard et al., 2022) and filtered onto 25 millimeter (mm) diameter, 0.7 micrometer (um) pore glass fiber filters. Filters were flash frozen and stored in liquid nitrogen until arrival to the Laboratoire d'Oceanographie de Villefranche (LOV) where they were stored in -80 degrees Celsius (C) until analysis. Samples were analyzed as described in Ras et

al., 2008. Pigment extraction was carried out in 3 milliliters (mL) Methanol containing an internal standard (Vitamin E acetate, Sigma). Methanol and Vitamin E acetate were injected regularly during each run to check for retention time reproducibility, peak area precision (<1%), and instrument stability.

Data Processing Description

Data Processing:
Data were processed with the ChemStation software. Zeros were replaced by <<LOD>>. All pigment peaks were inspected and quality controlled as good, acceptable, or qualitative (based on peak symmetry and purity, spectral shape, signal to noise ratio, and calibrated compounds), and any measurements below the detection limit were discarded.

Quality Flag Descriptions:
[0] below detection limit
[1] good
[2] acceptable
[3] qualitative

BCO-DMO Processing:
- renamed fields to comply with BCO-DMO naming conventions;
- added the following columns by joining to the event log: Latitude_Start, Longitude_Start, Latitude_End, Longitude_End, DateTime_Start, DateTime_End, Location, Campaign, Basis, Method_or_Device

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Data Files

File
pigments.csv (Comma Separated Values (.csv), 582.50 KB) MD5:7de2876f5807f26dffc1967534152680 Primary data file for dataset ID 889930.

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Supplemental Files

File
tara_pacific_event_log.csv (Comma Separated Values (.csv), 132.65 KB) MD5:b1ff3318210d345b2da9be1eef2ebda1 Tara Pacific expedition event log. Supplemental File for dataset ID 889930. Column names, descriptions, and units: Event = identifier for sampling event. Latitude_Start = latitude at start of event in decimal degrees North. Longitude_Start = longitude at start of event in decimal degrees East. Latitude_End = latitude at end of event in deicmal degrees North. Longitude_End = longitude at end of event in decimal degrees East. DateTime_Start = date and time at start of event in ISO 8601 format (YYYY-MM-DDThh:mm:ss). DateTime_End = date and time at end of event in ISO 8601 format (YYYY-MM-DDThh:mm:ss). Location = location of cruise (Pacific Ocean). Campaign = name of campaign/expedition. Basis = name of vessel. Method_or_Device = name of sampling method or instrument.

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Related Publications

Lombard, F., Bourdin, G., Pesant, S., Agostini, S., Baudena, A., Boissin, E., Cassar, N., Clampitt, M., Conan, P., Silva, O. D., Dimier, C., Douville, E., Elineau, A., Fin, J., Flores, J. M., Ghiglione, J. F., Hume, B. C. C., Jalabert, L., John, S. G., … Gorsky, G. (2022). Open science resources from the Tara Pacific expedition across coral reef and surface ocean ecosystems. https://doi.org/10.1101/2022.05.25.493210
Methods

Ras, J., Claustre, H., & Uitz, J. (2008). Spatial variability of phytoplankton pigment distributions in the Subtropical South Pacific Ocean: comparison between in situ and predicted data. Biogeosciences, 5(2), 353–369. https://doi.org/10.5194/bg-5-353-2008
Methods

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Parameters

Parameter	Description	Units
Event	Event identifier	unitless
Sample_ID	Sample identifier	unitless
Sampling_event_label	Event label, follows Tara Pacific data conventions: TARA_EVENT_[sampling-event_date_time-utc]_[sampling-design label]_[sampling-day-night_label]_[sampling-environment_feature_label]_[sample- material_label]_[sampling-protocol_label]_[sample-storage_container-label] Refer to Lombard et al. (2022) for more information on the labeling protocols.	unitless
Depth_top_m	Depth top/min	meters (m)
Depth_bot_m	Depth bottom/max	meters (m)
Depth_water_m	The mid-depth at which the water was sampled. (Note: the min and max depth associated with the samples take into account the potential variability in sampling depth, but Depth_water_m would be considered the sampling depth.)	meters (m)
Sampling_design_label	Sampling design label, follows Tara Pacific data conventions. Provided to facilitate the identification and integration of data that originate from the same open ocean station (OA###), island (I##), site (S##) or coral colony (C###), and hence share provenance and environmental context. Refer to Lombard et al. (2022) for more information on the labeling protocols.	unitless
Sample_comment	Sample comment	unitless

Env_feature	Description of sampling environment	unitless
Sampling_protocol	Sampling protocol or method	unitless
Sample_replicates	Sample replicates (filtration replicates of the same water sample)	unitless
Technical_replicate	Technical replicates (measurement replicates performed during the sample analysis in the lab)	unitless
Analysis	Analysis date	unitless
Analysis_comment	Analysis comment	unitless
Chl_c3	Chlorophyll c3 (Chl c3) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Chlc3	Quality flag for Chl_c3	unitless
Chl_c1_c2	Chlorophyll c1+c2 (Chl c1+c2) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Chlc2	Quality flag for Chl_c1_c2	unitless
Chlide_a	Chlorophyllide a (Chlide a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Chlda	Quality flag for Chlide_a	unitless
Perid	Peridinin (Perid) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Peri	Quality flag for Perid	unitless
Phaeopho_a	Phaeophorbide a (Phaeopho a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Phda	Quality flag for Phaeopho_a	unitless

But_fuco	19-Butanoyloxyfucoxanthin (But-fuco) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_But	Quality flag for But_fuco	unitless
Fuco	Fucoxanthin (Fuco) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Fuco	Quality flag for Fuco	unitless
Neo	Neoxanthin (Neo) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Neo	Quality flag for Neo	unitless
Hex19_4_kfuco	19'-Hexanoyloxy-4-ketofucoxanthin (19Hex-4-kfuco) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Hex4K	Quality flag for Hex19_4_kfuco	unitless
Pras	Prasinoxanthin (Pras) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Pras	Quality flag for Pras	unitless
Viola	Violaxanthin (Viola) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Viola	Quality flag for Viola	unitless
Hex_fuco	19-Hexanoyloxyfucoxanthin (Hex-fuco) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Hex	Quality flag for Hex_fuco	unitless
Myxox	Myxoxanthophyll (Myxox) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Myxo	Quality flag for Myxox	unitless

Diadino	Diadinoxanthin (Diadino) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Diadino	Quality flag for Diadino	unitless
Anthera	Antheraxanthin (Anthera) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Anthera	Quality flag for Anthera	unitless
Allo	Alloxanthin (Allo) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Allo	Quality flag for Allo	unitless
Diato	Diatoxanthin (Diato) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Diato	Quality flag for Diato	unitless
Zea	Zeaxanthin (Zea) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Zea	Quality flag for Zea	unitless
Lut	Lutein (Lut) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Lut	Quality flag for Lut	unitless
BChl_a	Bacteriochlorophyll a (BChl a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Bchla	Quality flag for BChl_a	unitless
DV_chl_a_1	Divinyl chlorophyll a (DV chl a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_DVChlb	Quality flag for DV_chl_a_1	unitless

Chl_b	Chlorophyll b (Chl b) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Chlb	Quality flag for Chl_b	unitless
Chl_b_DV_chl_b	Chlorophyll b plus divinyl chlorophyll b (Chl b+DV chl b) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_TChlb	Quality flag for Chl_b_DV_chl_b	unitless
DV_chl_a_2	Divinyl chlorophyll a (DV chl a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_DVChla	Quality flag for DV_chl_a_2	unitless
Chl_a	Chlorophyll a (Chl a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Chla	Quality flag for Chl_a	unitless
Chl_a_DV_chla_chlide_a	Chlorophyll a plus divinyl chlorophyll a plus chlorophyllide a (Chl a+DV chla+chlide a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Tchla_QA	Quality flag for Chl_a_DV_chla_chlide_a	unitless
Phaeophytin_a	Phaeophytin a (Phaeophytin a) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Phytna	Quality flag for Phaeophytin_a	unitless
Carotene	Carotene (Carotene) determined by HPLC	milligrams per cubic meter (mg/m^3)
QA_Tcar	Quality flag for Carotene	unitless
Latitude_Start	Latitude at start of sampling event	decimal degrees North
Longitude_Start	Longitude at start of sampling event	decimal degrees East

Latitude_End	Latitude at end of sampling event	decimal degrees North
Longitude_End	Longitude at end of sampling event	decimal degrees East
DateTime_Start	Date and time at start of sampling event	unitless
DateTime_End	Date and time at end of sampling event	unitless
Location	Location of cruise (Pacific Ocean)	unitless
Campaign	Name of campaign/expedition (TARA_PACIFIC_2016-2018)	unitless
Basis	Name of vessel (SV Tara)	unitless
Method_or_Device	Name of sampling method or instrument	unitless

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Instruments

Dataset-specific Instrument Name	Aligent 1200 Series Gradient HPLC System
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	Instrument calibration is done once per year using standards from DHI Water and Environment (Denmark) and Sigma Aldrich (Chla and Chlb). Preventive maintenance of the instrument is done once per year (seal replacements, window detectors, injection valve, and worn parts). Long-term quality control of the instrument's performance is done by injecting mixed pigment standards from DHI several times a year.
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

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Deployments

Tara Pacific Expedition

Website	https://www.bco-dmo.org/deployment/889986
Platform	Tara
Description	The Tara Pacific expedition (2016-2018) sampled coral ecosystems around 32 islands in the Pacific Ocean and the ocean surface waters at 249 locations, resulting in the collection of nearly 58,000 samples. Tara is a 36-meter aluminum-hulled schooner, formerly named "Antarctica" then "Seamaster". More details on the Tara Pacific expedition and its sampling program can be found in Lombard et al., 2022 (doi: 10.1101/2022.05.25.493210).

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Project Information

Island mass effects on planktonic communities in the open ocean (Island Mass Effect)

Website: https://oceans.taraexpeditions.org/en/m/about-tara/les-expeditions/tara-pacific/

Coverage: South Pacific

NSF Award Abstract:

This study is using existing data to characterize the Island Mass Effect (IME) at 20 locations across the Pacific Ocean. The Island Mass Effect occurs when islands and atolls alter atmospheric and oceanic circulation, resulting in local enrichment of surface waters with nutrients. Local fertilization, in turn, promotes phytoplankton blooms and high plankton biomass that can be advected into the surrounding open ocean and enhance regions of low nutrient availability and low plankton biomass. The Island Mass Effect (IME) is thought to be sufficiently important to affect regional fisheries and biogeochemical processes, but most of our current understanding of this phenomenon comes from satellite remote sensing observations of elevated chlorophyll concentrations that serve as a proxy for phytoplankton biomass. This project entails a systematic, basin-scale evaluation of changes in phytoplankton and zooplankton biomass and composition along environmental gradients from the lagoons and coastal water of islands into the open ocean. The study is making use of a large dataset collected during the TARA Pacific expedition (2016-2018), and results are providing new information about marine ecological responses to IME and the plankton inventories needed to improve ecosystem models for under sampled regions of the world’s oceans. In addition to supporting graduate and undergraduate students, this project offers a training workshop for early career scientists on best practices for the collection and processing of ship-based underway data.

Islands in the oligotrophic gyres of the Pacific Oceans alter oceanic and atmospheric circulation and provide sources of fertilization to promote local phytoplankton blooms. This so-called Island Mass Effect (IME) is a ubiquitous phenomenon in the Pacific Ocean where vast areas are known to be limited by the availability of macro- and micro-nutrients, yet it is mostly understood from satellite remote sensing observations of elevated chlorophyll concentrations. Beyond remote sensing of chlorophyll, concurrent changes in plankton community composition and structure have been examined for only a small number of islands, limiting our understanding of the biological responses to IME. In this project, the investigators are examining the IME at 20 locations by evaluating phytoplankton community composition, mesozooplankton biomass, and plankton diversity. The investigators are making use of a comprehensive data set collected during the TARA Pacific expedition (2016-2018) that includes: environmental measurements (temperature, salinity, nutrients and trace metals), plankton samples (flow cytometry, plankton imaging, pigments, and genomics), high resolution measurements of optical properties from which biogeochemical proxies are derived, satellite remote sensing data (chlorophyll, temperature, sea surface height), and currents from an ocean circulation model (Mercator Oceans).

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2025402

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