Optical Plankton Counter data from R/V New Horizon, R/V Thomas G. Thompson, and R/V Roger Revelle process cruises off the Oregon Coast from 2000-2002 as part of the U.S. GLOBEC program (NEP project)

Website: https://www.bco-dmo.org/dataset/2469
Data Type: Cruise Results
Version: 1
Version Date: 2006-06-09

Project
» U.S. GLOBEC Northeast Pacific (NEP)

Program
» U.S. GLOBal ocean ECosystems dynamics (U.S. GLOBEC)

Contributors	Affiliation	Role
Zhou, Meng	University of Massachusetts Boston (UMB-SMS)	Principal Investigator
Allison, Dicky	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Optical Plankton Counter data from R/V New Horizon, R/V Thomas G. Thompson, and R/V Roger Revelle process cruises off the Oregon Coast from 2000-2002 as part of the U.S. GLOBEC program (Northeast Pacific project)

Table of Contents

Coverage

Spatial Extent: **N**:44.6665 **E**:-103.0707 **S**:39.0004 **W**:-128.8078
Temporal Extent: 2000-05-30 - 2002-06-17

Dataset Description

This dataset includes ALL the biomass values, zero and non-zero. The data files are very large. In order to map the data, see the opc_ccs_nonzero dataset [http://globec.whoi.edu/jg/serv/globec/nep/ccs/process/opc_ccs_nonzero.ht.... In the 'nonzero' dataset, values of 0 in the 'biomass' column have been removed.

For an alternate display, including both zero and non-zero data, see opc_ccs_alt [http://globec.whoi.edu/jg/serv/globec/nep/ccs/process/opc_ccs_alt.html0]. In the 'alt' dataset, OPC size classes are displayed as rows in a 'size_class' column, rather than as separate columns.

U.S. GLOBEC Northeast Pacific California Current Program

Optical Plankton Counter (OPC) Data

Contact for this dataset is:
Meng Zhou
Dept. of Environmental, Coastal and Ocean Sciences
University of Massachusetts-Boston
Boston, MA 02125
Email: meng.zhou@umb.edu
Phone: 617-287-7419; Lab: 617-287-6186
FAX: 617-287-7474

This project addresses one of 3 central hypotheses of the U.S. GLOBEC Northeast Pacific (NEP) Study: Spatial and temporal variability in mesoscale circulation constitutes the dominant physical forcing on zooplankton biomass, production, distribution, species interactions and retention and loss in coastal regions. (U.S. GLOBEC Northeast Pacific Implementation Plan, U.S. GLOBEC Report No. 17).

For more Information about these data contact Dr. Zhou.

Last modified: June 29, 2006

Methods & Sampling

We attached an Optical Plankton Counter (see Zhou and Tande, 2002) to the OSU towed body (SeaSoar) to make 3-dimensional mesoscale surveys (in a 100-km-wide coastal region from Newport, Oregon to Crescent City, California) aimed at determining the distribution and productivity of zooplankton in relation to their physical environment. The OPC provides counts and size estimates of zooplankton sized particles that pass through the instrument. The OPC data with other data sets (e.g., acoustics; ADCP-derived velocities) collected on these surveys, and from companion ships doing net sampling of zooplankton will allow estimation of growth and mortality rates of zooplankton using the biomass spectra method (Zhou and Huntley, 1997).

Data Processing Description

The OPC-CCS data are organized on the GLOBEC server by transect within cruise. The master (level 0) page lists all of the cruises--there were two cruises in each of 2000 and 2002. Clicking on a cruise will show all of the casts collected and processed from that cruise (Level 1), along with the start date and time of the transect. Clicking on a cast will bring up the Level 2 file that shows OPC profile data. The raw data stream is averaged and output at every 4-m bin. The towed body undulates between a near-surface, shallow depth and a deeper depth (which hopefully is ABOVE the bottom). During normal ascent and descent rates of the SeaSoar, approx. 5-30 readings are averaged within every 4 m depth bin. At times of particularly slow depth change, more readings are included in these averages. Average latitude and longitude and date/time (GMT) for each depth bin are shown. OPC data for each reported depth bin include the total abundance of particles (no per m3), total carbon biomass (ug C/m3; estimated from equivalent spherical diameter (ESD) based on Rodriguez and Mullin (1986)), and a biomass spectrum (50 size classes of particles). The header for the biomass spectrum header (minimum of 0.33; maximum of 4.09) values are log10 based carbon intervals of individual particle size. There are 50 biomass size classes. The data for each of the spectra are the accumulated carbon of that size particle, normalized by the water volume, then normalized by the carbon interval, then expressed as log10 units. So the unit of biomass for each spectral class is log10(biomass spectrum (1/m3)).

26 Oct 2012 - BCO-DMO changed naming convention used for size class column headers, which had been using illegal characters. Size class column headers now begin with "s_" (for "size class") and the letter "d" is used to indicate a decimal point.

Note 1: A fluorometer was interfaced with the OPC only for cruise NH0005. For all other cruises, the 'fluor' field value of 0.00 means 'no data'.

Note 2: Biomass spectrum contents: Header value of 0.33 means particles of ca. 10^0.33 = 2.138 ugC per particle. Largest particle size (header value 4.09 is particles of ca. 12302 ugC per particle.

Note 3: The original data contained values of '-99.00' to represent zero counts within any particular size (according to correspondence with Dr. Meng Zhou). BCO-DMO changed the '-99.00' values to '0.00' on 16 Oct

2012 so that they are not misinterpreted.

[table of contents | back to top]

Data Files

File
opc_ccs.csv(Comma Separated Values (.csv), 166.74 MB) MD5:4123bd77da19d686bd495cf64249d8c0 Primary data file for dataset ID 2469

[table of contents | back to top]

Related Publications

Rodriguez, J., & Mullin, M. M. (1986). Relation between biomass and body weight of plankton in a steady state oceanic ecosystem1. Limnology and Oceanography, 31(2), 361–370. doi:10.4319/lo.1986.31.2.0361
Methods

Zhou, M. and K. S. Tande (2001) Optical Plankton Counter workshop report. International Global Ocean Ecosystems Dynamics Program Report, No. 17, 67 pp.
Results

Zhou, M., & Huntley, M. (1997). Population dynamics theory of plankton based on biomass spectra. Marine Ecology Progress Series, 159, 61–73. doi:10.3354/meps159061
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
cruiseid	Cruise ID	unitless
year	Year	unitless
transect	Transect Description	unitless
start_month_gmt	Month of Transect Start (GMT)	unitless
start_day_gmt	Day of Transect Start (GMT)	unitless
start_time_gmt	Time of Transect Start (GMT)	unitless
elptime	Elapsed time from Start Time.	hours
month_gmt	Month	unitless
day_gmt	Day	unitless
time_gmt	Time	unitless
lat	Latitude [decimal degrees]	decimal degrees
lon	Longitude [decimal degrees]	decimal degrees
depth	Depth of Observation [meters]	meters
abundance	Total Abundance [counts/m3]	counts/m3
biomass	Total Biomass [ug C/m3]	microgram C/meter^3
biovol	Total Biovolume [mm3/m3]	mm3/m3
fluor	Chlorophyll [mg/m3] See Note 1 above.	mg/m3

s_0d33	Biomass spectrum size class minimum particle size of 10^0.33	microgram Carbon/particle
s_0d41	Biomass spectrum size class minimum particle size of 10^0.41	microgram Carbon/particle
s_0d49	Biomass spectrum size class minimum particle size of 10^0.49	microgram Carbon/particle
s_0d56	Biomass spectrum size class minimum particle size of 10^0.56	microgram Carbon/particle
s_0d64	Biomass spectrum size class minimum particle size of 10^0.64	microgram Carbon/particle
s_0d72	Biomass spectrum size class minimum particle size of 10^0.72	microgram Carbon/particle
s_0d79	Biomass spectrum size class minimum particle size of 10^0.79	microgram Carbon/particle
s_0d87	Biomass spectrum size class minimum particle size of 10^0.87	microgram Carbon/particle
s_0d95	Biomass spectrum size class minimum particle size of 10^0.95	microgram Carbon/particle
s_1d02	Biomass spectrum size class minimum particle size of 10^1.02	microgram Carbon/particle
s_1d10	Biomass spectrum size class minimum particle size of 10^1.1	microgram Carbon/particle
s_1d18	Biomass spectrum size class minimum particle size of 10^1.18	microgram Carbon/particle
s_1d25	Biomass spectrum size class minimum particle size of 10^1.25	microgram Carbon/particle
s_1d33	Biomass spectrum size class minimum particle size of 10^1.33	microgram Carbon/particle
s_1d41	Biomass spectrum size class minimum particle size of 10^1.41	microgram Carbon/particle
s_1d48	Biomass spectrum size class minimum particle size of 10^1.48	microgram Carbon/particle
s_1d56	Biomass spectrum size class minimum particle size of 10^1.56	microgram Carbon/particle
s_1d64	Biomass spectrum size class minimum particle size of 10^1.64	microgram Carbon/particle
s_1d71	Biomass spectrum size class minimum particle size of 10^1.71	microgram Carbon/particle
s_1d79	Biomass spectrum size class minimum particle size of 10^1.79	microgram Carbon/particle
s_1d87	Biomass spectrum size class minimum particle size of 10^1.87	microgram Carbon/particle
s_1d94	Biomass spectrum size class minimum particle size of 10^1.94	microgram Carbon/particle
s_2d02	Biomass spectrum size class minimum particle size of 10^2.02	microgram Carbon/particle
s_2d10	Biomass spectrum size class minimum particle size of 10^2.1	microgram Carbon/particle
s_2d17	Biomass spectrum size class minimum particle size of 10^2.17	microgram Carbon/particle
s_2d25	Biomass spectrum size class minimum particle size of 10^2.25	microgram Carbon/particle
s_2d33	Biomass spectrum size class minimum particle size of 10^2.33	microgram Carbon/particle
s_2d40	Biomass spectrum size class minimum particle size of 10^2.4	microgram Carbon/particle
s_2d48	Biomass spectrum size class minimum particle size of 10^2.48	microgram Carbon/particle
s_2d56	Biomass spectrum size class minimum particle size of 10^2.56	microgram Carbon/particle
s_2d63	Biomass spectrum size class minimum particle size of 10^2.63	microgram Carbon/particle
s_2d71	Biomass spectrum size class minimum particle size of 10^2.71	microgram Carbon/particle
s_2d79	Biomass spectrum size class minimum particle size of 10^2.79	microgram Carbon/particle
s_2d86	Biomass spectrum size class minimum particle size of 10^2.86	microgram Carbon/particle
s_2d94	Biomass spectrum size class minimum particle size of 10^2.94	microgram Carbon/particle
s_3d02	Biomass spectrum size class minimum particle size of 10^3.02	microgram Carbon/particle
s_3d09	Biomass spectrum size class minimum particle size of 10^3.09	microgram Carbon/particle
s_3d17	Biomass spectrum size class minimum particle size of 10^3.17	microgram Carbon/particle
s_3d25	Biomass spectrum size class minimum particle size of 10^3.25	microgram Carbon/particle
s_3d32	Biomass spectrum size class minimum particle size of 10^3.32	microgram Carbon/particle
s_3d40	Biomass spectrum size class minimum particle size of 10^3.4	microgram Carbon/particle

s_3d48	Biomass spectrum size class minimum particle size of 10^3.48	microgram Carbon/particle
s_3d55	Biomass spectrum size class minimum particle size of 10^3.55	microgram Carbon/particle
s_3d63	Biomass spectrum size class minimum particle size of 10^3.63	microgram Carbon/particle
s_3d71	Biomass spectrum size class minimum particle size of 10^3.71	microgram Carbon/particle
s_3d78	Biomass spectrum size class minimum particle size of 10^3.78	microgram Carbon/particle
s_3d86	Biomass spectrum size class minimum particle size of 10^3.86	microgram Carbon/particle
s_3d94	Biomass spectrum size class minimum particle size of 10^3.94	microgram Carbon/particle
s_4d01	Biomass spectrum size class minimum particle size of 10^4.01	microgram Carbon/particle
s_4d09	Biomass spectrum size class minimum particle size of 10^4.09	microgram Carbon/particle

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Optical Plankton Counter
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

Dataset-specific Instrument Name	SeaSoar
Generic Instrument Name	SeaSoar
Dataset-specific Description	We attached an Optical Plankton Counter (see Zhou and Tande, 2002) to the OSU towed body (SeaSoar) to make 3-dimensional mesoscale surveys(in a 100-km-wide coastal region from Newport, Oregon to CrescentCity, California) aimed at determining the distribution andproductivity of zooplankton in relation to their physical environment.
Generic Instrument Description	Towed, undulating vehicle usually equipped with a VPR, TAPS, PAR, CTD

[table of contents | back to top]

Deployments

NH0005

Website	https://www.bco-dmo.org/deployment/57557
Platform	R/V New Horizon
Report	http://globec.whoi.edu/nep/reports/ccs_cruises/nh0005/nh0005cr.pdf
Start Date	2000-05-28
End Date	2000-06-13
Description	**Methods & Sampling** We attached an Optical Plankton Counter (see Zhou and Tande, 2002) to the OSU towed body (SeaSoar) to make 3-dimensional mesoscale surveys (in a 100-km-wide coastal region from Newport, Oregon to Crescent City, California) aimed at determining the distribution and productivity of zooplankton in relation to their physical environment. The OPC provides counts and size estimates of zooplankton sized particles that pass through the instrument. The OPC data with other data sets (e.g., acoustics; ADCP-derived velocities) collected on these surveys, and from companion ships doing net sampling of zooplankton will allow estimation of growth and mortality rates of zooplankton using the biomass spectra method (Zhou and Huntley, 1997). **Processing Description** The OPC-CCS data are organized on the GLOBEC server by transect within cruise. The master (level0) page lists all of the cruises--there were two cruises in each of 2000 and 2002. Clicking on a cruise will show all of the casts collected and processed from that cruise (Level1), along with the start date and time of the transect. Clicking on a cast will bring up the Level2 file that shows OPC profile data. The raw data stream is averaged and output at every 4-m bin. The towed body undulates between a near-surface, shallow depth and a deeper depth (which hopefully is ABOVE the bottom). During normal ascent and descent rates of the SeaSoar, approx. 5-30 readings are averaged within every 4 m depth bin. At times of particularly slow depth change, more readings are included in these averages. Average latitude and longitude and date/time (GMT) for each depth bin are shown. OPC data for each reported depth bin include the total abundance of particles (no per m3), total carbon biomass (ug C/m3; estimated from equivalent spherical diameter (ESD) based on Rodriguez and Mullin (1986)), and a biomass spectrum (50 size classes of particles). The header for the biomass spectrum header (minimum of 0.33; maximum of 4.09) values are log10 based carbon intervals of individual particle size. There are 50 biomass size classes. The data for each of the spectra are the accumulated carbon of that size particle, normalized by the water volume, then normalized by the carbon interval, then expressed as log10 units. So the unit of biomass for each spectral class is log10(biomass spectrum (1/m3)).

NH0007

Website	https://www.bco-dmo.org/deployment/57558
Platform	R/V New Horizon
Report	http://globec.whoi.edu/nep/reports/ccs_cruises/nh0007/nh0007cr.pdf
Start Date	2000-07-27
End Date	2000-08-12
Description	**Methods & Sampling** We attached an Optical Plankton Counter (see Zhou and Tande, 2002) to the OSU towed body (SeaSoar) to make 3-dimensional mesoscale surveys (in a 100-km-wide coastal region from Newport, Oregon to Crescent City, California) aimed at determining the distribution and productivity of zooplankton in relation to their physical environment. The OPC provides counts and size estimates of zooplankton sized particles that pass through the instrument. The OPC data with other data sets (e.g., acoustics; ADCP-derived velocities) collected on these surveys, and from companion ships doing net sampling of zooplankton will allow estimation of growth and mortality rates of zooplankton using the biomass spectra method (Zhou and Huntley, 1997). **Processing Description** The OPC-CCS data are organized on the GLOBEC server by transect within cruise. The master (level0) page lists all of the cruises--there were two cruises in each of 2000 and 2002. Clicking on a cruise will show all of the casts collected and processed from that cruise (Level1), along with the start date and time of the transect. Clicking on a cast will bring up the Level2 file that shows OPC profile data. The raw data stream is averaged and output at every 4-m bin. The towed body undulates between a near-surface, shallow depth and a deeper depth (which hopefully is ABOVE the bottom). During normal ascent and descent rates of the SeaSoar, approx. 5-30 readings are averaged within every 4 m depth bin. At times of particularly slow depth change, more readings are included in these averages. Average latitude and longitude and date/time (GMT) for each depth bin are shown. OPC data for each reported depth bin include the total abundance of particles (no per m3), total carbon biomass (ug C/m3; estimated from equivalent spherical diameter (ESD) based on Rodriguez and Mullin (1986)), and a biomass spectrum (50 size classes of particles). The header for the biomass spectrum header (minimum of 0.33; maximum of 4.09) values are log10 based carbon intervals of individual particle size. There are 50 biomass size classes. The data for each of the spectra are the accumulated carbon of that size particle, normalized by the water volume, then normalized by the carbon interval, then expressed as log10 units. So the unit of biomass for each spectral class is log10(biomass spectrum (1/m3)).

T0205

Website	https://www.bco-dmo.org/deployment/57595
Platform	R/V Thomas G. Thompson
Report	http://globec.whoi.edu/nep/reports/ccs_cruises/t0205cr.pdf
Start Date	2002-06-01
End Date	2002-06-17
Description	**Methods & Sampling** We attached an Optical Plankton Counter (see Zhou and Tande, 2002) to the OSU towed body (SeaSoar) to make 3-dimensional mesoscale surveys (in a 100-km-wide coastal region from Newport, Oregon to Crescent City, California) aimed at determining the distribution and productivity of zooplankton in relation to their physical environment. The OPC provides counts and size estimates of zooplankton sized particles that pass through the instrument. The OPC data with other data sets (e.g., acoustics; ADCP-derived velocities) collected on these surveys, and from companion ships doing net sampling of zooplankton will allow estimation of growth and mortality rates of zooplankton using the biomass spectra method (Zhou and Huntley, 1997). **Processing Description** The OPC-CCS data are organized on the GLOBEC server by transect within cruise. The master (level0) page lists all of the cruises--there were two cruises in each of 2000 and 2002. Clicking on a cruise will show all of the casts collected and processed from that cruise (Level1), along with the start date and time of the transect. Clicking on a cast will bring up the Level2 file that shows OPC profile data. The raw data stream is averaged and output at every 4-m bin. The towed body undulates between a near-surface, shallow depth and a deeper depth (which hopefully is ABOVE the bottom). During normal ascent and descent rates of the SeaSoar, approx. 5-30 readings are averaged within every 4 m depth bin. At times of particularly slow depth change, more readings are included in these averages. Average latitude and longitude and date/time (GMT) for each depth bin are shown. OPC data for each reported depth bin include the total abundance of particles (no per m3), total carbon biomass (ug C/m3; estimated from equivalent spherical diameter (ESD) based on Rodriguez and Mullin (1986)), and a biomass spectrum (50 size classes of particles). The header for the biomass spectrum header (minimum of 0.33; maximum of 4.09) values are log10 based carbon intervals of individual particle size. There are 50 biomass size classes. The data for each of the spectra are the accumulated carbon of that size particle, normalized by the water volume, then normalized by the carbon interval, then expressed as log10 units. So the unit of biomass for each spectral class is log10(biomass spectrum (1/m3)).

R0208

Website	https://www.bco-dmo.org/deployment/57574
Platform	R/V Roger Revelle
Report	http://globec.whoi.edu/nep/reports/ccs_cruises/r0208cr.pdf
Start Date	2002-07-31
End Date	2002-08-19
Description	**Methods & Sampling** We attached an Optical Plankton Counter (see Zhou and Tande, 2002) to the OSU towed body (SeaSoar) to make 3-dimensional mesoscale surveys (in a 100-km-wide coastal region from Newport, Oregon to Crescent City, California) aimed at determining the distribution and productivity of zooplankton in relation to their physical environment. The OPC provides counts and size estimates of zooplankton sized particles that pass through the instrument. The OPC data with other data sets (e.g., acoustics; ADCP-derived velocities) collected on these surveys, and from companion ships doing net sampling of zooplankton will allow estimation of growth and mortality rates of zooplankton using the biomass spectra method (Zhou and Huntley, 1997). **Processing Description** The OPC-CCS data are organized on the GLOBEC server by transect within cruise. The master (level0) page lists all of the cruises--there were two cruises in each of 2000 and 2002. Clicking on a cruise will show all of the casts collected and processed from that cruise (Level1), along with the start date and time of the transect. Clicking on a cast will bring up the Level2 file that shows OPC profile data. The raw data stream is averaged and output at every 4-m bin. The towed body undulates between a near-surface, shallow depth and a deeper depth (which hopefully is ABOVE the bottom). During normal ascent and descent rates of the SeaSoar, approx. 5-30 readings are averaged within every 4 m depth bin. At times of particularly slow depth change, more readings are included in these averages. Average latitude and longitude and date/time (GMT) for each depth bin are shown. OPC data for each reported depth bin include the total abundance of particles (no per m3), total carbon biomass (ug C/m3; estimated from equivalent spherical diameter (ESD) based on Rodriguez and Mullin (1986)), and a biomass spectrum (50 size classes of particles). The header for the biomass spectrum header (minimum of 0.33; maximum of 4.09) values are log10 based carbon intervals of individual particle size. There are 50 biomass size classes. The data for each of the spectra are the accumulated carbon of that size particle, normalized by the water volume, then normalized by the carbon interval, then expressed as log10 units. So the unit of biomass for each spectral class is log10(biomass spectrum (1/m3)).

[table of contents | back to top]

Project Information

U.S. GLOBEC Northeast Pacific (NEP)

Website: http://nepglobec.bco-dmo.org

Coverage: Northeast Pacific Ocean, Gulf of Alaska

Program in a Nutshell

Goal: To understand the effects of climate variability and climate change on the distribution, abundance and production of marine animals (including commercially important living marine resources) in the eastern North Pacific. To embody this understanding in diagnostic and prognostic ecosystem models, capable of capturing the ecosystem response to major climatic fluctuations.

Approach: To study the effects of past and present climate variability on the population ecology and population dynamics of marine biota and living marine resources, and to use this information as a proxy for

how the ecosystems of the eastern North Pacific may respond to future global climate change. The strong temporal variability in the physical and biological signals of the NEP will be used to examine the biophysical mechanisms through which zooplankton and salmon populations respond to physical forcing and biological interactions in the coastal regions of the two gyres. Annual and interannual variability will be studied directly through **long-term observations** and detailed **process studies**; variability at longer time scales will be examined through **retrospective analysis** of directly measured and proxy data. Coupled **biophysical models** of the ecosystems of these regions will be developed and tested using the process studies and data collected from the long-term observation programs, then further tested and improved by hindcasting selected retrospective data series.

[table of contents | back to top]

Program Information

U.S. GLOBal ocean ECosystems dynamics (U.S. GLOBEC)

Website: http://www.usglobec.org/

Coverage: Global

U.S. GLOBEC (GLOBal ocean ECosystems dynamics) is a research program organized by oceanographers and fisheries scientists to address the question of how global climate change may affect the abundance and production of animals in the sea.

The U.S. GLOBEC Program currently had major research efforts underway in the Georges Bank / Northwest Atlantic Region, and the Northeast Pacific (with components in the California Current and in the Coastal Gulf of Alaska). U.S. GLOBEC was a major contributor to International GLOBEC efforts in the Southern Ocean and Western Antarctic Peninsula (WAP).

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0002257
National Oceanic and Atmospheric Administration (NOAA)	unknown NEP NOAA

[table of contents | back to top]