Ocean Biogeographic Information System

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1. LONG-TERM GOALS

The Ocean Biogeographic Information System (OBIS) aims to be the primary authoritative source of data on the distribution of all marine species of the world, and to provide this data with online quality control, mapping, and analysis tools, including correlating distributions to environmental datasets, in the advancement of marine science, management, and education. Specifically, by 2010 OBIS will become:

- a world-wide information facility serving and archiving data from global marine biodiversity and global ocean observing system studies.
- an international standards body for data modeling, service discovery, and information exchange in the realm of ocean biogeography and marine biodiversity.
- a global forum for integrated ocean biogeography and biodiversity studies.

2. OBJECTIVES

OBIS intends to create a data resource of broad utility to meet the diverse needs of user groups including resource managers, navies, industries, and environmental and educational groups. OBIS' primary objective is to make basic marine data sets and resources accessible and interoperable.

OBIS is developing as both a major international research program and a federation of databases made interoperable through the OBIS Portal. It is building coalitions with national and international database systems to:

- energize regional-, national-, and international-scale development of ocean biogeographic and systematic databases;
- foster collaboration and interoperability by promoting standards and protocols;
- advance integrated biological and oceanographic research by supporting a multidisciplinary ocean information portal;
- speed the dissemination of and public access to ocean biogeographic information while appropriately addressing intellectual property rights issues.
- promote uniform quality control standards for marine biological data (data will be presented using consistent nomenclature in formats conducive to analysis and comparison);
- bring relevant geo-referenced and species-referenced biological and environmental data together in an interoperable network;
- bring the marine biology community together through coalitions among existing regional, national, and international information systems and research programs;
- lead the world in marine species-relevant geographic database development;
- develop a procedure for timely provision of synoptic environmental datasets and map products for the analysis of biological and environmental data at multiple spatial and temporal scales to reveal ecological and biogeographic patterns;
- support the objectives and principles of the Global Biodiversity Information Facility (GBIF);
- provide data interoperability, analytical tools, and access to all components of an open-access, globally-distributed network of systematic, ecological, and environmental

information systems that operate as a dynamic digital atlas to communicate biological information about the ocean and serve as a platform for further study of marine biogeographical relationships.

3. APPROACH

a. Data access: providing marine data from a wide range of sources

Never before have global data on the distribution of marine species of the world been available from a single source. OBIS provides 'free and open' access via the World Wide Web to a wide range of distributed data and data services, including taxonomically- and geographically-resolved data on marine life; data from museums, fisheries, and ecological studies; data from all ocean environments – seabed to plankton, coastal to deep sea; interactivity with many other databases, including other on-line databases; access to physical oceanographic data at regional and global scales; software tools for checking species names, mapping, modeling, and biogeographic analysis.

b. Taxonomic authority: gathering comprehensive, accurate, quality- and taxonomically-controlled data

Species-level data are needed for a wide variety of purposes, for scientists, policy-makers, and the public at large. They are important to basic research such as evolution, biogeography, population biology, and ecology; they are important to applied research such as predicting and detecting species introductions, and establishing marine reserves. Taxonomic knowledge is essential, for example, in being able to distinguish between similar species, one of which may be a source of pharmaceuticals and the other not. One complication is that not all taxonomists share the same view of species definitions or apply the same name to some species, so correctly using data from existing collections is not entirely straight-forward. Quality control is achieved only through direct involvement of taxonomic authorities for each group. Therefore, OBIS has mobilized the marine systematic community to digitize and store geo-referenced distribution data on authoritatively identified species. The OBIS community shares its expertise on marine systematics with Species2000, ITIS (the Integrated Taxonomic Information System), and the Electronic Catalogue of Names of Known Organisms Program of GBIF.

c. Data integration quality control: integrating heterogeneous data sources

With the advance of new technologies, digitization of existing records, and active field explorations such as those in the CoML, the production of heterogeneous data with complex interrelationships will increase daily. The volume and diversity of these data constitute an urgent research issue in data integration and quality control. The major topics include:

1) community-endorsed global data and metadata standards,
2) new tools and algorithms for integration and data cleaning,
3) efficient algorithms for data aggregation, and specifically, geospatial and temporal data aggregation.

d. Data analysis: providing the ability to discover scientifically important patterns and unique events

The emergence of GOOS and GBIF indicates a paradigm shift in earth system sciences. The ever-increasing volume of ecosystem data and their successful integration pose new challenges to researchers. New, scalable algorithms and tools must be developed to efficiently search for scientifically challenging, spatio-temporal patterns and to identify unique, sometimes disruptive, ecosystem events in large, integrated databases. Data mining techniques are inductive in nature, and the main purpose of scientific data mining is to assist scientists at the initial stage of scientific discovery, i.e., generating hypotheses based on observations and heuristic relationships. Patterns identified with automatic data-mining techniques have to be examined carefully by domain experts and further validated by deduction-based methods. Because of the complexity and our lack of understanding of ecosystem processes, we need to combine data mining, traditional statistical analysis, and mathematical modeling to understand complex marine ecosystems and to formulate meaningful predictions. OBIS promotes a synthetic and cooperative approach to ecosystem study and will serve as a global forum for integrated ocean biodiversity study and biogeographical research.

e. Data visualization: developing a new generation of marine Geographical Information System (GIS) and other visualization tools

Data visualization is an important part of the knowledge-discovery process. It is particularly important in marine ecosystem studies because of the spatio-temporal nature of ocean ecosystem data. Current GIS systems cannot deal well with 4-D data so new data structures and algorithms must be developed. Meanwhile, many existing GIS tools cannot meet the user demand for Internet-based mapping services. OBIS is actively working in these two areas and several products have already been offered on the OBIS portal.

f. Data utilization: developing education and outreach initiatives supported by OBIS data access, analysis and visualization services

OBIS is creating a central hub for the collection, access, analysis and visualization of data on marine organisms. In the next five years we will build on these strengths to create educational outreach projects for students, teachers and members of the public. Projects will include creating content specifically for teachers and students such as the NSDL CephSchool project and lesson plans available at http://iobis.org/educatio.shtml.

4. WORK COMPLETED

Please describe the actual tasks completed or technical accomplishments in the past year.
Include dates and locations in the field and at sea.

A. OBIS COMMITTEES MEMBERSHIP

i. International Committee

Chair Dr. Mark J. Costello (Chief Executive Officer of OBIS)
Senior Lecturer, Department of Marine Sciences
Leigh Marine Laboratory
University of Auckland
Warkworth, New Zealand

Mr. Robert M. Branton (Chair of the OBIS Management Committee, Manager of the Canada Regional OBIS Node)
Centre of Marine Biodiversity
Bedford Institute of Oceanography
Dartmouth, Nova Scotia, Canada

Professor Ann Bucklin
Department of Marine Sciences
University of Connecticut
Groton, Connecticut, USA

Dr. Daphne G. Fautin
Professor, Department of Ecology and Evolutionary Biology
Curator, Natural History Museum and Biodiversity Research Center
University of Kansas
Lawrence, Kansas, USA

Dr. Rainer Froese (FishBase Coordinator)
Leibniz-Institut für Meereswissenschaften an der Universität Kiel (Leibniz Institute of Marine Sciences at the University of Kiel)
Kiel, Germany

Dr. J. Frederick Grassle (Director of the OBIS Secretariat, Chair of the CoML Scientific Steering Committee)
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Dr. Patrick N. Halpin (Chair of the OBIS Technology Committee)
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Nicholas School of the Environment and Earth Sciences
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Senior Curator (Crustacea)
Museum Victoria
Melbourne, Victoria, Australia

Dr. Tony Rees
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Dr. Edward Vanden Berghe
Manager, Flanders Marine Data and Information Centre
Vlaams Instituut voor de Zee (VLIZ, Flanders Marine Institute)
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Ex officio

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New Brunswick, New Jersey, USA

Dr. Yunqing (Phoebe) Zhang (OBIS Portal Manager)
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New Brunswick, New Jersey, USA

ii. Management Committee

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Bedford Institute of Oceanography
Dartmouth, Nova Scotia, Canada

Vishwas Chavan (Manager, Indian Ocean Regional OBIS Node – IndOBIS)
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Alicja Mosbauer (Manager, Australia Regional OBIS Node -- OzOBIS)
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Don Robertson (Manager, New Zealand/Southwestern Pacific Regional OBIS Node)
General Manager, Biodiversity, Biosecurity & Information Services
National Institute of Water & Atmospheric Research Ltd (NIWA)
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Junko Shimura (Manager, Japan Regional OBIS Node)
Japanese GTI National Focal Point
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iii. Technical Committee

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New Brunswick, New Jersey, US

B. NEW OBIS STAFF

i. Deepal Shah is the OBIS portal web programmer

ii. Lissa Jerry is the OBIS web developer

C. CANDIDATES FOR THE OBIS EDITORIAL BOARD

i. Invitations are slowly going out to candidates

ii. Candidates include:

- Scientists responsible for quality of databases served by OBIS
- Specialists responsible for quality of software tools used by OBIS and/or guidance as to new tools
- Leading taxonomists, ecologists, and specialists in biodiversity informatics who can advise OBIS about data sources and quality, and encourage usage

iii. Invitations:

- RONs are to be invited to nominate such candidates to the Editorial Board.
- IC members volunteered to invite candidates.
- CoML Project investigators are to be invited after data are provided to OBIS.

D. OBIS POLICY

i. The IC agrees to direct offers to serve data to RONs and present Data Providers in first instance.

ii. The IC agrees to direct offers of freshwater species to FishBase. If freshwater species occur within larger marine data sets served to OBIS these will be accepted until a system for filtering them out (e.g., by name or taxon) is available.

iii. The OBIS schema, in addition to required and optional fields now includes the "highly recommended" fields. If these fields are already part of a dataset, then they should be made accessible through the DiGIR server. [See the OBIS Schema Version 1.1: Definition of the Data Standard at: http://iobis.org/tech/provider/schemadef1]

iv. Revised citation and 'user beware' (i.e., data limitations) text have been drafted and posted to the OBIS website and included below.

OBIS Data Use Agreement and Recommended Citation

By using data, software, or other information accessed through the OBIS Portal, I agree that, in any publication or presentation of any sort based wholly or in part on material so accessed, I will:

1. Acknowledge the use of specific records from contributing databases in the form appearing in the 'Citation' field thereof (if any); and acknowledge the use of the OBIS facility in one of the following prescribed forms:

For OBIS website:
Ocean Biogeographic Information System. [date accessed] www.iobis.org

For data used:
Author, initials. Database title. Retrieved [date accessed] from www.iobis.org
Examples:
(a) Single level:

Stocks, K. SeamountsOnline: an online information system for seamount biology. Version 3.1. Retrieved [date] from www.iobis.org.

(b) multiple level (for example, to cite a database published on a Compact Disc and accessed through):

Picton, B.E., Emblow, C.S., Morrow, C.C., Sides, E.M., Tierney, P., McGrath, D., McGeough, G., McCrea, M., Dinneen, P., Falvey, J., Dempsey, S., Dowse, J. and Costello, M. J. 1999. Marine sites, habitats and species data collected during the BioMar survey of Ireland. In: Picton, B.E. and Costello M. J. (eds), The BioMar biotope viewer: a guide to marine habitats, fauna and flora in Britain and Ireland, Environmental Sciences Unit, Trinity College, Dublin. Retrieved [date] from www.iobis.org.

2. For information purposes, provide to OBIS Portal Support <obissupport(at)marine.rutgers.edu> the full citation of any publication I make (printed or electronic) that cites OBIS or any constituent part.

3. I recognize the limitations of data in OBIS

User Beware: Limitations of data in OBIS

Scope
OBIS is in some ways comparable to a scientific journal that makes data freely available on the internet. Thus the geographic and taxonomic scope, and quantity of data provided depend on the scientists and organizations that provide data. However, in contrast to data in a journal, the 'reader' can select and combine data in OBIS from a variety of sources.

Quality assurance
Only data from authoritative scientists and science organizations approved by OBIS are served. At present, no independent peer-review of the data is conducted. OBIS relies on user feedback to identify technical, geographic, and taxonomic errors in data served. However, although errors will exist in OBIS data, OBIS is confident that the data are the best available in electronic form.

Data ownership
Data providers retain ownership of the data provided. OBIS does not own or control or limit the use of any data or products accessible through its website. Accordingly, it does not take responsibility for the quality of such data or products, or the use that people may make of them.

Data use
Appropriate caution is necessary in the interpretation of results derived from OBIS. Users must recognize that the analysis and interpretation of data require background knowledge and expertise about marine biodiversity (including ecosystems and taxonomy). Users should be aware of possible errors, including in the use of species names, geo-referencing, data handling, and mapping. They should cross-check their results for possible errors, and qualify their interpretation of any results accordingly.

Users must be aware that OBIS is a gateway to a system of databases distributed around the world. More information on OBIS data is available from the data sources websites and contact persons. Users should email any questions concerning OBIS data or tools (e.g. maps) to the appropriate contact person and copy this request to OBIS at <obissupport(at)marine.rutgers.edu>.

Data gaps
1. Major gaps in data and knowledge about the oceans are reflected in OBIS' data coverage
2. Most of the planet is more than 1 km under water: this deep sea is the least surveyed part of our world.
3. Coastal areas have been adequately sampled only for the distribution of most birds, mammals, and reptiles, and some of the larger fish species.
4. The oceans have been better sampled in the northern than the southern hemisphere, as reflected in the distribution of data in OBIS.
5. Most marine species have not yet been recognized or named. A major effort is required to describe marine species, especially invertebrates and all deep-sea organisms.
6. Of the marine species that have been described, some have been discovered to be several species, and others combined into single species. Thus, there are changes in the application of species names over time. A checklist of all current marine species names is not available but it is estimated that 230,000 have been described. Only about 20% of these names have been organized into global species checklists (published as the "Catalogue of Life"). OBIS includes distribution data on (a) many of these validated names and (b) additional names that remain to be organized into global species checklists. Thus, OBIS has some distribution data for approximately 20% of marine species.
7. Some species distribution data are not available in any form, as they have not have been published nor made available for databases.
8. Only some of the recently collected, and less of the older published, data have been entered into databases. Thus databases are very incomplete.
9. Of existing databases, many are not connected to OBIS.

You can help address these data gaps by (a) recognizing and encouraging scientists and organizations to make their data available online so they are accessible to OBIS, and/or (b) advocating for and carrying out field surveys and taxonomic studies designed to fill geographic and taxonomic gaps in knowledge.

E. REGIONAL OBIS NODES (RONS)

i. Milestones

RON	Contract in Effect	Payment (Date)	Interoperable with Portal (DiGIR installed)	Data Accessible through Portal
Australia	May05	US$41,196.00 (Jul05)	Sep05	Oct05
India	Mar05	US$47,709 (May05)	Sep05	Sep05
New Zealand	Mar05	(expected in Sep05)	Sep05	Oct05
South Africa	Jul05	US$10,000 (Aug05)	Aug05	Aug05
South America				
-Argentina Subnode	Jun05	US$10,500 (Jul05)	Aug05	Aug05
-Brazil Subnode	May05	US$8,000 (Jul05)	Aug05	Oct05
-Chile Subnode	Apr05	US$28,999.50 (Jul05)	Sep05	Oct05

ii. Accelerate RON progress to achieve two milestones: (1) DiGIR server software installed by the end of July, in time for the CoML SSC meeting in Cairns, in August 2005, and (2) data ready on the Portal or DiGIR in time for the All CoML Programs meeting in Frankfurt, in November 2005.

iii. OBIS Canada

- Sponsored by: Centre for Marine Biodiversity (CMB) and Bedford Institute of Oceanography (BIO), utilizes the NW Atlantic Registry of Marine Species of 6000 + names, 11 collections published so far, more to come (i.e., POST).
- Technical foundation: discovery metadata on Canadian Geospatial Data Infrastructure (CGDI, http://cgdi.gc.ca/CGDI.cfm) and Global Change Master Directory (GCMD, http://gcmd.gsfc.nasa.gov/) discovery portals, OBIS DiGIR provider server installed and running, PLONE web content management server installed, currently have offsite demonstration mock-up.
- Multi-Species Mapper: ACON MapSQL/XML application provides general purpose point and click web-based multi-dimensional online analysis, mapping and data retrieval, ACON (A CONtouring) Program in use at DFO, as MAC/PC application since ’85 and as Virtual Data Center web application since ’98, Jerry Black received the Department of Fisheries and Oceans (DFO) Canada National Award of Excellence for development of ACON in June 2005.
- Relevance to OBIS: DFO/NMFS survey & ARC specimen web applications on Gulf of Maine Biogeographic Information System (GMBIS) in 2001, MapSQL application on CMB website in 2003, MapSQL application demonstrated at OBISMC1 in 2004, MapSQL application on OBISCanada mock-up website in 2005, XML features now being deployed for use with OBIS Portal.
- MapSQL/XML Features: No real limit to number of dimension being managed, e.g., latitude, longitude, depth, time, species, size; zoom in and out, enlarge, clip as well as drill down through taxonomic hierarchy; save maps and/or data in a number of formats, e.g., html formatted table, tab delimited table, ESRI shape file; species list is linked to OBIS species list.

- OBIS Schema Expansion: Objective is to provide reliable estimates of population indices for marine species from research trawl surveys; presentation at OBI Conference in Hamburg Germany Nov 2004; paper accepted by Ecology Progress Series.

iv. EurOBIS
- Part of the Marine Biodiversity and Ecosystem Functioning EU Network of Excellence (MarBEF, http://www.marbef.org/), online with approx 400,000 records, a GIS-like interface, supported by a taxonomic register and by a geographical database
- All taxon names from EurOBIS are matched against European Register of Marine Species (ERMS, http://www.marbef.org/data/erms.php)
- Utilizes a Gazetteer, which is more than a flat list, more like a network of places, with services that include: name finder that returns a matching name/code, approximate spelling and classification, diversity index calculator, Taxonomic Distinctness -- based on classification in ERMS, SVG/JPG map generator, C-Squares mapper

v. Framework for Participation in the Regional Ocean Biogeographic Information System Node (RON) Network

Understandings

(1) OBIS is an open-ended, international, coordinated information system set up to advance technical and scientific efforts and to act as a global information facility for digitized marine biodiversity data.
(2) This document is not legally or financially binding.
(3) The OBIS Management Committee, governing board of the RON network, will strive to reach decisions by consensus whenever possible.

Purpose and Goal

The purpose of the RONs is to create a network in partnership with the International OBIS Portal to promote the sharing and use of the world's marine biodiversity data. This network is to create and support an information system that:
(a) is technically and institutionally capable of linking databases that are created and individually maintained by the International Portal and RONs and, where necessary and appropriate, to archive data sets;
(b) is world-wide in scale;
(c) is interoperable with other regional, national, and international information systems;
(d) is publicly accessible by individuals throughout the world;
(e) develops the web-based, visualization, analysis, modeling, and other information technologies needed for the seamless exchange and use of distributed and aggregated data; and
(f) acknowledges and maintains the integrity and long-term viability of all data sources.

Roles and Responsibilities of Regional OBIS Nodes

The most important function of the RONs is to foster the on-line provision of marine biogeographic data from their regions and areas of expertise (e.g., a European RON should actively arrange for data held within European databases to be made available on-line through a European OBIS portal).

Each RON will populate the OBIS Portal with data and aid development of on-line data analysis and presentation tools, and is an integral part of OBIS. Spatial boundaries for each RON are self-defined. Regions may overlap geographically. Gaps will be addressed by the OBIS Management Committee by encouraging development of new RONs. Varying regional circumstances will bring unique features to each RON. Some may have particular strengths in certain data types or software resources, or both. The RONs will differ in the scope of their data, type of data, and geographic coverage. For

example, some may focus on governmental fishery or oceanographic data, and others on museum and academic sources of data. Each RON is encouraged to have in-house database expertise, and in all cases, a RON will have a long-term institutional commitment to maintaining their databases and services. It is appreciated that this will be contingent on future funding which may be impossible to guarantee, but will be central to the business plan of the OBIS RON.

Each RON supports the development of other RONs, but are independently motivated by the vision to 'publish' quality data on-line, so as to increase the availability of data to researchers, educators, and students around the world in the interest of scientific discovery.

Each RON will seek its own regional and national funding. However, RONs would support each other's applications, emphasizing the added value to their network. It is envisaged that a RON will involve two to three staff who may also be involved in related projects and activities. Modest overlap in capabilities and services among RONs would not be redundant, but would provide backup services to the global user community should other Nodes malfunction.

Some RONs may become an OBIS Portal 'mirror' site to serve as backup in case the Portal goes off line for any reason and to improve system performance efficiencies.

Each RON will have access to a technical 'start-up' kit, developed and distributed by the OBIS Portal. This kit contains components to cover all aspects of serving data, including policy and website content, establishment of databases, and installation of data exchange protocols for serving data on-line.

At an individual Node web site, each RON will include OBIS in the name of the RON (e.g., the European Node name is EurOBIS; the Indian Ocean Node is named IndOBIS), the OBIS logo at the top of the front page, and a link back to OBIS from the species name page or species level results. Each Node should be willing to provide RON usage statistics to the Portal.

Each RON will make news about the RON and its community available to the Portal (e.g., using the automated Plone news delivery or via email to the OBIS manager).

OBIS will present itself to the world through the International OBIS Portal and possible mirror sites. Each RON will present itself to its regional user communities through its own portals and pages at the OBIS Portal. Each RON will provide to the Portal a standard set of RON-description information (see "Step II: Set up the RON Information Page" from the "RON Development Manual", http://iobis.org/obisrons/dev).

Each RON will provide 'helpdesk' services to its community.

The role of the RONs will be, in order of priority:
(1) To build OBIS data content.
(2) To serve data online, including integration with the International OBIS Portal.
(3) To develop a regional OBIS community, including data providers and data users.
(4) To contribute to the technical function of the OBIS Portal through: mirror sites, data management, visualization, presentation, analysis and modeling tools, application of standards, etc.
(5) To contribute to the scientific quality of OBIS through expertise and advice in ocean data, taxonomy, fisheries, ecology, habitat, etc.
(6) To participate in various activities associated with OBIS such as representation on the OBIS Management Committee, and various ad hoc efforts as appropriate..

vi. Data coming into the Portal from the RONs.
A mix of freshwater and marine data coming into the Portal is OK, they will be filtered later. But in the long-term, the RONs need to distinguish between marine (and those species with a marine phase, e.g., diadromous species) and freshwater data as early in the collection process as possible and then make the marine (and partial-marine species) data available to the Portal. A few species lists that distinguish marine from other species are available, as Tony has drafted for the OBIS Index, and ERMS and Fauna Europaea have for Europe.

With regard to species lists, the Global Change Master Directory (http://gcmd.gsfc.nasa.gov/), a directory to earth science data and services, has requested coordination of metadata with OBIS . The GCMD contact is Melanie Meaux (mmeaux@gcmd.nasa.gov). Bob Branton has had discussions with GCMD and gotten positive feedback about helping OBIS with creating metadata and providing authoring tools.

F. DATA ON THE PORTAL
i. Data online. Table of OBIS Data Providers and number of records being contributed (those in **BOLD** have been added since Nov 2004)

Data Source	Total Records Crawled	Total Records
BATS Zooplankton	635	635
Hexacorals Database	23387	28364
CephBase	3175	3175
DFO Scotian Summer Research Trawl Survey	60108	60109
FishBase	727402	793318
History of Marine Animals (HMAP)	242384	242384
Indo-Pacific Mollusks	16261	16261
NODC WOD01 Plankton Database (NODC)	1281125	1281125
SeamountsOnline	7318	7319
ZooGene	114	114
Southampton Oceanography Center Discovery Collections Midwater Database (SOC)	92851	92851
OBIS-SEAMAP	278682	278682
AADC_seabirds	82122	105863
AADC_ellie_sightings_heard	1794	1794
AADC_weddell_census	4603	4603
AADC_weddell_sightings	17588	17588
SAHFOS_CPR_ZOOPLANKTON	1374234	1374234
SAHFOS_CPR_PHYTOPLANKTON	721921	721921
AADC_whale_catch	7122	7122
Taxonomic Information System for the Belgian coastal area (EUROBIS)	36900	36936

Generic Taxonomical Database System	3617	13962
EPA's EMAP Database	39882	39882
NBI	156904	156948
Ifremer BIOCEAN database (Deep Sea Benthic Fauna)	23876	23876
Eastern Canada Benthic Macro Fauna (Canadian Regional Node)	5650	5650
Atlantic Reference Centre (Canadian Regional Node)	112007	112007
Electronic Atlas of Ichthyoplankton on the Scotian Shelf of North America (Canadian Regional Node)	4106	4106
Gwaii Haanas Marine Plants (Canadian Regional Node)	6351	6353
Canadian Museum of Nature - Fish Collection (Canadian Regional Node)	39897	39920
Atlantic Canada Conservation Data Centre (Canadian Regional Node)	1365	1365
Nova Scotia Museum of Natural History - Marine Birds, Mammals, and Fishes (Canadian Regional Node)	579	579
Gwaii Haanas Invertebrates (Canadian Regional Node)	24311	24311
Bay of Fundy Species List (Canadian Regional Node)	2380	2381
Marine Invertebrate Diversity Initiative (Canadian Regional Node)	295	295
ECNASAP (Canadian Regional Node)	521085	521085
Resolute Passage Copepod Distribution(Canadian Regional Node)	3428	3428
Benthic fauna in the Pechora Sea (EUROBIS)	**1324**	**1324**
Temporal cover of N3, a station in Kiel bay (EUROBIS)	**171**	**171**
MedOBIS (EUROBIS)	**11391**	**11398**
Biogeography Scheldt Estuary (EUROBIS)	**31747**	**31747**
Macrobel: Long term trends in the macrobenthos of the Belgian Continental Shelf (EUROBIS)	**21043**	**21086**
Meiobenthos of subtidal sandbanks on the Belgian Continental Shelf (EUROBIS)	**6450**	**6491**
BioMar (EUROBIS)	93003	93003
The SERTC Invertebrate Database: Invertebrates of the southeastern United States	**2097**	**2097**
Grand Manan Basin Benthos(Canadian Regional Node)	**244**	**244**
Davis Strait and Baffin Bay Zooplankton (Canadian Regional Node)	**9767**	**9768**
A comparison of benthic biodiversity in the North Sea, English Channel and Celtic Seas (EUROBIS)	**2588**	**2589**
MICROBIS database	**2679**	**2679**
Status of the population of South American sea lion	**227**	**227**

ii. Data planned to come online including RON, CoML projects, Smithsonian, and data rescue projects.

a. RON:

Regional OBIS Node	Data
Australia	Initial dataset will be ~200,000 records from CSIRO – Marine and Atmospheric Research surveys. Follow-on datasets to come from federal and state fisheries agencies and departments of environment, the museum community, and others, including individuals in Universities.
Canada	OBIS Canada is presently providing access to 12 datasets. New datasets planned to come online include: Gulf of Maine Biodiversity Discovery Corridor Pacific Ocean Shelf Tracking (POST) DFO Pacific shrimp and tanner crab trawls/traps
China	Number of species: 20,000 expected, species list currently contains more than 10,000 species, including 1,086 macroalgae species, 1,016 protozoa species, 5,981 invertebrate species, and 2,406 vertebrate species. Specimen database: compiled from specimens stored in the Marine Biological Museum, Chinese Academy of Sciences. Number of specimens in the Museum is about 700,000, collected from surveys since 1889. About 50,000 specimens have been recorded. Holotype database: more than 1,100 holotypes of marine organisms stored in the Marine Biological Museum. Image library: More than 2,000 photographs created, with more expected, of specimens in the Marine Biological Museum.
Europe	EurOBIS is presently providing access to 9 datasets, with more planned.
Indian Ocean	Electronic Catalogue of Known Biota of Indian Ocean (75,000 records) Digitized Biological Collections
Japan	Yet to be described
New Zealand	Coverage from Fiji to Antarctica, including New Zealand: 1. New Zealand and Ross Sea marine algae, invertebrate and fish 2. Fijian marine algae, invertebrate and fish data In relation to environmental parameters

Regional OBIS Node	Data
South America Argentina Southwest Atlantic Ocean	Patagonian Large Marine Ecosystem (PLME): 10,000 high-quality locations for 7 marine bird and mammal species Additional 10,000 records of species distribution for the PLME Draft checklist ver 2.0 with additional 50.000 records Number of species: 620 Number of species with distribution: 57 Number of total records: 50,000 Digitization of collections within the region (including providing software orientation and hands-on training to museums curators)
South America Brazil Tropical and Subtropical Atlantic	Number of species: 1035 Number of species with distribution: 1035 Number of total records: 108,512
South America Chile Tropical, Sub-tropical and eastern south Pacific	Electronic catalogue of known biota of the eastern South Pacific Number of species: 850 Number of species with distribution: 150 Number of total records: 60,000
Sub-Saharan Africa	310 000 records from the following datasets are planned to come online: Invertebrates and Fish - Iziko Museum Fish - South Africa Institute for Aquatic Biodiversity (SAIAB) Marine mollusks - Natal Museum Seaweeds - Bolus Herbarium Marine biodiversity data from Sub-Saharan African countries (not yet identified)
U.S.A.	Gulf of Maine: Fisheries, Marine Census Alaska Data Hawaii: Collections (Bishop Museum Collection Data Base), HI GAP, Corals

b. CoML projects:
CoML projects milestones include becoming interoperable with OBIS by installing DiGIR provider software and providing data, in time for the CoML All Programs meeting in Frankfurt, November, 2005.

c. Smithsonian:
With support from the Lounsbery Foundation, the Smithsonian Environmental Research Center (SERC) – Marine Invasions Research Lab is expected to make the Invasions Species database interoperable with OBIS. Additionally, Smithsonian data from Anna Weitzman may be forthcoming.

d. Data Capture 2004-06: Mark Costello, Geoff Boxshall and Dennis Gordon are leading this effort

Taxon (common name)	**Global No. of marine species**	**Expert (affiliation)**	**Estimated cost** (in US Dollars)	**Status**	**Action**
Urochordata (sea-squirts, ascidians)	2100	Dr Karen Sanamyan Kamchatka Institute of Ecology, Petropavlosk	$10,000	Mike Ruggiero (ITIS) arranging funding for world list of Ascidia (but this may exclude distribution)	ITIS, Costello
Polychaetes (bristle-worms)	~8000	Dr Klaus Ruetzler (USA), Dr Adrian Glover (UK), Dr C. Glasby (Australia)		Discussions in progress with polychaete community	
Lucinidae bivalve molluscs	500	Dr John D. Taylor, (Natural History Museum, London)	$8,000		
Gastrotrichs Italy	150	Dr Antonio Todaro (University of Modena, Italy)		In georeferenced database, to go directly to EurOBIS and MedOBIS	EurOBIS (MedOBIS)
Brachyura (crabs of North Eastern Atlantic	(70 in NE Atlantic)	Dr David McGrath Ireland)	$4,000	Proposal for 20K Euros submitted to Heritage Fund – Ireland	None
Cumacea	1200	Dr Les Watling (University of Maine, USA)			Edward and Mark
Copepoda parasitic on marine fishes	~1500	Geoff Boxshall NHM, London)		Pilot taxa already funded by NHM, London	
Serpulid tubeworms		Dr Harry ten Hove, University of Amsterdam	$6,000	No progress	None
Marine triclads world	75	Rony Sluys univ Amsterdam		Small database	None
Digenetic trematode flukes of fishes	5000 (on 34000 spp fish)	Dr Tom Cribb, University of Queensland, Australia	$7,000	No progress	Australia RON
Atlantic Isopoda, deep-sea invertebrates		Buz Wilson, Australian Museum		Direct to CoML projects and RON	Australia RON
Great Barrier Reef collection Acarina		Jurgen Otto James cook University		Direct to CoML projects and RON	Australia RON
World Bopyrdiae, Ispoda	500	John Markham			
Eastern Indonesia SIBOGA 1899-1900 expedition all invertebrates and fish	7500 (400 stations)	Rob van Soest		Direct to Indian Ocean RON	Indian Ocean RON
World Stomatopoda		Marjorie Reaka (Univ Maryland)			
World Bryozoa	6000	Scott Lidgard			

Taxon (common name)	**Global No. of marine species**	**Expert (affiliation)**	**Estimated cost** (in US Dollars)	**Status**	**Action**
Gnathostomulida		Wolfgang Sterrer, Bermuda Aquarium			
SOC pelagic database		Phil Pugh		Now served to OBIS	None
Antarctic and Arctic plankton, fish benthos		Jan Weslawski		Direct to CoML Arctic and Antarctic projects	Costello
Bennioidea Mediterranean and E Atlantic	50	Peter Wirtz, Azores		Direct EurOBIS	Edward
Material published in journal AmphiPacifica (mainly Pacific Amphipoda		Ed Bousfield (retired, Ottawa)			Canadian RON
E. Pacific decapod crustaceans		Mary Wicksten & Michael Hendrickx Univ Texas			
Gulf of St Lawrence marine invert's		Pierre Brunel (retired)			Canadian RON
Zooplankton Baltic Sea and Gulf of riga		Elmira Boikova, Uni Latvia			EurOBIS
N Atlantic expeditions 1980-83		Annelies Pierrot Uni Amsterdam			EurOBIS
Invert's Portugal		Helena Moreira Univ Aveiro		Direct EurOBIS	EurOBIS
NZ region and Ross Sea invertebrates		Dennis Gordon		Direct NZ RON	SW Pacific RON
Zooplankton Black Sea and E Medit		Ahmet Kideys		Direct MedOBIS and EurOBIS	EurOBIS (MedOBIS)
Decapoda and Stomatopoda French Polynesia		Joseph Poupin, Brest France		Direct NZ RON	SW Pacific RON
Aplacophora		Amy Scheltema (now database in Sweden)		Contact new database manager	
Porifera of world		Rob van Soest		Agreed to be hosted by VLIZ	EurOBIS

e. South Korea – Dr. Youn-Ho Lee, and colleagues Dr. Sung-Dae Kim and Soo-Young Park, from the Marine Living Resources Research Division in the Korea Ocean Research & Development Institute (KORDI), visited Rutgers (June 2005) to discuss establishing an OBIS presence in Korea, including installation of DiGIR server software.

G. STATUS OF OBIS FUNDED PROJECTS

Data rescue sub-projects funded in 2004 by the OBIS IC from its Sloan Foundation grant.

Title	Provider	Grant	Status
Nemertea worms	Ray Gibson, Liverpool	$5,000	Completed – paid

New Zealand Bryozoa	Dennis Gordon, NIWA	$12,000	(now cleaning up file) Completed – paid. To go online from the New Zealand RON.
Marine turbellarian flatworms	Dr Seth Tyler, University of Maine.	$10,000	Complete, will connect to the OBIS Portal directly.
Pelagic Ostracods	Martin Angel	$4,000	Actively under way, stage payments have been authorized and are in the system. To go online via EurOBIS.
Pycnogonids	Roger Bamber	$9,000	Actively under way, stage payments have been authorized and are in the system. To go online via EurOBIS.
Total originally committed		$40,000	

H. OBIS WEB PAGES

The text and content are being brought up to date and made more comprehensive and user friendly.

Statistics about Portal usage are available online at (http://www.iobis.org/awstats/awstats.pl?config=iobis, user name: obisic, password: reverse of user name). A summary table/paragraph of usage statistics will be made available in a public place on the Portal.

Web redesign: Feedback will come from CoML outreach representatives , and in parallel, Rutgers will get comments from a web consultant. Design for a new OBIS logo, from the web consultant, have been finalized (see below).

Redefined categories for "Contributors" have been drafted and listed on the website. The Portal will also be adding a feedback acknowledgement page.

I. OBIS SCHEMA

The schema contains fields that are now highly recommended in addition to required and optional. The highly recommended fields within the new schema provides a mechanism for Data

Providers to complete more fields to enable better data searches on the Portal (e.g., by depth) and correct source citation.

J. METADATA

The immediate need for metadata is to describe OBIS data sources. Longer term development of discovery metadata will be in collaboration with the Marine Metadata Initiative, remaining cognizant of developed and developing standards, such as FGDC, ISO, Dublin Core, GCMD (NASA), IODE GEBICH, TDWG and other approaches.

The OBIS Canada and EurOBIS RONs will advise on terminology as they use FGDC and ISO compatible fields.

Marine habitat terminology and classification are being developed by the IC Chair (Mark Costello) and Co-Chair (Karen Stocks) with NatureServe. A discussion paper about habitat concepts was drafted by Mark Costello.

K. OBIS PORTAL

Mirror site implementations are underway at CSIRO and San Diego Supercomputer Center.

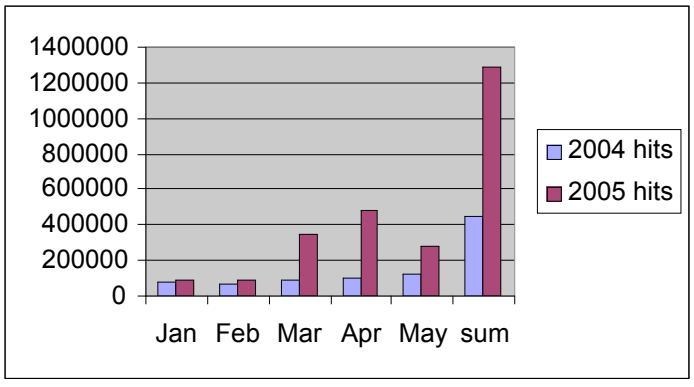
Data upload facility using a template spreadsheet is ready to send to providers offering to supply data. Later, an automated facility may be designed where providers can add records which, following peer-review by OBIS, go online.

Mapper software that can map more than one species has been developed at OBIS Canada, using the ACON mapper. The ACON mapper is capable of mapping multiple dimensions, not only multiple species.

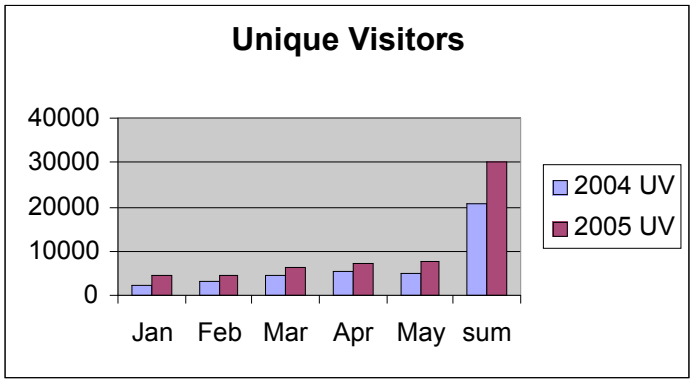
Updates to the Portal since the CoML All Programs meeting in Paris (Nov 04):

1. 8 new data sources with over 70,000 new data records have been added. These records were mostly contributed by EurOBIS.
2. Data Access: in the first five months of 2005 access tripled and unique visitors increased 50% (estimation) compared to same period in 2004.

Web Access: Hits per month



Web Access: Unique visitors per month



3. Website moved to a Plone-based web content management system.
4. RON Development: OBIS Start-up kit and RON development manual have been developed; services are being provided to the RON developers for installation (downloadable from the Portal)
5. System Development: OBIS Portal has been re-modeled in the "Module-View-Control" architecture for performance and maintenance needs.

L. OBIS TOOLS

Links to NCBI (which provides a path to GenBank) and Google Scholar have been added to the Portal.

Pat Halpin, Chair of the OBIS Technical Committee, is working with the Environmental Science Research Institute (ESRI) of Redlands, California on the development of an OBIS User Needs Assessment and User Needs Document.

M. OBIS DATA ANALYSIS

A Pew grant is funding development of a world atlas of fishes by Rainer Froese, FishBase editor and OBIS IC member.

Analysis by Phoebe Zhang and Ron O'Dor show that 74% of the records in the Portal include information on depth zones.

Additional analysis of data on the Portal is underway by Camilo Mora and Mark Costello in New Zealand.

A Gordon and Betty Moore Foundation grant to San Diego Supercomputer Center is supporting Karen Stocks and Phoebe Zhang to develop new portal architecture and functionality.

5. WORK PLANNED

Please describe your work plans for the upcoming year (if applicable). Include upcoming dates and locations in the field and at sea.

A. GIS
OBIS-SEAMAP is preparing a proposal for an OBIS mini-grant to build a prototype for an OBIS Portal service where many Portal search and mapping functions can be delivered in a Web-interfaced GIS. Standards-based Web Map Service, Web Feature Service, and/or Web Coverage Service will be implemented to interoperate OBIS data with many other kinds of oceanography data types, especially those widely adopted in IOOS. Both commercial (i.e., ESRI) and freeware GIS products, for example MapServer and the OBIS Canada ACON software, will be considered for prototyping. The prototype will demonstrate OBIS data usability and interoperability in an operational ocean observation system environment.

B. ITIS AND SPECIES 2000
OBIS is working with ITIS and Species 2000 to get more marine species checklists available (e.g., tunicates by Karen Sanamyan and phoronids and brachiopods by Christian Emig with ITIS). See data rescue list for global taxon lists to be hosted by EurOBIS at VLIZ, including world Porifera.

A table of marine taxa, leading experts, total number species, and existence of global species authority files and distribution data is being prepared by Mark Costello.

Availability of taxonomic information, including identification guides and literature being discussed with Internet Archives, Consortium for the Barcode of Life, and NCBI. Gary Poore has joined OBIS IC to advise on these and related taxonomy issues. Gary will investigate the use of crustacea.net (http://www.crustacea.net/) identification tools, images, and species descriptions by OBIS.

C. GLOBAL ENVIRONMENT FACILITY (GEF) PROPOSAL
Mark Costello is working with Victor Gallardo and Lucie Rogo (ex CBD-GTI, now with BioNET). The plan is to develop a large, multi-country proposal to GEF to fund taxonomy workshops, databases, specimen collections, identification guides, and to launch new permanent positions in marine taxonomy for the southern hemisphere (where most marine biodiversity exists), involving the RONs. PBIN has a part in the proposal.

D. OBIS BUSINESS STRATEGY

i. Building Blocks:

PHASE	APPROACH	RESULT
Develop Product	Demonstrate concept of interoperability and dissemination through portal (done by Karen, Phoebe and Fred)	1st portal
	Demonstrate capture of significant amounts of data and online data visualization, exploration, and mapping tools (done)	Present portal

PHASE	APPROACH	RESULT
	Demonstrate value of product to science, education and management (data discovery, statistics, gap analyses, new insights). (not done)	*Scientific papers & presentations. Educational materials.*
Develop Market Approval	Communicate OBIS to scientific audiences including data providers and users (done and must continue).	Presentations at conferences and other meetings
Build Confidence	Impress upon scientific and government community that OBIS is a credible, authoritative, and valuable part of the global and national science infrastructure (done and must continue)	Authoritative data sources; Editorial Board Feedback system
	Develop relationships with other communities through their organizations, (a) oceanographic (IOC, IODE, IOOS, GOOS, IABO, SCOR), (b) fisheries (FAO, ICES, FishBase, Worldfish), (c) biodiversity (GBIF, TDWG, ITIS, Species 2000, NCBI, CBOL, Diversitas), (d) conservation (Natureserve, Conservation International, WWF), (e) governmental (DFO, NOAA, ORAP, NOPP, EEA? ….?.)	In progress
Demonstrate Added Value	1. Interoperability (e.g., overlaying physical and biological data from multiple sources) 2. Species name authority (ITIS is doing this, but only for North America, so it is partnering with CoL, but OBIS provides internationalization) 3. Data integration (including single source) 4. International context 5. Public accessibility 6. Discoverability 7. Analytical capabilities 8. Visualization tools 9. International standards and protocols	
	ACTIVITY	SOURCE
Funding *	Distribute costs globally	Regional OBIS Nodes
	Data capture	Project grants
	New functionality	Project grants
	Data analysis and presentation services	Clients (e.g. research projects, government agencies, NGO)
	Coordination (secretariat, meetings)	?
	Portal and website	?

* OBIS is a public-good and thus merits public funding. Aspects may be sponsored by industry and new developments by research funding, but core operations will be paid for by government funding. This will include funding at Regional OBIS Nodes and central Portal, and coordination activities (secretariat, meetings, etc.).

ii. Options to fund OBIS after 2010

- One or more organizations agree to host the portal and its website.
- One or more organizations agree to host the secretariat, and/or sponsor staff.
- IOC, IODE, FAO, SCOR, UNEP, or others fund secretariat and meetings.
- RONs provide an annual contribution to secretariat and cover their own costs to meetings.
- RONs provide an annual contribution to secretariat and meeting's costs.
- Mixture of above.

iii. Planned Proposals

a. ESRI – Pat Halpin lead.

b. U.S. National Science Foundation – MMI lead, with an independent proposal

c. New Zealand Foundation for Research Science and Technology (NZFRST) – two 3-4 year projects, Mark Costello and Don Robertson leads.

d. Biological Databases and Informatics (BDI) at NSF – Pat Halpin lead.

e. SCAR-MarBIN – Proposal submitted, Edward Vanden Berghe lead.

f. Outreach "phenomenal oceans" materials for lecturers and teachers – Rutgers and MBARI.

E. DEVELOP ROLES FOR TAXONOMIC GUIDES, ONLINE SPECIES IMAGES, GENETIC INFORMATION ON THE OBIS PORTAL

i. Taxonomic Guides:

- Taxonomists: Describe new taxa (species and higher taxa); Research phylogenies and biogeography; Provide an identification service, or tools for do-it-yourself identification;
- Problems for taxonomists and taxonomy : Many species still remain undescribed; Taxonomists are in short supply, busy, costly and "greying"; Students are not encouraged into taxonomy per se; Pressure to divert effort to molecular methods over morphology; Few institutions hire dedicated taxonomists, museums excluded; Taxonomists and parataxonomists may work in geographic isolation; Few environmental organizations appear prepared to pay for taxonomist input; Taxonomic guides tend to be regional; Ironically, taxonomic guides blinker users to the presence of undescribed species and are used when inapplicable
- Strategies: Continue to describe new taxa – but economically; Train new taxonomists – and make them employable; Ensure the taxonomist's job is interesting and rewarding; Ensure that morphological taxonomy continues to support molecular studies; Ensure that taxonomists in museums continue to be supported; Provide tools for taxonomists and parataxonomists to exchange information; Build the cost of identifications into the cost of environmental surveys; Integrate taxonomic guides beyond the regional; Alert parataxonomists, ecologists and others to the presence of undescribed species and to appropriate sources
- Taxonomists ask questions: How many species found in one survey occur in another? How many are described, how many not described? What is latitudinal range of each species?
- The answers now are: We don't know! We don't know! We don't know!
- Some Solutions:
- 1. Synthesize lists on paper and on the web;
- 2. Prepare identification guides on paper;
- 3. Identification guides, electronic on CD-ROM:

- ETI (Expert Centre for Taxonomic Identification) Bioinformatics – The World Biodiversity Database consists of 16 separate projects, in total covering 27772 unique taxa. All projects (except the cranefly database) were generated using the Web Publisher facility of ETI's Linnaeus II software. E.g. Crabs of Japan Based on the three volume work "Crabs of Japan and the Adjacent Seas" (1976) by Tsune Sakai, revised by others 2004
- Polychaetes An interactive identification guide – keys to the worlds families and genera and Australian species, prepared as interactive keys with illustrations and diagnoses, uses DELTA (DEscriptive Language for Taxonomy)
- 4. Identification guides, electronic on web:
- Some ETI Bioinformatics projects e.g., Crustacea of the North Sea (illustrated binary (or trinary) key to 651 species using Linnaeus II)
- Crustacea.net – uses DELTA and working towards documenting >849 known families of Crustacea
- Web-based Systems: provide free access world-wide; provide information and identification systems that make it easier for other biologists to do their work; can be readily updated; allow unlimited illustration; are attractive and pleasurable way to use taxonomic resources
- Taxonomic Databases: nomenclature -- e.g. Platypus; bibliography -- e.g. Endnote; specimens -- e.g. KE Emu; morphological -- e.g. DELTA
- crustacea.net enhances information from each of these databases to provide an information-rich system
- DEscriptive Language for Taxonomy – DELTA: Only software currently suitable for an information system of the required power; Several outputs from the one database (i.e., natural language descriptions; interactive keys; nexus format data for phylogenetic analyses online)
- Crustacea.net: is free; mechanism for solving the problems we have been talking about; cooperative world-wide project for crustacean identification; initial focus was on family level keys; now extending to genera; some species level keys are available
- What's in Crustacea.net?: checklists; monographs (including synonymies, types and type localities, descriptions, illustrations, distributions); illustrated interactive keys
- Crustacea.net Project: cooperative effort among international scientists; analogous to a monographic series (i.e., refereed, authorship for contributors (a new form of scientific publication)); differences only in form of presentation, availability and updateability
- Where to with Crustacea.net?: Jim Lowry (Australian Museum) continues a series of international workshops and training on using DELTA; Crustacean taxonomists are contributing DELTA databases in various forms for inclusion on web; Preparation of material for web is unfunded and therefore slow
- Role of OBIS?: Taxonomists continue to contribute databases for free; Some are funded, others not; Preparation of material for web demands different skills (more sophisticated knowledge of DELTA and HTML); Maintenance of website is ongoing
- OBIS could play a role in supporting crustacea.net.

ii. Species Images:

- OBIS is exploring the incorporation of online species images linked to search results on the Portal. Images may be available on the Portal or by linking to existing online images sites, e.g., Google.

iii. Genetic Information:

- Working with the Consortium for the Barcode of Life (David E. Schindel): An international affiliation of: 70+ Members Org's, 35+ countries, 6 continents; including natural history museums, biodiversity organizations; Users are from government agencies and private sector biotech companies, as well as database providers; first barcoding publications came out in 2002; the Cold Spring Harbor planning workshops convened in 2003; Sloan Foundation grant and project launch occurred in May 2004, the Secretariat opens at Smithsonian, September 2004; first international conference occurs in February 2005
- A DNA barcode is a short gene sequence taken from standardized portions of the genome, used to identify species
- CBOL Mission: To explore and develop the potential of DNA barcoding as a practical, cost-effective tool for: taxonomic research, biodiversity studies and conservation, and diverse applications that use taxonomic information in service to science and society
- CBOL Goals: create a reference barcode database; identify high-priority taxa and societal needs; promote/facilitate barcoding projects and 'CBOL campaigns'; improve methods, address shared obstacles through WGs; populate database from collections; more portability, less time/expense; improve taxonomic research environment
- Barcoding marine species: FishBOL -- adults, larvae and eggs; sustainability of fisheries, food fraud; ballast water and invasive species; environmental quality monitoring; understudied groups; damaged specimens
- Recent CBOL Developments: Barcode Section of GenBank; marine invasives/ballast water: EPA, USGS, CSIRO; International Network for Barcoding Invasive and Pest Species (INBIPS); APEC Workshop on Invasives, Beijing; Launch of FishBOL; All Birds Barcoding Initiative (ABBI)
- Barcode Database: Agreement with GenBank/NCBI to create Barcode Section of GenBank; Specifications for barcode records in GenBank; Agreement among GenBank, EMBL, DDBJ; Action plan for specimen ID; Action plan for species name sources; NCBI assembling authority files

6. RESULTS

Please describe meaningful scientific and/or technical results achieved in the report year. Make the significance clear. Emphasize what was learned, not what was done. This should be a summary of significant results and conclusions.

Data available from the OBIS Portal increased from 17 data sources, 2.4 million records resolved to the genus level or below, and 23,000 marine species in the summer of 2004 to 48 data sources, 4.7 million total records resolved to the genus level or below, and 38,000 marine species by the summer of 2005.

In 2004-2005 southern hemisphere RONs, supported by the OBIS Secretariat, in Australia, Indian Ocean, New Zealand, South America, and Sub-Saharan Africa regions developed. The OBIS nodes in Canada and Europe began making large volumes data available. These two

developments were instrumental in achieving the increased data availability numbers. The expressed purpose of Regional OBIS Nodes is to foster the on-line provision of marine biogeographic data from their regions and areas of expertise to the international OBIS Portal.

New members of the International Committee were appointed broadening the base and scope of areas of expertise available to the OBIS community. Gary Poore, a Senior Curator (Crustacea) from Museum Victoria, in Melbourne, Australia brings to the IC expertise in using and developing crustacea.net and is a world leader in crustacean taxonomy (especially electronic identification guides and isopods). Ann Bucklin, another new member of the IC, from the University of Connecticut, brings expert knowledge of genetic data and its applications to help advise OBIS to interact with such data. In addition she is involved in collecting zooplankton data, the most abundant data type in OBIS, with more to be gathered, especially doing data analysis in conjunction with oceanographic data (chlorophyll, SST productivity), and to help develop synergies with GOOS, IMBER and the like.

New associated funding has come to OBIS from:
the North Pacific Research Board, for the Alaska marine information system (AMIS): an integrated web-based information system for the NPRB;

the NSF, for the Integrated Ocean Biogeographic Information System for Knowledge Discovery in Bio-Informatics;

Moore Foundation to UCSD subcontracted to OBIS, for Integration of the Information System

Formal endorsement of the CoML and OBIS has come from IODE, IOC, IABO. The foremost of agreements is that IODE and OBIS will collaborate in mutual development activities at IODE National Oceanographic Data Centres (NODCs) and Regional OBIS Nodes (RONs) where those Centres and Nodes have geographic overlap. The NODCs and RONs are both globally distributed networks that will enhance each other's capabilities, especially in the blending of physical oceanographic data at the NODCs with the marine biological diversity data at the RONs.

7. IMPACT AND APPLICATIONS

Please describe the potential future impact for the CoML applicable issues below. Impact is taken to mean “to have an effect on” and/or “to produce changes.”

a. Ocean Observing Systems

What applicability does this project have for ocean observing systems?

We expect OBIS to be the leading biological component of the global ocean data network.

b. Marine Ecosystem-based Resource Management

What is the potential future impact on Ecosystem-based resource management?

OBIS will be the primary source of species distribution data at a global level. This information is essential to know if a species is rare or common, where an introduced species came from, and if certain areas have more species (hotspots) and merit special protection.

c. Capacity Building and Training (Delete this section if there are none)

What is the potential future impact on Capacity Building and Training?

OBIS data will become more widely used by university and high-school students, and their teachers and members of the public to discover available data, reveal biogeographic patterns, and related species to the geographic and marine environment. Already, OBIS provides Lesson Plans online, and this year a third year University of Auckland used OBIS extensively in their Marine Ecology course.

8. GEOGRAPHIC EXPANSION

Describe the current geographic scope of your project, as well as your plans, if any, to expand this scope (this includes "spin off" projects replicating your protocols).

Spin Off Project Name	Principal Investigator	Geographic Locale
OBIS Australia	Alicja Mosbauer, National Oceans Office, Australia	E Indian Ocean, SW Pacific Ocean, Southern Ocean, Tasman, Coral, Arafura and Timor Seas
OBIS Canada	Bob Branton, Centre for Marine Biodiversity	Arctic Ocean, NW Atlantic Ocean, NE Pacific Ocean
OBIS China	Sun Song, Institute of Oceanology	China EEZ
EurOBIS	Edward Vanden Berghe, Vlaams Instituut voor de Zee (VLIZ)	NE Atlantic Ocean, North Sea, Baltic Sea, English Channel, Irish Sea, Mediterranean Sea, Black Sea
IndOBIS	Vishwas Chavan, National Chemical Laboratory and National Institute of Oceanography	Indian Ocean
OBIS Japan	Junko Shimura, National Institute for Environmental Studies	Japan EEZ
OBIS New Zealand	Don Robertson, National Institute of Water & Atmospheric Research	Ross Sea, New Zealand EEZ, and surrounding ocean, Fijian EEZ

Spin Off Project Name	Principal Investigator	Geographic Locale
OBIS South America Argentina Sub-Node	Mirtha Lewis, Centro Nacional Patagónico - (CENPAT) – CONICET	Southwestern Atlantic
Brazil Sub-Node	Fábio Lang da Silveira and Rubens Lopes, University of São Paulo (USP) and Reference Center on Environmental Information (CRIA)	Tropical and sub-tropical southwest Atlantic
Chile Sub-Node	Ruben Escribano, University of Concepcion	Tropical, sub-tropical and eastern south Pacific
Sub-Saharan Africa	Marten Grundlingh, Southern African Data Centre for Oceanography (SADCO)	South-East Atlantic Ocean, South-west Indian Ocean
United States of America	Mark Fornwall, National Biological Information Infrastructure (NBII)	USA EEZ

9. RELATED EFFORTS

a. Links to Other CoML Projects

Please identify other projects within CoML with which your project shares common themes, cruises of taxonomic expertise. Identify any crossover personnel.

Project Name	Cross-Over Person(s)	Nature of Relationship
1. ArcOD (Arctic Ocean Diversity)	ArcOD: Rolf Gradinger, Russ Hopcroft, Bodil Bluhm OBIS: Richard Chinman	OBIS will serve project data. Data expected in 2005.
2. CAML (Census of Antarctic Marine Life)	CAML: Michael Stoddart, Colin Summerhayes OBIS: Richard Chinman	OBIS will serve project data. Data expected in 2005.
3. CeDAMar (Census of Diversity of Abyssal Marine Life)	CeDAMar: Pedro Martinez Arbizu, Craig Smith, Angelika Brandt OBIS: Richard Chinman	OBIS will serve project data. Data expected in 2005.
4. CenSeam (Global Census of Marine Life on Seamounts)	CenSeam: Karen Stocks, Malcolm Clark, Ashley Rowden OBIS: Karen Stocks	OBIS serves project data. Data expected in 2005.

5. ChEss (Biogeography of Chemosynthetic Ecosystems)	ChEss: Paul Tyler, Chris German, Eva Ramirez Llodra OBIS: Karen Stocks	OBIS will serve project data. Data expected in 2005.
6. CMarZ (Census of Marine Zooplankton)	CMarZ: Ann Bucklin, Shuhei Nishida OBIS: Richard Chinman	OBIS serves project data.
7. CoMargE (Continental Margin Ecosystems on a Worldwide Scale)	CoMargE: Myriam Sibuet OBIS: Mark Costello	OBIS will serve project data. Data expected in 2005.
8. CReefs (Coral Reefs)	CReefs: Rusty Brainard, Julian Caley, Nancy Knowlton OBIS: Daphne Fautin	OBIS will serve project data. Data expected in 2005.
9. FMAP (Future of Marine Animal Populations)	FMAP: Hiroyuki Matsuda, Ransom A. Myers, Gunnar Stefansson OBIS: Phoebe Zhang	OBIS will serve project data. Data expected in 2005.
10. GoMA (Gulf of Maine Area Program)	GoMA: Lewis Incze, Evan Richert OBIS: Bob Branton	OBIS serves project data
11. HMAP (History of Marine Animal Populations)	HMAP: Poul Holm, Andrew Rosenberg, David Starkey OBIS: Phoebe Zhang	OBIS serves project data
12. ICOMM (International Census of Marine Microbes)	ICOMM: J.W. de Leeuw, Mitch Sogin OBIS: Vishwas Chavan	OBIS will serve project data. Data expected in 2005.
13. MAR-ECO (Patterns and Processes of Ecosystems in the Northern Mid-Atlantic)	MAR-ECO: Odd Bergstad Aksel, Mike Vecchione OBIS: Mark Costello	OBIS will serve project data. Data expected in 2005.
14. NaGISA (Natural Geography in Shore Areas)	NaGISA: Brenda Konar, Yoshihisa Shirayama OBIS: Karen Stocks	OBIS will serve project data. Data expected in 2005.
15. POST (Pacific Ocean Shelf Tracking)	POST: David Welch OBIS: Pat Halpin	OBIS will serve project data. Data expected in 2005.
16. TOPP (Tagging of Pacific Pelagics)	TOPP: Barbara Block, Dan Costa OBIS: Pat Halpin	OBIS will serve project data. Data expected in 2005.

b. Partnerships

Please identify any organizations, government agencies, science programs, and non-CoML projects with which your CoML project has an affiliation and briefly describe the nature of each relationship.

The partnerships listed below are ones additional to those listed in previous tables (e.g., data providers, and RONs)

Organization Name	Point-of-Contact	Nature of Relationship
Conservation International	Roger McManus	Data analysis interests
FishBase	Rainer Froese	Exchange data and know-how
GBIF	Jim Edwards	Exchange data, share software, and know-how
Generic Taxonomical Database System	Tim Deprez	OBIS serves project data
Hexacorallia	Daphne Fautin	Exchange data, share software tools, and know-how
IABO	Annelies Pierrot	Exchange data, share software, and know-how
ICES	Adi Kellermann	Exchange data, share software, and know-how
Indo-Pacific mollusks	Paul J. Morris	OBIS serves project data
IOC	Patricia Bernal	Exchange data, share software, and know-how
IODE	Leslie Rickards	Exchange data, share software, and know-how
IOOS	Peter Fippinger, Fred Grassle	Exploring exchange of data, sharing software, and know-how Further opportunities include development of an OBIS demonstration project, working in collaboration with ORAP, the US Node, IOOS, and NOAA, with the goal of putting data into OBIS.
Marine Biodiversity and Ecosystem Functioning EU Network of Excellence (MarBEF)	Edward Vanden Berghe	OBIS serves project data
Marine Invertebrate Diversity Initiative	Paul Boudreau	OBIS serves project data
MMI	John Graybeal	Share metadata development and know-how, serve on steering committee
NatureServe	Denny Grossman	Collaboration in habitat classification

10. PUBLICATIONS

Please list references for Submitted, In Press, or Published; books, chapters, or significant papers (since August 2004). Please also include papers in preparation or development with an estimated date of submission or publication.

1. Appeltans, W.; Claus, S.; Cuvelier, D.; Vanden Berghe, E. (2005). Europe counts marine life, in: Mees, J.; Seys, J. (Ed.) (2005). VLIZ Young Scientists' Day, Brugge, Belgium 25 February 2005: book of abstracts. VLIZ Special Publication, 20: pp. 19.
2. Appeltans, W.; Vanden Berghe, E. (2004). MARBEF data management. MARBEF Newsletter 1: 8-9.
3. Appeltans, Ward; Vanden Berghe, Edward; Mees, Jan. A taxonomic and biogeographic information system of marine species in the Southern North Sea developed by Flanders Marine Institute, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
4. Best, B.; Halpin, Patrick. Emerging Open Source Software, Standards and Protocols Used for Sharing and Analyzing Marine Biogeographic Data, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
5. Branton, R.; Ricard, D. Using OBIS to Provide Reliable Regional Scale Estimates of Population Indices for Marine Species from Research Trawl Surveys, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
6. Branton, R.; Van Guelpen, Lou. A Next Step in the Emergence of Self-funded OBIS Regional Nodes: Industry Sponsored Data Product Development on the CMB-BIO Internet Portal, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
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8. Chavan, Vishwas; Wafar, M.V.M.; Krishnan, S. Biodiversity Informatics and Indian Ocean: Challenges and Potentials, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
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10. Costello, M.J.; Grassle, J.F.; Zhang, Y.; Stocks, K.; Vanden Berghe, E. (2005). Where is what, and what is where? Online mapping of marine species. MARBEF Newsletter 2: 20-22.
11. Costello, Mark J.; Emblow, Chris; Bouchet, Philippe; Legakis, Anastasios. An analysis of gaps in knowledge of marine biodiversity in Europe, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.

12. Costello, Mark J.; Grassle, Fred; Zhang, Yunqing; Stocks, Karen I.; Rees, Tony. The evolution and future challenges of the Ocean Biogeographic Information System, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
13. Deprez, Tim; Vincx, Magda; Vanden Berghe, Edward; Mees, Jan. NeMys: an evolving biological information system, a state of art, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
14. Fabri, Marie-Claire; Galeron, Joëlle; Maudire, Gilbert. BIOCEAN – A new database for deep-sea benthic ecological data, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
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16. Finney, Kim. Key Ingredients For Developing A National Oceans Portal, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
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25. Rees, Tony. Evolving concepts in the architecture and functionality of OBIS, the Ocean Biogeographic Information System, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 105.
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29. Vanden Berghe, E.; Appeltans, W. (2004). The European Register for Marine Species revived, in: Mees, J.; Seys, J. (Ed.) (2004). VLIZ Young Scientists' Day, Brugge, Belgium 5 March 2004: book of abstracts. VLIZ Special Publication, 17: pp. 77
30. Vanden Berghe, E.; Bouchet, P.; Boxshall, G.; Costello, M.J.; Emblow, C. (2004). European Register for Marine Species version 2.0: data management, current status and plans for the future, in: (2004). Ocean Biodiversity Informatics, Hamburg, Germany: 29 November to 1 December 2004: book of abstracts. pp. 29.
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11. EDUCATION & OUTREACH

Please list substantial Education & Outreach activities associated with this effort (since August 2004) and indicate the target audience for each. Please indicate the success of each effort, if known.

Year 2004	Dates	Location	OBIS in Attendance
Pacific Biodiversity Information Forum (PBIF) workshop held in association with the Governing Board meetings of GBIF	4-8 Oct	Wellington New Zealand	Don Robertson
The Second GTI Regional Workshop in Asia–Oceania	9-10 Oct	Wellington New Zealand	Don Robertson
Year 2005			
Consortium for the Barcode of Life: Library and Laboratory: the Marriage of Research, Data and Taxonomic Literature	7-9 Feb	London, UK	Vishwas Chavan Fred Grassle
Global Biodiversity Information Facility (GBIF) SpeciesBanks Workshop	2-4 Mar	Amsterdam, Netherlands	Michael Brown (associated with Mark Costello) Vishwas Chavan Simon Claus (associated with Edward Vanden Berghe) Rainer Froese (keynote speaker) Junko Shimura
Joint Workshop European Science Foundation (ESF) -- Marine Biodiversity and Ecosystem Functioning EU Network of Excellence (MarBEF): Long Term and Large Scale Management of Marine Biodiversity Information	28 Feb-4 Mar	Helgoland, Germany	Edward Vanden Berghe

Global Biodiversity Information Facility (GBIF) - Modeling Biodiversity Data workshop	4-8 Apr	Mexico City, Mexico	Siddharth Paralikar (associated with Vishwas Chavan) Wan-Hsu Tsai (associated with Daphne Fautin)
Global Biodiversity Information Facility (GBIF) Governing Board 10th meeting	18-22 Apr	Brussels, Belgium	Rainer Froese (from the GBIF OBIS Node) Junko Shimura (from the GBIF Japan Node and Japan Regional OBIS Node)
Global Biodiversity Information Facility (GBIF) Nodes Committee 7th meeting	20-22 Apr	Brussels, Belgium	Richard Chinman Phoebe Zhang
Global Biodiversity Information Facility (GBIF) ECAT (Electronic Catalogue of Names of Known Organisms) meeting	21-22 Apr	Brussels, Belgium	Junko Shimura
Global Biodiversity Information Facility (GBIF) OCB (Outreach and Capacity Building) meeting	21-22 Apr	Brussels, Belgium	Vishwas Chavan
OBIS Management Committee (MC) meeting	23-24 Apr	Oostende, Belgium	All OBIS Management Committee members represented
Inauguration of the Intergovernmental Oceanographic Commission (IOC) Project Office for International Oceanographic Data and Information Exchange (IODE), Oostende, Belgium	25 Apr	Oostende, Belgium	Edward Vanden Berghe Bob Branton
IODE 18th Session	26-30 Apr	Oostende, Belgium	Edward Vanden Berghe Bob Branton
The Future of Marine Biodiversity: The Known, Unknown and Unknowable (KUU) Symposium	22-25 Apr	La Jolla, California	Fred Grassle Karen Stocks
Census of Marine Life (CoML) Scientific Steering Committee (SSC) meeting	26-27 Apr	La Jolla, California	Fred Grassle

Consortium for the Barcode of Life - Species' Names List meeting	28-29 April	Front Royal, Virginia	Daphne Fautin Fred Grassle Phoebe Zhang
7th Indo-Pacific Fish Conference	16-21 May	Taipei, Taiwan	Rainer Froese (keynote speaker)
Scientific Committee on Antarctic Research - Marine Biodiversity Information Network (SCAR-MarBIN) meeting (in conjunction with CAML Scientific Steering Group, 27-31 May)	25-26 May	Brussels, Belgium	Edward Vanden Berghe
OBIS International Committee (IC) meeting	23-24 Jun	San Francisco, California	All OBIS International Committee members to attend
CoML Australia, Voyage of Discovery Workshop	13 Jul	Darwin, Australia	Alicja Mosbauer Tony Rees
A Research Coordination Network to Study the Historical Ecology of the Trans-Atlantic Biota (CORONA) 4th Meeting	20-24 Jul	Roscoff, France	Mark Costello
U.S.- New Zealand Bilateral Climate Change Agreement meetings	21 Jul	Wellington New Zealand	Don Robertson
International Amphipod Workshop	24-27 Jul	Cork, Ireland	Mark Costello
GBIF Review Response Team	7-8 August	Copenhagen	Mark Costello
Marine Metadata Initiative workshop	9-11 August	Boulder, Colorado	Karen Stocks Mark Costello
IABO/IAPSO/IAG Dynamic Planet Conference (including a CoML Session)	22-26 Aug	Cairns, Australia	Mark Costello Fred Grassle
Census of Marine Life (CoML) Scientific Steering Committee (SSC) meeting	26-28 Aug	Cairns, Australia	Fred Grassle
Taxonomic Databases Working Group (TDWG) - 2005 Annual Meeting	11-18 Sep	St. Petersburg, Russia	Phoebe Zhang

MTS/IEEE Oceans 05 Conference (including USNC CoML sessions)	19-23 Sep	Washington, DC, USA	Daphne Fautin
ICoMM (CoML microbes) workshop	25-26 Sep	MBL, Woods Hole, USA	Vishwas Chavan
GBIF Governing Board 11th meeting	10-14 Oct	Stockholm, Sweden	Daphne Fautin (Head of Delegation of the GBIF OBIS Node)