ScanFish Optical Plankton Counter (OPC) data from R/V Pelican cruises PE03-NGOMEX, PE04-NGOMEX, PE06-NGOMEX, PE07-NGOMEX, PE09-05, and PE11-06 in the Northern Gulf of Mexico between 2003 and 2010

Website: https://www.bco-dmo.org/dataset/746081

Data Type: Cruise Results

Version: 1

Version Date: 2018-09-12

Project

» NGOMEX - Living Marine Resources of the Northern Gulf of Mexico (GoMX - NGOMEX)

Program

» Gulf of Mexico - Deepwater Horizon Oil Spill (GoMX - DHOS)

Contributors	Affiliation	Role
Roman, Michael R.	University of Maryland Center for Environmental Science (UMCES/HPL)	Principal Investigator
Boicourt, William C.	University of Maryland Center for Environmental Science (UMCES/HPL)	Co-Principal Investigator
Huebert, Klaus B.	University of Maryland Center for Environmental Science (UMCES/HPL)	Co-Principal Investigator, Contact
Pierson, James J.	University of Maryland Center for Environmental Science (UMCES/HPL)	Co-Principal Investigator
York, Amber	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

An optical plankton counter (OPC) and CTD mounted to a ScanFish platform were towed and undulated behind the R/V Pelican during cruises PE03-NGOMEX, PE04-NGOMEX, PE06-NGOMEX, PE07-NGOMEX, PE09-05, and PE11-06 in the Northern Gulf of Mexico between 2003 and 2010. CTD and MIDAS data were synchronized and merged with simultaneously collected OPC data and aggregated into 1 second time bins. Bottom depth was obtained from

the NOAA NCEI coastal relief model. For a complete list of measurements, refer to the supplemental document 'Field_names.pdf', and a full dataset description is included in the supplemental file 'Dataset_description.pdf'. The most current version of this dataset is available at: http://www.bco-dmo.org/dataset/746081

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Coverage

Spatial Extent: **N**:29.70087 **E**:-89.3751 **S**:28.22673 **W**:-94.24128

Temporal Extent: 2003-07-30 - 2010-09-07

Dataset Description

Subsets of these data were published in the papers listed in the "Related Resources" section.

Related dataset:
* Pump mesozooplankton samples: https://www.bco-dmo.org/dataset/746107

Acquisition Description

Methodology:
A CTD and optical plankton counter mounted to a ScanFish platform were towed and undulated behind the vessel.

Sampling and analytical procedures:
The ScanFish was towed at a mean speed of 2.7 m/s with mean vertical descent and ascent

rates of 0.3 m/s.

Notes for specific data columns:

Dissolved oxygen concentration (column "oxy"): values corrected vs. CTD rosette casts and Winkler titrations when available.

Sample volume (column "vol"): estimated from OPC mouth opening and changes in lat, lon, and depth

Data column definitions for particle counts and biovolume density include the term "ESD" which stands for "equivalent spherical diameter."

Biovolume densities (data column names beginning with "v_") were calculated using the following formula:
v = sum(4/3*pi*(0.5*ESD*1e-3)^3)/vol

The light attenuance (column "light") has relative units and the OPC unit used starting Sep. 5, 2010 22:30:00 UTC was calibrated differently.

Processing Description

Data processing:
Previously processed CTD files (https://www.bco-dmo.org/dataset/3547) and MIDAS files (https://www.bco-dmo.org/dataset/3548) were synchronized and merged with simultaneously collected OPC data. Quality controlled and interpolated MIDAS data were used as the common reference system for longitude, latitude, and time. Since the OPC clock gradually and unpredictably drifted relative to MIDAS time, synchronization was accomplished by measuring and correcting for temporal lag via cross-correlations of moving windows of OPC and CTD pressure sensor time series (with the remaining error generally <0.5 s). Data were then aggregated into 1 s time bins. The standard reference for depth was OPC pressure, adjusted to compensate for non-zero readings on deck of the research vessel over the course of each cruise. The 15 arc second resolution NOAA NCEI coastal relief model for the northern Gulf of Mexico was used as a reference for bathymetry. Data were divided into distinct vertical profiles, and only those profiles were included in the final dataset that either sampled the water column from <3 m below the surface to <3 above the bottom or sampled >30 m of vertical distance, or both. Estimated OPC particle sizes from 256 to 2048 µm equivalent spherical diameter were aggregated into 12 logarithmically spaced size bins (other particle sizes were excluded). For CTD files with both raw and corrected oxygen data, the corrected version was used. All data processing was performed using the R language and environment for statistical computing.

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date.
* modified parameter names to conform with BCO-DMO naming conventions. Periods in column names changed to underscores.
* added ISO Timestamp column
* rounded decimal places of columns. Number of decimal places provided by data contributor.
* Missing data values are shown as the BCO-DMO missing data identifier "nd" meaning "no data."

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Related Publications

Kimmel, D. G., Boicourt, W. C., Pierson, J. J., Roman, M. R., & Zhang, X. (2009). A comparison of the mesozooplankton response to hypoxia in Chesapeake Bay and the northern Gulf of Mexico using the biomass size spectrum. Journal of Experimental Marine Biology and Ecology, 381, S65–S73. doi:10.1016/j.jembe.2009.07.012

Kimmel, D. G., Boicourt, W. C., Pierson, J. J., Roman, M. R., & Zhang, X. (2010). The vertical distribution and diel variability of mesozooplankton biomass, abundance and size in response to hypoxia in the northern Gulf of Mexico USA. Journal of Plankton Research, 32(8), 1185–1202. doi:10.1093/plankt/fbp136

Pierson, J. J., Roman, M. R., Kimmel, D. G., Boicourt, W. C., & Zhang, X. (2009). Quantifying changes in the vertical distribution of mesozooplankton in response to hypoxic bottom waters. Journal of Experimental Marine Biology and Ecology, 381, S74–S79. doi:10.1016/j.jembe.2009.07.013

Roman, M. R., Pierson, J. J., Kimmel, D. G., Boicourt, W. C., & Zhang, X. (2012). Impacts of Hypoxia on Zooplankton Spatial Distributions in the Northern Gulf of Mexico. Estuaries and Coasts, 35(5), 1261–1269. doi:10.1007/s12237-012-9531-x

Zhang, H., Ludsin, S. A., Mason, D. M., Adamack, A. T., Brandt, S. B., Zhang, X., … Boicourt, W. C. (2009). Hypoxia-driven changes in the behavior and spatial distribution of pelagic fish and mesozooplankton in the northern Gulf of Mexico. Journal of Experimental Marine Biology and Ecology, 381, S80–S91. doi:10.1016/j.jembe.2009.07.014

Zhang, H., Mason, D., Stow, C., Adamack, A., Brandt, S., Zhang, X., … Ludsin, S. (2014). Effects of hypoxia on habitat quality of pelagic planktivorous fishes in the northern Gulf of Mexico. Marine Ecology Progress Series, 505, 209–226. doi:10.3354/meps10768

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Parameters

Parameter	Description	Units
profile	ScanFish profile ID which includes profile start time in UTC	unitless
lon	MIDAS longitude	decimal degrees
lat	MIDAS latitude	decimal degrees
ISO_DateTime_UTC	Timestamp (UTC) in standard ISO 8601:2004(E) format YYYY-mm-ddTHH:MM:SSZ	unitless
depth	OPC depth	dbar
temp	CTD temperature	degrees Celsius (C)
sal	CTD salinity	unitless
oxy	CTD dissolved oxygen concentration	milligrams per liter (mg/l)
chl	CTD chlorophyll a fluorescence	milligrams per cubic meter (mg/m^3)
CDOM	CTD colored dissolved organic matter fluorescence	milligrams per cubic meter (mg/m^3)
light	OPC light attenuance. The units are relative. The OPC unit used starting Sep. 5, 2010 22:30:00 UTC was calibrated differently.	relative
n_0256_0279	OPC particle count (0256 to 0279 um ESD)	unitless
n_0279_0304	OPC particle count (0279 to 0304 um ESD)	unitless
n_0304_0332	OPC particle count (0304 to 0332 um ESD)	unitless
n_0332_0362	OPC particle count (0332 to 0362 um ESD)	unitless
n_0362_0395	OPC particle count (0362 to 0395 um ESD)	unitless
n_0395_0431	OPC particle count (0395 to 0431 um ESD)	unitless
n_0431_0470	OPC particle count (0431 to 0470 um ESD)	unitless

n_0470_0512	OPC particle count (0470 to 0512 um ESD)	unitless
n_0512_0558	OPC particle count (0512 to 0558 um ESD)	unitless
n_0558_0609	OPC particle count (0558 to 0609 um ESD)	unitless
n_0609_0664	OPC particle count (0609 to 0664 um ESD)	unitless
n_0664_0724	OPC particle count (0664 to 0724 um ESD)	unitless
n_0724_0790	OPC particle count (0724 to 0790 um ESD)	unitless
n_0790_0861	OPC particle count (0790 to 0861 um ESD)	unitless
n_0861_0939	OPC particle count (0861 to 0939 um ESD)	unitless
n_0939_1024	OPC particle count (0939 to 1024 um ESD)	unitless
n_1024_1117	OPC particle count (1024 to 1117 um ESD)	unitless
n_1117_1218	OPC particle count (1117 to 1218 um ESD)	unitless
n_1218_1328	OPC particle count (1218 to 1328 um ESD)	unitless
n_1328_1448	OPC particle count (1328 to 1448 um ESD)	unitless
n_1448_1579	OPC particle count (1448 to 1579 um ESD)	unitless
n_1579_1722	OPC particle count (1579 to 1722 um ESD)	unitless
n_1722_1878	OPC particle count (1722 to 1878 um ESD)	unitless
n_1878_2048	OPC particle count (1878 to 2048 um ESD)	unitless
vol	OPC sample volume	cubic meters (m^3)
v_0256_0279	OPC biovolume density (0256 to 0279 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0279_0304	OPC biovolume density (0279 to 0304 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0304_0332	OPC biovolume density (0304 to 0332 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0332_0362	OPC biovolume density (0332 to 0362 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0362_0395	OPC biovolume density (0362 to 0395 um ESD)	cubic millimeters per cubic meter

		(mm^3/m^3)
v_0395_0431	OPC biovolume density (0395 to 0431 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0431_0470	OPC biovolume density (0431 to 0470 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0470_0512	OPC biovolume density (0470 to 0512 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0512_0558	OPC biovolume density (0512 to 0558 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0558_0609	OPC biovolume density (0558 to 0609 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0609_0664	OPC biovolume density (0609 to 0664 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0664_0724	OPC biovolume density (0664 to 0724 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0724_0790	OPC biovolume density (0724 to 0790 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0790_0861	OPC biovolume density (0790 to 0861 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0861_0939	OPC biovolume density (0861 to 0939 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_0939_1024	OPC biovolume density (0939 to 1024 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_1024_1117	OPC biovolume density (1024 to 1117 um ESD)	cubic millimeters

		per cubic meter (mm^3/m^3)
v_1117_1218	OPC biovolume density (1117 to 1218 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_1218_1328	OPC biovolume density (1218 to 1328 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_1328_1448	OPC biovolume density (1328 to 1448 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_1448_1579	OPC biovolume density (1448 to 1579 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_1579_1722	OPC biovolume density (1579 to 1722 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_1722_1878	OPC biovolume density (1722 to 1878 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
v_1878_2048	OPC biovolume density (1878 to 2048 um ESD)	cubic millimeters per cubic meter (mm^3/m^3)
bathy	NOAA NCEI coastal relief model bottom depth	meters (m)

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Instruments

Dataset-specific Instrument Name	Sea-Bird 9 CTD
Generic Instrument Name	CTD profiler

Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column and permits scientists observe the physical properties in real time via a conducting cable connecting the CTD to a deck unit and computer on the ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	GMI ScanFish
Generic Instrument Name	towed undulating vehicle
Generic Instrument Description	A towed undulating vehicle is a generic class of instruments. See the data set specific information for a detailed description. These are often prototype instrument packages designed to make very specific measurements.

Dataset-specific Instrument Name	Focal Technologies Optical Plankton Counter OPC-1T
Generic Instrument Name	Optical Plankton Counter
Generic Instrument Description	An OPC provides quantitative measurements of abundance and sizes of mesozooplankton ranging between approximately 0.25 and 14 mm in Equivalent Spherical Diameter (ESD), and has the capability to integrate measurements from other sensors such as a CTD, fluorometer and Global Positioning System (GPS). It can be deployed on a variety of instruments such as SeaSoar, Aries, Scanfish, MOCNESS, a bongo net or simple towing frame. The data from an OPC are typically transmitted to a data acquisition computer through two conducting wires in a towing cable at real time, but it can also be modified to have an internal memory. Large amounts of data are produced. The procedures employed by OPC users vary from; i) estimating integrated biomass by

	integrating the OPC size distributions, ii) comparing size distributions between OPC and net samples, and iii) simply isolating a size region in the OPC size distribution which correspond solely to specific taxa, eg. Calanus spp.. from: Zhou, M., Tande, K., 2002. Optical Plankton Counter Workshop. GLOBEC Report 17, University of Tromso, Tromso

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Deployments

PE03-NGOMEX

Website	https://www.bco-dmo.org/deployment/58120
Platform	R/V Pelican
Start Date	2003-06-30
End Date	2003-08-05
Description	2003 Sampling cruise to the Northern Gulf of MexicoNote: Deployment Id assigned by BCO-DMO staff (not official)

PE04-NGOMEX

Website	https://www.bco-dmo.org/deployment/58121
Platform	R/V Pelican
Start Date	2004-07-28
End Date	2004-08-02
Description	2004 Sampling cruise to the Northern Gulf of MexicoNote: Deployment Id assigned by BCO-DMO staff (not official)

PE06-NGOMEX

Website	https://www.bco-dmo.org/deployment/58122
Platform	R/V Pelican
Start Date	2006-08-04

End Date	2006-08-13
Description	2006 Sampling cruise to the Northern Gulf of MexicoNote: Deployment Id and Chief Scientist assigned by BCO-DMO staff (not official)

PE07-NGOMEX

Website	https://www.bco-dmo.org/deployment/58123
Platform	R/V Pelican
Start Date	2007-07-21
End Date	2007-08-07
Description	2007 Sampling cruise to the Northern Gulf of MexicoNote: Deployment Id and Chief Scientist assigned by BCO-DMO staff (not official)

PE09-05

Website	https://www.bco-dmo.org/deployment/58124
Platform	R/V Pelican
Start Date	2008-08-01
End Date	2008-08-12
Description	2008 Sampling cruise to the Northern Gulf of MexicoNote: Cruise ID confirmed with R2R catalog Original cruise data are available from the NSF R2R data catalog

PE11-06

Website	https://www.bco-dmo.org/deployment/58640
Platform	R/V Pelican
Start Date	2010-09-01
End Date	2010-09-07
Description	2010 Sampling cruise to the Northern Gulf of MexicoNote: Cruise ID confirmed with R2R catalog Original cruise data are available from the NSF R2R data catalog

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Project Information

NGOMEX - Living Marine Resources of the Northern Gulf of Mexico (GoMX - NGOMEX)

Coverage: Northern Gulf of Mexico, 28-30N 89-94W

NGOMEX - Living Organisms of the Northern Gulf of Mexico A synthesis of data collected in the Northern Gulf of Mexico from 2003-2004, 2006-2008 and 2010 Data include: - CTD Profiles - Rosette Samples - MIDAS underway metereological - Towed SCANFISH - Net Trawls - Zooplankton counts High-resolution mapping of the major ecosystem components of the NGOMEX by year References: Kimmel, D. G., W. C. Boicourt, J. J. Pierson, M. R. Roman, X. Zhang. 2010. The vertical distribution and diel variability of mesozooplankton biomass, abundance and size in response to hypoxia in the northern Gulf of Mexico USA. Journal of Plankton Research 32(8): 1185-1202. doi:10.1093/plankt/fbp136 Pierson, J. J., M. R. Roman, D. G. Kimmel, W. C. Boicourt, & X. Zhang. 2009. Quantifying changes in the vertical distribution of mesozooplankton in response to hypoxic bottom waters. Journal of Experimental Marine Biology and Ecology 381: S74-S79. doi.org/10.1016/j.jembe.2009.07.013 Kimmel, D. G., W. C. Boicourt, J. J. Pierson, M. R. Roman, & X. Zhang. 2009. A comparison of the mesozooplankton response to hypoxia in Chesapeake Bay and the northern Gulf of Mexico using the biomass size spectrum. Journal of Experimental Marine Biology and Ecology 381: S65-S73. doi.org/10.1016/j.jembe.2009.07.012 Zhang, H., S. A. Ludsin, D. M. Mason, A. T. Adamack, S. B. Brandt, X. Zhang, D. G. Kimmel, M. R. Roman, & W. C. Boicourt. 2009. Hypoxia-driven changes in the behavior and spatial distribution of pelagic fish and mesozooplankton in the northern Gulf of Mexico. Journal of Experimental Marine Biology and Ecology. 381: S80-91. http://dx.doi.org/10.1016/j.jembe.2009.07.014

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Program Information

Gulf of Mexico - Deepwater Horizon Oil Spill (GoMX - DHOS)

Coverage: Northern Gulf of Mexico

Grants for Rapid Response Research (RAPID) The RAPID funding mechanism is used for proposals having a severe urgency with regard to availability of, or access to data, facilities or specialized equipment, including quick-response research on natural or anthropogenic

disasters and similar unanticipated events. GOM - Broader Impacts The need to understand the impact of this largest oil spill to date on ecosystems and biochemical cycling is self evident. The consequences of the disaster and accompanying clean up measures (e.g. the distribution of dispersants) need to be evaluated to guide further mediating measures and to develop and improve responses to similar disasters in the future. Would it be advantageous if such oil aggregates sink, or should it rather remain suspended? Possibly measures can be developed to enhance sinking or suspension (e.g. addition of ballast minerals) once we understand their current formation and fate. Understanding the particle dynamics following the input of large amounts of oil and dispersants into the water is a prerequisite to develop response strategies for now and in the future.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1043261
NSF Division of Ocean Sciences (NSF OCE)	OCE-1043248
NSF Division of Ocean Sciences (NSF OCE)	OCE-1043249
National Oceanic and Atmospheric Administration (NOAA)	NA06NOS4780148
National Oceanic and Atmospheric Administration (NOAA)	NA09NOS4780198
Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine (GRP)	NAS-GRP-2000006418

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