Gulf of Maine CPR Metadata Guide

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2021-11-30

Metadata File for NOAA's Continuous Plankton Recorder Dataset.

Gulf of Maine Transect (December 2021)

Data for the Gulf of Maine Continuous Plankton Recorder (CPR) Route was collected under funding and support provided by _________. The primary operator of the global network of CPR routes is the Marine Biological Association.

About the CPR Program

The continuous plankton recorder is a unique plankton sampling device developed by Sir Alister Hardy. The device is designed to be deployed behind a towing vessel (typically a merchant ship) to continuously sample the upper water column for plankton at 5-10m depth. The earliest CPR device was first deployed in 1931 in the North Sea, and since then a number of long-term sampling routes have been maintained across the globe. The CPR survey program is now one of the longest running sampling records for phytoplankton and zooplankton.

For more information on the CPR Survey program please visit: www.cprsurvey.org

Gulf of Maine Transect History

The operation of the Gulf of Maine CPR transect has been conducted since 1961 through joint collaboration between the Sir Alister Hardy Foundation (now Marine Biological Association) and the Northeast Fisheries Science Center under NOAA. While the core sampling methodology and sample processing has remained consistent, there are some noteworthy changes-of-hand and differences in data storage formatting between research entities.

From Jossi et al. 2003 (p.317):

> From July 1961 until October 1974 the Oceanographic Laboratory in Edinburgh, Scotland, conducted monthly monitoring using the CPR on what is now known as the C0 route in the Gulf of Maine between Cape Sable, Nova Scotia, and the Boston, Massachusetts, area (Fig. 1). During these years this route was labelled 'EB'. In 1972 US NOAA-Fisheries and the U.K. Natural Environment Research Council developed an aide-memoire for the extension of the long-term CPR survey into additional areas of the western North Atlantic. On the U.S. side the resulting monitoring programme was designated as the Marine Resources Monitoring, Assessment and Prediction (MARMAP) Ships of Opportunity (SOOP) Program. The SOOP routes are meant to supplement the time and space coverage of their research-vessel surveys, and to allow examination of spatial and temporal variations at scales smaller than those permitted using research-vessel

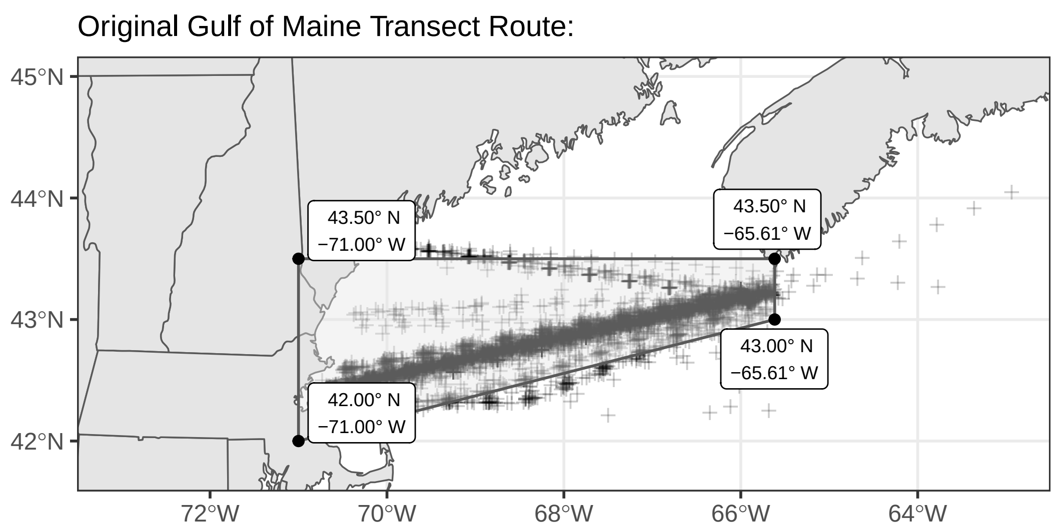
> data. From 1972–1974 SOOP staff handled logistics for this route, preparing instruments, meeting ships, training personnel, and sending samples and data to Edinburgh for analysis. During 1974 it became impossible to find a vessel able to tow the CPR along this route, but in 1977 a new vessel had been located and the entire operation, including data processing and analysis, was moved to Narragansett…

Transect Details

The Gulf of Maine CPR route is one of the longest-running CPR survey routes in the world. The continued sampling of the region is a product of joint cooperation between the Sir Alister Hardy Foundation (SAHFOS) and the Northeast Fisheries Science Center (NEFSC)

From Jossi et al. 2003 (p. 317):

> The C0 ('Gulf of Maine') route extends from the Massachusetts coast, to Cape Sable, Nova Scotia, for a distance of 244 nm (452 km). Because the ships of opportunity that tow the CPR follow slightly different paths from month to month, a tetragon was devised to define the route and to exclude any outlying samples during analyses. The four corners of this tetragon are defined by the following geographical positions: 43°30'N 71°00'W; 43°30'N 65°37'W; 43°00'N 65°37'W; 42°00'N 71°00'W.

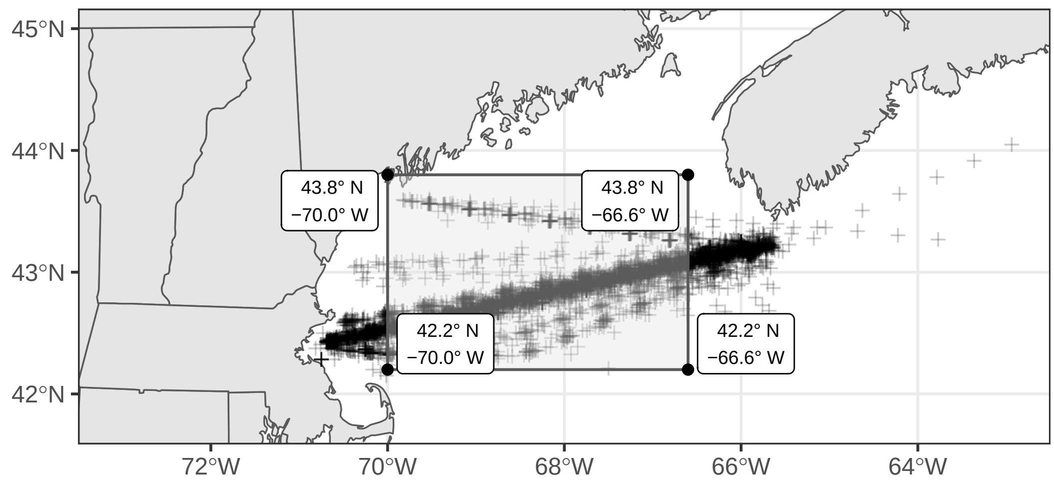


Portland Route Change

Beginning in 2013, a change in the ship of opportunity occurred. This change in the CPR tow vessel shifted the transect end from Boston to Portland Maine. This is now the current route sampled by the Gulf of Maine CPR program.

To preserve a "commonly sampled area" a new bounding box has been employed by researchers at the Gulf of Maine Research Institute.

Expanded Gulf of Maine Transect Route:



CPR Device Details

The continuous plankton recorder is designed to be towed at speeds $15 - 20kts$. The sampling device has an opening size of $1.27cm$, and uses a $270\mu m$ silk mesh that is spooled by an internal mechanism as water passes through the sampling device. As the device is towed through the water column, plankton are filtered onto the constantly moving band of silk. The sampled plankton is then sandwiched between an additional layer of silk mesh before becoming wound onto a storage spool which is held in a tank containing formalin.

Details on the sampling device itself, changes to its design, and the processing of samples can be found in:

- Richardson et al., 2006
- Batten & Clark et al., 2003
- John & Reid, 2001
- Jonas, Walne, Beaugrand, Gregory & Hays, 2004
- Reid et al., 2003
- Warner & Hays, 1994

Measurement Scales

Once CPR samples have been collected and processed into silk transects, plankton abundances are then processed at four measurement scales related to the size of the organisms. At each scale a different fraction of a silk transect is observed, a different magnification level is used, and a different semi-quantitative abundance scale is used.

The four measurement scales include:

1. Phytoplankton Color Index (PCI)

2. Phytoplankton (Larger Phytoplankton)
3. Zooplankton Traverse (smaller zooplankton)
4. Zooplankton Eyecount (larger zooplankton)

For details on the sample processing methodology and the categorical counting system used please see Richardson et al. 2006.

Measurement Units

When integrating the CPR data into their internal databases, NOAA performs additional steps to convert CPR abundances into equivalent units used by additional plankton sampling programs (MARMAP).

From Jossi et al. 2003:

> In addition to the SAHFOS standard processing, plankton abundance data are converted to units more easily compared with NOAA-Fisheries research-vessel results, i.e., No/100m3 for zooplankton and No/m3 for phytoplankton. Also, because of the one-dimensional spatial nature of the data, they are routinely processed into time-space matrices for the purposes of map algebra analyses. In 1978, as part of an agreement with the United States Maritime Administration (MARAD) and NOAA's National Ocean Service (NOS), concurrent measurements of water-column temperature by means of expendable bathythermographs (XBTs), and surface salinity were added along C0. In 1991, with the assistance of NOS and NOAA's National Weather Service (NWS), continuous near-surface temperature and salinity measurements were also taken, and water-column temperature and weather observations were transmitted to shore via satellite.

Getting Totals Across Development Groups:

Because of how different taxa are grouped by development stages, and how the CPR survey tracks abundances at different measurement scales totals it is not always equivalent to get total abundances by summing across groups:

From Richardson et al. 2006:

> An undesirable consequence of the category counting system and use of accepted values is that taxonomic entities that should sum perfectly within a higher taxonomic group do not always do so. Consider the taxonomic entity "Calanus V–VI total", which includes all stage V–VI "Calanus finmarchicus", "Calanus helgolandicus", and "Calanus glacialis" seen during the zooplankton eyecount procedure, and should theoretically equal the sum of the abundances for each species counted individually. (Note that throughout this contribution, taxonomic entities recorded explicitly in the database are enclosed within double quotations.) If 10 individuals of each species were counted these would be recorded in the CPR database as category 4 (4–11 specimens) for each species, and category 6 (26–50 specimens) for "Calanus V–VI total". However, the numerical values extracted from the database would show the accepted value of 6 for each of the three individual species and 35 for the combined taxon. This would mean the abundance of each of the individual Calanus species does not sum to that for "Calanus V–VI total". In such situations, if the abundance of all three Calanus taxa is needed, then it is better to use the combined taxonomic entity "Calanus V–VI total", rather than summing the abundances of the individual taxa.

References

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