

## **SEAMOUNTSONLINE: AN ONLINE RESOURCE FOR DATA ON THE BIODIVERSITY OF SEAMOUNTS**

**Karen Stocks**

*University of California San Diego, SDSC, MC 0505, 9500 Gilman Drive, La Jolla, CA 92093-0505 USA*  
*kstocks@sdsc.edu*

### **ABSTRACT**

SeamountsOnline is an online resource for researchers and managers seeking data on the biodiversity of seamounts (undersea peaks in the ocean's floor). The goal is to bring together data on species that have been sampled or observed from seamounts and make these data freely available through a searchable website (<http://seamounts.sdsc.edu>). The data in SeamountOnline are being compiled from many literature publications and the holdings of researchers and institutions working on seamounts. The database covers seamounts globally and includes fishes, invertebrates, and plants; users can view a list of the species that have been found on a particular seamount, a list of all the seamounts from which a particular species has been found, find out what amount of research has been done on a particular seamounts, and search a bibliography of over 1200 literature references on seamounts. SeamountsOnline is currently serving data on 2700 species (or higher taxonomic groups) from almost 200 seamounts, and is expanding continually.

### **INTRODUCTION**

Seamounts are submerged mountains on the ocean's floor. They are of interest to scientific research and biodiversity studies because they support unique communities of life. As described in Stocks (this vol.) and Froese and Sampang (this vol.), many seamounts have assemblages of species not found in other deep-sea habitats, high levels of endemic species (species found only on one seamount or seamount range and nowhere else in the oceans to date), certain extremely long-lived and slow-growing species, and a few examples of 'living fossils' – species thought long extinct. Why seamounts support such unusual ecosystems, and what they can tell us about the processes that create and maintain species in the oceans, are active areas of scientific research.

Seamounts are also of conservation, management, and policy concern. Major commercial fisheries target the dense schools of fishes that aggregate around some seamounts, and there is growing concern that these fisheries are not managed sustainably and are damaging fragile communities on seamounts (Stocks, this vol.; Froese and Sampang, this vol. Watson and Morato, this vol.). Countries are working to manage these fisheries and decide whether and where to site marine protected areas on seamounts within their national waters. Internationally, the need for marine protected areas or other fisheries controls for seamounts in the high seas is being considered within the United Nations (Alder and Wood, this vol.).

Both scientific and management interests in seamounts share the need for access to information on the biodiversity of seamounts. While a substantial amount of research has been conducted on seamounts, most studies have looked at a single seamount or small seamount chain. The data have been published in many sources, in many languages, and some cases remain in unpublished datasets held by researchers or institutions – they are not easily accessible. The purpose of SeamountsOnline (<http://seamounts.sdsc.edu>) is to aggregate and integrate the disparate sources of data on the biodiversity of seamounts and make them freely and openly available (for non-commercial uses) through a searchable web portal (Stocks, 2004b).

SeamountsOnline is also a data contributor to the Ocean Biogeographic Information System (Zhang and Grassle, 2003), an international portal for marine species distribution data. Data in SeamountsOnline can be accessed through the OBIS website at <http://www.iobis.org> as well as through the SeamountsOnline website.

## DATA CONTENT

The core information that SeamountsOnline collects is a species distribution record: this is a record of the observation or collection of a particular species from a known seamount location. The project is compiling a database of these records, drawing them from the published literature and from the electronic data holdings of researchers and institutions. The spatial scope is global – data from seamounts the world over are being included. Biologically, the system covers only multicellular organisms: fishes, plants, and invertebrates. The focus is on species-level information, but because it is often difficult to identify organisms down to species the system also accommodates data on genera, families, and other less-precise groups.

Supporting each record is information on who provided the record and how and when the sample was collected or the observation made. SeamountsOnline strives to collect data from high-quality resources – peer-reviewed publications and datasets from reputable institutions and researchers are targeted – but cannot guarantee that these data resources are error-free. The system provides as much supporting information as possible to allow people to make an informed choice about using the data contents.

The system also gives information on the source of each record in order to credit the data providers. SeamountsOnline does not compensate people who contribute datasets – data are contributed by the dataset owners as a service to the community. In order to acknowledge this contribution, SeamountsOnline always attaches source information to every record served, and requires users to cite the original data source(s), not just SeamountsOnline, when using data in publications or presentations. In the spirit of facilitating free and open access to data, SeamountsOnline also makes all of its data available through the Ocean Biogeographic Information System (<http://www.iobis.org>), an international federation of marine data providers.

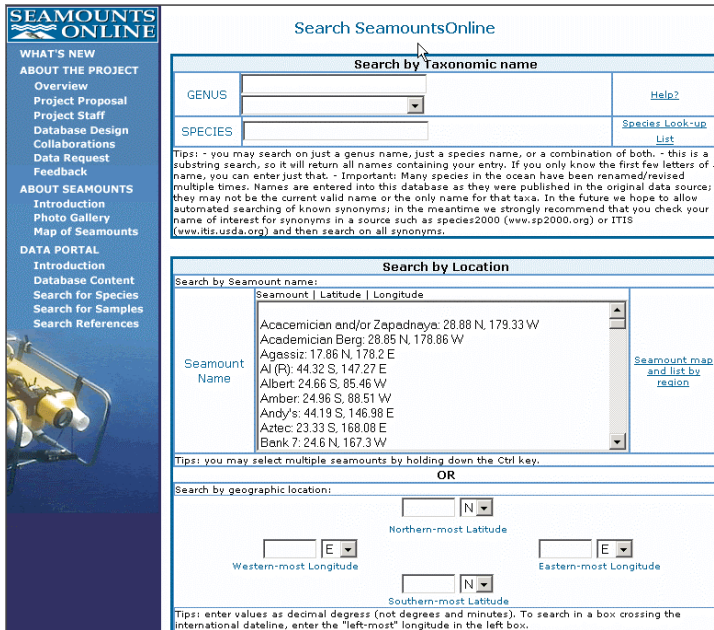
At the time of writing, SeamountsOnline held 10100 records that included 2700 species or higher taxonomic groups and 190 seamounts. This is by far the largest resource for seamount biology that exists. But it is a work in progress, and is not complete – there are existing seamount data that remain to be included. The SeamountsOnline project is actively seeking, and continually entering, new data. Certain regions and groups of organisms are better represented than others, and the reader is referred to the 'Database Content' link on the SeamountsOnline webpage for a current description of the holdings. In part the coverage represents the progress of SeamountsOnline in incorporating data, and in part it reflects the strengths and gaps in the sampling that has been done to date.

## USING THE SYSTEM

There are three main avenues through which users can access the data in SeamountsOnline. Each is described below, and can be reached through a link on main menu of the SeamountsOnline homepage.

### *Search for Species*

Through this search interface, the user can specify 1) a species or genus of interest and/or 2) either a particular seamount by name or a geographic area by latitude and longitude bounds. Figure 1 shows the interface for this option. From a search on a species or genus name the system will return a list of all seamount locations where that taxon has been found. From a search on a seamount name or region the system will return a list of all species that have been recorded from that location. The default return is a data table containing the taxonomic name (genus, species, and, where available, subspecies, and authority), seamount name, latitude and longitude with precision estimates, and the author(s) and publication year of the original data source (Figure 2). In the search interface, users can request the following additional fields: Family and Phylum name, depth of capture, date collected, number collected, and the full bibliographic citation of the source data. Each observation includes a sample number that is live-linked to the full sample information (see below). The results from a search can be downloaded either as a tab-separated text table or as a Microsoft Excel file. They can also choose to download the full sample information associated with each observation, either as one merged table or as separate species-observation and sample tables.



**Figure 1.** Interface for the “Search by Species” search option. The user can enter a genus or species of interest to retrieve a list of all the locations where that organism has been found, or can select a location of interest (by either clicking a seamount name or entering a latitude-longitude box) to see all the species recorded from that seamount. The searches can also be combined to ask for “all records of genus X in region Y.”

### Search for samples

This interface describes the amount of sampling activity that has been conducted on a particular seamount. This information is important for evaluating whether species lists are complete and representative, and whether data are comparable between seamounts. For example, if a seamount of interest has only been sampled with a bottom trawl, then the absence of a particular midwater species from the observations does not necessarily mean that the species is not present there. To search for samples, the user selects a seamount of interest. The system returns a list of all the samples known from that seamount. The returned data for each sample includes, where available, the date(s) taken, the latitude and longitude location with precision, the depth, the depth zone (i.e., benthic or midwater), whether the sample was quantitative, the station or sample name/number given in the original data source, the gear used, the taxonomic groups recorded (e.g., “only fish were counted”), the cruise and vessel, and the individual or institution taking the sample (Figure 3). The results from a given seamount can be downloaded as either a tab-separated text file or as a Microsoft Excel file.

Results from your search in SeamountsOnline

Please cite both SeamountsOnline and the original data source when using these data.

Click on any field title to see a definition of that field.

Species Data (comma delimited text) [Download]

Back to Search for Species Page

Genus	Species	Subspecies	Authority	Seamount Name	Sample ID	Latitude	Longitude	Lat/Lon Precision	Data Source
Adelosebastes	latens		Abe and Nakabo	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Apristurus	sp.			Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Barbourisia	rufa		Parr, 1945	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Chaceon	imperialis		Manning, 1992	Multipeak	130	+42.33	+170.83	0.01	Manning, R.B., 1992
Chionoecetes	japonicus	pacificus	Sakai, 1978	Multipeak	130	+42.33	+170.83	0.01	Sakai, T., 1978
Coryphaenoides	acrolepis		(Bean, 1884)	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Coryphaenoides	dineurus		(Gilbert, 1896)	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Coryphaenoides	longifilis		Gunther, 1877	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Coryphaenoides	pectoralis		(Gilbert)	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Geryon	affinis		A. Milne Edwards and Bouvier, 1894	Multipeak	130	+42.33	+170.83	0.01	Sakai, T., 1978
Holbyrnia	kulkovi		Fedorov and Sazonov	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Lithodes	longispina		Sakai	Multipeak	130	+42.33	+170.83	0.01	Sakai, T., 1978
Lithodes	nintokuae		Sakai, 1978	Multipeak	130	+42.33	+170.83	0.01	Sakai, T., 1978
Macroregonia	macrochira		Sakai, 1978	Multipeak	130	+42.33	+170.83	0.01	Sakai, T., 1978
Paralomis	pacifica		Sakai, 1978	Multipeak	130	+42.33	+170.83	0.01	Sakai, T., 1978
Progeron	guinotae		Crosnier	Multipeak	130	+42.33	+170.83	0.01	Sakai, T., 1978
Rondelietia	loricata		Abe and Hotta, 1963	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Sagamichthys	abei		Parr, 1953	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986
Symphysurus	pacificus		Birley and Schroeder	Multipeak	535481	+42.26	+170.45	0.5	Borets, L.A., 1986

**Figure 2.** Example of the data returned from a “search for species” query. In this example, all species from Multipeak seamount were requested. Additional information on the depth and date of collection, number found, Phylum and Family of each species, the full data citation, etc., can also be selected for inclusion.

## Search References

In the process of building the SeamountsOnline database, over 1200 bibliographic citations relating to seamounts were collected. Users can search this bibliographic database for authors, seamount names, or other terms of interest. The result of a search is a text list of references with the author, year, title and source given for each reference. This can be downloaded by copying from the screen and pasting to a local application. There is also a feature for downloading the entire bibliography as a text file in the same format as the screen return. The coverage is strongest for biological aspects of seamounts but also includes some references about seamount geology, hydrology, etc.

## DATA REQUEST

SeamountsOnline is continually seeking new seamount data. Though data are being hand-entered from publications, this process is labour-intensive and often can access only summarized or condensed data. SeamountsOnline will grow most efficiently, and thus become most useful, if researchers and institutions are willing to provide electronic datasets for inclusion. These contributions are always fully acknowledged, and all intellectual property rights remain with the data provider. Please contact the author if you have data to contribute.

## ACKNOWLEDGEMENTS

SeamountsOnline has received funding from the National Science Foundation (DBI-0074498, OCE-0340839) and the Natural Resources Defense Council. The San Diego Supercomputer Center provides server and other infrastructure support. Lisa Levin and David Stockwell have given valuable assistance as have Phoebe Zhang and Fred Grassle from the OBIS secretariat. Daphne Fautin was kind enough to provide a schema of her "Biogeoinformatics of Hexacorals" database (<http://www.kgs.ukans.edu/Hexacoral>) to assist in the design of SeamountsOnline. The project also gratefully acknowledges the researchers who have freely provided their data to SeamountsOnline in digital format: Bertrand Richer de Forges and collaborators for the ORSTOM data from the Norfolk and Lord Howe ridges, Heino Fock and Franz Uiblein for Great Meteor Seamount fish data, George Boehlert for ichthyoplankton data from Hancock Seamount, the Scripps Institution of Oceanography's Vertebrate and Benthic Invertebrate Collections, WWF for North Atlantic data, and S.P. Avila for molluscs of Ormonde seamount.

## REFERENCES

- Alder, J. and Wood, L. 2004. Managing and protecting seamount ecosystems. Pp. 67-73 *In: Morato, T. and Pauly, D. (eds.). Seamounts: Biodiversity and Fisheries. Fisheries Centre Research Report 12(5).*
- Froese, R. and Sampang, A. 2004. Taxonomy and biology of seamount fishes. Pp. 25-31 *In: Morato, T. and Pauly, D. (eds.). Seamounts: Biodiversity and Fisheries. Fisheries Centre Research Report 12(5).*
- Stocks, K. 2004. Seamount invertebrates: composition and vulnerability to fishing. Pp 17-24 *In: Morato, T. and Pauly, D. (eds.). Seamounts: Biodiversity and Fisheries. Fisheries Centre Research Report 12(5).*
- Stocks, K. 2004b. SeamountsOnline, an online information system for seamount biology. Pp. 77-89 *In: Vanden Berghe, E., Brown, M., Costello, M., Heip, C., Levitus, S. and Pissierssens, P. (eds). Proceedings of The Colour of Ocean Data, an International symposium on oceanographic data and information management with special attention to biological data, Brussels, Belgium, November 25-27, 2002. IOC Workshop Report No. 188, VLIZ Special Publication No. 16.*
- Watson, R. and Morato, T. 2004. Exploitation patterns in seamount fisheries: a preliminary analysis. Pp. 61-65 *In: Morato, T. and Pauly, D. (eds.). Seamounts: Biodiversity and Fisheries. Fisheries Centre Research Report 12(5).*
- Zhang, Y. and Grassle, J. F. 2003. A portal for the Ocean Biogeographic Information System. *Oceanologica Acta* 25:193-197.

The following samples have been recorded from the seamount(s) you selected  
 Blank fields indicate missing information.  
 Click on any field title to see a definition of that field.

Comma Text Delimited Download

Back to Search for Sample Page

Seamount Name	Sample ID	Sample Verbatim	Station Verbatim	Data Source	
Andy's	143		55	Koslow and Gowlett-Holmes, 1998	
Start Date (mm/dd/yyyy)	End Date (mm/dd/yyyy)	Latitude	Longitude	Lat/Lon Precision	
1/29/1997		-44.18	+146.94	0.01	
Min Depth (m)	Max Depth (m)	Seamount Zone	Water Zone	Quantitative?	Species Found
620	800	unknown	Benthic/Near Bottom	Yes	<a href="#">Click Here</a>
Method/Effort	1 epibenthid sled haul, 25 mm mesh net, 0.72 sq m mouth opening				
Taxa Covered	Comprehensive for hydroids, decapod crustacea, ophiuroid echinoids, holothuroid echinoids, bivalve molluscs and cephalopod molluscs				
Cruise	SS 9701				
Vessel	Southern Surveyor				
Taken By	CSIRO				
Notes					

**Figure 3.** Example of the data returned from a "search by sample" query. This figure shows the data returned from one sampling event – if multiple sampling events had occurred on this seamount, then a series of these data boxes would be returned.