

Near-surface abundance information for phytoplankton and zooplankton in the Mid-Atlantic bight determined from surveys made by the continuous plankton recorder from 2014 to 2017

Website: <https://www.bco-dmo.org/dataset/905985>

Data Type: Cruise Results

Version: 1

Version Date: 2023-08-15

Project

» [Collaborative Research: Understanding the impact of warming on the structure and function of marine communities](#) (WARMEM)

Contributors	Affiliation	Role
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Abstract

This dataset contains four years of data for the continuous plankton recorder survey program's mid-Atlantic bight transect. This dataset contains relative near-surface abundance information for phytoplankton and zooplankton across a transect crossing the continental shelf from Sandy Hook, New Jersey, USA to the Southeast ending at the shelf break. This survey is organized by the Marine Biological Association (formerly the Sir Alister Hardy Foundation). Sample processing for these four years was funded by the National Science Foundation under award number 1851866.

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
 - [BCO-DMO Processing Description](#)
- [Data Files](#)
- [Supplemental Files](#)
- [Related Publications](#)
- [Related Datasets](#)
- [Parameters](#)
- [Instruments](#)
- [Project Information](#)
- [Funding](#)

Coverage

Spatial Extent: N:40.337 E:-67.252 S:35.458 W:-73.703

Temporal Extent: 2014-04-26 - 2017-06-03

Dataset Description

This dataset is a subset of data from one of the many transects sampled as part of the CPR survey network. If a longer more complete record is desired, it can be acquired through communication with the Marine Biological Association (formerly the Sir Alister Hardy Foundation) at <https://www.cprsurvey.org/>.

Methods & Sampling

The continuous plankton recorder (CPR) sampling device is a high-speed sampling device designed to be towed behind commercial vessels sampling surface waters (less than 50 meters in depth). The device has an opening aperture size of 5 by 10 centimeters (cm) through which water and plankton are sampled. The constant flow through the device through this aperture powers a winding mechanism that spools sampling mesh at a fixed rate relative to water flow. Zooplankton and phytoplankton that pass through the aperture are sandwiched between two layers of a silk filtering mesh (270 micrometers (μm)). Each sampling location is roughly equivalent to 10 nautical miles of distance traveled by the towing vessel. For more details on the sampling protocols please see Warner & Hays (1994).

This dataset is from CPR sampling performed by ships of opportunity (SOO). All sampling was performed with a continuous plankton recorder device using standard deployment protocols. Sampling was conducted along the continental shelf surface waters extending off the coast of New Jersey, USA in the Mid-Atlantic Bight.

Data Processing Description

The data provided here have been processed by the Marine Biological Association in accordance with CPR survey protocols and have not been further refined by any software or analysis in this form. The dataset is organized by 3 stages corresponding to the size of organisms sampled. These three stages are: 1) phytoplankton, 2) zooplankton "traverse", and 3) zooplankton "eye count". Each stage has a distinct sample processing protocol for how the taxa are counted and identified. These steps were all performed by the Marine Biological Association and generated the digital record of this dataset from the physical samples collected. For more information on these methods see Warner & Hays (1994), Rae (1952), or Colebrook (1960).

Data were reshaped for submission to BCO-DMO. All three stages of measurement were pivoted to a long-form organization that created a taxa_number column from all columns containing count information for a specific taxa. These counts are now present as row-entries, with one row for each taxa. Taxonomic names were joined in from the species key Excel sheet adding a new column.

BCO-DMO Processing Description

- Imported original file named "mid_atlantic_long_bco_dmo_complete.csv" into the BCO-DMO system.
- Marked 'NA' as a missing data value.
- Renamed the final data file "905985_v1_mid-atlantic_cpr_2014-2017.csv"

[[table of contents](#) | [back to top](#)]

Data Files

File
905985_v1_mid-atlantic_cpr_2014-2017.csv (Comma Separated Values (.csv), 14.75 MB) MD5:020d562b5f53f766aeef69b19f804415
Primary data file for dataset ID 905985. This is the "tidy" reshaped format that is most usable. The original Excel file has been reshaped to a long format, and the original column names have been matched with the associated taxa that they represent using the species key.
Column descriptions and units are provided in the "Parameters" section of the metadata record.

[[table of contents](#) | [back to top](#)]

Supplemental Files

File

BCO_DMO_Reshape_MAB.R

(R Script, 4.22 KB)

MD5:1087f1cb439ab4f2c159b61976f748d3

R script that performs the start-to-finish reshaping steps to go from the original excel file to a more readily-usable long-format.

Mid-Atlantic CPR 2014-2017 - Original File Format

filename: MB_CPRdata.xlsx

(Microsoft Excel, 161.00 KB)

MD5:9238fe56f48bface6fdbde860679bfc

Supplemental file for dataset ID 905985. This is the 4-sheet organization the data originally were delivered in. This format best represents how the data are generated, but is not immediately usable. There is a sheet for each of the measurement scales and a fourth sheet that is a key for matching columns to taxa.

[[table of contents](#) | [back to top](#)]

Related Publications

Colebrook, J. M. (1960). Continuous plankton records: methods of analysis, 1950-1959. *Bulletins of Marine Ecology* 5, 51-64.

Methods

Rae, K. S. M. (1952). Continuous plankton records: explanation and methods, 1946-1949. *Hull Bulletins of Marine Ecology*, 3, 135-155.

Methods

Warner, A. J., & Hays, G. C. (1994). Sampling by the continuous plankton recorder survey. *Progress in Oceanography*, 34(2-3), 237-256. [https://doi.org/10.1016/0079-6611\(94\)90011-6](https://doi.org/10.1016/0079-6611(94)90011-6)

Methods

[[table of contents](#) | [back to top](#)]

Related Datasets

IsPartOf

Broughton, D. (2019). 1958-Present CPR Survey Data Catalog [Data set]. The CPR Survey, Marine Biological Association of the UK. <https://doi.org/10.17031/1628>

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
sample_id	Transect identification number. A 7-8 digit alpha-numeric code detailing three components of the survey program. The cruise number (first three digits), the sampling area (next two text characters), followed by a dash and a number indicating the station number within that sampling cruise (1-2 digits).	unitless
latitude	Latitude coordinate for the mid-point of the 10 mile transect for the sample; positive values = North	decimal degrees
longitude	Longitude coordinate for the mid-point of the 10 mile transect for the sample; negative values = West	decimal degrees
midpoint_UTC	Datetime for the middle point of the transect for the sample in ISO 8601 format (time zone UTC)	unitless
year	4-digit year for the sample	unitless
month	Month (numbered 1-12) for the sample	unitless
PCI	Phytoplankton Color Index (PCI). An ordinal scale indication of the relative density of phytoplankton measured by the level of physical discoloration to the silk mesh. "NA" represents missing data (not applicable or not recorded).	unitless
taxa_num	Taxonomic identification number. Used internally to match wide-format column names to taxa_name using a species key.	unitless
count	Abundance of the taxon at the station. Numbers reflect abundance per 10 nautical miles sampled by the CPR device. All taxa are counted whenever present. Absence of a taxon in a sample is indicated by a count of 0. "NA" means a numeric count value was not recorded during initial data collection, which suggests the taxon was not present. However, because a "0" was not explicitly recorded in these instances, "NA" is used in this dataset to denote a lack of a count value.	abundance per sample
taxa_name	Taxonomic name of the sample.	unitless
measurement_stage	Magnification scale used to subsample and count relative abundance for the count field. These correspond to the sample processing scales of the CPR survey program.	unitless

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	CPR
Generic Instrument Name	Continous Plankton Recorder
Dataset-specific Description	The primary sampling equipment is the continuous plankton recorder (CPR) device. Details on manufacturer name and model numbers may be obtained from the Marine Biological Association (formerly the Sir Alister Hardy Foundation) at https://www.cprsurvey.org/ .
Generic Instrument Description	The CPR is a plankton sampling instrument designed to be towed from merchant ships or ships of opportunity on their normal sailings. The CPR is towed at a depth of approximately 10 metres. Water passes through the CPR and plankton are filtered onto a slow-moving band of silk (270 micrometre mesh size) and covered by a second silk. The silks and plankton are then spooled into a storage tank containing formalin. On return to the laboratory, the silk is removed from the mechanism and divided into samples representing 10 nautical miles (19 km) of tow. CPR samples are analyzed in two ways. Firstly, the Phytoplankton Color Index (PCI) is determined for each sample. The colour of the silk is evaluated against a standard colour chart and given a 'green-ness' value based on the visual discoloration of the CPR silk produced by green chlorophyll pigments; the PCI is a semiquantitative estimate of phytoplankton biomass. In this way the PCI takes into account the chloroplasts of broken cells and small phytoplankton which cannot be counted during the microscopic analysis stage. After determination of the PCI, microscopic analysis is undertaken for each sample, and individual phytoplankton and zooplankton taxa are identified and counted. Reid, P.C.; Colebrook, J.M.; Matthews, J.B.L.; Aiken, J.; et al. (2003). "The Continuous Plankton Recorder: concepts and history, from plankton indicator to undulating recorders". <i>Progress in Oceanography</i> 58(2-4): 117-175. doi:10.1016/j.pocean.2003.08.002. Warner, A.J., and Hays, G.C.; Hays, G (1994). "Sampling by the Continuous Plankton Recorder survey". <i>Progress in Oceanography</i> 34(2-3): 237-256. doi:10.1016/0079-6611(94)90011-6.

[[table of contents](#) | [back to top](#)]

Project Information

Collaborative Research: Understanding the impact of warming on the structure and function of marine communities (WARMEM)

Coverage: Northeast US; Mid-Atlantic and Gulf of Maine continental shelf ecosystems

NSF Award Abstract:

Rising temperatures are impacting marine ecosystems around the world, and the rate of warming is expected to accelerate. The ecosystems in the northwest Atlantic Shelf, including in the Gulf of Maine and Mid-Atlantic Bight, have experienced some of the fastest decadal and 30 year warming rates in the historical record, and these strong warming trends were punctuated by marine heatwaves in 2012, 2016, and 2018. Most studies of climate impacts in the ocean have focused on how rising temperatures affect individual species. This project focuses on the impact of warming, both short-term events and long-term trends, on the entire ecosystem. It leverages the region's recent warming and history of consistent sampling to contrast the properties of the plankton and fish communities in the colder Gulf of Maine with the warmer Mid-Atlantic Bight. Through statistical analyses, size-based modeling, and food web modeling, this project evaluates direct and indirect influences of temperature on biological processes, community characteristics, and emergent ecosystem properties. This study characterizes composition and features of the plankton and fish communities and compares ecosystem changes across space and through time. It also isolates the direct influence of temperature on metabolism and growth from the indirect influence of temperature through changes in the oceanography. An understanding how marine ecosystems respond to warming is essential to successfully manage these ecosystems in a changing climate. The project team is actively engaged in translating knowledge into fisheries management at a regional and national level. This project also educates the next generation of citizens and scientists by expanding the ecosystem modeling activity in the Gulf of Maine Research Institute's

LabVenture program, which serves ~10,000 Maine middle school students each year. An online curriculum on modeling, a topic area in the Next Generation Science Standards that many teachers find challenging is under development. The project also supports a postdoctoral researcher and a graduate student and contributes to Stony Brook University's program to encourage participation of women in the sciences.

Temperature affects metabolism and growth, with most species growing faster but maturing earlier and at a smaller size in warmer conditions. This project characterizes the direct influence of temperature on fish growth patterns and incorporates this knowledge into a trait-based, size-spectrum model of a fish community. This model quantifies how changes in temperature and zooplankton composition translate into changes in size structure of the fish community. Warming causes poleward movement of species such that traditionally cooler ecosystems come to resemble warmer ecosystems of the past. This project uses a dynamic food-web model to synthesize how changes in species composition have altered the flow of energy in Gulf of Maine and Mid-Atlantic Bight ecosystems. It also quantifies the stability of these communities and their resilience to perturbations like marine heatwaves, with the expectation that gradual warming causes communities to become more diverse and thus more stable, while abrupt warming may have the opposite effect. Both components contrast the ecosystem properties in the warmer mid Atlantic with those in the cooler Gulf of Maine as well as those properties in the past with those under the recent very warm conditions. The comparative approach also untangles the direct impact of warming on organisms from the indirect effects from vertical stratification. In particular, comparing the recent thermally stratified period with the 1990s, when reduced salinity led to an abrupt, multi trophic-level community shift, make it possible to isolate the direct effects of temperature from its influence through hydrography.

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.

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851866

[[table of contents](#) | [back to top](#)]