

# 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                   |
|------------------------------------|---|------------------------|
| <a href="#">Karp-Boss, Lee</a>     | University of Maine                                 | Principal Investigator |
| <a href="#">Bourdin, Guillaume</a> | Tara Ocean Foundation                               | Student                |
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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'Océanographie 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  |
|---|
| <b>pigments.csv</b> (Comma Separated Values (.csv), 582.50 KB)<br>MD5:7de2876f5807f26dfc1967534152680<br>Primary data file for dataset ID 889930. |

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## Supplemental Files

| File   |
|--|
| <b>tara_pacific_event_log.csv</b> (Comma Separated Values (.csv), 132.65 KB)<br>MD5:b1ff3318210d345b2da9be1eef2ebda1<br>Tara Pacific expedition event log. Supplemental File for dataset ID 889930.<br>Column names, descriptions, and units:<br>Event = identifier for sampling event.<br>Latitude_Start = latitude at start of event in decimal degrees North.<br>Longitude_Start = longitude at start of event in decimal degrees East.<br>Latitude_End = latitude at end of event in decimal degrees North.<br>Longitude_End = longitude at end of event in decimal degrees East.<br>DateTime_Start = date and time at start of event in ISO 8601 format (YYYY-MM-DDThh:mm:ss).<br>DateTime_End = date and time at end of event in ISO 8601 format (YYYY-MM-DDThh:mm:ss).<br>Location = location of cruise (Pacific Ocean).<br>Campaign = name of campaign/expedition.<br>Basis = name of vessel.<br>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 <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| QA_Chlc2      | Quality flag for Chl_c1_c2   | unitless  |
| Chlide_a      | Chlorophyllide a (Chlide a) determined by HPLC                       | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Chlda      | Quality flag for Chlide_a  | unitless  |
| Perid         | Peridinin (Perid) determined by HPLC                                 | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Perid      | Quality flag for Perid   | unitless  |
| Phaeopho_a    | Phaeophorbide a (Phaeopho a) determined by HPLC                      | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Phda       | Quality flag for Phaeopho_a  | unitless  |
| But_fuco      | 19-Butanoyloxyfucoxanthin (But-fuco) determined by HPLC              | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_But        | Quality flag for But_fuco  | unitless  |
| Fuco          | Fucoxanthin (Fuco) determined by HPLC                                | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Fuco       | Quality flag for Fuco  | unitless  |
| Neo           | Neoxanthin (Neo) determined by HPLC                                  | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| QA_Hex4K      | Quality flag for Hex19_4_kfuco                                       | unitless  |
| Pras          | Prasincoxanthin (Pras) determined by HPLC                            | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Pras       | Quality flag for Pras  | unitless  |
| Viola         | Violaxanthin (Viola) determined by HPLC                              | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Viola      | Quality flag for Viola   | unitless  |

|            |   |   |
|------------|---|---|
| Hex_fuco   | 19-Hexanoyloxyfucoxanthin (Hex-fuco) determined by HPLC | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Hex     | Quality flag for Hex_fuco                               | unitless  |
| Myxox      | Myxoxanthophyll (Myxox) determined by HPLC              | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Myxo    | Quality flag for Myxox                                  | unitless  |
| Diadino    | Diadinoxanthin (Diadino) determined by HPLC             | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Diadino | Quality flag for Diadino                                | unitless  |
| Anthera    | Antheraxanthin (Anthera) determined by HPLC             | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Anthera | Quality flag for Anthera                                | unitless  |
| Allo       | Alloxanthin (Allo) determined by HPLC                   | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Allo    | Quality flag for Allo                                   | unitless  |
| Diato      | Diatoxanthin (Diato) determined by HPLC                 | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Diato   | Quality flag for Diato                                  | unitless  |
| Zea        | Zeaxanthin (Zea) determined by HPLC                     | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Zea     | Quality flag for Zea                                    | unitless  |
| Lut        | Lutein (Lut) determined by HPLC                         | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| QA_Lut     | Quality flag for Lut                                    | unitless  |
| BChl_a     | Bacteriochlorophyll a (BChl a) determined by HPLC       | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| 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 <sup>3</sup> ) |
| QA_Phytna              | Quality flag for Phaeophytin_a   | unitless  |
| Carotene               | Carotene (Carotene) determined by HPLC   | milligrams per cubic meter (mg/m <sup>3</sup> ) |
| 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

|   |  |
|---|--|
| <b>Dataset-specific Instrument Name</b> | Aligent 1200 Series Gradient HPLC System   |
| <b>Generic Instrument Name</b>          | High-Performance Liquid Chromatograph  |
| <b>Dataset-specific Description</b>     | Instrument calibration is done once per year using standards from DHI Water and Environment (Denmark) and Sigma Aldrich (Ch1a and Ch1b). 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.  |
| <b>Generic Instrument Description</b>   | 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

|                    |   |
|--------------------|---|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/889986">https://www.bco-dmo.org/deployment/889986</a>   |
| <b>Platform</b>    | Tara  |
| <b>Description</b> | 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                       |
|--|-----------------------------|
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-2025402</a> |

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