

DATA ACCESS TUTORIAL 2013 OCB PI SUMMER WORKSHOP

DATA ACCESS: TEXT-BASED SEARCH

SCENARIO 1: You have a general idea of what you are looking for.

Go to: <http://bco-dmo.org>

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The DATABASE links in the left navigation area provide an idea of how the data are organized. Data sets are grouped by Program (largest collection), Project (smaller in scope than a Program), Deployment (cruise, mooring, and many other examples), Dataset (a logical collection of data).

One could start with any of those navigation links and search to find the data of interest. If you know you are interested in data from an OCB project (for example, “CoFeMUG”) you may start at the top level “Programs”.

Select Programs from the left navigation area. Enter OCB in the search box. Click the button.

Select “Ocean Carbon and Biogeochemistry” from the Program list.

URL: <http://osprey.bco-dmo.org/program.cfm?flag=view&id=18&sortby=program>

Your browser display should look like the image on the next page, showing a brief description of the OCB program.

BCO-DMO
Biological & Chemical Oceanography Data Management Office

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Program: Ocean Carbon and Biogeochemistry

Affiliated programs: IMBER-US, US SOLAS, NACP-OCB Coastal
Acronym: OCB
URL: [Program Web Site](#)
Start date: 2006
End date:
Geolocation: Global

OCB
Ocean Carbon & Biogeochemistry

Description:

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO₂ and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Scroll down and expand the Projects section from “Additional program information”.

URL: <http://osprey.bco-dmo.org/program.cfm?flag=viewwp&id=18&sortby=program>

Select “Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre” (CoFeMUG) from the list of project names.

California Current Ecosystem Long Term Ecological Research site	(CCE LTER)
Carbon Dioxide Dynamics in Mode Water of the North Atlantic Ocean	(CarboMODE)
Carbon Dioxide Information Analysis Center - Global Ocean CO ₂	(CDIAC Ocean CO ₂)
CArbon Retention In A Colored Ocean Project	(CARIACO)
Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre	(CoFeMUG)
Coccolithophores of the Patagonian Shelf 2008	(COPAS08)
Composition of the plankton community and its contribution to particle flux in the Sargasso Sea	(Plankton particle flux)

The browser displays the project description page.

URL: <http://osprey.bco-dmo.org/project.cfm?id=34&flag=view>

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Project: Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre

Acronym: CoFeMUG
 Programs:
 [Ocean Carbon and Biogeochemistry \[OCB\]](#)
 [U.S. GEOTRACES \[U.S. GEOTRACES\]](#)
 Start date: 2005-03
 End date: 2008-03
 Geolocation: South Atlantic subtropical gyre and Benguela upwelling region



▼ **Description:**

The geochemistries of dissolved cobalt (Co) and iron (Fe) in the oceanic water column share several characteristics such as extremely low concentrations, redox chemistry, low solubility, and utilization as micronutrients by marine microbes. Iron has been the subject of considerable research focus in recent years due to its role in limiting phytoplankton productivity in oceanic and coastal upwelling environments. Cobalt has been much less studied, but recent data show it may be important in influencing primary productivity or phytoplankton community composition in certain geographical areas.

The CoFeMUG project predated GEOTRACES, so while it is not formally recognized as a GEOTRACES section, it is considered a GEOTRACES-related project and the CoFeMUG data are GEOTRACES compliant.

State-of-the-art geochemical and molecular biological techniques were used to address biogeochemical questions in the South Atlantic, and focus especially on the two trace metals, cobalt and iron. The 27-day cruise in November and December 2007 to the South Atlantic was designed to study cobalt and iron biogeochemistry and focus on four major hypotheses.

1. Large fluxes of labile cobalt are associated with upwelling systems even in Aeolian dominated environments.
2. Cobalt and phosphate show correlations in (and only in) surface waters due to micronutrient utilization and rapid remineralization. The slope of the correlation is dependent on the chemical speciation of cobalt.
3. The absence of Trichodesmium populations in the subtropical and tropical South Atlantic is caused by iron limitation.

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Scroll down that page and expand the Datasets section.

URL: <http://osprey.bco-dmo.org/project.cfm?flag=viewd&id=34&sortby=project>

Additional Project Information

► [Funding](#)

► [Datasets](#)

► [Deployments](#)

► [Project coordinators](#)

Select the data set of interest from the list. For this example, choose “nutrients and metals”. URL: <http://osprey.bco-dmo.org/dataset.cfm?id=13570&flag=view>

Additional Project Information

- ▶ Funding
- ▼ Datasets

Dataset
16S rRNA clone library
cobalt_prelim
cruise_report
event_log
Fe Speciation
INVENTORY
Metaproteome
nutrients and metals
Pigments

- ▶ Deployments
- ▶ Project coordinators

Dataset: nutrients and metals

Project:	Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre
Principal Investigator:	Mak Saito (Woods Hole Oceanographic Institution)
BCO-DMO Data Manager:	Shannon Rauch (Woods Hole Oceanographic Institution)
Validated:	yes
Data version:	7 October 2009
Version date:	Mar 20, 2013

Dataset handle ID (e.g. DOI or other persistent identifier): not yet assigned

▶ **Current state:** Final no updates expected

▼ **Description:** Analysis of nutrients, Cobalt, Iron, and Manganese from TM bottle samples.
 Analysis of nutrients, Cobalt (total and labile), dissolved Iron, and dissolved Manganese of water samples drawn from Trace Metal Rosette (TMR) bottle casts.

Related Publications:

Noble, A.E., C. H. Lamborg, D. C. Ohnemus, P. J. Lam, T. J. Goepfert, C. I. Measures, C. H. Frame, K. L. Casciotti, G. R. DiTullio, J. Jennings, M. A. Saito. 2012. Basin-scale inputs of cobalt, iron, and manganese from the Benguela-Angola front to the South Atlantic Ocean. *Limnology and Oceanography*, 57(4) 989-1010. doi:10.4319/lo.2012.57.4.0989

Sohm, J. A., J. A. Hilton, A. E. Noble, J. P. Zehr, M. A. Saito, and E. A. Webb. 2011. Nitrogen fixation in the South Atlantic Gyre and the Benguela Upwelling System. *Geophys. Res. Letters*. 38: L16608, doi:10.1029/2011GL048315

▶ **Acquisition description:**

▶ **Processing description:**

From the dataset display page, expand the **Deployments** section to see the cruises during which the nutrients and metal data were collected.

URL: <http://osprey.bco-dmo.org/dataset.cfm?id=13570&flag=view>

More information about this dataset:

- ▶ Funding
- ▼ Deployments

Deployment	Synonyms	Start date	Platform	Investigator	
KN192-05	CoFeMUG KN192-5	Nov 16, 2007	R/V Knorr	Mak Saito (Chief Scientist)	data info

- ▶ Instruments associated with this dataset
- ▶ Parameters associated with this dataset
- ▶ Data types

These data were collected on one cruise, KN192-05. If data were collected on multiple deployments, all deployment names would be listed here (e.g. cruises, moorings, floats, gliders, etc.). To see more information about the cruise, including a description and other available data, one could click on the deployment name.

However, we want the data ...

For this dataset there are two choices: [GetData](#) and [Map It](#). At this point, please click the [GetData](#) button to access these data online.

Browser displays URL: http://data.bco-dmo.org/jg/serv/BCO/CoFeMUG/KN192-5/nutrients_metals.html in another window or browser tab depending on the browser configuration.

/BCO/CoFeMUG/KN192-5/nutrients_metals ---- Level 0

Directory
Documentation
Download & Other Operations

Level 0
Next Level
Flat Listing

```

# Nutrients and metals from TMR casts
# CoFeMUG cruise KN192-05
# PI: Mak Saito (WHOI)
# Version: 20 March 2013
# Notes: 'lt' = 'less than'; refer to documentation for flag definitions.
=====
cruise_id
-----
KN192-5

```

Click on the blue cruise ID at level 0 to expand the data display. Then, click on a station number to see the data for that station.

/BCO/CoFeMUG/KN192-5/nutrients_metals --cruise_id eq KN192-5,sta eq 20-- Level 2

Directory
Documentation
Download & Other Operations

Level 0
Next Level
Flat Listing

```

# Nutrients and metals from TMR casts
# CoFeMUG cruise KN192-05
# PI: Mak Saito (WHOI)
# Version: 20 March 2013
# Notes: 'lt' = 'less than'; refer to documentation for flag definitions.
=====
cruise_id
-----
KN192-5
=====
sta lat lon lon_360 depth_w
-----
20 -17.500 11.250 11.25 720
=====
depth ev_code run_id cast date year mon day time NO3_NO2 NO3_NO2_flag PO4 PO4_flag SiO4 SiO4_flag NO2 NO2_flag NH4 NH4_flag
-----
11 TMR41 MS0822B 41 20071206 2007 12 06 1724 21.90 1 1.431 1 3.12 1 0.786 1 0.175 1
29 TMR41 MS0822B 41 20071206 2007 12 06 1724 22.92 1 1.579 1 3.79 1 0.866 1 0.292 1
70 TMR41 MS0822B 41 20071206 2007 12 06 1724 25.32 1 1.723 1 4.93 1 0.919 1 0.400 1
150 TMR41 MS0822B 41 20071206 2007 12 06 1724 29.09 1 2.056 1 11.35 1 0.696 1 0.200 1
190 TMR41 MS0822B 41 20071206 2007 12 06 1724 30.60 1 1.958 1 10.88 1 0.101 1 0.117 1
239 TMR41 MS0822B 41 20071206 2007 12 06 1724 32.94 1 2.095 1 11.57 1 0.043 1 0.133 1
299 TMR41 MS0822B 41 20071206 2007 12 06 1724 36.13 1 2.258 1 15.23 1 0.054 1 0.108 1
400 TMR41 MS0822B 41 20071206 2007 12 06 1724 39.26 1 2.525 1 18.44 1 0.017 1 0.142 1
600 TMR41 MS0822B 41 20071206 2007 12 06 1724 39.75 1 2.623 1 27.16 1 0.041 1 0.000 1

```


Explanation of buttons in the data system:

Directory	displays (returns to) the Data Directory listing for this cruise
Documentation	displays the supporting documentation for this dataset
Data Display	returns to data display from documentation display
Download & Other Operations	options for download, sub-setting and reformatting of data
Level 0	returns to level 0
Next Level	expands the data to the next level of detail
Flat Listing	displays one record per line of the current level of data

Now that we've seen the data, let's look at it on a map. Return to the previous browser window (or tab) with the display of dataset metadata.

URL: <http://osprey.bco-dmo.org/dataset.cfm?id=13570&flag=viewp>

Click the **Map It** button to launch the MapServer GIS for this dataset. The browser opens a new window or tab, and the display should look similar to this for URL:

<http://mapservice.bco-dmo.org/mapserver/maps-ol/index.php?datasetId=13570>

The screenshot displays the BCO-DMO MapServer Geospatial Interface. The top navigation bar includes the BCO-DMO logo, the title "MapServer Geospatial Interface", and links for "Contact", "Help", and "NSF Acknowledgment".

The main interface is divided into several sections:

- BCO-DMO repository:** Contains search options: "BROWSE map", "KEYWORD search", "ADVANCED search", and "Start over". A "Quick find" field is present for entering a deployment name.
- Available programs:** A table listing programs and their counts:

Name	#
ASCOS	1
CAMEO	1
CoML	91
Dimensions of Biodiversity	0
ETBC	4
FeSynth	15
GoMX - DHOS	17
Historical	11
- Available projects:** A table listing projects and their counts:

Name	#
ACIDIC	3
Active bacteria in surface waters	1
AESOPS	16
Aleutian Archipelago	0
ALEX-GoME	38
AMT	0
- Available deployments:** A table listing deployments:

Name
KN192-05
- Visible deployments:** A section for highlighting selected deployments on the map, currently showing "KN192-05 (CoFeMUG)".
- Map:** A map of the Atlantic Ocean showing the deployment track in pink. The map includes a coordinate grid and labels for "Brazil Basin", "Angola Basin", and "Atlantic Ridge".
- Datasets:** A section for available datasets, currently showing "nutrients and metals" with deployment "KN192-05".

Some things to notice on the map shown on the previous page:

- The KN192-05 cruise track, with the map zoomed in to the area of the cruise (west coast of Africa).
- Up top, the MapServer is in “BROWSE map” mode.
- Because we launched the MapServer from the text-based data discovery system, the only “Available deployment” (in the right-most panel directly above the map) is KN192-05, the only deployment contributing data to this dataset.

Once again, there are many ways to access additional information from this display:

- Clicking the + box to the left of the KN192-05 cruise ID in the “Available deployments” or “Visible deployments” panels, displays metadata about that cruise including a link to the cruise report if one is available.
- In the “Visible deployments” panel (in the top-right corner of the window), right click on the cruise ID to display available options for that cruise.

Down below (right) in the “Datasets” panel:

- Clicking on the + symbol in the green circle, or anywhere on the row with the dataset name (nutrients and metals), requests that this dataset be ‘mapped’.

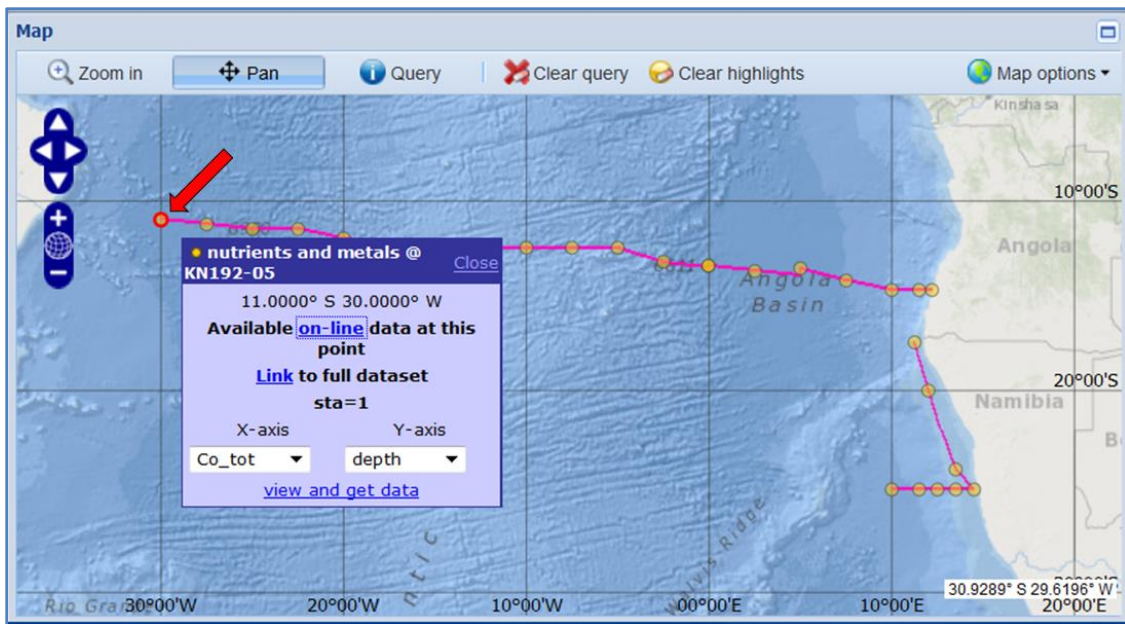
Try it ... small colored dots will appear on the map, and the Datasets panel on the right has shifted to a display of “Mapped datasets”, of which there is only one at the moment. The single mapped dataset is listed, with a color-coded dot, the dataset name (nutrients and metals), a number (28) that indicates the number of sampling locations included in this dataset, from the selected cruise (KN192-05).

Once again, we have several ways to get more information: Right-clicking anywhere on the text in the row with the dataset name pops up a menu with several options:

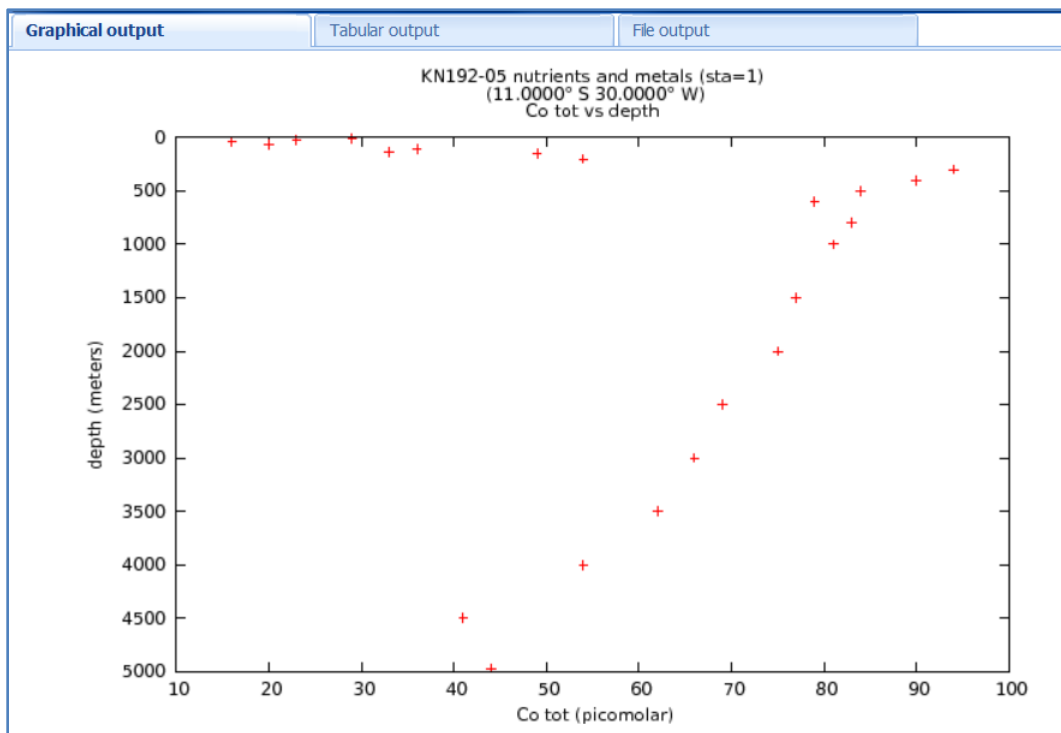
- “View/export mapped dataset” shows a tabular listing of the sampling locations, with options for data export;
- “View mapped dataset on-line” opens the full dataset online;
- “Choose a color” allows you to change the color of the dots on the map;
- “MapServer link to mapped dataset” gives you the ability to save/bookmark the MapServer link to this dataset (for later access)
- “Remove mapped dataset” removes this dataset from the map (removes the dots). Note that unchecking the box to the left of the dataset name temporarily removes the dataset. Checking the box again displays them.

The line underneath the dataset name, shows more options/information for each dataset (different options are available depending on the data type).

The MapServer also provides the ability to generate ‘quick view’ plots of the data at a sampling location. On the map, select the dot for station 1 (the western-most point indicated by the red arrow in the figure below), to bring up a dialog box that offers: links to the data from the database and a way to select variables from the dataset to generate a ‘quick view’ X-Y plot. (If the blue box ever gets in the way, just move it aside.)



Choose 'Co_tot' for the X-axis and 'depth' for the Y-axis. Click "view and get data" at the bottom of the box to generate the plot on the next page of total Cobalt concentration vs. depth.



Notice once again, several tabs at the top make it easy to view a tabular list of the data in the graph or download the data from the "File output tab". Close the graph.

(Note: this dataset has the option to plot data from multiple stations, as indicated by the line stating "Click here to create an aggregate graph by sta" under the dataset name in the "Mapped datasets" panel. This function will be demonstrated in part 3 of this tutorial.)

DATA ACCESS: MAP BROWSE

SCENARIO 2: You are interested in data from a particular geographic region.

Go to: <http://bcodmo.org/> the BCO-DMO home page

At the bottom of the DATABASE column on the left, click on the GEOSPATIAL ACCESS map.



The MapServer system map showing all the deployments from the BCO-DMO database opens in a new window or tab.

BCO-DMO MapServer Geospatial Interface

BCO-DMO repository

BROWSE map KEYWORD search ADVANCED search Start over Quick find: enter a deployment name

Available programs

Name	#
ASCOS	1
CAMEO	1
CoML	91
Dimensions of Biodi...	0
ETBC	4
FeSynth	15
GoMX - DHOS	17
Historical	11

Available projects

Name	#
ACIDIC	3
Active bacteria in sur...	1
AESOPS	16
Aleutian Archipelago...	0
ALEX-GoME	38
AMT	0

Include projects not belonging to any programs?

Available deployments

Name
A16N (RB-03-04B)
A16N (RB-03-04C)
AB_63_1
AB_63_2
AB_63_3
AB_63_4A
AB_63_A
AB_64_5
AB_64_6
AB_64_7
AB_64_8
ACIDIC-CMEN-GIFET

Visible deployments

Select deployment(s) to view dataset(s). Right-click a row for more options.

<input type="checkbox"/>	AB_63_1
<input type="checkbox"/>	AB_63_2
<input type="checkbox"/>	AB_63_3
<input type="checkbox"/>	AB_63_4A
<input type="checkbox"/>	AB_63_A
<input type="checkbox"/>	AB_64_5
<input type="checkbox"/>	AB_64_6
<input type="checkbox"/>	AB_64_7
<input type="checkbox"/>	AB_64_8
<input type="checkbox"/>	ACIDIC-CMEN-GIFET

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Map

Zoom in Pan Query Clear query Clear highlights Map options

Datasets

Available datasets Mapped datasets

Group by: deployment Remove all

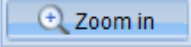
Select dataset(s) to add to your map. Right-click a row for more options.

Dataset	Deployment

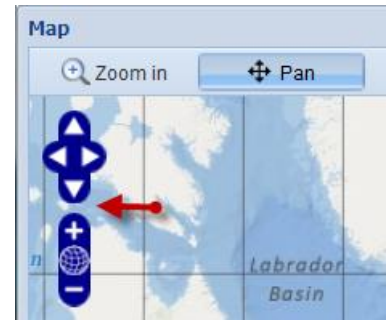
A common way to use the MapServer GIS is to define a region of interest on the map.

For example: you are interested in phytoplankton blooms in the North Atlantic.

The colored lines represent cruise tracks; symbols represent fixed sampling sites (e.g. mooring locations or time-series sites). Zoom in to the cruise track just west of Europe (between the Labrador and North Sea in the vicinity of Ireland at 50° N 20° W).

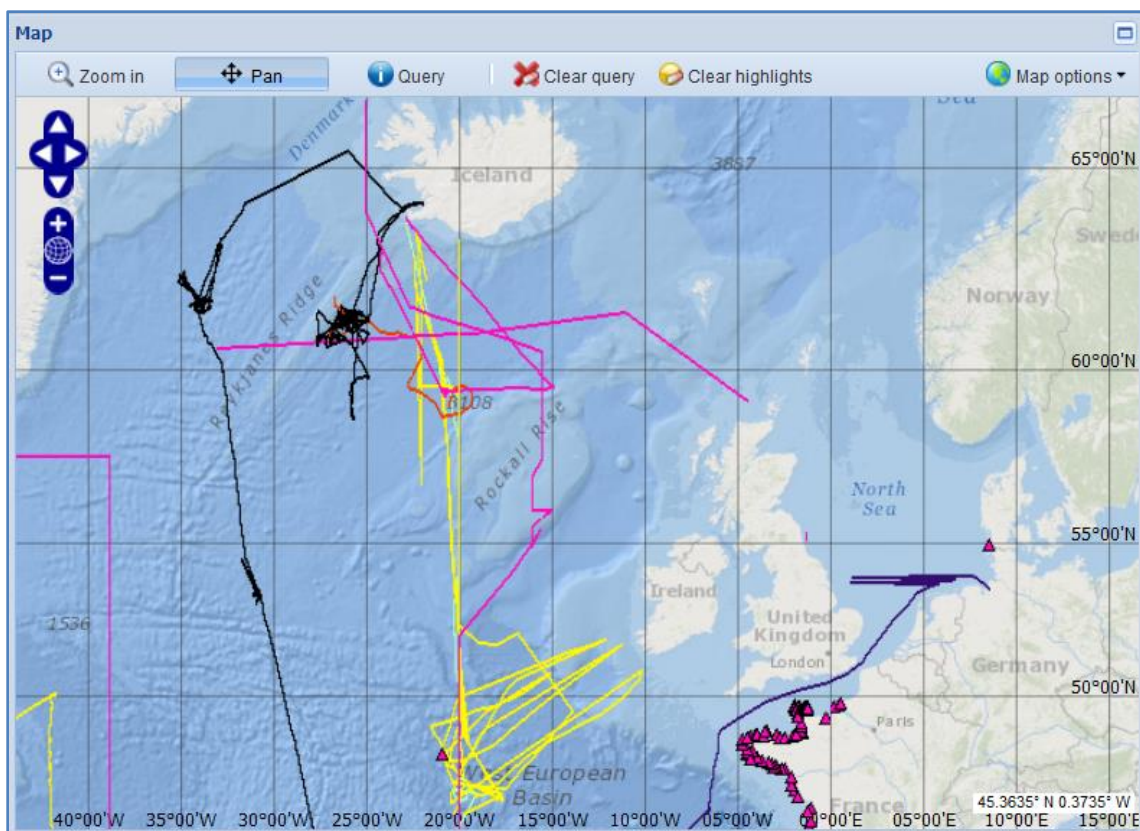
Click the “Zoom in”  button and then click and drag to define an area on the map.

Notice the available map positioning tools shown at right (indicated by the red arrow).



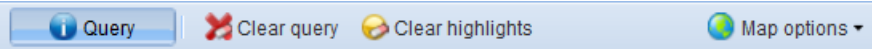
The default mode is Pan, and if using the “Zoom in” button you will need to put the “mapper” in Zoom mode each time if doing multiple zoom actions. Suggestion: once the area of interest has been selected using “Zoom in”, use the zoom tools (+ and - buttons).

Use the various map positioning tools (shown above right) until your map looks something like the screen shot below.



There is a lot of information displayed on this map and in the associated panels. We notice an assortment of cruise tracks (colored lines) and fixed sampling locations (colored triangles). The map system offers several tools for figuring out what is being shown on the map. The map controls appear in a tool bar above the map.

To find out what cruises these are, use the Query tool (click on the Query button now). Then click on a colored item on the map. For example, click on the cruise track southwest of Ireland (in the image below, this is the yellow line with the red X on it).



Look in the “Visible deployments” panel in the upper right of the browser window. The deployment we clicked on will be highlighted in light blue.

The screenshot shows the BCO-DMO repository interface. The top navigation bar includes buttons for Query, Clear query, Clear highlights, and Map options. The main interface is divided into several panels:

- Available programs:** A table listing programs such as ASCOS, CAMEO, CoML, ETBC, FeSynth, GoMX - DHOS, and Historical.
- Available projects:** A table listing projects such as ACIDIC, Active bacteria in su..., AESOPS, Aleutian Archipelag..., ALEX-GoME, and AMT.
- Available deployments:** A table listing deployments such as A16N (RB-03-04B), A16N (RB-03-04C), AB_63_1, AB_63_2, AB_63_3, AB_63_4A, AB_63_A, and AB_64_5.
- Visible deployments:** A list of deployments with a search bar and a 'Highlight selected deployments on map?' checkbox. The deployment 'Aircraft_P3_NABE' is highlighted in light blue.
- Map:** A map of the North Atlantic Ocean showing various cruise tracks. A yellow track with a red X is visible southwest of Ireland.
- Datasets:** A panel for managing datasets, including a 'Group by' dropdown and a 'Remove all' button.

The list of visible deployments indicates that the selected navigation track is from a deployment called “Aircraft_P3_NABE”. Clicking on the + sign to the left of the deployment name reveals that this track is from a NASA P3 aircraft flight done as part of the US JGOFS NABE basin study. Many more options are available by right-clicking on the deployment name or any other deployment of interest in the “Visible deployments” list.

But let’s find some data ...

Use the “Zoom in” tool to zoom in closer to the area around Iceland.

Click the “Query” button and then click on the cruise track southwest of Iceland (in the image below, this is the black line with the red X on it).

In the Visible deployments panel, this deployment is identified as KN193-03. Right click on the highlighted KN193-03 line in the Visible deployments panel, and select “View deployment metadata”.

The screenshot displays the BCO-DMO repository interface. The top navigation bar includes 'Contact', 'Help', and 'NSF Acknowledgment'. The main interface is divided into several panels:

- Available programs:** A table listing programs like ASCOS, CAMEO, CoML, etc.
- Available projects:** A table listing projects like ACIDIC, Active bacteria in su..., etc.
- Available deployments:** A table listing deployments like A16N (RB-03-04B), AB_63_1, etc.
- Visible deployments:** A list of deployments with a context menu open over 'KN193-03'. The menu options are: 'Single-out deployment', 'Zoom to deployment', 'View deployment metadata' (selected), and 'Export deployment as KML'.
- Map:** A map showing the North Atlantic region with various cruise tracks. A red 'X' marks a specific location on a black track southwest of Iceland.
- Datasets:** A section showing available datasets for the selected deployment, including 'Calibration Reports - NAB08', 'Cruise Track', 'CTD 1m averaged profiles', 'CTD full resolution profiles', and 'Niskin Bottle Hydrography'.

This opens up a new browser window or tab with a view of the deployment metadata/documentation (shown on the next page).

View of KN193-03 deployment (cruise) metadata (documentation) retrieved by the MapServer from the BCO-DMO database.

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Deployment: KN193-03

Map It

Deployment: KN193-03
 Deployment synonyms: NAB08 Process Cruise
 Coordinated deployments: B10-2008, B4-2008, B9-2008, Biofloat_48, SG140, SG141, SG142, SG143
 Platform: R/V Knorr
 Platform type: vessel
 Start date: 5/1/2008
 End date: 5/22/2008
 Location: subpolar North Atlantic, Iceland Basin, 60.7° to 61.7° N, 25° to 27.7° W


Deployment report: none

▼ Description

A three-week process cruise on the R/V Knorr operated in the vicinity of five autonomous platforms that had been deployed in early April by another vessel. A total of 10 simultaneous float and CTD calibration profiles were taken to calibrate sensors on the Lagrangian mixed layer float (Biofloat 48) and to validate proxy measurements (i.e., optical attenuation to particulate organic carbon, etc.). One simultaneous Seaglider and CTD calibration profile was collected for each of the four Seagliders. Knorr also carried out a number of bow-tie surveys around the Lagrangian mixed layer float. A second float, Biofloat 47, had ceased functioning shortly after deployment was rescued at the beginning of the cruise. Two SOLOPC floats were deployed but were damaged on deployment and sank. A number of successful short deployments of PELAGRA floating were made during the cruise.

Core ship-board measurements supported by project funding were: 1) CTD profiles (temperature, conductivity, oxygen, chlorophyll fluorescence, optical backscatter, and beam transmission) on all four cruises; 133 CTD profiles were obtained on this cruise. 2) analysis of water samples collected with the CTD Rosette (chlorophyll, HPLC pigments, nutrients, particulate organic carbon, particulate absorption spectrum, phytoplankton, oxygen and other guest investigator measurements).

GEOSPATIAL ACCESS



Return to the map (the browser window with this URL address:

<http://mapservice.bco-dmo.org/mapserver/maps-ol/index.php>). Most likely this is in the browser tab that precedes the one you have been looking at with the deployment metadata (that looks like the screen shot above).

Now take the map out of Query mode by clicking on the “Pan” button (to the left of the “Query” button) and then click the “Clear query” button to remove the red X from the map.

Let’s see what data the 2008 North Atlantic Bloom Experiment (NAB 2008) investigators have shared from their KN193-03 cruise.

In the “Datasets” panel (in the lower right of the browser window), select the “CTD 1m averaged profiles” dataset from the list of available datasets from this cruise. Notice the dots that appear on the map, which represent the CTD casts.

Use the Zoom + tool to zoom in until the spatial extent looks similar to the image below (some additional dialog windows from the next step have already been opened and are visible in the image below).

The screenshot displays the BCO-DMO MapServer Geospatial Interface. The top navigation bar includes 'BCO-DMO repository', 'MapServer Geospatial Interface', and links for 'Contact', 'Help', and 'NSF Acknowledgment'. Below the navigation bar are search and filter options: 'BROWSE map', 'KEYWORD search', 'ADVANCED search', 'Start over', and a 'Quick find' search box.

The main interface is divided into several panels:

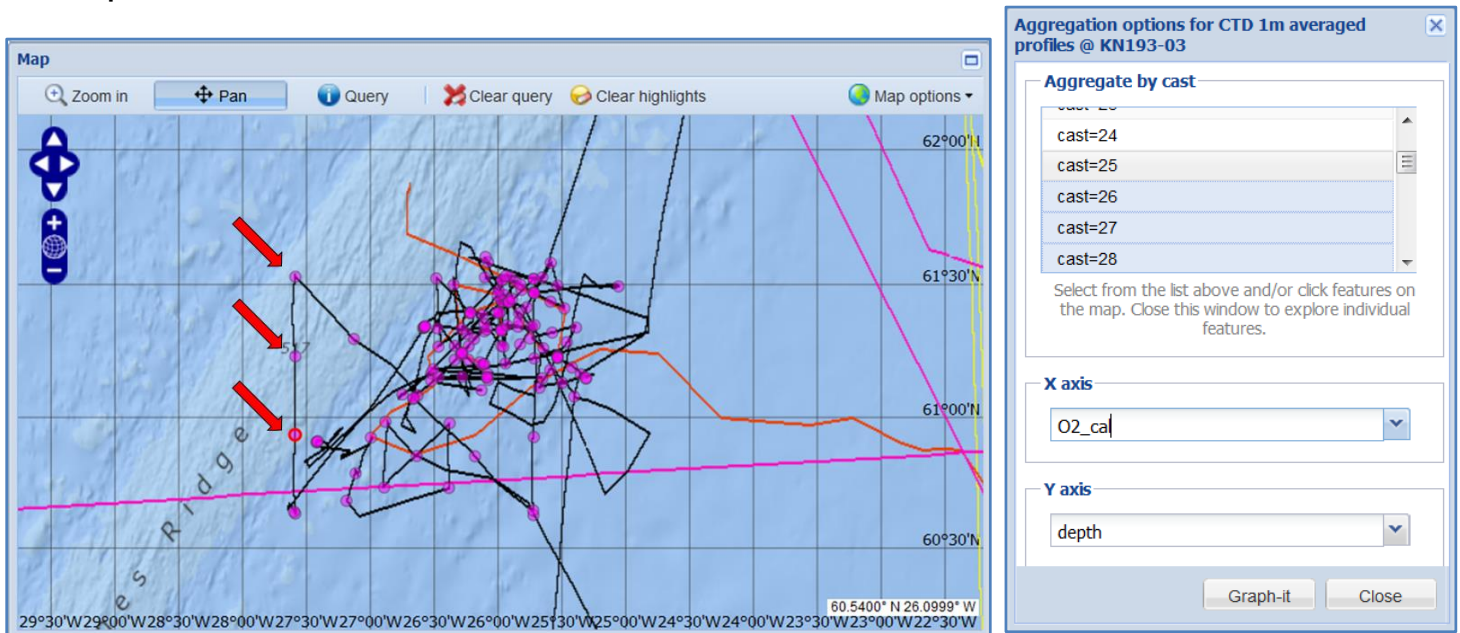
- Available programs:** A table listing programs like ASCOS, CAMEO, CoML, etc.
- Available projects:** A table listing projects like ACIDIC, Active bacteria in su..., AESOPS, etc.
- Available deployments:** A table listing deployments like A16N (RB-03-04B), AB_63_1, etc.
- Visible deployments:** A list of selected deployments including All-119-5, Aircraft_P3_NABE, Biofloat_48, etc.
- Map:** A map showing the spatial extent of the data, with a grid and coordinates. The map includes a 'Zoom in' button, 'Pan' tool, 'Query' tool, and 'Map options' dropdown.
- Datasets:** A panel showing 'Available datasets' and 'Mapped datasets'. The 'Mapped datasets' panel shows the selected dataset 'CTD 1m averaged profiles (133) @ KN193-03' with a red circle around the text 'Click here to create an aggregate graph by cast.'

This CTD dataset provides the option of making a graph containing data from multiple casts. In the “Mapped datasets” panel, click where indicated to create an aggregate graph by cast (circled in the image above).

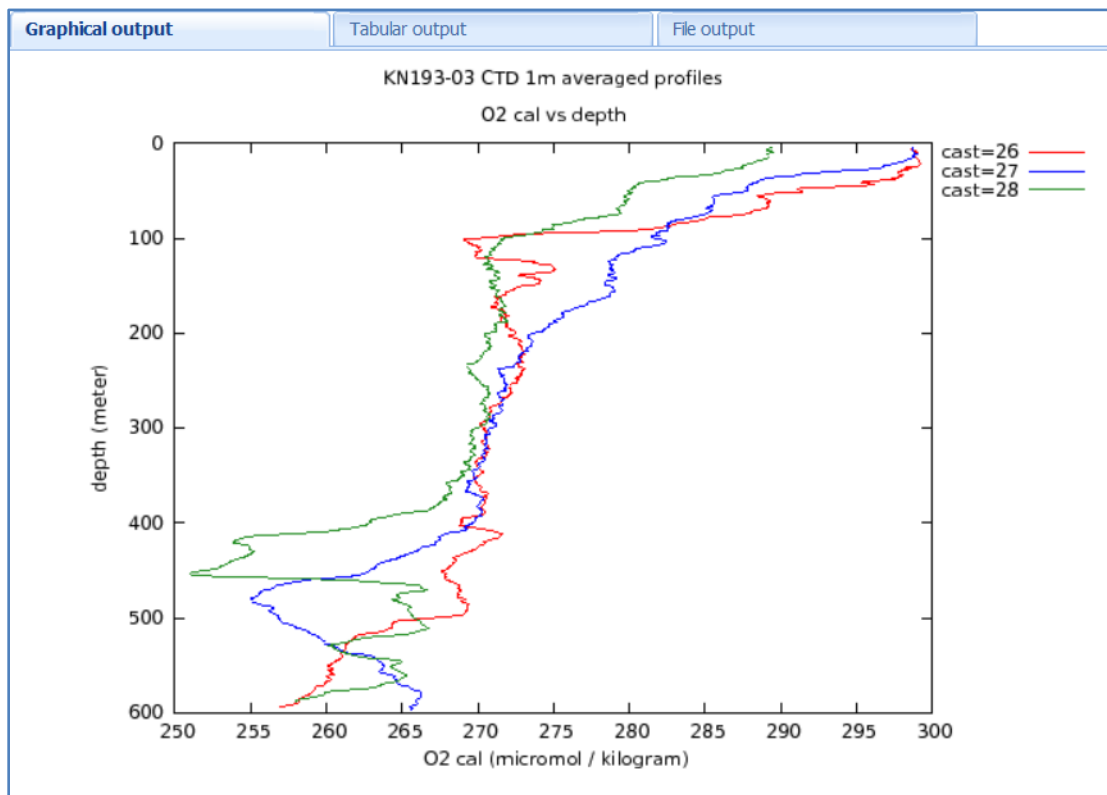
A window opens that allows you to choose the casts to include in the graph. Let’s make a graph of casts 26, 27, and 28. You can select stations in two ways:

1. Click on the dots on the map. Each selected dot will be highlighted in the aggregation options window; OR
2. Hold down the CTRL key and click on the station names in the aggregation options window.

Casts 26, 27, and 28 are indicated by the arrows in the image below. After selecting the stations (using either method), choose 'O2_cal' for the X-axis and 'depth' for the Y-axis. The aggregation options window should look like the image below. Then, click the "Graph-it" button.

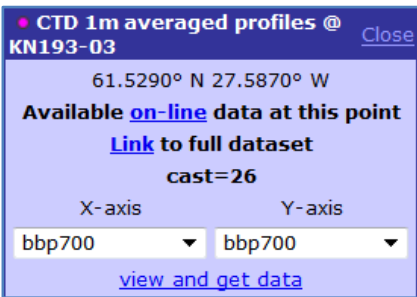


The resulting graph should look like the one below, where calibrated oxygen from 3 casts is plotted against depth. Each cast is represented by a different color, as indicated in the legend located in the upper left-hand corner.

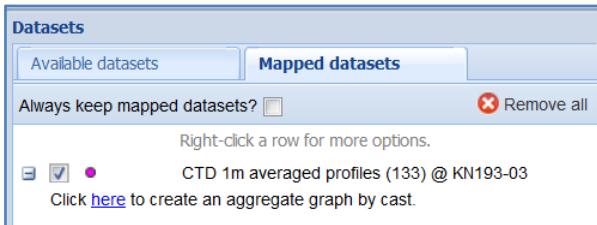


Close the graph and the aggregation options window.

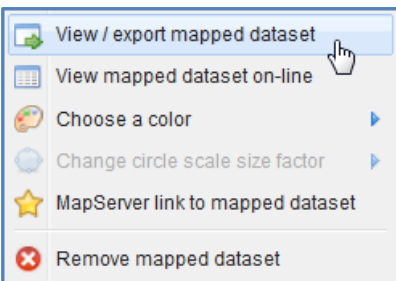
The data can be downloaded using several different methods:



From the map, one can view the data from any selected point (“Available on-line data at this point”), or one can view all the records in the full data dataset (“Link to full dataset”).



Another option is to right click on the dataset line in the Datasets panel (to the right of the map display).



Right clicking the dataset name brings up the dataset options menu, from which one can export the data. Choose “View/export mapped data”.

In addition to the data table display, one has the option to download the data as tab-separated values (TSV) or KML (Google Earth) formatted files.

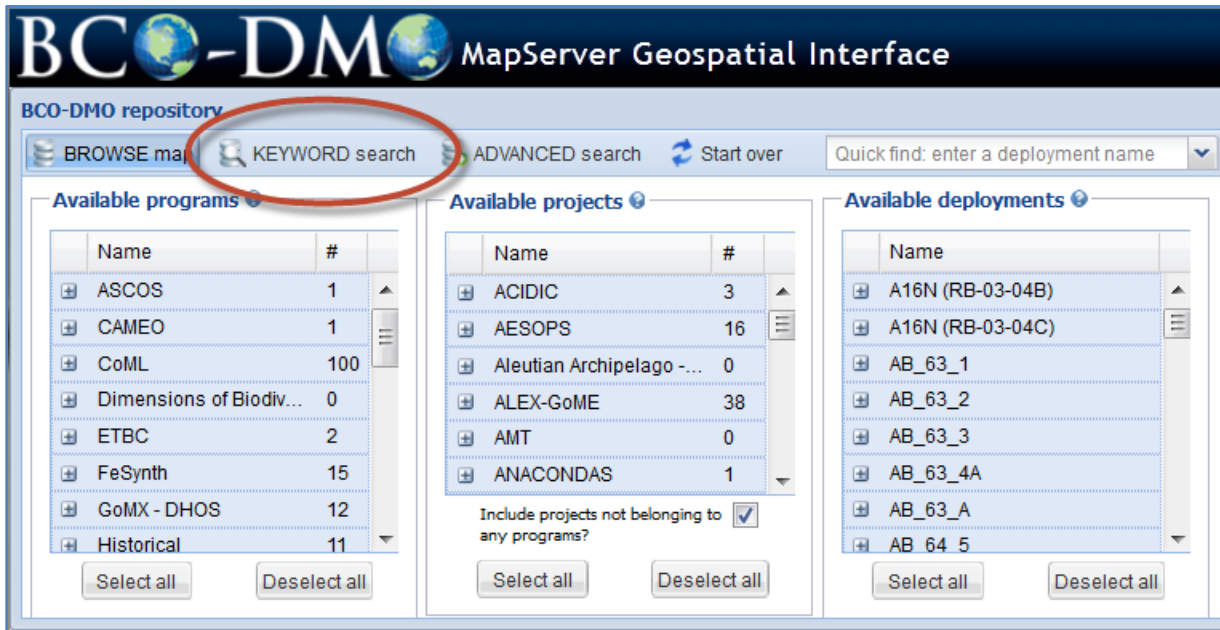
Locate on map	On-line link	ID	cast	date	time
center-map	highlight	link	cast=1	1	20080502 1905
center-map	highlight	link	cast=2	2	20080504 1657
center-map	highlight	link	cast=3	3	20080504 1921
center-map	highlight	link	cast=4	4	20080504 2222
center-map	highlight	link	cast=5	5	20080505 0227
center-map	highlight	link	cast=6	6	20080505 0516
center-map	highlight	link	cast=7	7	20080505 1002
center-map	highlight	link	cast=8	8	20080505 1300
center-map	highlight	link	cast=9	9	20080505 1639
center-map	highlight	link	cast=10	10	20080506 0934
center-map	highlight	link	cast=11	11	20080506 1118
center-map	highlight	link	cast=12	12	20080506 1312
center-map	highlight	link	cast=13	13	20080507 0847
center-map	highlight	link	cast=14	14	20080507 1233
center-map	highlight	link	cast=15	15	20080507 1546
center-map	highlight	link	cast=16	16	20080507 2156
center-map	highlight	link	cast=17	17	20080508 0209
center-map	highlight	link	cast=18	18	20080508 0504

Cancel Save as TSV Save as KML

DATA ACCESS: MAP KEYWORD SEARCH

SCENARIO 3: You are interested in data of a particular type from a particular geographic area.

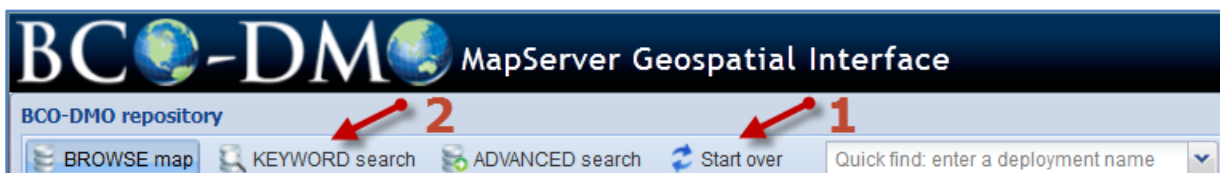
The MapServer has a KEYWORD search that is useful for finding certain types of data.



The screenshot shows the BCO-DMO MapServer Geospatial Interface. At the top, there are navigation tabs: BROWSE map, KEYWORD search (circled in red), and ADVANCED search. To the right of these tabs is a 'Start over' button and a 'Quick find: enter a deployment name' dropdown menu. Below the tabs are three panels: 'Available programs', 'Available projects', and 'Available deployments'. Each panel contains a table with columns for 'Name' and '#'. The 'Available programs' table lists programs like ASCOS, CAMEO, CoML, etc. The 'Available projects' table lists projects like ACIDIC, AESOPS, etc. The 'Available deployments' table lists deployments like A16N (RB-03-04B), AB_63_1, etc. Each panel has 'Select all' and 'Deselect all' buttons at the bottom.

To test out the KEYWORD search function,

1. Click “Start over” in the top tool bar above the search panels (to clear the map and restart with a fresh map), and
2. click the “KEYWORD search” menu item toward the upper left-hand corner of the browser.



This screenshot is similar to the previous one but highlights the steps mentioned in the text. A red arrow labeled '1' points to the 'Start over' button, and another red arrow labeled '2' points to the 'KEYWORD search' tab.


Enter something of interest in the “Keyword search string” text entry box.

For example, type in “pigments”.


If you are interested in pigments from only a certain geographic area, you can zoom-in to that area on the map, then choose “Yes” next to “Restrict results to map?”


You may also specify a date range in the minimum and maximum date fields.

Search criteria

Keyword search string (optional): 


Restrict results to map? Yes No

Minimum date (optional): 

Maximum date (optional): 

Results will appear in a new window.

For now, let's just search for "pigments". Click the "Run Search" button. The results appear in a new window. Select the eighth one down, "chlorophyll phaeophytin".

Keyword search results 

Dataset	Description
AREAL Summary	Summary of Areal (mixed layer integrated) data
bottle_merged	Merged bottle and nutrient data
bottle_summ	Niskin bottle summary product; basic hydrographic data, thorium-234, pigments and nutrients
Chl - Summary	Measured Chlorophyll a and Phaeopigment concentrations
chlorophyll	Chlorophyll data from EN321 and EN325, Georges Bank, 1999
chlorophyll and phaeophytin	pigments; chlorophyll and phaeophytin
chlorophyll_oxygen	Niskin bottle chlorophyll, Phaeo and oxygen
chlorophyll_phaeophytin	pigments chlorophyll-a and phaeophytin sampled from Niskin bottles
chloro_Daly	Chlorophyll data (CTD water bottle data) from LMG0203
chloro_Vernet	Chlorophyll data from bottles, buckets and ice
chlor_phaeo	Extracted Chlorophyll and Phaeopigment, Georges Bank, 1995.
chl_fluor	Chlorophyll-a and phaeopigments, fluorometric method
CTD Profiles	Two decibar-averaged CTD profiles from the Hawaii Ocean Time-Series (HOT)
dist-pp	Productivity, PIC, Chl-a and Phaeo Pigments along ship's track
GT10 - CTD - ODF/SIOR Bottle	CTD - ODF/SIOR Bottle
GT11 - CTD - ODF/SIOR Bottle	CTD - ODF/SIOR Bottle
HPLC	HPLC Pigments
HPLC pigments OC	pigments from HPLC analysis of bottle samples collected aboard Oceanus

The map updates to show that these data have been reported from two deployments: OC404-01 and OC404-04. At this point, you can choose a different search result if this was not what you were looking for, or you close the results window. Let's close the search results. Zoom-in to the cruise tracks (if needed).

The cruise tracks are displayed on the map, and the datasets available from both cruises are listed in the "Datasets" panel. They are grouped by dataset by default. Choose "deployment" from the "Group by" drop-down menu to change the grouping. (This is more useful for cruises that have many datasets.)

Datasets

Available datasets | Mapped datasets

Group by: deployment Remove all

Select dataset(s) to add to your map. Right-click a row for more options.

Dataset	Deployment
Deployment: OC404-01	
HPLC pigments OC	OC404-01
chlorophyll_phaeophytin	OC404-01
Deployment: OC404-04	
HPLC pigments OC	OC404-04
chlorophyll_phaeophytin	OC404-04

The datasets have been discovered and at this point one can proceed to map the datasets, view the data, or make quick view plots.

BCO-DMO repository | MapServer Geospatial Interface

Contact | Help | NSF Acknowledgment

Search criteria

Keyword search string (optional): pigments

Restrict results to map? Yes No

Minimum date (optional):

Maximum date (optional):

Results will appear in a new window.

Run search | Clear search

Available deployments

Name
OC404-01
OC404-04

Select all | Deselect all

Visible deployments

Highlight selected deployments on map?

Select deployment(s) to view dataset(s). Right-click a row for more options.

OC404-01 (EDDIES 2004 Survey 1)
OC404-04 (EDDIES 2004 Survey 2)

Page 1 of 1 | 1 - 2 of 2

Map

Zoom in | Pan | Query | Clear query | Clear highlights | Map options

Map showing North Atlantic Ocean with cruise tracks for OC404-01 and OC404-04.

Datasets

Available datasets | Mapped datasets

Group by: deployment Remove all

Select dataset(s) to add to your map. Right-click a row for more options.

Dataset	Deployment
Deployment: OC404-01	
HPLC pigments OC	OC404-01
chlorophyll_phaeophytin	OC404-01
Deployment: OC404-04	
HPLC pigments OC	OC404-04
chlorophyll_phaeophytin	OC404-04

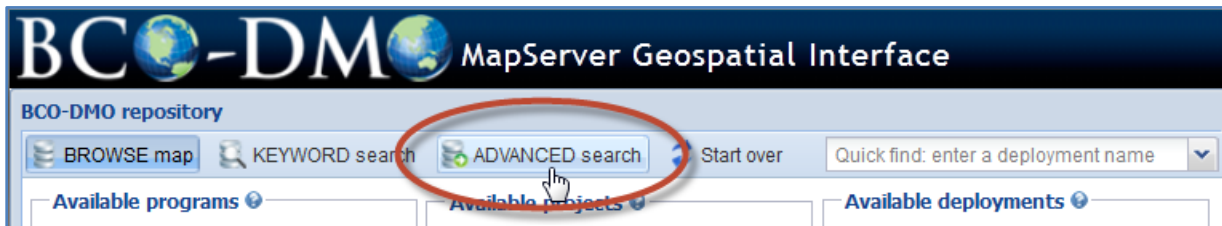
DATA ACCESS: MAP SEMANTIC SEARCH

SCENARIO 4: You have an idea what you are looking for, but you do not know the Program, Project, or Deployment name.

The MapServer ADVANCED search is a semantically-enabled, faceted search. It provides access to the same data as the “BROWSE map” and “KEYWORD search” modes, but the use of the facets (search categories) allows the user to construct their own hierarchical filter/search.

A beta version of this interface was released in May 2012, and is available as the ADVANCED search option (still as a beta version) from the MapServer.

Try it out ...



Click on the ADVANCED search button. The map interface will reinitialize, clearing any selections you have made previously; click “Yes” in the pop up dialog box to confirm this and to continue. The browser should look like the image on the next page.

The screenshot displays the BCO-DMO MapServer Geospatial Interface (beta). The interface is divided into several panels:

- Search Panel (Left):** Contains three search facets: "Programs" (listing studies like Arctic Summer Cloud Ocean Study), "Projects" (listing research topics like Algal Communities in Distress), and "People" (listing researchers like Abbott, Mark). There are also sections for "Deployments" and "Instrument Categories".
- Datasets Panel (Top Right):** Shows a table of available datasets, grouped by deployment. The table includes columns for "Dataset" and "Deployment".

Dataset	Deployment
Deployment: 2009-MI_LOCO-Lander	
Moorings - Metadata	2009-MI_LOCO-Lander
SH70 SAMI pCO2	2009-MI_LOCO-Lander
Deployment: 2010-MI_LOCO-Lander	
Moorings - Metadata	2010-MI_LOCO-Lander
SH70 SAMI pCO2	2010-MI_LOCO-Lander
Deployment: 2010-PISCO_moorings-LB	
Moorings - Metadata	2010-PISCO_moorings-LB
Deployment: 2010-PISCO_moorings-SH	
- Visible deployments Panel (Middle Left):** A list of deployment identifiers such as AB_63_1, AB_63_2, AB_63_3, AB_63_4A, AB_63_A, AB_64_5, AB_64_6, AB_64_7, AB_64_8, ACIDIC-CM..., ACIDIC-FCK..., ACIDIC-SHL..., AE0811, AE0813, AE0816, AE0820, and AE0823.
- Map Panel (Bottom Right):** A map of the Arctic region showing various deployment locations marked with colored symbols and lines. The map includes a search bar, "Clear query", "Clear highlights", and "Map options" buttons.

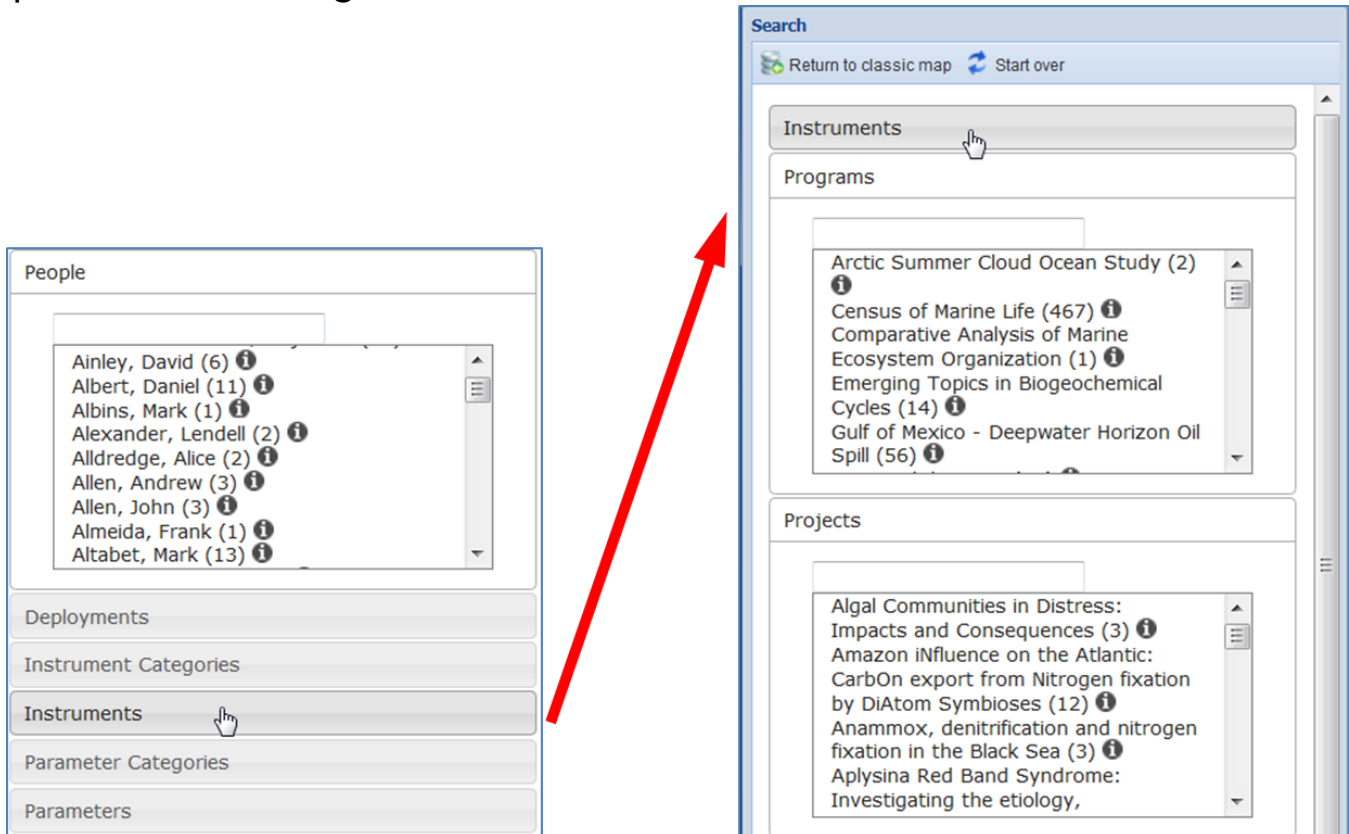
The elements of the ADVANCED (semantic) search interface are similar to the MapServer layout you have seen in the previous scenarios in this tutorial, but those elements have been rearranged. The search panel is now on the left, the map on the lower right, and the dataset panel is above the map.

The Search panel initializes with the Programs, Projects and People search boxes (or “facets”) open and active. The facets can be arranged by clicking on the facet label, then dragging and dropping at the desired location within the left-hand panel. Selections made in the upper facets narrows the choices in the active facets below. Selections made in the search facets are reflected in the “Available datasets” panel above the map.

For this exercise, let’s assume you know the type of instrument that collects the data you want to find. For example, you have read a paper about some data collected with a MOCNESS system using 1-m² nets, and the paper says the data are available from BCO-DMO.

In the search panel on the left, scroll down so you can see the “Instruments” bar.

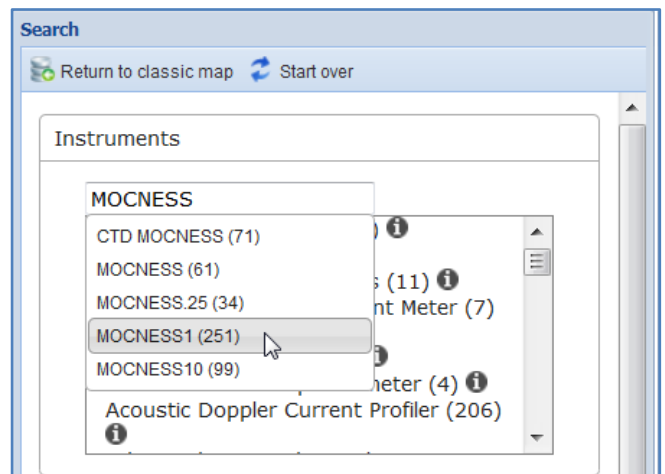
Click anywhere in the Instruments bar, drag it up to the top of the Search panel, and drop it above the “Programs” box.



Now, click on the “Instruments” title to open that search facet.

Enter an instrument name to search for; for example, in the text entry box under the label “Instruments”, type “MOCNESS”. We are interested in a MOCNESS with 1-m² nets, so select “MOCNESS1” from the list of matches that pop up.

Observe how the lists change in the open search boxes (Programs, Projects, People) below Instruments and the list of “Available datasets” and “Visible deployments” (the panels on the right of the browser window) also get updated to reflect that you are only interested in data from a MOCNESS1 tow.



At this point you could further narrow the search by selecting a deployment on the map, or by selecting a dataset that looks interesting, but let’s try choosing a deployment (cruise ID) from the “Deployments” search box.

In the Search panel on the left, scroll down and slide the Deployments facet up above “Programs” (below “Instruments”). Open the “Deployments” search facet. Scroll down to EN307 and click on it to select it from the list. Observe how the panels on the right update to display only results from deployment EN307.

If you scroll down in the Search panel, you can see that the EN307 MOCNESS1 data were reported by Peter Wiebe (indicated in the “People” panel) as part of the US GLOBEC Georges Bank project (indicated in the “Programs” panel). There is one dataset “zoo_MOC_GoM” listed in the “Available Dataset” section. Your browser window should look similar to the image below.

The screenshot displays the BCO-DMO MapServer Geospatial Interface (beta). The search panel on the left shows the following facets:

- Instruments:** MIT Vane (1), MOCNESS (61), MOCNESS.25 (34), MOCNESS1 (251), MOCNESS10 (99), Manual Biota Sampler (9), Marine-Atmospheric Emitted Radiance Interferometer (1).
- Deployments:** EN267 (2), EN267I (2), EN268 (1), EN274 (2), EN276 (4), EN278 (4), EN282 (4), EN307 (1), EN319 (2).
- Programs:** U.S. GLOBal ocean ECosystems dynamics (1).
- Projects:** U.S. GLOBal ocean ECosystems dynamics (1).

The Datasets panel on the right shows the available datasets for deployment EN307:

Dataset	Deployment
zoo_MOC_GoM	EN307

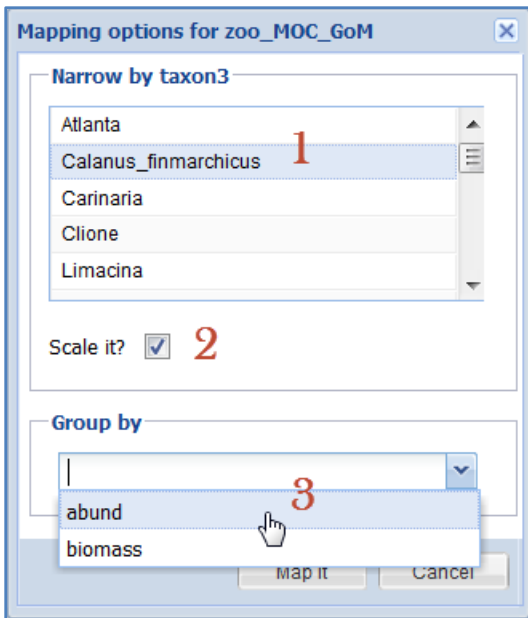
The map on the right shows the Gulf of Maine region with a deployment track overlaid. The track starts near Boston and extends eastward towards Browns Bank. The map includes a coordinate grid and a scale bar.

The close-up screenshot shows the Datasets panel with the following details:

- Available datasets:** zoo_MOC_GoM
- Deployment:** EN307
- Action:** Add dataset to map

To map the dataset, click on the “zoo_MOC_GoM” dataset from the “Available datasets” panel in the upper right.

A dialog box pops up with “Mapping options” for this dataset. This particular type of dataset has some custom mapping options.

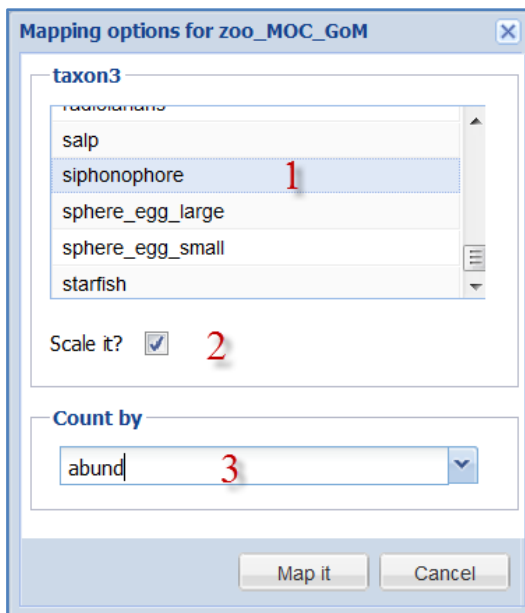


Select the options in the dialog box:

1. First, you must choose a taxon from the list. Select *Calanus finmarchicus*.
2. Select the “Scale it” option to display the results using symbol sizes scaled to indicate higher or lower values.
3. Last, you can choose “biomass” or “abund” (abundance) as the measurement by which to group the data. Select abund.

Click the “Map it” button to see the results.

The relative size of the circles indicates differences in the abundance of *Calanus finmarchicus* at the MOCNESS1 sampling locations on this cruise.



One can display multiple taxa from a MOCNESS1 dataset. Click on the “Available datasets” tab and then click on the zoo_MOC_GoM dataset once again. In the pop up dialog box, scroll to the bottom of the taxon list and select (1) siphonophore, (2) “Scale it”, and (3) abund.

Click the “Map it” button to put the scaled symbols on the map indicating abundance of siphonophores from the MOCNESS1 tow data.

As with the other MapServer search modes, clicking or right-clicking on different elements in the display pops up dialog boxes that display either information about the item or additional options for that item (e.g. access to that selection in the database, or the option to do ‘quick view’ plots).

The final browser window looks something like this if you have clicked on the northern most sampling location.

The screenshot displays the BCO-DMO MapServer Geospatial Interface (beta) with the following components:

- Search Panel:** Includes "Return to classic map" and "Start over" buttons.
- Instruments Panel:** Lists various instruments such as MOCNESS (61), MOCNESS.25 (34), MOCNESS1 (251), MOCNESS10 (99), Manual Biota Sampler (9), Marine-Atmospheric Emitted Radiance Interferometer (1), Mass Spectrometer (24), and McLane Pump (14).
- Deployments Panel:** Lists deployment IDs including EN268 (1), EN274 (2), EN276 (4), EN278 (4), EN282 (4), EN307 (1), EN319 (2), EN320 (4), and EN322 (2).
- Programs Panel:** Lists "U.S. GLOBAL ocean ECosystems dynamics (1)".
- Datasets Panel:** Shows "Mapped datasets" with two entries:
 - zoo_MOC_GoM (4) @ EN307:** taxon3: Calanus_finmarchicus, circle scale factor 1, grouped by abund. Legend shows five pink circles of increasing size corresponding to values 817, 1977, 3136, 4296, and 5455.
 - zoo_MOC_GoM (4) @ EN307:** taxon3: siphonophore, circle scale factor 1, grouped by abund. Legend shows five yellow circles of increasing size corresponding to values 2, 29, 56, 83, and 111.
- Visible deployments Panel:** Shows "EN307" selected.
- Map Panel:** Displays a map of the Gulf of Maine with a popup window for "zoo_MOC_GoM @ EN307". The popup provides coordinates (43.5157° N 67.8867° W), a link to the full dataset, total count (2,216), and cast number (4). It also includes dropdown menus for "abund" on both X and Y axes and a "view and get data" link.

Glossary of Terms

BCO-DMO	Biological and Chemical Oceanography Data Management Office http://bcodmo.org/
GIS	Geospatial Information System; a map system to display spatial data
MapServer	Open Source software for publishing spatial data and providing interactive mapping applications via the Web http://mapserver.org/
OCB	Ocean Carbon and Biogeochemistry research program http://www.us-ocb.org/
US GLOBEC	GLOBAL Ocean ECosystems Dynamics research program http://www.usglobec.org/
US JGOFS	United States Joint Global Ocean Flux Study http://usjgofs.whoi.edu/

Acknowledgments

The MapServer interface is a custom implementation of the Open Source MapServer software developed at the University of Minnesota. The BCO-DMO MapServer system is the result of collaboration between programmer Charlton Galvarino (Second Creek Consulting, Columbia, SC) and BCO-DMO staff members. In particular, BCO-DMO marine biology data specialist, Dicky Allison has led this development effort. Funding for this work is provided by the National Science Foundation Division of Ocean Sciences and Office of Polar Programs.



<http://bco-dmo.org>

HOW TO SUBMIT DATA

DATA CONTRIBUTION:

BCO-DMO works with investigators to publish data from research projects funded by the NSF Geosciences Directorate (GEO) Division of Ocean Sciences (OCE) Biological and Chemical Oceanography Sections and Polar Programs (PLR) Antarctic Sciences (ANT) Organisms and Ecosystems Program. Once published, BCO-DMO also fulfills NSF requirements for long-term preservation by submitting data to the appropriate national data center for archive (e.g., NOAA's National Oceanographic Data Center).

To start the process, please visit our "How to Get Started" page:

<http://www.bco-dmo.org/how-to-get-started>

Here you will find the necessary forms to contribute metadata related to programs, projects, deployments and datasets. These forms are available in Rich Text Format (.rtf), making them accessible using any word processing application:

Program: A large coordinated research effort, usually comprising multiple projects generating several datasets. (e.g., OCB, U.S. GEOTRACES, SEES-OA)

Project: A project usually encompasses one or more datasets, and may be part of a larger program (e.g. CoFeMUG is a project affiliated with U.S. GEOTRACES), or could be (and most are) unaffiliated with any program.

Deployment: A specific cruise, mooring, laboratory or some other unique event of data collection and/or analysis.

Dataset: A collection of values representing scientific observations, measurements, or derivations.

Step 1: Complete Metadata Forms

Use the forms described above to document new information to the Office.

Step 2: Prepare Data Files

We accept data in any format, however comma or tab-delimited (preferred), or Excel spreadsheets are most common. If the dataset is too large to contribute as an email attachment, contact our office for instructions on the best way to contribute your data.

Step 3: Email BCO-DMO

Once completed, metadata forms and data files can be emailed as attachments to the office along with a brief communication explaining the nature of the submission, by addressing the email to: info@bco-dmo.org

You will receive a response from the Office confirming your submission and informing you of the staff assigned to your dataset. BCO-DMO staff members will work with you to publish your data and metadata.

Additional Information:

Also available on the “How To Get Started” page are useful links to additional information on the NSF OCE data policy, submitting data in spreadsheets, data archives, and more. Feel free to contact the Office with any questions or concerns you may have regarding your data submission.