# Growth rates of xenic and axenic marine Prochlorococcus and Synechococcus cultures from laboratory experiments conducted in 2016 and 2017

**Website**: https://www.bco-dmo.org/dataset/774634
**Data Type**: experimental
**Version**: 1
**Version Date**: 2019-08-13

**Project**
» Aggregation of Marine Picoplankton (Marine Plankton Aggregation)



| Contributors | Affiliation | Role |
|---|---|---|
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**Abstract**
Growth rates of xenic and axenic marine Prochlorococcus and Synechococcus cultures from laboratory experiments conducted in 2016 and 2017.

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## Coverage

**Temporal Extent**: 2016 - 2017

## Dataset Description

Growth rates of xenic and axenic marine Prochlorococcus and Synechococcus cultures from laboratory experiments conducted in 2016 and 2017.

These data were published in Cruz and Neuer, 2019.

Related datasets from the same laboratory experiments:
Picocyanobacteria TEP: Cell Abundance https://www.bco-dmo.org/dataset/774628
Picocyanobacteria TEP: Suspended Aggregates https://www.bco-dmo.org/dataset/774639
Picocyanobacteria TEP: TEP Concentration https://www.bco-dmo.org/dataset/774646

### Methods & Sampling

Methodology:
Duplicate cultures of Synechococcus WH8102 (axenic), Synechococcus WH7805 (xenic) and Prochlorococcus

marinus MED4 (xenic and axenic) were sampled every other day for 17-19 days for the quantification of single cells, suspended aggregates (aggregates ca. 5-60 µm), and TEP. Single cell abundance was determined using epifluorescence microscopy.

### Data Processing Description

BCO-DMO Data Manager Processing Notes: Growth Rates
* Excel sheet extracted to a csv file
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.

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## Data Files

| File |
|---|
| **growth_rate.csv** (Comma Separated Values (.csv), 2.72 KB) MD5:10d1bb36b707035fb0bb90784d2bd7d1<br>Primary data file for dataset ID 774634 |

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## Related Publications

Cruz, B. N., & Neuer, S. (2019). Heterotrophic Bacteria Enhance the Aggregation of the Marine Picocyanobacteria Prochlorococcus and Synechococcus. Frontiers in Microbiology, 10. doi:10.3389/fmicb.2019.01864
*Results*

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Culture | Culture name | unitless |
| Days_min | Starting day the growth rate was calculated with. Days since the experiment started. | unitless |
| Days_max | Ending day the growth rate was calculated with. Days since the experiment started. | unitless |
| Growth_Rate_rep1 | Growth rate of the number of cells per day for replicate 1. | per day |
| Growth_Rate_rep2 | Growth rate of the number of cells per day for replicate 2. | per day |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | AxioScope.A1, Carl Zeiss, Germany |
| **Generic Instrument Name** | Fluorescence Microscope |
| **Generic Instrument Description** | Instruments that generate enlarged images of samples using the phenomena of fluorescence and phosphorescence instead of, or in addition to, reflection and absorption of visible light. Includes conventional and inverted instruments. |

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## Project Information

**Aggregation of Marine Picoplankton (Marine Plankton Aggregation)**

**Coverage**: Bermuda Atlantic Time-Series station

NSF abstract:

Marine phytoplankton are microscopic algae that live in the sunlit zone of the ocean. They play an important role in the uptake of carbon dioxide from the atmosphere through photosynthesis, similar to what plants do on land, and are the basis of the marine food web. However, instead of storing this organic carbon in leaf tissue and roots, marine phytoplankton are grazed by planktonic animals, or die and subsequently sink out of the sunlit zone in the form of aggregates, also called "Marine Snow". These particles not only export the organic carbon contained in their cells to the deep ocean, but also serve as food for animals and bacteria that live in the deep. A considerable portion of these phytoplankton are extremely small, among the tiniest of all organisms known. These extremely small cells have not been thought to play an important role in the formation and sinking of marine snow; however, recent findings challenge this view. This project will investigate how the smallest of these phytoplankton contribute to the rain of sinking particles from the sunlit surface to the deep ocean. This research is important because, in some of the largest expanses of the open oceans, these minute cells dominate the phytoplankton community, and larger plankton organisms are very sparse. The project, through a combination of work in the laboratory and at a field station, will shed light on how these tiny phytoplankton cells make aggregates, which ultimately enable them to sink as "Marine Snow". The project also provides unique opportunities for undergraduate students at Arizona State University, a land-locked public university, to gain experience in working with marine research. The project will serve to educate one PhD student, one MS student in an accelerated BS-MS program, and 8-10 undergraduate students/semester in a unique, inquiry based learning effort termed Microbial EducatioN Training and OutReach (MENTOR). The undergraduate students will also participate in Arizona State University (ASU)'s School of Life Sciences, Undergraduate Research Program (SOLUR), which seeks to increase the participation of minorities in science. They will also contribute towards developing web and classroom materials, based on this project, which will then be distributed through a partnership with the award-winning ASU-sponsored Ask A Biologist K-12 web site.

The oceanic "biological carbon pump", the photosynthetically mediated transformation of dissolved inorganic carbon into particulate and dissolved organic carbon and its subsequent export to deep water, functions as a significant driver of atmospheric carbon uptake by the oceans. The traditional view of the biological carbon pump in the ocean is that of sinking of large aggregates (marine snow) or fecal pellets, which are made up of large, mineral ballasted cells of phytoplankton. However, recent evidence, stemming from in situ investigations of particulate matter, trap studies and modelling studies, have shown that micron-sized phytoplankton such as picocyanobacteria as well as picoeukaryotes can contribute significantly to the sinking of particulate matter. The specific mechanisms behind the sinking of these micrometer sized cells remain elusive as the cells are too small to sink on their own, and mesozooplankton is likely unable to ingest single cells. Intriguingly, recent research by the investigators has shown that the ubiquitous picocyanobacteria Synechococcus are able to form aggregates and sink at velocities comparable to those of marine snow. They found that the matrix of the Synechococcus aggregates was made of Transparent Exopolymeric Particles (TEP), and that TEP production was enhanced under nutrient limited culture conditions. Interaction with clays and presence of heterotrophic bacteria also enhanced aggregation and sinking velocity. This study aims to further investigate aggregation of other common picoplankton in the laboratory and aggregation occurring in natural settings at an oligotrophic open ocean site, the Bermuda Atlantic Time-series Site (BATS). Ultimately, this project will increase and refine our understanding of the role of the smallest phytoplankton in aggregation and sinking - information vital to understanding carbon cycling processes in the oceans.

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## Funding


| Funding Source | Award |
| --- | --- |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1658527 |


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