Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices

First Session

National Oceanographic Data Center
Silver Spring, MD, USA
25-27 June 2002

UNESCO

IOC/IODE-BCDMEP-I/3
Paris, 27 June 2002
English only

Abstract
The 1st Session of the IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices was held in Silver Spring, MD, USA, from 25–27 June 2002 and was hosted by the National Oceanographic Data Center. The Group members presented an overview of current activities in biological and chemical data management in their respective institutions. The Group discussed the need for an inventory of existing databases and agreed to define and distribute a questionnaire to request information about documenting systems, databases and inventories. The Group decided to commence planning for an international workshop that would provide a forum for scientists to be informed of the latest developments in biological and chemical data management.

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1. ORGANISATION OF THE SESSION

1.1 OPENING OF THE SESSION

The Session was opened at 0900 on Tuesday 25 June 2002 by Sydney Levitus, Director, World Data Center for Oceanography and host of the meeting. Mr Levitus welcomed the participants to the First Session of the IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices and agreed to chair this first meeting. Ms Renee Tatusko from NODC/WDC then presented details of the organisational arrangements for the meeting.

The Technical Secretary for the meeting, Mr Greg Reed, outlined the objectives of the meeting. He recalled two important events that had a direct influence on the establishment of the Group of Experts on Biological and Chemical Data Management and Exchange Practices. The first was the International Workshop on Oceanographic Biological and Chemical Data Management held in Hamburg, Germany in May 1996. The overall goal of the workshop was to improve the quantity and quality of chemical and biological data available to the scientific community; some thirty papers were presented on issues of biological and chemical data management. The second event was the Sixteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE) held in Lisbon, Portugal, 31 October - 8 November 2000, where the Committee adopted Recommendation IODE-XVI.4 establishing a Group of Experts on Biological and Chemical Data Management and Exchange Practices to develop standards for biological and chemical oceanographic data. This recommendation is attached in Annex III. Mr Reed briefly outlined the IODE system – a network of National Oceanographic Data Centres and Responsible National Oceanographic Data Centres – and described the groups that provide expert advice to the IODE Committee or guide projects. These groups are respectively 'IODE Groups of Experts' and 'IODE Steering Groups'. He also outlined the reporting procedures for Groups of Experts to the IODE committee.

Mr Levitus provided an overview of the International Workshop on Oceanographic Biological and Chemical Data Management. This workshop was a result of the decision of the Fifteenth Session of the IOC Committee on IODE to convene a meeting in recognition of the role that historical, digital archives of oceanographic biological, chemical and carbon dioxide data play in understanding the World Ocean's biogeochemical cycles. The Workshop concentrated on a few parameters to ensure that progress was made in understanding how best to manage this data. Mr Levitus recalled that the problems of archiving oceanographic data magnify when the scope of the archive extends through the geochemical to the bio-geochemical. The challenge is to develop the database, data analysis and data visualization structures that will enable widely distributed, multidisciplinary investigators to work with each other's data. The Hamburg Workshop on Oceanographic Biological and Chemical Data Management was convened to discuss the issues involved and identify ways to solve existing problems. More than 40 experts from 15 countries and 3 international organizations attended the Workshop.

1.2 ADOPTION OF THE AGENDA

The Chairman outlined the Provisional Timetable and Agenda for the meeting and invited comment on the agenda. The Group adopted the Agenda, which is given in Annex I.

2. PRESENTATIONS BY PARTCIPANTS

Each participant provided a detailed presentation describing the chemical and biological data management activities in their own institutions. A summary of each of these presentations is given in Annex IV.

3. GROUP DISCUSSIONS

The question was raised as to the status of the UNESCO Marine Species Register. This register is specifically for marine organisms; in a first phase, a list of families of marine organisms would be completed. Does IOC still fund ETI to maintain this register? Peter Schalk should be contacted to establish current status of the register.

It was noted that since First International Workshop in Hamburg, taxonomic systems have advanced significantly. Funding is always an issue but GEBCDMEP could organise another meeting. There is still a lot of data to be digitised and there is always the danger that this priceless resource could be lost. An International workshop would provide a forum for scientists to be informed of the latest developments and of the need to provide their data to global databases. This proposed international meeting could be announced at the COD Symposium in November in Brussels, and held 1 to 1½ years after that time (i.e. spring 2004).

The Group discussed the need for an inventory of existing databases and systems. Group members agreed to document systems and databases currently in use within their organisations. Results from, and experiences with this preliminary internal enquiry would be used to define a questionnaire to request information about documenting systems, databases and inventories. This questionnaire will be distributed at the COD symposium in November 2002. The IOC secretariat offered to host a website with links to these databases and other resources, e.g., OBIS and HELCOM.

The subject of metadata databases to describe biological and chemical datasets was raised. The IOC metadata system, MEDI, is currently used to describe oceanographic datasets and this system could be used to represent chemical and biological datasets. Additional keywords, such as taxonomic descriptors, may be required in MEDI and these extra requirements should be investigated.

The ICES Working Group on Marine Data Management (WGMDM) has drafted guidelines on biological data management (A.5.3, A.5.2). The GEBCDMEP could review these guidelines and provide feedback to ICES WGMDM. There may also be other pertinent guidelines and documentation available, such as those produced by the ICES OSPAR steering group. The group agreed to review the ICES WGMDM guidelines and ascertain what other relevant documentation is available.

The group noted that ITIS is a useful tool for use in the IODE system. The group agreed that a letter should be written to ITIS informing them of the establishment of the GEBCDMEP and to indicate that the group desires to cooperate with ITIS. A copy of this letter should be sent to ITIS Canada and ITIS Mexico. A similar letter should be sent to ETI and FAO Fisheries.

It was noted that the composition of the GEBCDMEP was largely focussed on biological data, however the group agreed that the initial priority should be biological data management and exchange but would seek additional expertise in chemical data management as required.

The Group discussed the Terms of Reference (as defined by Recommendation IODE-XVI.4) and agreed to the following amendments:

(i) Document the systems and taxonomic databases ***and inventories*** currently in use in various data centres

(v) Encourage data holders to contribute data to data centres for the creation of a global integrated oceanographic profile and plankton databases ***and other biological databases***

4. GEBCDMEP ACTION PLAN

The Group developed an Action Plan for the intersessional period based on the agreed action items arising from the meeting and assigned tasks to each member of the Group. The following Action Items were agreed:

1. Define a model for questionnaire to request information about documenting systems, databases and inventories. Group to discuss online. Document systems of the institutions represented in GE and announce the results at COD symposium in November 2002. [*Action: All*]
2. Distribute the questionnaire at the COD symposium and encourage other institutions to provide feedback. [*Action: Chair GEBCDMEP*]
3. Investigate suitability of MEDI for describing biological datasets. [*Action: Edward Vanden Berghe and Greg Reed*]
4. Chair and IOC secretariat would draft a letter to ICES, ITIS, ETI and FAO informing them of the establishment of the GEBCDMEP. This draft would be circulated to members of the Group for comment before distribution. [*Action Chair, IOC Secretariat*]
5. Start preparations for the 2nd International Symposium on Biological and Chemical Data Management to be held, possibly, in Spring 2004. Suni Wilhelms to investigate the possibility of holding the symposium in Hamburg. Syd Levitus would draft a letter of intent outlining the topics to be covered. [*Action: Sunhild Wilhelms, Sydney Levitus*]

5. ELECTION OF THE GEBCDMEP CHAIR

Nominations were called for the position of Chair of the Group. Syd Levitus nominated Edward Vanden Berghe and the Group unanimously elected Dr Vanden Berghe as Chair of GEBCDMEP for the next intersessional period.

6. DATE AND PLACE OF THE NEXT SESSION

The Group agreed to held a short meeting (1-2 hours) at the COD Symposium in November 2002 to discuss progress of the action items; dates for the next formal meeting of the GE will be discussed at this occasion.

7. CLOSURE OF THE SESSION.

The GEBCDMEP Chair thanked everybody for contributing to the meeting. He especially thanked the session's hosts from the NOAA-NODC/WDC, Syd Levitus and Renee Tatusko for the excellent arrangements.

The Chair closed the session on Thursday 27 June at 17:00 hrs.

ANNEX I

TIMETABLE AND AGENDA

Tuesday, 25 June 2002.

0900 - 0915	Welcome and brief introduction, *Syd Levitus (NOAA-NODC/WDC)*
0915 - 0930	Logistics and social arrangements, *Renee Tatusko (NOAA-NODC/WDC)*
0930 - 1015	Review terms of reference for the Group of Experts, *Greg Reed (IOC)*
1015 - 1045	Break
1045 - 1130	Review of the "International Workshop on Oceanographic Biological and Chemical Data Management"; World Ocean Database 2001, *Syd Levitus (NOAA-NODC/WDC)*
1130 - 1215	The Integrated Taxonomic Information System (ITIS), *Janet Gomon (Smithsonian Institution)*
1215 - 1330	Lunch
1330 - 1415	Biological and Chemical Data Management Activities at the World Data Center for Oceanography, *Todd O'Brien (NOAA-NODC/WDC)*
1415 - 1445	Chemical and Biological Data Management Activities at the Russian Oceanographic Data Center, *Alexander Kouznetsov (Russian Institution for Hydrometeorological Information/Russian National Oceanographic Data Center)*
1445 - 1515	Break
1515 - 1600	Biological Database Activities at the Flanders Marine Institute, *Edward Vanden Berghe (Flanders Marine Institute)*
1600 - 1630	NODC Direct, *Mike Ford (NOAA-NODC)*

Wednesday, 26 June 2002.

0900 - 0945	Harmful Algal Bloom Data Management System (HAB-DMS), *Michelle Tomlinson (NOAA-NODC)*
0945 - 1030	NOAA's Coral Reef Information System, *Doug Hamilton (NOAA-NODC)*
1030 - 1100	Break
1100 - 1130	The Oceanography in Chile: Research and Data Management Activities, *Humberto González (Universidad Austral de Chile)*
1130 - 1215	Chemical and Biological Data Management at the British Oceanographic Data Center, *Gwenaelle Moncoiffe (British*

	Oceanographic Data Center)
1215 - 1330	Lunch
1330 - 1415	Biological and Chemical Data Management Activities at the Japan Oceanographic Data Center, *Makoto Terazaki (University of Tokyo)*
1415 - 1445	Biological Data Management Activities at the Bedford Institute of Oceanography, *Mary Kennedy (Bedford Institute of Oceanography)*
1445 - 1515	Break
1515 - 1600	Marine Environmental Data Management at the German Oceanographic Data Center, *Sunhild Wilhelms (Bundesamt fuer Seeschifffahrt und Hydrographie)*
1600 - 1645	Marine Biological and Chemical Data Management Activities in China, *Guo Fengyi (National Marine Data & Information Service/National Oceanographic Data Center)*

Thursday, 27 June 2002.

0900 - 1030	Tour of NOAA Library, *Albert "Skip" Theberge, Jr. (NOAA Library)*
1030 - 1115	Overview of the Ocean Biogeographic Information System (OBIS), *Cynthia Decker (Census of Marine Life and U.S. Navy)*
1115 - 1215	Start group discussion
1215 - 1330	Lunch
1330 - 1600	Conclude group discussion and overview of action items

ANNEX II

LIST OF PARTICIPANTS

Humberto Gonzalez Estay
Universidad Austral de Chile
Institute of Marine Biology
PO Box 567
Valdivia
Chile
Tel: +56 63 221 559
Fax: +56 53 221 455
email: hgonzale@uach.cl

Gwenaelle Moncoiffe
British Oceanographic Data Centre
(BODC)
Bidston Observatory
Bidston Hill, Prenton
Merseyside
CH43 7RA
United Kingdom
Tel: +44 (0) 151 653 1518
Fax: +44 (0) 151 652 3950
E-mail: gmon@bodc.ac.uk

Edward Vanden Berghe
Manager, Flanders Marine Data and
Information Centre
Flanders Marine Institute
Vismijn, Pakhuizen 45-52
B-8400 Ostend
Belgium
Tel +32 59 342130
Fax +32 59 342131
E-Mail: wardvdb@vliz.be

Alexander Kouznetsov
Head of Laboratory
Russian NODC/RIIMI-WDC
6, Koroleva Str., Kaluga District
Obninsk 249020
Russian Federation
E-mail: kuznet@meteo.ru

Guo Fengyi
National Marine Data & Information
Service
93 Liuwei Road, Hedong District
TIANJIN 300171
China
Tel: +86-22 2401 0803
Fax: +86-22 2401 0926
E-mail: guofy@mail.nmdis.gov.cn

Makoto Terazaki
Ocean Research Institute
The University of Tokyo
Minamidai 1-15-1 Nakano-ku
Tokyo 164-8639
Japan
Tel: +81 3 5351 6528
Fax: +81 3 5351 6530
E-mail: terazaki@ori.u-tokyo.ac.jp

Mary Kennedy
Zooplankton Research
Ocean Sciences Division
Bedford Institute of Oceanography
Canada
E-mail: KennedyM@mar.dfo-mpo.gc.ca

Sydney Levitus
Director, World Data Center for
Oceanography-Silver Spring
NODC/NOAA, E/OC5
1315 East West Highway, Room 4362
Silver Spring, MD 20910-3282
United States of America
Tel.: 301-713-3294
Fax: 301-713-3303
E-mail: Sydney.Levitus@noaa.gov

Todd O'Brien
National Oceanographic Data Center
NODC/NOAA, E/OC5
1315 East-West Highway,
Silver Spring, MD 20910-3282
United States of America
Tel: 301-713-3294
Fax: 301-713-3303
E-mail: todd.o'brien@noaa.gov

Renee Tatusko
NODC/Ocean Climate Laboratory-E/OC5,
NOAA/NESDIS,
1315 East-West Highway,
Silver Spring, MD 20910-3282
United States of America
Tel: 301-713-3295
Fax: 301-713-3303
E-mail: renee.tatusko@noaa.gov

Michelle Tomlinson
NODC/NOAA, E/OC1
1315 East-West Highway,

Silver Spring, MD 20910-3282
United States of America
Tel: 301-713-3272
Fax: 301-713-3303
E-mail: michelle.tomlinson@noaa.gov

Sunhild Wilhelms
DOD/BSH
Bernhard Nocht Strasse 78
Postfach 30 12 20
D□20305 Hamburg
Germany
Tel: +49 40 3190 3537
Fax: +49 40 3190 5000
E-mail: wilhelms@bsh.d400.de

OBSERVERS FROM OTHER ORGANIZATIONS

Janet R. Gomon
Deputy Director, Integrated Taxonomic Information System (ITIS)
National Museum of Natural History
Smithsonian Institution
10th & Constitution Avenue, NW
Washington, DC 20560-0190
USA
Tel: 1 202.357.2015
Fax: 1 202.786.2934
Email: gomon.janet@nmnh.si.edu

SECRETARIAT

Greg REED
Intergovernmental Oceanographic Commission (IOC)
1 rue Miollis
75732 Paris Cedex 15
FRANCE
Tel: [33](1) 45 68 40
Fax: [33](1) 45 68 58 12
E-mail: g.reed@unesco.org

ANNEX III

Recommendation IODE-XVI.4

ESTABLISHMENT OF A GROUP OF EXPERTS ON BIOLOGICAL AND CHEMICAL DATA MANAGEMENT AND EXCHANGE PRACTICES

The IOC Committee on International Oceanographic Data and Information Exchange,

Recognizing the increasing importance of managing and archiving biological and chemical data,

Noting the recent development of global research and monitoring programmes that focuses on issues such as climate change and ecosystem dynamics, and relies heavily on biological and chemical data,

Recommends the formation of a Group of Experts on Biological and Chemical Data Management and Exchange Practices;

Further recommends that the tasks of the Group of Experts should include:

(i) documenting the systems and taxonomic databases currently in use in various data centres;

(ii) documenting the advantages and disadvantages of different methods and practices of compiling, managing and archiving biological and chemical data;

(iii) developing standards and recommended practices for the management and exchange of biological and chemical data, including practices for operational biological data;

(iv) encouraging data centres to compile inventories of past and present biological and chemical data holdings;

(v) encouraging data holders to contribute data to data centres for the creation of regional and global integrated oceanographic profile and plankton databases;

Invites the IOC Governing Bodies to support this Group of Experts;

Encourages IOC Member States to nominate experts having expertise in biological and chemical data management and exchange practices to the Group of Experts;

Requests that the Group of Experts maintains close relations with GIPME, OSLR and other relevant programmes;

Further requests that a progress report be submitted regularly to the IODE Officers and the IODE Committee**.**

ANNEX IV

PRESENTATION SUMMARIES

Syd Levitus. World Ocean Database 2001 (WOD01)

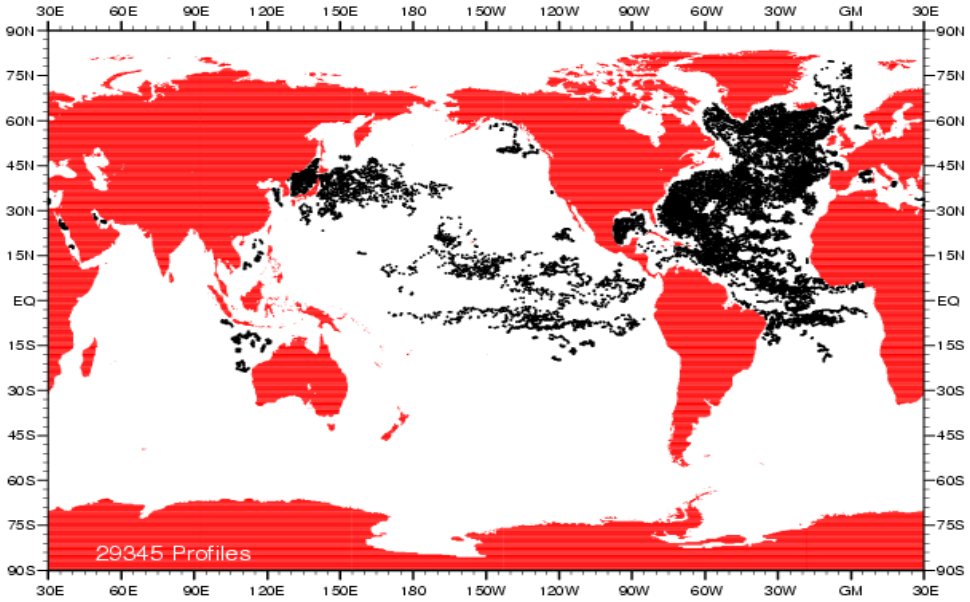
World Ocean Database 2001 (WOD01) released March 2002.

PROBE	WOD98	ADDED (% increase)	TOTAL
Bottle (OSD)	1,373,440	715,184 (52%)	2,121,042
High Resolution Conductivity/Temperature/Depth (HCTD)	189,555	120,783 (64%)	311,943
Mechanical Bathythermograph (MBT)	2,077,200	336,953 (16%)	2,376,206
Expendable Bathythermograph (XBT)	1,537,203	215,735 (14%)	1,743,590
Fixed Platform (*e.g.*, TAO, TRITON, PIRATA)	197,715	183,303 (93%)	297,936
Drifting Buoys*	0	50,549	50,549
Profile Float (PFLOAT: P-ALACE, SOLO, APEX)*	0	22,637	22,637
Expendable Conductivity/Temperature/Depth (XCTD)*	0	811	811
Towed Conductivity/Temperature/Depth (UOR)*	0	37,651	37,631
Autonomous Pinniped Bathythermograph (APB)*	0	75,665	75,665
Total Casts/Profiles	5,292,032	1,773,383 (34%)	7,037,213
Total Surface-Only data (cruises)	0	4743	4743

* indicates data from a "new" instrument type added to the WOD series

- WOD01 can be obtained on-line from (www.nodc.noaa.gov) or as hard copies by sending an e-mail to (wdc@nodc.noaa.gov)

Argo P-ALACE FLOAT Profiles added to WOD98 from GTSPP

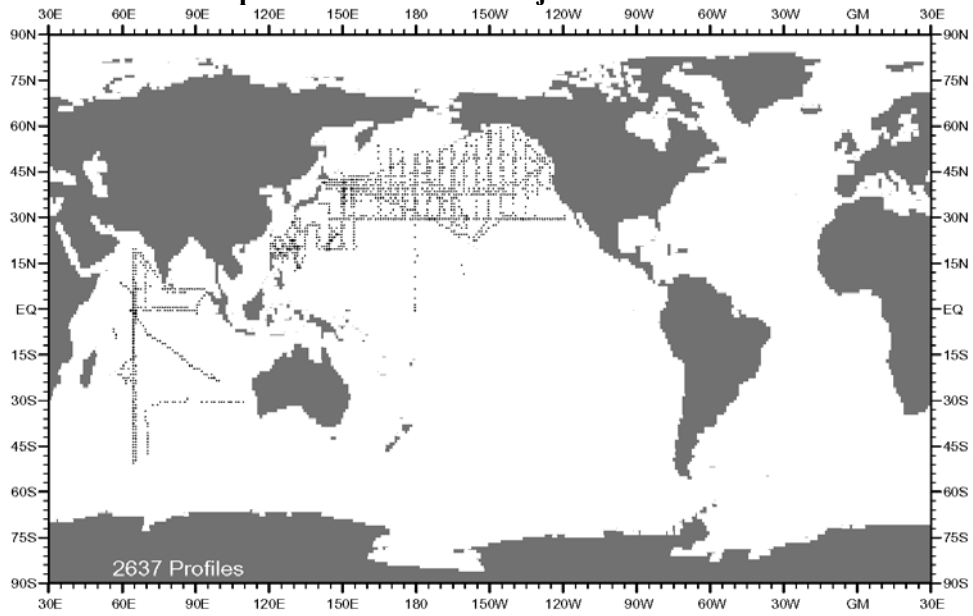


Location of all P-ALACE Float profiles added since publication of WOD98 (as of 11/05/01).
Dots show location of 1/4-degree squares containing any data.

The Global Oceanographic Data Archaeology and Rescue (GODAR) Project

- Established in 1993 by the Intergovernmental Oceanographic Commission
- "Data Archaeology": the process of seeking out, restoring, evaluating, correcting, and interpreting historical data sets;
- "Data Rescue": the effort to save data at risk of being lost to the science community by digitizing manuscript data and copying data on older, failing electronic media, and then archiving these data into an internationally available electronic database.

Example of data rescued as part of the GODAR Project



Ocean Station data profiles from the Far Eastern Hydrometeorological Institute of Scientific Research
Dots show location of 1-degree squares containing any data.

Regional *GODAR Project* meetings

- Six regional *GODAR Project* workshops were held worldwide that encompassed all countries that make oceanographic measurements.
- Attendance of these meetings in total was approximately 150 oceanographic data managers and scientists.

a) GODAR I	Obninsk, Russia	May, 1993
b) GODAR II	Tianjin, China	March, 1994
c) GODAR III	Goa, India	December, 1995
d) GODAR IV	Valletta, Malta	April, 1995
e) GODAR V	Cartagena, Colombia	April, 1996
f) GODAR VI	Accra, Ghana	March, 1997

- Each meeting produced a Workshop Report that included listings of data in Manuscript and electronic form in each participating country.

International *GODAR* Review Meeting

- July 1999, Silver Spring, Maryland
- Meeting conclusions:
  1. *GODAR Project* has been successful,
  2. variables to be included under the *GODAR Project* should be expanded to include sea level,
  3. GODAR-*WESTPAC* project be initiated.

International Program Support for Data Archaeology and Rescue Activities

- Support for data archaeology and rescue activities in oceanography and meteorology, and specifically for the *GODAR Project* has come from many sources,
  - *e.g.*, World Climate Research program's *CLIVAR* program (WCRP, 1995; 1999) and the IPCC Assessment (1996).

Reasons for Building Global Historical *in situ* Oceanographic Databases

a) The international scientific community advises national and international bodies on such issues as climate change.
   - Historical data are required to support such studies.
   - The international scientific community must have access to the most complete oceanographic data bases possible.
   - These data bases must be accessible in electronic form and available internationally without restriction.

b) Ocean measurement programs are expensive. Scientists planning such programs should have access to all available data in order to make the most efficient use of scarce scientific resources such as ships.
c) Pollutants flow across boundaries. The international community should have access to all historical data for pollution transport studies. This is particularly important for studies of the coastal environment. Natural variability versus anthropogenically induced changes.
d) To develop and improve long-range weather forecasts. Statistical forecasting and hindcasting studies require historical ocean data.

Specific uses for ocean profile-plankton data and products

a) Planning observational programs.
b) Diagnostic studies describing role of the ocean as part of the earth's climate system.
c) Boundary and Initial conditions for numerical models.
d) Verification for ocean and atmosphere simulations.
e) "Sea truth" for satellite ocean altimetry measurements".
f) Initial state for acoustic tomography inversions.
g) Paleontological reference fields (e.g. CLIMAP).

Financial Support for the *GODAR Project*

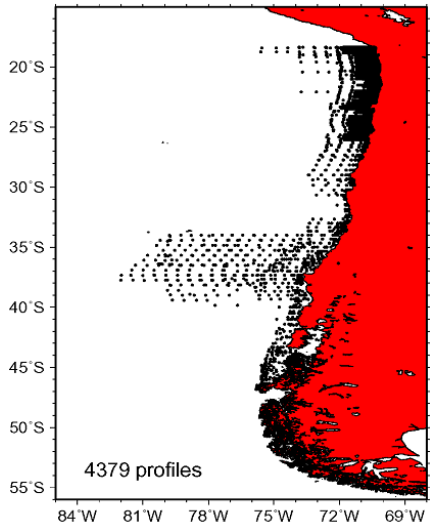
- The IOC has provided important support in the form of staff time and resources.
- The NOAA Climate and Global Change Program and the NOAA ESDIM Program have provided crucial support for U.S. participation, for meeting support, visits by scientific and data management personnel, and for digitization of many data sets for the world ocean.
- The European Community has provided support for the MEDAR/MEDATLAS project and for GODAR meetings.
- Individual countries and international institutions (e.g. ICES) have provided support as Japan is doing with its leadership of the GODAR-WESTPAC project.

The World Ocean Database Project

- "*World Ocean Database Project*" was proposed by S. Levitus at the IODE XVI meeting held in Athens, Greece during December, 2001.
- The purpose of this project is to:
  a) Encourage a more timely exchange of modern oceanographic data;
  b) Encourage the development of regional quality control procedures for oceanographic data;
  c) Encourage the development of regional oceanographic atlases.
  d) Planning for a meeting on "Quality Control of Oceanographic Profile-Plankton Data" will start soon. Meeting to be held within one tear.

An example of *World Ocean Database* type product

- Biological Atlas of the Arctic Seas 2000
- Chile WOD Contribution



Janet Gomon. The Integrated Taxonomic Information System (ITIS)

TOPICS

- OVERVIEW OF ITIS
  - What is ITIS? What are its benefits?
  - ITIS History – Global cooperation and coordination
  - ITIS Data – Original Source; Quantity; Taxonomic groups
  - ITIS System/Tools
  - ITIS Processes – Experts and authoritative lists; Quality control; Quality indicators
- NEXT STEPS AND VISION
- LESSONS LEARNED

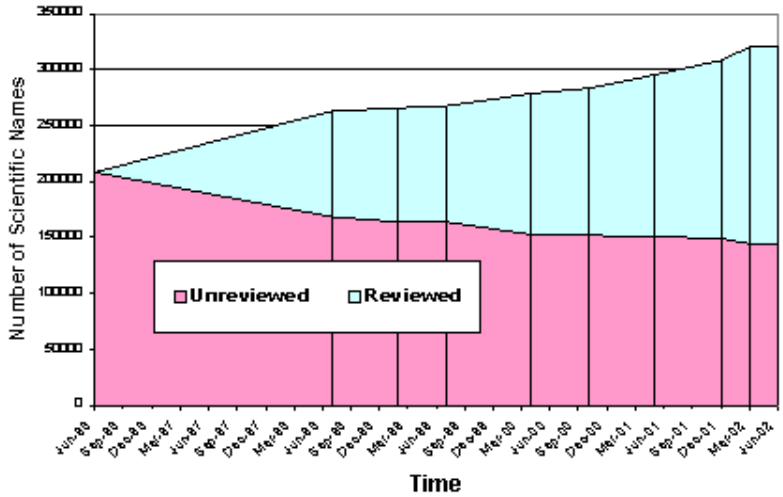
WHAT IS ITIS?

- Dynamic reference database of biological names
  - scientifically credible and quality controlled
- A tool
  - standalone
  - embedded in networked information infrastructures; digital libraries; other applications
  - used in cataloging, metatagging, data access portals
- A partnership
- Provides a shared "common denominator" for accessing biodiversity and ecosystem information
  - Enables cross-referencing to a standard
  - Data can be summarized, analyzed across organizations, geographical regions, and time
- Onward linkages from ITIS names to many related sources for further information

HISTORY OF ITIS

1976 - NODC Taxonomic Code: flat file, intelligent number, provisional data
1985 - NODC and EPA partnership
1992 - NODC, EPA, USGS, decision to upgrade the NODC Code
1993 - ITIS effort started: scientific credibility, enhanced public access
1996 - ITIS came on-line; MOU among partners (NOAA, EPA, USGS, USDA, and Smithsonian)
1997 - Data Development Team established
1998 - Agriculture and Agri-Foods Canada joins
1999 - ITIS*^{CA} goes public; National Park Service joins ITIS; IT IS supports OBIS
2001 -CONABIO joins ITIS; ITIS*^{NA} launched; ITIS joins GBIF; ITIS & Species 2000 join forces, challenge community to complete Catalogue of Life; NSF PEET collaboration

DATA DEVELOPMENT STATUS



HOW MANY NAMES?

Taxonomic Group	World Species	N. American Species	ITIS Scientific Names*
Monera	8,000	?	1,465
Protista	80,000	?	15,509
Fungi	72,000	?	3,857
Plantae	270,000	28,000	85,411
Animalia	1,320,000	130,000	214,602
TOTALS	**1,750,000**	**158,000+**	**320,844**

***ca. 80,000 common names**

ITIS DATA STATUS "Completed"

Cephalopods	World	Diatoms	Great Lake
Shrimp/prawn groups	World	Bony fishes	US/Canada
Marine lobsters	World	Mollusks	US/Canada
Isopods	World	Amphibians	US/Canada
Scleractinia	World	Lizards	US/Canada
Fish groups	World	Snakes	US/Canada
Ants	World	Club Mosses	US/Canada
Mammals	World	Mosses	US/Canada
Crocodiles	World	Leeches	N/M America
Turtles	World	Mayflies, stoneflies	N/M America
Birds	World	Millipeds	N/M America
Caddisflies	World	Dragonflies	New World
Vascular plants	US/Canada	Copepods	Mexico

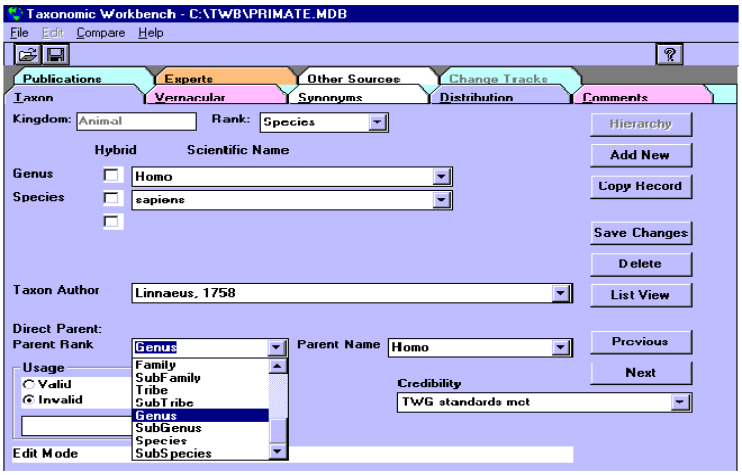
ITIS DATA STATUS "In progress"

Bony fishes	World	Lichen-forming ascomycetes	World
Sea anemones	World	Parasitoid wasps (in part)	World
Nemertea	World	Amphibians	Mexico
Commercial shrimp	World	Birds	Mexico
Diptera	World	Reptiles	Mexico
Amphipods (in part)	World	Lepidoptera	N. Amer.
Snakes (in part)	World	Hypogeous fungi	N. Amer

SUBMITTING DATA TO IT IS

- Submission guidelines
- Nomenclature comparison tool (your name list against ITIS)
- Taxonomic Workbench (downloadable)
- Download all or parts of ITIS database
  - all accessible via U.S. web site

TAXONOMIC WORKBENCH



ITIS DATA ELEMENT GROUPS

- Taxonomy and Nomenclature
  - Scientific name, Author, Date
  - Kingdom, Taxonomic Rank, Synonyms, Common Names
  - Taxonomic Status
  - Current Standing
  - Credibility Rating
  - Taxonomic Completeness (genus and above)
  - Currency
- Taxonomic Hierarchy
- References – Experts, Other Sources, Publications
- Geographic Information
  - Division
  - Jurisdiction/Origin (native or introduced)
- Comments

ITIS IN USE

- U.S. National Biological Information Infrastructure (NBII)
  - BioBot search engine
  - Metatags for web pages
  - Bird Conservation Node
- U.S. Geological Survey – Acute Toxicity Database
- National Park Service – NP Species Information System
- Environmental Protection Agency – STORET National Water Resources Database
- Digital Libraries:
  - University of California Berkeley
  - American Museum of Natural History – museum colls., library colls.
- Publishers
- 7 million hits/yr.; 800,000 visits/yr. – U.S. web site only

NEXT STEPS

- Near-term
  - NODC legacy data review
  - Improve user efficiencies
    - New nomenclature comparison tool
    - Online editing/peer-review workbench tools
    - Bulk load
  - New uses of ITIS
    - Links with online interactive keys
    - Use with handheld computers for field/on-board surveys
    - Use in metadata tools
  - FGDC biological nomenclature and taxonomy standard

- Training "package"
- Improve methods of attribution, incentives for systematists to contribute

VISION

- Longer-term
  - Multiple classifications and categorizations
  - Taxon concept-based system; additional change tracking
  - One-stop shop gateway for biological information
  - Further integration with other systems

LESSONS LEARNED

- Global vs. regional databases
- Single vs. multiple classifications
- Incentives
- Data quality vs. data volume
- Current/valid names vs. valid names and synonyms
- Requirements for success
  - Usefulness to resource managers, systematists, decision-makers
  - Applications of ITIS – global collaborations on key issues
  - Sustainable operating models

FOR MORE INFORMATION

- Web Sites:
  - ITIS *http://www.itis.usda.gov - (U.S.)*
  - ITIS *^{NA} *http://sis.agr.gc/ca/itis/ - (North America)*
  - ITIS *^{CA} *http://www.agr.gc.ca/itis - (Canada)*
  - ITIS *^{MX} *http://siit.conabio.gob.mx - (Mexico)*
- Email Addresses:
  - *Itiswebmaster@www.it is.usda.gov general*
  - *ruggiero.michael@nmnh.si.edu Director, ITIS*
  - *gomon.janet@nmnh.si.edu Deputy Director*

Todd O'Brien. World Ocean Database 2001 Biological Data Management

Sample Collection Effort

TEMPERATURE

- "what is measured" is straight forward
- instant measurement with fairly automated QC and processing
- "electronic profile" is ready in minutes to hours
- Metadata is simple and of minor importance

PLANKTON COUNTS

- "what is measured" is very minor importance gear and mesh dependent
- sample processing requires human expert and hand processing (often via microscope)
- "electronic profile" takes days to weeks
- Metadata is complex and of great importance

Issues of Plankton Data

- Acquiring the Data
- Processing the Data
  - There are no standard data formats.
  - There are no standard sampling protocols.
  - There are no standard taxonomic systems.
- Applying Quality Control

Acquiring new data

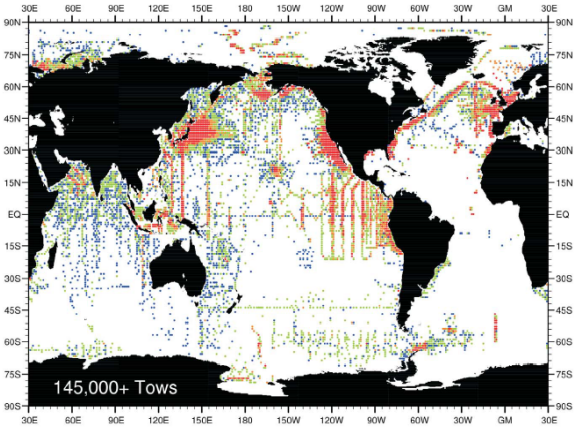
- U.S. National Oceanographic Data Center
- World Data Center A for Oceanography
- Other Institutions and Data Centers
- Global Oceanographic Data Archaeology &
- Rescue Project (GODAR)
- Direct Investigator Submission

The WOD Plankton at a glance ...

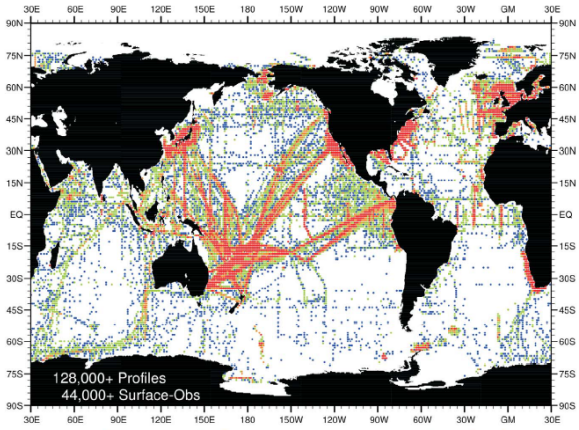
- All data types in a single database (WOD)
  - one location, one format, one documentation
  - T, S, O, "nutrients", chlorophyll, "plankton"
  - multiple-variables study possible
- Plankton metadata based on "Hamburg 1996"
  - presented internationally to various data centers, projects & working groups
- WOD uses ITIS for its taxonomic descriptions
  - Integrated Taxonomic Information System

WORLD OCEAN DATABASE 2001

- 6,500,000+ temperature profiles
- 2,100,000+ salinity profiles
- 600,000+ oxygen profiles
- 250,000+ nutrient profiles (NO3 ; PO4 ; SiO4)
- 150,000+ chlorophyll profiles*
- 145,000+ plankton tows*
- … and also pH, alkalinity, tCO2, pCO2



WORLD OCEAN DATABASE 2001
Distribution of Plankton Tows



WORLD OCEAN DATABASE 2001
Chlorophyll Data

Metadata Summary

COLLECTING INFO

- Sampling Method
  - gear type / model
  - mesh size
  - towing method
- Sample Processing
  - count/weight/volume method
  - preservation and other factors

COLLECTED INFO

- What was caught
  - scientific name (latin)
  - sex, life stage, size, "spp."
- What was measured
  - count, mass, volume, C
  - original and common unit
- Quality Control Flags
- Biological Grouping Code

WOD01 Plankton Measurements

- Total Sample Biomass
  - Total Volume (displacement, settled)
  - Total Mass (wet, dry, carbon, ash-free dry)
- Taxon Specific Obs.
  - abundance (counts)
  - relative abundance ("+","-",common, rare)
  - ind. mass (wet or dry)
  - ind. size (length or volume)
- Taxon Descriptors
  - name(TSN or WOD code)
  - modifier (sp., other, total)
  - life stage (larva, adult, egg)
  - sex(male, female)
  - realm(benthic, pelagic)
  - troph (auto-, hetero-)
  - shape(loricate, thecate)
  - size range (15 – 45 µm)

Plankton Quality Control

- Creating Comparable Values
  - Review of sampling methods and gear
  - Taxonomic validation (via ITIS)
  - Taxonomic grouping (via WOD-BGC)
  - Conversion to common base units (via metadata)
- Automated Checks
  - Loose group-based value range checks
  - Statistical Checks
- Mean Value Fields
  - Comparison against other historical data

ITIS Integrated Taxonomic Information System

- Advantages
  - Numeric storage: efficient, fast searching
  - Archive Safe: Individual ITIS codes will never change
  - QUALITY-REVIEWED BY TAXONOMIC EXPERTS

  - Online ITIS database has full taxonomic inter-relation, references, quality indicators, and common names
- Challenges
  - Need a look-up table (85272 = Calanus finmarchicus)
  - No taxonomic inter-relation inherent in codes themselves (WOD01 "Biological Grouping Code")

Taxonomic Indexing & Quality Review

- All taxonomic names are verified in the ITIS database
  - check confirms accepted usage, synonyms, and spelling (i.e., QC)
  - If not in ITIS database, submitted to ITIS for review and addition
- All plankton are indexed by their ITIS numeric code, and by an OCL Biological Grouping Code (BGC)
  - ITIS code allows for fine detail searches (e.g., species X)
  - OCL BGC allows for fast group searches (e.g. "copepods", "diatoms", "dinoflagellates", "phytoplankton")

Examples of non-ITIS 'taxa'

- Non-taxonomic groups
  - "jellyfish"
  - "algae (enthic)
  - "phototrophic nanoplankton"
  - "small, truncated-conical lagellate"
  - "spherical flagellate, 10 – 15 microns"
- Life stages
  - Calyptopis
  - veliger
- Modified names
  - Biddulphia sp. (frustule)
  - other Mollusca
- Combined taxa
  - Foraminifera + Radiolaria
- Variant spellings
  - Foraminifera , Foraminiferida
- Mispellings
  - Calanus finmarchius (males)

Biological Grouping Code … a supplement to ITIS

- Major Groups
  - bacterioplankton, phytoplankton, protozooplankton, zooplankton, ichthyoplankton, "biomass"
- Minor groups
  - based on the major taxonomic phyla
  - ("diatoms", "dinoflagellates", "cnidarians", "mollusks", "crustaceans")
- Focus Groups
  - level 1- "copepods", "cephalopods"
  - level 2- "calanoid copepods", "squid"

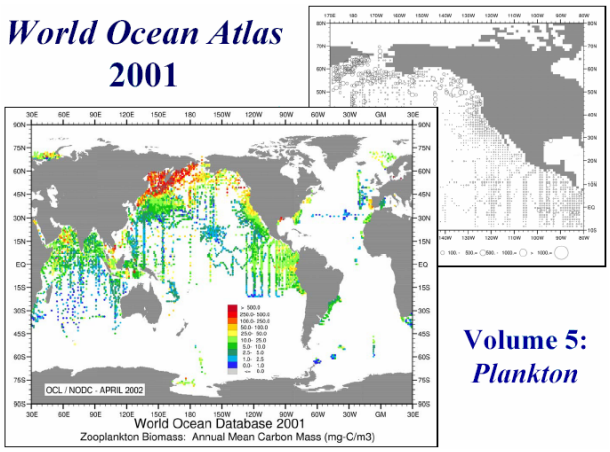
Applying Plankton Metadata

- Goal: Units of "per m3" 80%
- Case One: Units of (per m2) 7%
  - (*/m2) / tow distance (m) = (*/m3)
    - tow distance (m) = as provided
    - vertical tow distance (m) = lower depth (m) - upper depth (m)
    - horizontal tow distance (m) = tow speed (m/sec) * tow duration (sec)
- Case Two: Units of (per haul or per sample) 13%
  - (*/haul) / water filtered (m3) = (*/m3)
    - water filtered (m3) = as provided
    - water filtered (m3) = tow distance (m) * mouth area (m2)
    - water filtered (m3) = "tow distance" (above) * mouth area (m2

Making data available (… for the present and future)

- NODC Archive ("NODC Direct")
- World Ocean Database (1994, 1998, 2001)
  - an integrated database, with all available collocated physical and chemical data, stored in a common format with optional quality review flags

- Data Products (internal & collaborative)
  - World Ocean Atlas 2001
  - International Atlas Series
- Plankton Online Component



World Ocean Database Plankton

- http://www.nodc.noaa.gov/OCL/plankton
- online data, documentation, and access software ...

"Credit" - A Crucial Metadatum

- Each and every station has a …
  - NODC Accession Number
  - Principal Investigator Field(s)
  - Project & Institute Fields
- Submitting Institution or PI Credit
- NODC/FGDC Catalog Entry
- Online Plankton Component
  - Data Set (Accession) Summaries
  - PI and Institution links

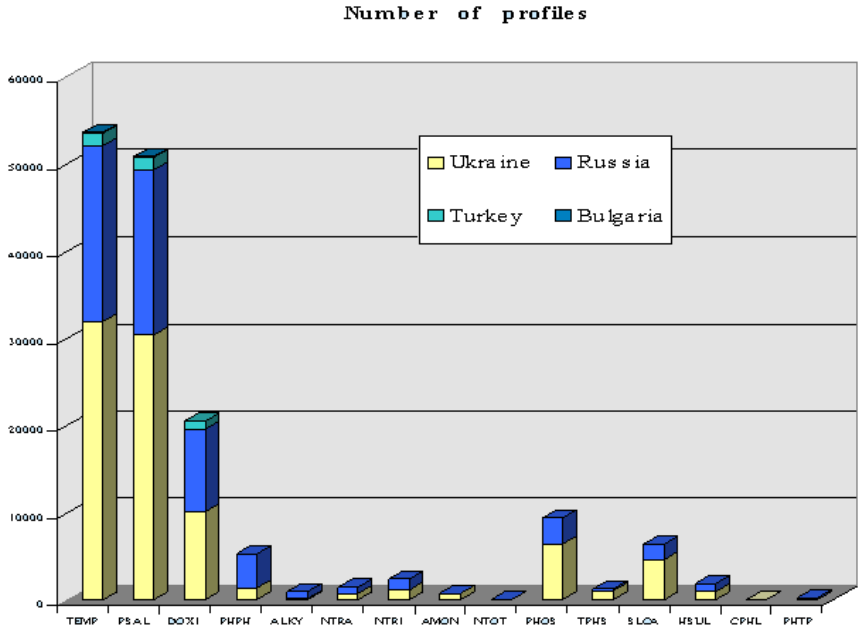
Alexander Kouznetsov. Chemical and Biological Data Management Activities at the Russian Oceanographic Data Center

Russian Ministries and Organizations involved in collection of chemical and biological data

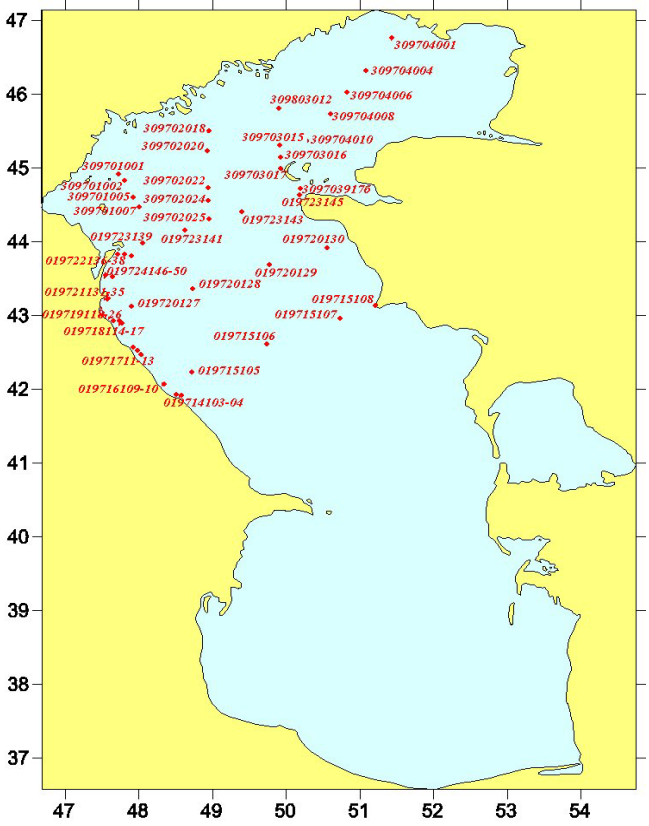
1. Academy of Sciences
   - Shirshov Institute of Oceanology in Moscow (>200 cruises)
   - Pacific Oceanological Institute in Vladivostok (125 cruises, 3000 chemical station, 1800 biological station)
   - Marine Biological Institute in Murmansk (>50 cruises)
2. State Committee of Fishery
   - Federal Research Institute of Fishery and Oceanography (VNIRO)
   - Regional research institutions on the Atlantic, Pacific oceans and adjacent to Russia seas (>4000 cruises, >5000 000 data base records)
3. Federal Service for Hydrometeorology and Environmental Monitoring
   - State Oceanographic Institute in Moscow
   - Institute of Global Climate and Ecology in Moscow
   - Far Eastern Hydrometeorological Research Institute in Vladivostok
   - Arctic and Antarctic Research Institute in St. Petersburg
   - All-Russian Research Institute of Hydrometeorological Information – World Data Centre B

Number of cruises (total)	T,S only	Chemical parameters	Contaminants
20235	6854(34%)	13301 (66%)	3560 (18%)

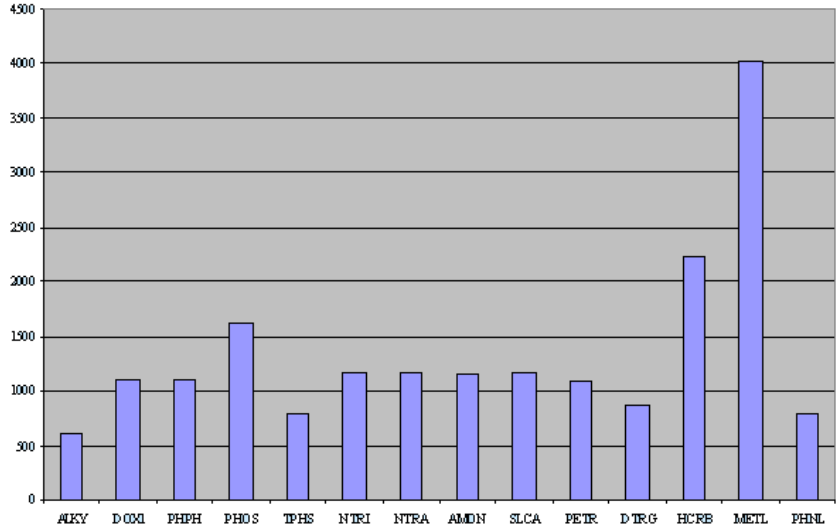
Frequency of different parameters for Black Sea



Environment monitoring network at the northern part of the Caspian Sea



Number of chemical parameter measurements in 2001



Current Status

1. A great amount of historical chemical data are held in RIHMI-WDC-B
2. Most of biological data are held in various organizations of State Committee of Fishery
3. Chemical and biological data obtained from Marine Environment Monitoring Network are held in State Oceanographic Institute
4. Some of chemical and biological data are held in nongovernmental agencies
5. The data holdings are managed through DBMS of various types (MsAccess, Oracle), various code systems are being applied for the data description
6. Some of historical and modern data are not digitized still

Areas of RNODC activity

1. Registration of marine information resources and announcement through the WEB-site

2. Standardization of metadata
3. Unification of code systems
4. Improvement of technologies for data collection and assembling
5. Updating of historical data (restore metadata, QC, quick access)
6. Development of Integrated Information System based on the WEB-technology

Local range control values for parameters in the Black Sea

Parameter	Unit	1	2	3	4	5	6	7	8	9	10	11
Temperature (min)	degree	-1	2	3	5	5	6	6	6	8	10	-2.5
Temperature (max)	degree	28	28	27	27	27	28	28	29	29	33	30
Salinity (min)	PSS	0	4	7	12	16	15	13	4	12	20	0
Salinity (max)	PSS	21	23	23	24	23	23	24	23	31	39	21
pH (min)	pH	7.4	7.2	7.5	7.4	7.5	7.5	7.6	7.5	7.5	7.5	7.2
pH (max)	pH	9.1	8.9	8.9	8.9	9.0	8.7	8.7	8.9	8.9	8.9	8.9
Alkalinity (min)	Mmole/m3	1200	1400	2800	2900	2800	2700	2700	1900	2800	2900	1500
Alkalinity (max)	Mmole/m3	4300	4500	4200	4500	4500	4600	4200	4500	4200	4000	4300
O2 (max)	Mmole/m3	600	570	580	450	380	480	400	520	450	450	600
O2 (max)	Mliter/liter	13.3	12.7	12.8	10.0	8.4	10.6	8.8	11.5	10.0	10.0	13.0
PO4 (max)	Mmole/m3	6	10	10	10	11	12	10	13	8	7	10
PO4 (max)	Mgramm/m3	180	310	290	290	340	370	290	390	230	200	300
SIO3 (max)	Mmole/m3	160	200	310	330	330	320	310	310	310	300	300
SIO3 (max)	Mgramm/m3	4400	5370	8610	9100	9100	8840	8630	8610	8610	8600	8600
NO2 (max)	Mmole/m3	5.86	2.9	1.5	0.8	0.8	1.0	0.5	15	1.5	1.5	10
NO2 (max)	Mgramm/m3	80	40	20	10	11	14	7	210	21	21	140
NO3 (max)	Mmole/m3	33	24	20	15	13	13	10	21	20	20	25
NO3 (max)	Mgramm/m3	460	330	270	210	170	170	120	290	280	280	350
NH4 (max)	Mmole/m3	15	70	96	98	100	105	94	100	96	70	70
NH4 (max)	Mgramm/m3	190	980	1340	1360	1380	1440	1300	1330	1340	1000	1000

Edward Vanden Berghe. Biological database activities at the Flanders Marine Institute

Introduction – VLIZ

- Founded in 1999, operational since 2000
- Financially supported by Ministry of Flanders (85%) and Province of West Flanders (15%)
- Autonomous institute
- Supports marine scientific research
- Does not undertake actual research activities
- Multidisciplinary
- All coastal and estuarine habitats
- Different "target groups"

History - Marine institutes in Ostend

- Pierre-Joseph Van Beneden (1843)
- Station Marine d'Ostende Marien Station (1883)
- ZWIO (1914-1927)
- ZWI (1927-1967)
- IZWO (1970-1999)
- VLIZ (1999-present)

Marine sciences in Flanders

- 60 research groups, 400 people
- 5 Flemish universities (RUG, KUL, UA, VUB, LUC)
- 3 Flemish institutes (IN, aWWK, aWL)
- 3 federal institutes (MUMM, DZV, BGD)
- private companies
- Disciplines: biology 15, mariculture-fisheries 4, chemistry 5, geology-geography 9, engineering 8, maritime sciences 5

VLIZ: objectives

- To create an information and coordination centre for marine, coastal, and estuarine scientific research in Flanders
- To promote Flanders with regard to marine scientific research
- To set up the Flanders Marine Data and Information Centre
- To establish an oceanographic platform

VLIZ: activities

- Publications - Collected reprints, Library acquisitions, Newsletter, 'grote rede'
- 'Oceanographic' platform - RV Zeeleeuw; greenhouses
- VMDC - Databases, multimedia library
- Other services - Requests for information; organising workshops

Flanders Marine Data and Information Centre – VMDC. Objectives

- To provide researchers, the government and those interested with data and information, in a suitable and prompt way
- To stimulate networking by documenting availability of data of research groups and governmental authorities, also on international scale
- To detect needs; create series of data for interdisciplinary research, taking into account the accepted international standards
- Integration of different types of data, including control on consistency and quality

'Salient points'

- VLIZ is a scientific institution, but does not conduct scientific research
  - Supports scientists (viz. running research vessel *Zeeleeuw*, greenhouses in Den Haan, library and information services)
  - Provides expertise (ao in terms of databases: development, maintenance, hosting)
  - Co-publishes data- and other publications (paper & CD)
- VLIZ does not generate data

  - Except for data acquisition system on board of the *Zeeleeuw*
  - Added value by integrating data sets from different sources
  - Added value by creating data compilations

Activities

- Website
- Development databases
  - Information: IMIS
  - Data: MIDAS, Meetnet Vlaamse Banken, biological databases
  - Other external datasets
- Collaboration in projects/international organisations

Website: http://www.vliz.be/

- Bilingual (Dutch, English)
- Contents
  - General information on VLIZ
  - Information on, and data resulting from Flemish research
- Preferred means of data distribution
  - Open, fast (does not require intervention)
  - Ease of use
- Technical:
  - Webserver: Apache, on Windows 2000
  - Databases: CGI-Bin programs in Visual Basic
  - Site Search engine: Search ++
- Future: extra services for members, passwords

Information: IMIS - Integrated Marine Information System

- Documenting Flemish marine sciences
- Different modules
  - Institutes and experts (addresses, contacts)
  - Literature/publications
    - also multimedia objects
    - *full content*
  - Datasets ('Metadata')
  - Projects, conferences, research equipment
- Integration of the different modules
- Compatibility with existing initiatives
  - Keywords/controled vocabulary: ASFA, ITIS
- Available through web site: http://www.vliz.be/vmdcdata/imis/index.htm

IMIS: modules

- Institutes/Expertise
  - MEDI; 1599 institutions, 3485 persons
- Literature
  - ASFA; 23006 records, 5537 with abstract
- Datasets
  - MEDI; only experimental input
- Projects, conferences, equipment
  - 736 projects; 239 conferences

IMIS: plans for the future

- Revision/second generation of IMIS is in progress
  - Full text of publications
  - Multiple affiliations for person
  - Formal link between authors and person

Data: MIDAS - Marine Information and Data Acquisition System

- Objectives

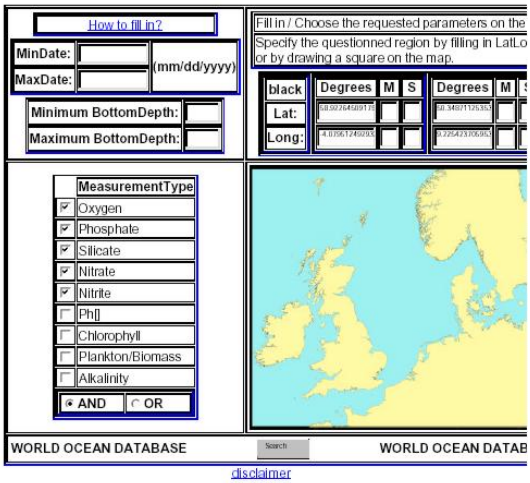
  - Planning and follow-up of scientific activities on board of research vessel 'Zeeleeuw'
  - Logging data automatic data acquisition system Zeeleeuw
  - Logging cruise data and making available to participating scientists
- Status
  - Partially functional since July 2001 (server), September 2001(client), November 2001 (web)

Meetnet Vlaamse Banken

- Activity of Waterwegen-Kust (Departement Leefmilieu en Infrastructuur, Administratie Waterwegen en Zeewezen)
- Meteorological and oceanographic measurements, in real time and continuous
- Data stored in database WWK, mirrored at VLIZ
- VLIZ will post recent measurements on Web site
- VLIZ is responsible to distribute data to the Flemish academic world

Data: World Ocean Database

- User-friendly interface to WOD, intended for the occasional user
- Prototype
- Building capacity in
  - Data re-distribution (cfr Meetnet Vlaamse Banken)
  - Scalable Vector Graphics
- Integrate in North Sea 'Portal', Antarctica portal; integrate with data from other sources
- WOD: user interface



Data: biological databases

- Prototype
- MASDEA
- Tisbe
- North Sea Macrobenthos Survey (1986)
- North Sea Macrobenthos Project (2000)
- Taxonomic descriptors for literature database
- Species register for the North Sea - linked to library and other databases

Marine species database for Eastern Africa (MASDEA)

- Biogeographic data on East Africa/Western Indian Ocean
- Originally developed at RECOSCIX-WIO
- 'Owned' by Intergovernmental Oceanographic Commission/UNESCO
- Maintained and further data entry at KMFRI and VLIZ (MoU in preparation)
- Accessible through the internet: http://www.vliz.be/vmdcdata/Masdea/index.htm

MASDEA: Objectives

- Species register for the Western Indian Ocean, including names that are no longer valid, but are still in the literature
- Guide to the literature relevant to biodiversity studies in the region
- Tool for biogeographical studies
  - Gap analysis
  - Identifying biodiversity hotspots

MASDEA: Area of Interest

- Geographic

    - Former collaborators of RECOSCIX-WIO Project
    - Kenya, Tanzania, Mozambique, Madagascar, Reunion, Mauritius, Seychelles, Eritrea
    - South Africa (ODINAFRICA partner)
    - Somalia, Djibouti, Comores
- Habitat
    - Open water
    - Also coastal areas (eg mangroves, estuaries)

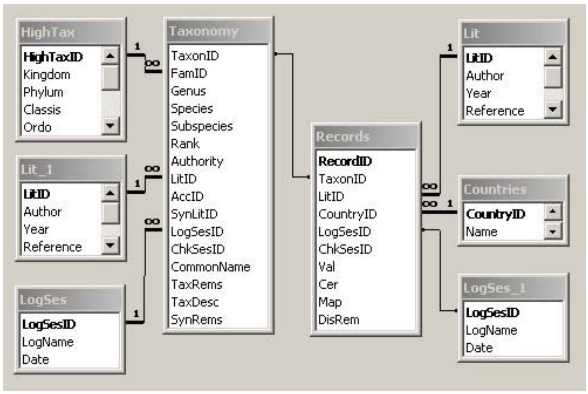
MASDEA: Principles for development

- Importance of keeping wrong and outdated information
- Importance of leaving an 'audit trail'
- Don't force an extra layer of codes on the users
- Keep it simple

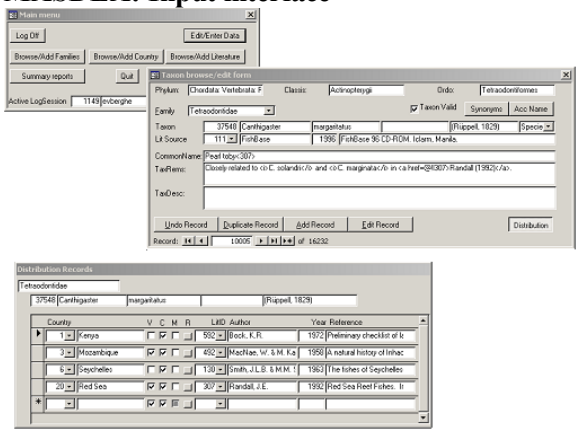
MASDEA: Structure of the database

- Three main tables:
    - Literature
    - Taxonomy
    - Distribution records
- Pick lists
    - Geography
    - Higher taxonomy
- Book-keeping
    - Logging sessions

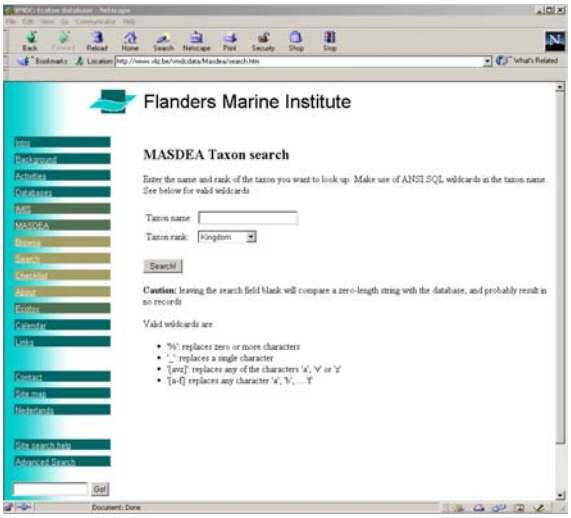
MASDEA: Structure



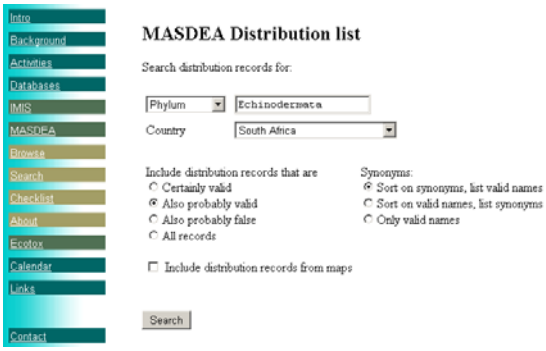
MASDEA: Input interface



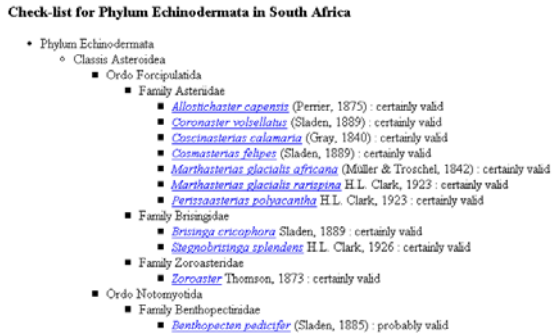
MASDEA: Web interface



MASDEA: Web interface



MASDEA: Web interface



Check-list for Phylum Echinodermata in South Africa

- Phylum Echinodermata
  - Classis Asteroidea
    - Ordo Forcipulatida
      - Family Asteriidae
        - *Allostichaster capensis* (Perrier, 1875) : certainly valid
        - *Coronaster volsellatus* (Sladen, 1889) : certainly valid
        - *Coscinasterias calamaria* (Gray, 1840) : certainly valid
        - *Cosmasterias felipei* (Sladen, 1889) : certainly valid
        - *Marthasterias glacialis africana* (Müller & Troschel, 1842) : certainly valid
        - *Marthasterias glacialis rarispina* H.L. Clark, 1923 : certainly valid
        - *Perrissasterias polyacantha* H.L. Clark, 1923 : certainly valid
      - Family Brisingidae
        - *Brisinga ericophora* Sladen, 1889 : certainly valid
        - *Stegnobrisinga splendens* H.L. Clark, 1926 : certainly valid
      - Family Zoroasteridae
        - *Zoroaster* Thomson, 1873 : certainly valid
    - Ordo Notomyotida
      - Family Benthopectinidae
        - *Benthopecten pedicifer* (Sladen, 1885) : probably valid

MASDEA: Web interface

Family Astropectinidae

***Astropecten antares* Döderlein, 1926**

Accepted name: *Astropecten cingulatus* Sladen, 1883 according to Clark, A.M. (1989)
Syn. rems: Jangoux 1985 placed A. antares in the synonymy of A. inermis, which was itself already placed in synonymy of A. cingularis by Döderlein 1917.

Source: Döderlein, L. (1926)
Remarks: Type locality: Mozambique, 9 m. (Clark & Rowe, 1971).
Description: Distribution: from the eastern side of the Cape of Good Hope to Mozambique (Clark & Rowe, 1971).

This specie could possible be omittted since its known range is only extended of the Cape of Good Hope to Mozambique (Clark & Rowe, 1971).

Distribution records:

Eastern Africa & Madagascar

- Clark, A.M. & F.W.E. Rowe (1971) : certainly valid

Madagascar

MASDEA: Geographic entities

- In principle, countries
- In practice: driven by information sources
  - Aggregates: 'Eastern Africa and Madagascar', Red Sea, Mascarene Islands, East Africa…
  - Separate entities: Rodriguez, Aldabra, Cargados Carajos…
- Comores: Archipelago, not republic

MASDEA: Present status

- Only few groups nearing completion
  - Echinodermata
  - Fish (from FishBase)
- Algae (from Catalogue on Indian Ocean algae)
- Number of records
  - Taxonomy (genus and below): 18908
  - Taxonomy (Family and above): 1424
  - Literature: 700
  - Distribution records: 50905

MASDEA: Conclusion

- MASDEA is a good tool to capture biogeographic and taxonomic information
- MASDEA is a work in progress
- Collaboration with taxonomists is sought
- To improve the quality of the existing data
- To add new groups

Aphia

- VLIZ's North Sea species register
- Serves as taxonomic backbone to other applications
- Extra information, like vernacular names in several languages
- Status: 12,000 taxonomic names
  - 2895 genera, 2789 valid
  - 5510 species, 4767 valid

Aphia: information stored

- Taxonomy, link with publications of IMIS
- Simplified distribution
- To be used as reference list in other databases (eg as an alternative to the species list of ASFA)
- Mainly based on traditional literature (= published papers and books), afterwards compared with other databases (ITIS, ETI)

Aphia: structure

- One main table, containing names of all ranks
- Every record has link to

    - parent
    - accepted taxon (to same record for valid species)
- 'Names' for infrageneric records are actually nameparts (different in ITIS)

TISBE

- Taxonomic Information System for the Belgian coastal area
- Biogeography, modeled on MASDEA
- Based on published information; possibility to store information on museum specimens
- Status: concept (only 61 distribution records entered)

North Sea Benthos Survey

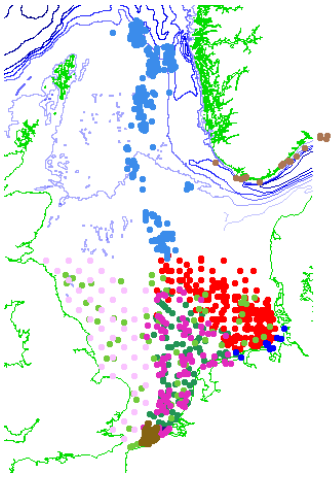
- Activity of ICES: Benthos Ecology Working Group
- Sampling campaign specifically for NSBS
- 9 cruises, April – May 1986
- Extra cruises in northern North Sea
- 235 stations, regular grid
- Standardised sampling
- Results
    - 1004 taxa
    - 16500 distribution records
    - database available through internet; published in literature and as ICES report
- Obstacles
    - Standardising taxonomic lists and identifications
    - Specimens not preserved (all used to determine dried weight)

North Sea Benthos Project

- Activity of ICES
- Update of NSBS
- No sampling specifically for this project, but relies on existing data
- Status
    - Collating species lists
    - Constructing database to capture all information
- New activity: in close collaboration with authors of previous survey (RIVO; CEMO)
- Objective: collect & collate all benthos sample information from the North Sea, sampled in 2000 (1999-2001)
- Status:
    - Synchronising species lists
    - Setting up data exchange procedures…
- Collaborators:
    - Germany: AWI/Senckenberg, BfG Koblenz
    - Holland: Rijkswaterstaat, NIOZ
    - Belgium: Fisheries Research Station, University Ghent
    - France: Station Marine de Wimereux
    - UK: CEFAS
    - Norway: Akvaplan – NIVA, NIVA
- Challenges:
    - No 'obligations', only common interest
    - No dedicated sampling, so
        - no standardised methodology
        - no regular grid
        - not even approximately even distribution over the North Sea

NSBP: data available

- 1329 locations
  - 609 without UG
- 54876 records
  - 29782 in the Southern North Sea
- 1493 taxonomic names
  - 1426 taxa



NSBP: problems

- Taxonomy used is different
  - Of 1426 names in the combined dataset, 814 occur in one dataset only (57 %)
  - Before cleaning up spelling variations… : 75 %
  - Incidence of species found only once ***within*** a dataset is much smaller:
    - Akvaplan-Niva: 110/629
    - NSBS: 201/1004
    - NIOZ: 56/218

NSBP: causes of problem

- Not the use of different species lists:
  - only 5 of the 233 genera of the combined lists are not listed in ITIS
  - 208 out of 1173 species are not listed in ITIS
- But a different interpretation of the taxonomy

NSBP: solutions

- On database level:
  - Document keys/publications used in identification
  - Document identifier
- In the real world
  - workshops to harmonise/standardise identifications

Doug Hamilton. NOAA's Coral Reef Information System

NOAA Coral Reef Information System (CoRIS)

- Vision and Goals
- Why it is needed
- Its Components
  - Coral Reef Data
  - Metadata
  - Web Site
  - Computer Systems and Software
- Support to data contributors
- Status and plans

CoRIS Vision and Goals

- Provide a **single point of discovery** for NOAA data and information of direct relevance to the management and preservation of the nation's coral reefs.
- Meet the information needs of **NOAA managers** in the preparation of biennial assessments on the status and trends in US coral reef ecosystem conditions.
- Support NOAA's contribution to the **US. Coral Reef Task Force National Action Plan**

CoRIS – Why is it needed?

- Currently, over **5,000 NOAA web pages** contain coral reef data and/or information
- Data from **NOAA Coral Reef Initiative** funded research and monitoring programs are to be available from one site
- A single web portal for **NOAA's coral reef activities** with:
  - Easy access to **data and information**
  - Library of coral reef **publications and documents**
  - **Customer support**, services and constituent needs
- Archive and preserve NOAA's coral reef data and information

CoRIS Components. Coral Reef Data and Information

- **Types of data** – potentially, any type of measurement or observation, in any format
  - In situ observations and measurements
    - Biological, chemical, physical, sediments, reef structure
  - Satellite (AVHRR) products
  - Other data useful in coral reef studies
    - Aerial photographs
    - Charts, tides
    - Bathymetry, shoreline
  - Data derived from corals – paleoclimate
- **Sources of data**
  - NOAA offices that have existing coral reef data
  - New data from NOAA funded research and monitoring
  - NOAA library – publications

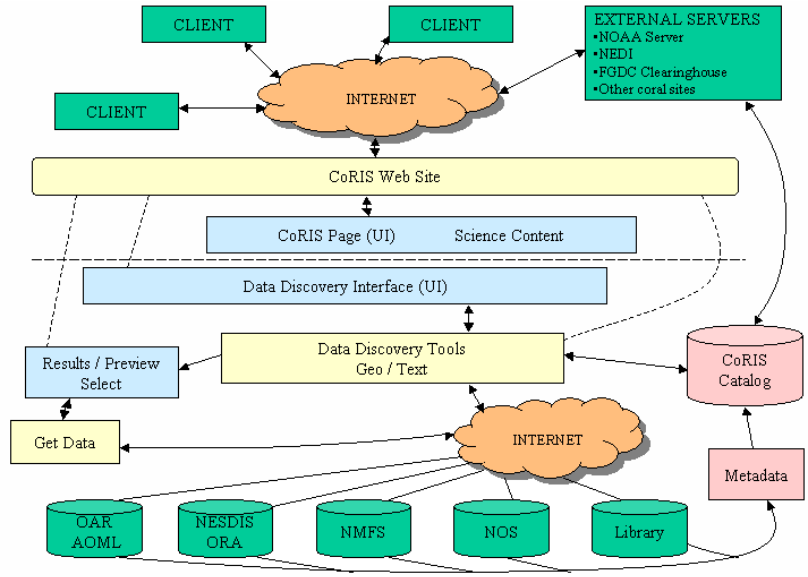
CoRIS Components. Metadata – a key component

- Provides **access paths** to data
- Conveys documentation of **methods**, source, etc.
- Each data set / product must be documented
- **Standards**
  - Federal Geographic Data Committee (FGDC)
  - National Biological Information Infrastructure (NBII)
  - CoRIS
- CoRIS **keywords** – helpful in searches
- **Links** to browse graphics & down-loadable product
- Or describe how to obtain data offline

CoRIS Components. CoRIS Web Site

- " The **single point of access** to NOAA's coral reef data and information"
- Rich content
  - Peer-reviewed **science essays** about corals and reefs
  - Summaries of on-line **debates** about significant coral reef issues
  - Library section with searchable **catalog** of publications and **links** to other useful coral reef web sites
  - **Glossary** of coral reef terms – peer-reviewed
- Data **discovery** search engines
- Access to supporting documents and files

CoRIS Architecture



CoRIS Web Site Data Discovery. GIS Search & Display

- Access to one or more data types with one geographic search
- Map display - geographic distribution of data found in the search
- Links to browse graphic and data products, if available
- Link to metadata

CoRIS Web Site Data Discovery. Text Keyword Search

- Users can define geographic and time limits, as well as **keywords**, as search parameters
- **Map display** can be used to define geographic limits
- **Results list** displays metadata title, several lines of the abstract, and links to browse graphics, data products and complete metadata
- Sub-elements of some data sets can be **retrieved individually**
- Will soon identify library items as well as data in the results list

CoRIS Computer & Software. Configuration

- Operational system: www.coris.noaa.gov
  - the system through which CoRIS is open to the public
  - holds operational version of the website and Metadata
  - meets NOAA security requirements
  - updated only when additions and changes have been successfully tested and approved under CM
- Test systems: "test.coris.noaa.gov"
  - web site assembly and testing
  - map and keyword search engine testing
  - additions and refinements are tested on these computers
- Development systems:
  - on which text, metadata, and software are developed
  - distributed among CoRIS participant offices

Support to Data Contributors

- Work with researchers and principal investigators in a **supporting role**
- Provide metadata **templates and guidance**
- Recommend **tools** for writing metadata
- Provide **sample** metadata
- **Review** metadata and work with contributors to correct or complete information
- "CoRIS Metadata Standards and Guidelines" issued in February 2002

CoRIS Status

- Prototype is completed and available at "coris.noaa.gov"
- Access to 8362 data products via 161 metadata
- Another 89 metadata files being developed
- 508 library publication references

Type of Data	No. of Metadata	No. of Data Products
NOS bathymetry in U.S. coastal areas	1	36
NOS coastal aerial photographs	1	4,279
NOS nautical chart images	1	397
NOS benthic habitat aerial photo mosaics	24	24
NESDIS AVHRR products	34	2660
NOS tide data	1	867
NESDIS paleoclimate data from corals	87	87
NESDIS coral bleaching reports	12	12
TOTAL	161	8,362

CoRIS Plans

- Short-term
  - Summer shakedown period
    - Add metadata for other data sets
    - Correct known problems
    - Respond to comments of reviewers
  - Formal release next fall – U.S. Coral Reef Task Force meeting
- Long Term
  - Merge search engine access to one page
  - Maintain and improve contents and operations
  - Include as much NOAA coral reef data as possible

CoRIS Staffing

- Content Design and Development Team
  - Editor
  - Writer
  - Web master
- Technical Team
  - Systems administrator
  - GIS and metadata interface programmers
- Metadata manager and technicians
- Project coordinator

CoRIS – Data Management Summary

- It is a system to provide access to coral reef data and information, plus supporting scientific material, and information about NOAA coral reef activities.
- Data and information are distributed, but over time will be archived.
- It is based on metadata and web standards.
- It uses commercial software for metadata management and for GIS displays.
- It is designed to work with data / metadata contributors in a supporting manner.

Humberto Gonzáles. The Oceanography in Chile: Research and Data Management Activities.

Oceanography in Chile is the discipline of marine sciences that has experienced the most conspicuous development during the last decade

- Disciplines: Biological-, Chemical-, Physical-, Geologicaland, Fishery-Oceanography.
- Domains: Oceanic-, Coastal-, Fjords and channels-,Antarctic-Oceanography, etc.
- Methods and approaches: From bottles and buckets to oceanography from the space and sophysticated models. From small-boats to research vessels. This, in a time period of one to two decades (from 1/3 to ½ of the productive life of one oceanographer).
- Funds: FONDECYT projects (restricted to one group) FONDAP projects (multidisciplinary, several groups).

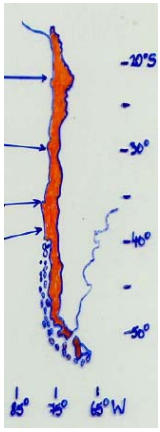
What have we already done?

Antofagasta: Fondecyt 5960002 (1996-98).

Coquimbo: Fondap y DID-UACh (1997-2000).

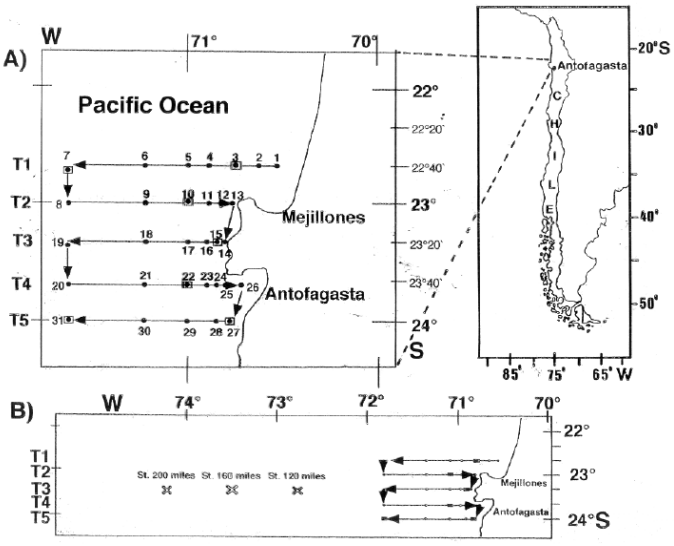
Concepción: Fondap (1997-2000).
Valdivia: FIP-2000-29 (2000-2001).

Mejillones: Fondecyt 1000419 (2000-03).
Iquique-Concepción: Fondap (2002-06).



Antofagasta

- Primary production and its fate in the pelagic food web and oceanatmosphere CO2 exchange in the northern Humboldt Current System:
- Possible effects of the 1997-98 El Niño in Chile.



Trophic ecology of the gelatinous zooplankton (filter-feeding and carnivorous) in the northern Humboldt Current System off Chile.

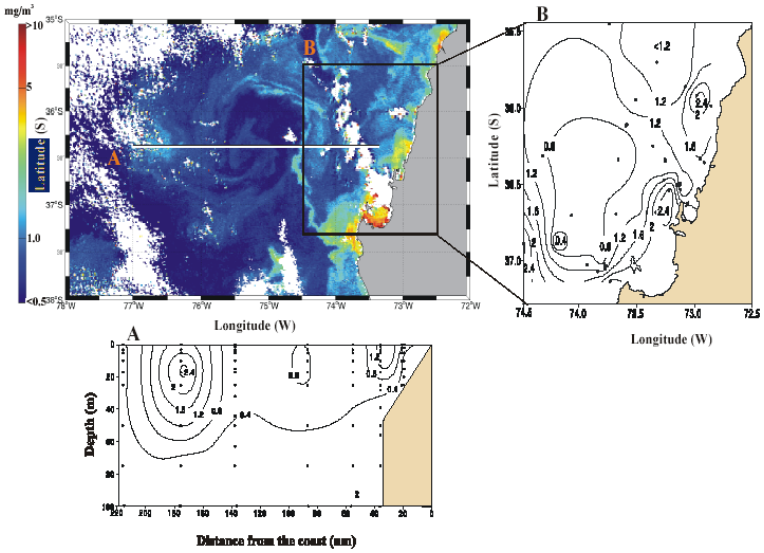
Predation Impact on copepod standing stock

	Stratum (m)	Copepod abundance (m^3)	% of small-size copepods	Ingested copepods (m^3)	%Daily predation impact
Spring	0-25	1097	90	27	3
	25-50	213	80	14	7
	50-100	198	88	1	3
Summer	0-25	1565	19	16	1

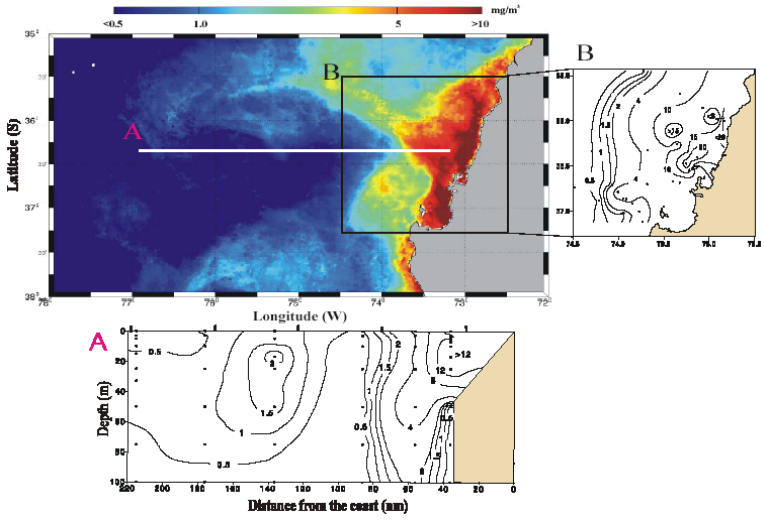
	25-50	280	80	49	18
	50-100	67	65	14	21
Winter	0-25	828	71	7	1
	25-50	62	70	6	10

Concepción

July 1999: Minimum upwelling



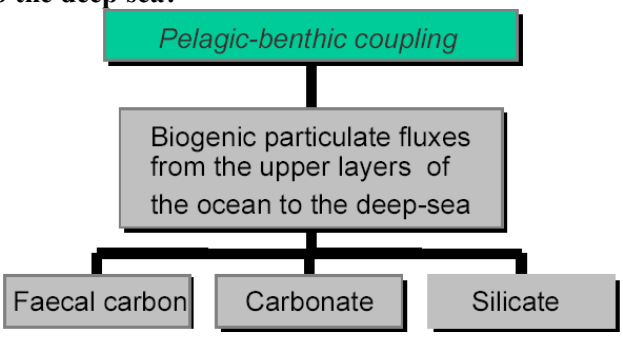
October 1998: Maximum upwelling



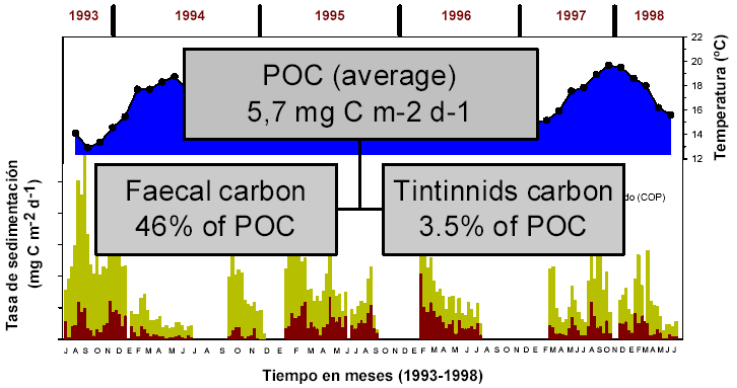
COQUIMBO

- Sedimentation rates of particulate material at 2.300 m depth in the oceanic zone off Coquimbo (30ºS) between 1993 and 1998.

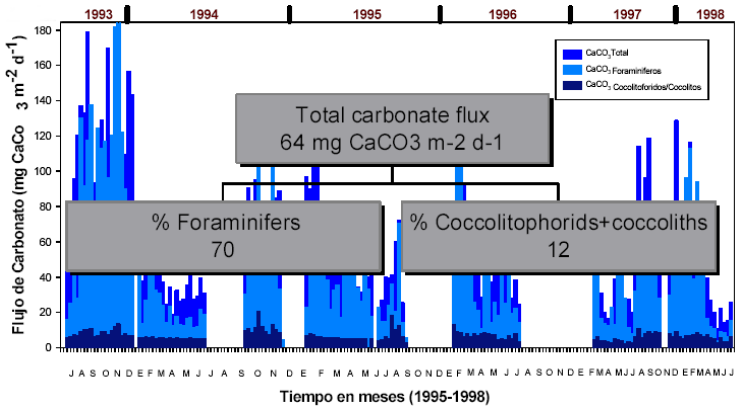
Which type of biogenic particles are the main contributors to vertical fluxes from the surface ocean to the deep sea?



Particulate Organic carbon (POC) Flux



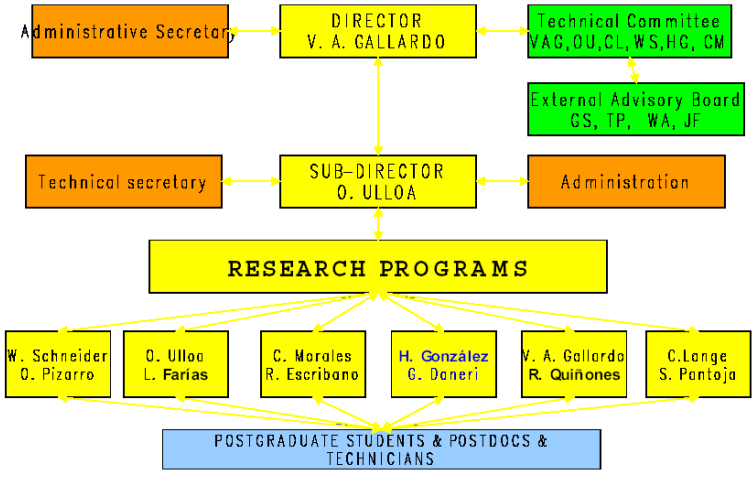
Carbonate Flux



Center for Oceanographic Research in the South East Pacific (COPAS)

- Universidad de Concepción (Concepción)
- Universidad Austral de Chile (Valdivia)
- Universidad del Mar (Viña del Mar)

Structure



Question Nº1

- What is the structure and function of the OMZ in the ESP and how does it impact the climate system?
  - The OMZ of the ESP is a unique ecosystem where novel biological communities and life strategies play a key role in the cycling of bioelements and represent an analogue to conditions of the ancient ocean. The OMZ impacts the biogeochemical cycling of carbon

and nitrogen at the global scale. Variations in the strength and/or extension of the OMZ modulate the concentration of greenhouse gases in the atmosphere and thus climate.

- Scientific challenges: SEVERAL

Question No. 2

- How do ENSO and other large scale phenomena that impact the ESP, feed back into the climate system?
  - ENSO and other large scale phenomena modify ocean heat content, redox conditions, productivity and community structure of the ESP. These changes feed back into the climate system by altering the meridional heat transport, fluxes of bioelements to the deep sea, and net sea-air exchange of heat and green house gases.
- Scientific challenges: SEVERAL

Question Nº3

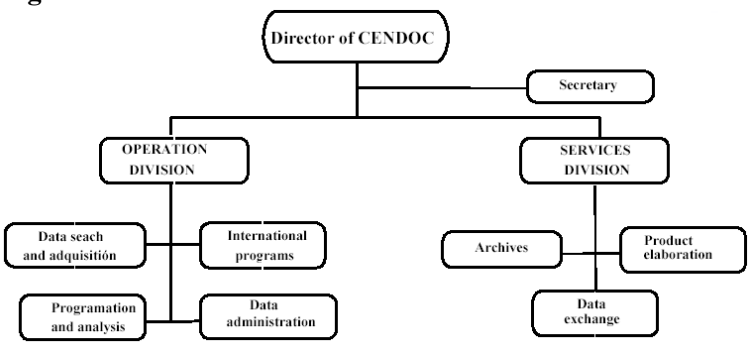
- What role does the AAIW play on the chemical, physical and biological characteristics of the ESP and how is this role modified by climate change?
  - The AAIW is characterized by a salinity minimum and high oxygen content. It is formed in the southern ESP and propagates northward at intermediate depths, ventilating the OMZ. The properties acquired during its formation at ca. 55ºS carry the imprint of global warming. This water mass holds a deep-sea ecosystem, whose biological components are likely to have a significant modifying effect on the vertical fluxes of organic matter.

Research Platforms

- R/V "Abate Molina"
- R/V "Vidal Gormaz"

Oceanographic Data Management

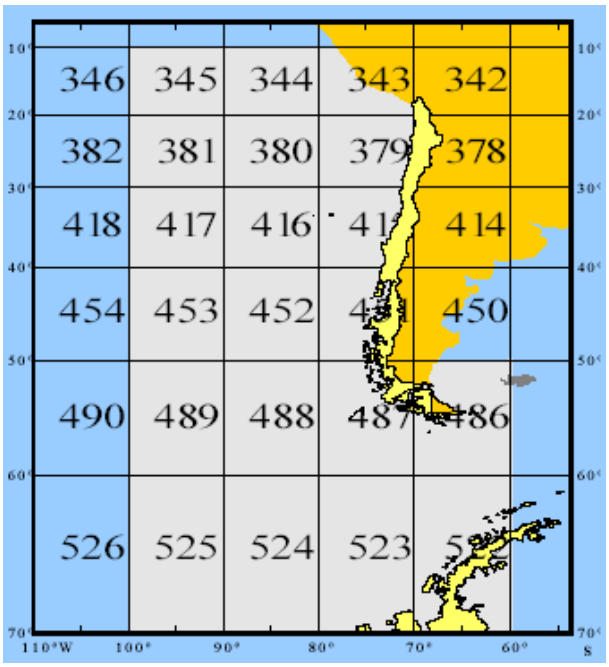
- National Oceanographic Data Centre of Chile - Centro Nacional de Datos Oceanográficos de Chile (CENDOC)



Structure of CENDOC

- Aim
  - To maintain a complete, high quality oceanographic database of different areas off the Chilean coast, with the purpose to open the information to national and international scientific communities who want to use it for research and/or the development of projects of national or international interest.

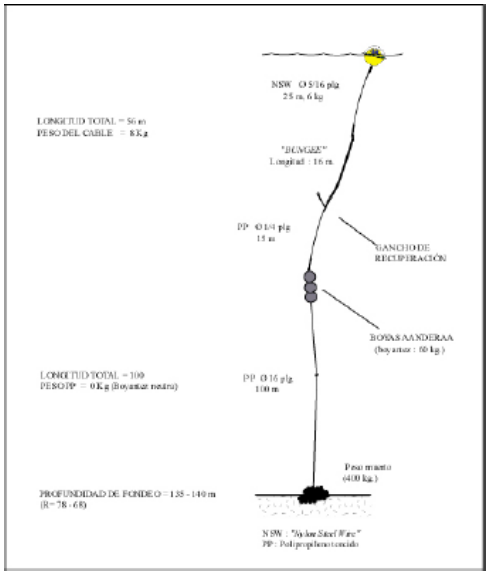
- Main Activities
  - Compilation, classification, normalization, validation and archiving the oceanographic data and information off the Chilean coast obtained through national data exchange.



  - National organization for the international oceanographic data exchange
  - Foreing Data Centers
    - Centro Mundial de Datos A en EE.UU
    - Centro Nac.de.EE.UU.para Investigaciones Climáticas (NCAR)
    - Centro Argentino de Datos Oceanográficos (CEADO)
    - Centro Japonés de Datos Oceanográficos (JODC)
    - Centro de Datos del Reino Unido (BODC)
  - Generating oceanographic products.
  - Databases
    - Oceanographic Stations
    - Sea Surface Temperature
    - Sea Level
    - XBT
    - Water Masses and Currents
    - Oceanic Waves
  - Oceanographic Stations
    - Temperature
    - Salinity
    - Oxygen
    - Nutrients

- Sea Surface Temperature and Sea Level

- Waves: TRIAXS BUOYS



International Efforts

- IAI Projects
  - Eastern Pacific Consortium fro Research on Global Change in Coastal and Oceanic Regions (ecologia.cicese.mx/~iaiepcor/)
  - New thermograph installations by EPCOR to enhance coastal monitoring network of East. Pacific

Gwen Moncoiffé. Chemical and Biological Data Management at the British Oceanographic Data Centre

Personal Profile: Scientific Background

- Biological Oceanography
- PhD in Microplankton Ecology (short-term and seasonal dynamics of microplankton primary production and respiration in an upwelling system)
- 5 years post-doc research in oceanic primary production and the cycling of nitrogen in the upper ocean

Personal Profile: Data Management

- 1998-2002: Data manager for the PROVESS Project, a multidisciplinary project funded by the EU-MAST Programme
- 2001-Data manager for two UK NERC-funded Programmes
  - Marine Productivity
  - Marine & Freshwater Microbial Bio-diversity

Chemical and biological data holdings at BODC

- A large variety of chemical and biological data including taxonomic data, originating from discrete or automatically logged water column sampling, benthic sampling or ocean atmospheric sampling
- Management of these data evolved in response to BODC commitments to large multidisciplinary research programmes

Completed multidisciplinary projects managed at BODC

- 1988-92: North Sea Project
- 1989-94: BOFS
- 1993-97: OMEX I
- 1994-98: ARABESQUE
- 1995-99: LOIS SES
- 1995-2000: PRIME
- 1997-2001: OMEX II
- 1993-2001: LOIS RACS
- 1998-2002: PROVESS

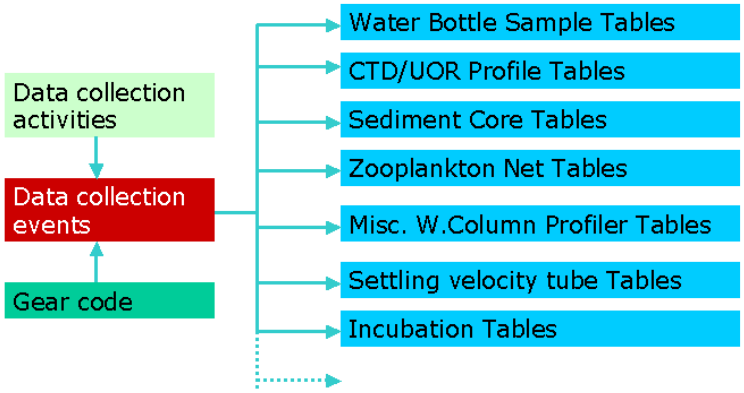
Project Data Management at BODC

- An end-to-end approach to oceanographic data management which aims to provide a service to the scientific community involved in the project while ensuring the long-term stewardship of the data
  - provides a centralised contact point for requesting data and metadata
  - facilitates the flow of data between participating laboratories
  - provides rapid access to a standardised (formats, units, etc.) and quality controlled set of fully integrated data and metadata
- Data scientist working in close relationship with the research scientists from the onset of the project or fieldwork programme (participation to meetings, workshops, fieldwork etc.)
  - facilitates communication regarding data quality, details of methodology, instrumentation, etc. (+ personal contact)
  - helps the data scientist to gain a better understanding of unfamiliar data sets
  - provides the data scientist with information that may not be included in cruise reports, etc.

BODC Project Database Structure for discrete measurements

- Most chemical and biological data from discrete sampling and continuous profilers are now managed within a fully normalised relational database structure, fully integrated with other oceanographic parameters and associated metadata

BODC Project Database Structure



The ARIES sampler

- Water Bottle Sample Tables
- CTD/UOR Profile Tables
- Zooplankton Net Tables
- Misc. W.Column Profiler Tables

BODC Parameter Dictionary

- Based on a 8-character parameter code containing two 4-character sub-fields
  - For biogeochemical data:

PPPP → ∞	**XX XX**
Code for parameter	Codes for protocol
CPHLHPP1	CPHL: chlorophyll-a HP: HPLC assay on an acetone extract P1: particulate phase filtered on GF/F filters

  - For taxonomic data:

XNNN → ∞	**MNNZ**
Code for genus (NNN) preceded by one-letter code for type of measurement (V volume, A area, C for carbon biomass, P or Z for abundance)	Codes for species (MNN) followed by one letter code for life stage/sex, protocol or non-standardised information

- Example for phytoplankton/microzooplankton:
  Genus *Amphidinium* Genus Code = 205
  Abundance > P; Area > A; Volume > V; Carbon > C

followed by:		
	M01Z for *A. carterae*	P205M01Z
	M02Z for *A. curvatum*	P205M02Z
	M00Z for *A. spp*	P205M00Z
	M00A for *A. spp* large	P205M00A
	M00B for *A. spp* small	P205M00B
	M00C for *A. spp* medium	P205M00C

- Example for mesozooplankton:
  Genus *Acartia* Genus Code = 301
  Abundance > Z

followed by:		
	M01U for *A. clausi* adult female	Z301M01U
	M01Y for *A. clausi* adult male	Z301M01Y
	M00A for *A. spp C1*	Z301M00A
	M00B for *A. spp* C2	Z301M00B
	M00C for *A. spp* C3	Z301M00C
	M00D for *A. spp* C4	Z301M00D
	M00D for *A. spp* C5	Z301M00E

Conclusions

- A flexible approach to oceanographic project data management which emphasises the importance of data managers working in close relationship with the research scientists
- The normalised relational database implemented at BODC for the OMEX I project in 1993 has been easily expanded since, to include new sampling gears, new methodologies and instruments, and new parameters
- Future links to external references (such as ITIS)

Makoto Terazaki. Biological and Chemical Data Management Activities at the Japan Oceanographic Data Center

History of JODC

- ICSU established the World Data Center system to serve the IGY (1957-1959).
- In 1961, the resolution recommend to IOC s member states the establishment of national oceanographic data centers was adopted at the 1st Session of the IOC.
- In 1965, JODC was established within the Hydrographic Department.
- In 1979, at the first session of the Programme Group for WESTPAC, it was decided that the JODC should serve as RNODC for WESTPAC.
- In 1984, the JODC started to develop a marine bilogical data management system
- In 1993, at the 27th Session, the General Conference of UNESCO adopted the resolution which called on IOC to establish a GOOS regional pilot activity in the North East Asian region.
- In 1994, online access through Internet was in practice.

Data holding status in WESTPAC region

Data holding status of Serial Station Data on the database of WDC-A Oceanography in WESTPAC region (90E to 130W, 50S to 60N) indicates as following (as in 1997);

Country	No. of Profiles	Country	No. of Profiles
AUSTRALIA	31585	NEW ZEALAND	1913
CANADA	11211	PAKISTAN	64
CHINA	5104	PANAMA	133
DENMARK	359	PHILIPPINES	239
FRANCE	10263	RUSSIA	31407
INDIA	265	SINGAPORE	412
INDONESIA	2990	SWEDEN	33
JAPAN	200537	TAIWAN	2895
KOREA	27354	THAILAND	2817
MALAGASY REP	162	UNITED KINGDOM	1599
MALAYSIA	154	UNITED STATES	33807
NETHERLANDS	519	UNKNOWN	1510
NEW CALEDONIA	36040	**TOTAL**	**403372**

Background of Marine Biological Data

In recent days, international recognition of the importance of marine biological data and growing social interests in marine ecosystem.

- the ocean carbon system .
- oceanic biodiversity .
- ocean ecosystem dynamics
- indicators for monitoring of marine environmental change

Needs

- complex analyze biological, physical and chemical data
- expand time and space scale of a biological study field

Key activities

- promote a exchange of marine biological data
- rescue and archaeology of marine biological data

Establishment of Advisory Board on Marine Biological Data Management

Purpose

This board aims to advice on the Marine Biological Management at JODC.

Structure

This board consists of marine biologists from national research institutes, Universities and private companies of environmental research.

Terms of Reference

- to be critical on the needs of Marine Biological Data Management system at JODC.
- to define the taxonomic code of marine species.

- to advise on methodology for a quality control of marine biological data.
- to design the strategy plan of marine biological data exchange.
- to advise on cooperation with national and international activities on above activities.

Structure of JODC Marine Biological Data Management Format

Present JODC system is focusing on only plankton data.
JODC format consists of following three parts:

- Observed Data Record
  location, time, measurement skill, observed biological value, etc.
- Observed Condition Record
  sea color, transparency, wave, weather, wind except biomass, etc.
- Marine Taxonomic Code
  The structure of JODC taxonomic code is following;
  - Name code
  - Classify code .
  - Flag of Name
  - Name of Organism

  JODC Taxonomic Code is able to change the classification of species and to allow synonym.

Productivity of Marine Biological Data in Japan

The following list of main organisations are observing Marine Biological Data in Japan:

- Japan Meteorological Agency; 5 Marine Observatories
- Fisheries Agency; 7 Fisheries Research Institutes
- National Institute of Polar Research
- Geological Survey of Japan
- National Institute for Research and Environment
- National Institute of Radiological Sciences
- Environment Agency; National Institute for Environmental Studies
- Universities
- Local Governments; 69 Fisheries Experimental Stations
- JAMSTEC
- JAMARC

Environmental assessment are operated on many coastal development projects.

Factor of the Restricting Marine Biological Data Exchange

- many technical skill of data sampling and analyzing
- classify enormous kind of ocean species
- variability of marine biological data on account of environmental change
- shortage of specialist and knowledge on digital management of marine biological data

Accuracy of marine biological data is affected from complexly above factors

PICNIC

- PICES Carbon Dioxide Data in North Pacific (PICNIC)
- planned to integrate the CO_2 data which is held by PICES 6 countries: Canada, China, Japan, Republic of Korea, Russia, and US.
- PICNIC collects the cruises which includes at least one CO_2 variables; dissolved inorganic carbon (DIC), CO_2 fugacity (CO_2), pH, and total alkalinity (TAlk). Furthermore, these cruise data also contain other CO_2 related parameters: dissolved oxygen, nutrients, C-13, C-14, CFCs, SF_6 and so far. These data would be available to understand the behavior of oceanic carbon cycle in the North Pacific.
- Most of data which are listed in PICNIC inventory have been observed in North Pacific, but some cruises extend to South Pacific and Southern Ocean.
- PICNIC web site is at: http://www.mirc.jha.or.jp/PICNIC/

Mary Kennedy. Biological Data Management Activities at the Bedford Institute of Oceanography

Management Policy for Scientific Data

- Data archiving
- Data submission
- Availability of access
- Inclusion of a Data Management Component in Science Project Plans
- National inventory
- Acquisition of Data from Third Party Sources
- Data Submitted under Regulations or Having Legal Aspects
- Data rescue
- Application of technology
- Access to Information and Privacy Act Considerations
- Working mechanisms
- Implementation

Science Data Inventory –SCIDAT

- Management tool for data managers
  - Help organize the data assets
  - Determine priorities
  - Monitor progress
  - Tool for multi-year planning
- Data asset inventory
  - What data is out there and who is the contact?

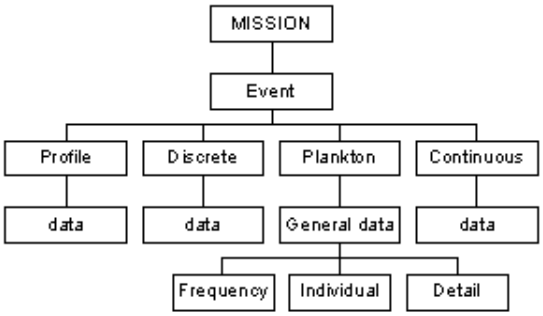
BIOCHEM - An Overview

- Regional Application Oracle database
- Archive for biological (Bio) and chemical (Chem) marine environmental sample measurements
- Query application based upon temporal and spatial criteria

Part 1: BioChem Data Sets

- The original database was designed to house 6 different kinds of oceanographic data
  - discrete data: latitude, longitude, date, time and depth constant. example bottle data (FOXPRO database)
  - profile data: latitude, longitude, and date constant, depth varying. example CTD, VOPC data
  - continuous data: latitude, longitude, date, time and depth changing. example forward lab, RDI, batfish
  - environmental: weather stuff
  - BLOB:
  - Plankton data: the really weird stuff. Mesh, volume of water filtered, split fractions, sieve sizes, etc

Part 2: BioChem Dbase design



BioChem Discrete Headers

- The header record contains
  - gear
  - position
  - date and time
  - position and date QC codes
  - depth
  - sounding
  - sampleid
  - deploymentid
  - collector
  - collectors comments
  - data managers comments

BioChem Data Types – Discrete

Retrieval	Data type	Priority	Data type description
Salinity	Salinity PSS	1	Salinity, salinometer, Practical Salinity Scale
Salinity	Salinity	2	Salinity, method unknown
Salinity	Salinity g/kg	2	Salinity, salinometer, pre-1978 definition
Salinity	Salinity autosal	3	Salinity, salinometer
Salinity	Salinity CTD PSS	4	Salinity, CTD, Practical Salinity Scale
Salinity	Salinity CTD g/kg	5	Salinity, CTD, pre-1978 definition
Salinity	Salinity CTD	6	Salinity, CTD
Sediment oil	Oil in sediment	1	Oil in sediment
Silicate	Silicate	1	Silicate
Strontium-90 - total	Strontium-90 - total	1	Strontium-90 - total
Sulfate	Sulfate	1	Sulfate
TOC	TOC	1	TOC
Temperature	Temperature_CTD	1	Temperature, CTD 1968 scale
Temperature	Temp_reuthern (elect)	2	Temperature, electronic reversing thermometer
Temperature	Temperature	3	Temperature, method unknown
Temperature	Temp_reuthern (glass)	4	Temperature, glass reversing thermometer
Temperature	Temperature_CTD_loop	5	Temperature, CTD from the seawater loop
Thymidine production	Thym.prod.	1	Thymidine production
Total nitrogen	Total nitrogen	1	Total nitrogen
Total phosphorus	Phosphorus - total	1	Phosphorus - total
Tritium	Tritium_AERU	1	Tritium, Bq/l
Tritium	Tritium	2	Tritium, tritium units
Tritium 81	Tritium 81	1	Tritium, referenced to 1981, in tritium units
Tritium error	Tritium error	1	Tritium error
Urea	Urea	1	Urea
V - filtered	V - filtered	1	V - filtered
Zn - filtered	Zn - filtered	1	Zn - filtered
Zn - unfiltered	Zn - unfiltered	1	Zn - unfiltered
conductivity_CTD	conductivity_CTD	1	conductivity from the CTD in Siemens per meter

BioChem Data Types – Plankton

- Plankton General Table
  - This is the equivalent of the "data type" – "data value" discrete table.
  - Plankton's data type is made up of 5 fields:
    - *"Species"*
    - stage
    - sex
    - sieve size
  - Plankton's data value is the count, weight and/or volume of the bug.

Data Management Plan for Biological Oceanography Data

- After a cruise Biological Oceanography has potential data from:

CTD		Light Measurements	
	Profiles	VOPC	
	Temperature		Profiles
	Salinity		Nets
	PAR	Zooplankton	
	Fluorescence		BIONESS
Bottles			Ring nets
	Nutrients		Multinet
	Chlorophyll	Acoustic Data	
	PI parameters		
	Oxygen	Plus ……	

Collectors Data Files

- How can we standardize our raw datafiles?
- Text or spreadsheet format
- If possible, please include:
  - Cruise number
  - Event number
  - Date & time – indicate local or gmt
  - Gear used
  - Sampleid – white sticky number
  - Collector's comments
  - Missing data indicators

Sharing and exchange practices

- standard fields
- standard units
- standard meta data
- quality control

How do you compare samples?

- Different sampling gear
- Different analysis protocols
- Different emphasis on taxonomic groups

Taxonomic coding

- Database code
- ITIS code
- NODC-taxonomic grouping code

ITIS

- Map *species* to ITIS in order to facilitate the exchange of data
- What happens when mapping is impossible?
  - species not included in ITIS master list•non-standard taxonomic group, such as Jelly, CHW eggs
- What is required to add new records to ITIS?

Taxonomic Groupings

- Now that data is in a database we wish to extract bits and pieces.
- This requires a secondary code to group species taxonomically
  - NODC taxcode
  - World Ocean Database 2001 "Biological Grouping Code"

Summary

- Data management policy
- dentify datasets
- Standardize formats
- Eliminate the need for data rescue!
- Archive data
- Include 'internationally accepted' metadata
- Include 'internationally accepted' codes for data exchange

Sunhild Wilhelms. Species lists and taxonomic information in the Marine Environmental Data Base - *MUDAB* - of the German NODC

Species lists for the German Bight, adjacent estuaries and the Western Baltic

- Status
  - Macrozoobenthos - reviewed, last update Dec. 2001
  - Phytoplankton - under revision
  - Zooplankton - under revisionPhytobenthos - under revision**Species list for Macrozoobenthos**

- Overview

Last up-date:	01.12.2001
Taxa included:	526 (ranging from phylum to subspecies)
Status:	reviewed by experts
Major Tax. Code:	ITIS
Sea regions:	German Bight and adjacent estuaries, Western Baltic and Baltic Proper
Purpose:	Handling of Monitoring data (National Programmes, HELCOM, OSPAR)
Perspective:	Inclusion of brackish water, riverine species

Species List for Phytoplankton

type group	Taxon	tax. rank	ITIS-code	Author	Synonyms	kingdom	sub-kingdom
Coccolithophorads	**Chrysochromulina**	genus	2160	Lackey, 1939		Plantae	
Coccolithophorads	**Phaeocystis globosa**	species	610059	Scherffel, 1900		Plantae	
Diatoms	**Biddulphia alternans**	species	2679		Triceratium alternans	Plantae	Chromista
Diatoms	**Chaetoceros diadema**	species	2795	(Ehrenberg) Gran		Plantae	Chromista
Diatoms	**Coscinodiscus wailesii**	species	2571			Plantae	Chromista
Diatoms	**Cylindrotheca closterium**	species	5318			Plantae	Chromista
Diatoms	**Navicula**	genus	3649	Bory		Plantae	Chromista
Diatoms	**Rhizosolenia robusta**	species	2901			Plantae	Chromista
Diatoms	**Rhizosolenia styliformis**	species	2904	Brightwell, 1858		Plantae	Chromista
Diatoms	**Skeletonema costatum**	species	2402	(Grev.) Cleve		Plantae	Chromista
Dinoflagellates	**Ceratium buceros var. tenue**	variety	10434			Plantae	
Dinoflagellates	**Dinophysis acuminata**	species	9938	Claparede and Lachmann, 1859		Plantae	
Dinoflagellates	**Gonyaulax spinifera**	species	10361			Plantae	
Dinoflagellates	**Noctiluca scintillans**	species	10150	(Macartney) Kofoid and Swezy, 1921		Plantae	
Dinoflagellates	**Peridiniumgranii**	species	10227			Plantae	
Dinoflagellates	**Prorocentrumminimum var. triangulatu**	variety	331228	(Pavillard)Schiller, 1933		Plantae	
Green algae	**Dictyosphaerium pulchellum**	species	6298	Wood, 1872		Plantae	
Green algae	**Pediastrumboryanum**	species	6032	(Turpin) Meneghini		Plantae	
Green algae	**Scenedesmus denticulatus**	species	6145	Lagerhiem		Plantae	

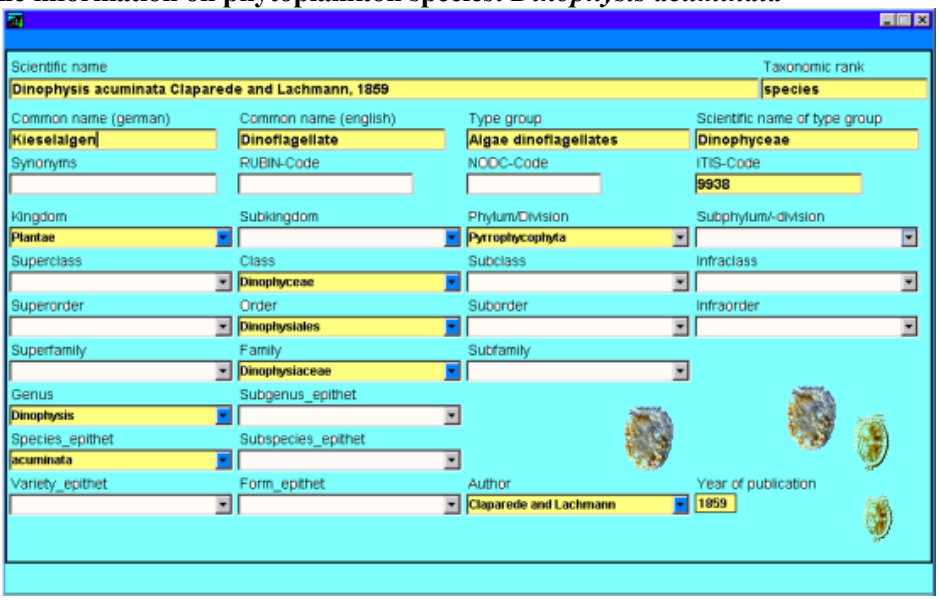
Species List for Phytoplankton

division	sub-division	super-class	class	subclass	infra-class	super-order	order	suborder	infra-order	super-family
Haptophyta			Prymnesiophyceae				Prymnesiales			
Haptophyta			Prymnesiophyceae				Prymnesiales			
Bacillariophyta			Coscinodiscophyceae				Biddulphiales			
Bacillariophyta			Coscinodiscophyceae				Chaetocerotales			
Bacillariophyta			Coscinodiscophyceae				Ciscinodiscales			
Bacillariophyta			Bacillariophyceae				Bacillariales			
Bacillariophyta			Bacillariophyceae				Naviculares			
Bacillariophyta			Coscinodiscophyceae				Rhizosoleniales			
Bacillariophyta			Coscinodiscophyceae				Rhizosoleniales			
Bacillariophyta			Coscinodiscophyceae				Thalassiosirales			
Pyrrophycophyta			Dinophyceae				Gonyaulacales			
Pyrrophycophyta			Dinophyceae				Dinophysiales			
Pyrrophycophyta			Dinophyceae				Dinophysiales			
Pyrrophycophyta			Dinophyceae				Noctilucales			
Pyrrophycophyta			Dinophyceae				Peridiniales			
Pyrrophycophyta			Dinophyceae				Prorocentrales			
Chlorophycota			Chlorophyceae				Chlorococcales			
Chlorophycota			Chlorophyceae				Chlorococcales			
Chlorophycota			Chlorophyceae				Chlorococcales			

Species List for Phytoplankton

family	sub-family	genus	subgenus epithet	species epithet	subspecies epithet	variety epithet	form epithet
Prymnesiaceae		Chrysochromulina					
Phaeocystaceae		Phaeocystis		globosa			
Biddulphiaceae		Biddulphia		alternans			
Chaetoceratataceae		Chaetoceros	(Hyalochaetae)	diadema			
Coscinodiscaceae		Coscinodiscus		wailesii			
Bacillariaceae		Cylindrotheca		closterium			
Naviculariaceae		Navicularia					
Rhizosoleniaceae		Rhizosolenia		robusta			
Rhizosoleniaceae		Rhizosolenia		styliformis			
Skeletonemaceae		Skeletonema		costatum			
Ceratiaceae		Ceratium		buceros		tenue	
Dinophysiaceae		Dinophysis		acuminata			
Dinophysiaceae		Gonyaulax		spinifera			
Noctilucaceae		Noctiluca		scintillans			
Peridiniaceae		Peridinium		granii			
Prorocentraceae		Prorocentrum		minimum		triangulatum	
Dictyosphaeriaceae		Dictyosphaerium		pulchellum			
Hydrodictyaceae		Pediastrum		boryanum			
Scenedesmaceae		Scenedesmus		denticulatus			

Taxonomic information on phytoplankton species: *Dinophysis acuminata*



Species list for Zooplankton

type group	Taxon	tax. rank	ITIS-code	Author	Synonyms	kingdom	phylum
Chaetognaths	**Parasagitta setosa**	species	158795	(Mueller, 1847)		Animalia	Chaetognatha
Cladocerans	**Evadne**	genus	83960			Animalia	Arthropoda
Copepods	**Acartia discaudata**	species	86096	(Giesbrecht, 1882)		Animalia	Arthropoda
Copepods	**Centropages typicus**	species	85767	Kroyer,1849		Animalia	Arthropoda
Copepods	**Euryterpra**	genus	85862	(Giesbrecht, 1881)		Animalia	Arthropoda
Copepods	**Limocalanus macrurus**	species	85775	Sars, 1862		Animalia	Arthropoda
Copepods	**Oithona**	genus	88802	Baird, 1843		Animalia	Arthropoda
Copepods	**Oithona similis**	species	88805	Claus, 1866		Animalia	Arthropoda
Copepods	**Pseudocalanus elongatus**	species	85370	(Boeck, 1865)		Animalia	Arthropoda
Copepods	**Temora longicornis**	species	85877	(Muller, 1785)		Animalia	Arthropoda
Tunicates	**Fritillaria borealis**	species	159675			Animalia	Chordata
Tunicates	**Oikopleura dioica**	species	159669			Animalia	Chordata

Species list for Zooplankton

subphylum	superclass	class	subclass	infraclass	superorder	order	suborder	infraorder
		Sagittoidea				Aphragmophora	Ctenodontina	
Crustacea		Branchiopoda	Phyllopoda			Diplostraca	Cladocera	
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Gymnoplea	Calanoida		
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Gymnoplea	Calanoida		
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Gymnoplea	Calanoida		
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Gymnoplea	Calanoida		
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Podoplea	Cyclopoida		
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Podoplea	Cyclopoida		
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Gymnoplea	Calanoida		
Crustacea		Maxillopoda	Copepoda	Neocopepoda	Gymnoplea	Calanoida		
Tunicata		Appendicularia				Copelata		
Tunicata		Appendicularia				Copelata		

Species list for Zooplankton

family	subfamily	genus	subgenus epithet	species epithet	subspecies epithet	variety epithet	form epithet
Sagittidae		Parasagitta		setosa			
Polyphemidae		Evadne					
Acartiidae		Acartia		discaudata			
Centropagidae		Centropages		typicus			
Temoridae		Eurytemora					
Centropagidae		Limnocalanus		macrurus			
Oithonidae		Oithona					
Oithonidae		Oithona		similis			
Pseudocalanidae		Pseudocalanus		elongatus			
Temoridae		Temora		longicornis			
Fritillariidae		Fritillaria		borealis			
Oikopleuridae		Oikopleura		dioica			

Species list for Phytobenthos

type group	Taxon	tax. rank	ITIS-code	Author	Synonyms	kingdom	subkingdom	Division
brown algae	**Desmarestia viridis**	species	11323	Mull.		Plantae		Phaeophycophyta
brown algae	**Fucus vesiculosus**	species	11335			Plantae		Phaeophycophyta
brown algae	**Laminaria saccharina**	species	11222			Plantae		Phaeophycophyta
brown algae	**Pilayella littoralis**	species	10824			Plantae		Phaeophycophyta
brown algae	**Scytosiphon lomentaria**	species	11435	(Lyngbye) Link		Plantae		Phaeophycophyta
green algae	**Cladophora pygmaea**	species	6821			Plantae		Chlorophycota
green algae	**Enteromorpha**	genus	6515	Link, 1820		Plantae		Chlorophycota
green algae	**Enteromorpha torta**	species	6547			Plantae		Chlorophycota
red algae	**Callithamnion corymbosum**	species	12932			Plantae		Rhodophycota
red algae	**Ceramium rubrum**	species	12983			Plantae		Rhodophycota
red algae	**Delesseria sanguinea**	species	13242			Plantae		Rhodophycota
red algae	**Polysiphonia elongata**	species	13465	Hudson		Plantae		Rhodophycota
seagrasses	**Zostera marina**	species	39074	Linnaeus		Plantae	Tracheobionta	Magnoliophyta

Species list for Phytobenthos

Sub-division	super-class	class	subclass	infra-class	super-order	order	suborder	infraorder	super-family
		Phaeophyceae				Desmarestiales			
		Phaeophyceae				Fucales			
		Phaeophyceae				Laminariales			
		Phaeophyceae				Ectocarpales			
		Phaeophyceae				Scytosiphonales			
		Chlorophyceae				Cladophorales			
		Chlorophyceae				Ulotrichales			
		Chlorophyceae				Ulotrichales			
		Rhodophyceae	Florideophycideae			Ceramiales			
		Rhodophyceae	Florideophycideae			Ceramiales			
		Rhodophyceae	Florideophycideae			Ceramiales			
		Rhodophyceae	Florideophycideae			Ceramiales			
		Liliopsida	Alismatidae			Najadales			

Additional important monitoring species: fish, seabirds, cetaceans, seals

type group	Taxon	tax. rank	ITIS-code	Author	Synonyms	kingdom	Sub-kingdom	phylum
Cetaceans	Phocoena phocoena	species	180473	(Linnaeus, 1758)		Animalia		Chordata
Cetaceans	Tursiopstruncatus	species	180426	(Montagu, 1821)		Animalia		Chordata
Seabirds	Haematopus ostralegus	species	176469	Linnaeus, 1758		Animalia		Chordata
Seabirds	Larus argentatus	species	176824	Pontoppidan, 1763		Animalia		Chordata
Seabirds	Sterna hirundo	species	176888	Linnaeus, 1758		Animalia		Chordata
Seals	Halichoreus grypus	species	180663	(Fabricius, 1791)		Animalia		Chordata
Seals	Phoca vitulina	species	180649	Linnaeus, 1758		Animalia		Chordata
Teleostei	Agonus cataphractus	species	167454	Linnaeus		Animalia		Chordata
Teleostei	Ammodytes tobianus	species	171676	Linnaeus	Ammodytes lancea	Animalia		Chordata
Teleostei	Clupea harengus	species	161722	(Linnaeus)		Animalia		Chordata
Teleostei	Gadus morhua	species	164712	Linnaeus, 1758		Animalia		Chordata
Teleostei	Limanda limanda	species	172881	(Linnaeus)		Animalia		Chordata
Teleostei	Platichthysflesus	species	172894	(Linnaeus, 1758)	Pleuronectes flesus	Animalia		Chordata
Teleostei	Pleuronectes platessa	species	172902	(Linnaeus)	Pleuronectes flesus	Animalia		Chordata
Teleostei	Zoarces viviparus	species	165324	(Linnaeus, 1758)		Animalia		Chordata

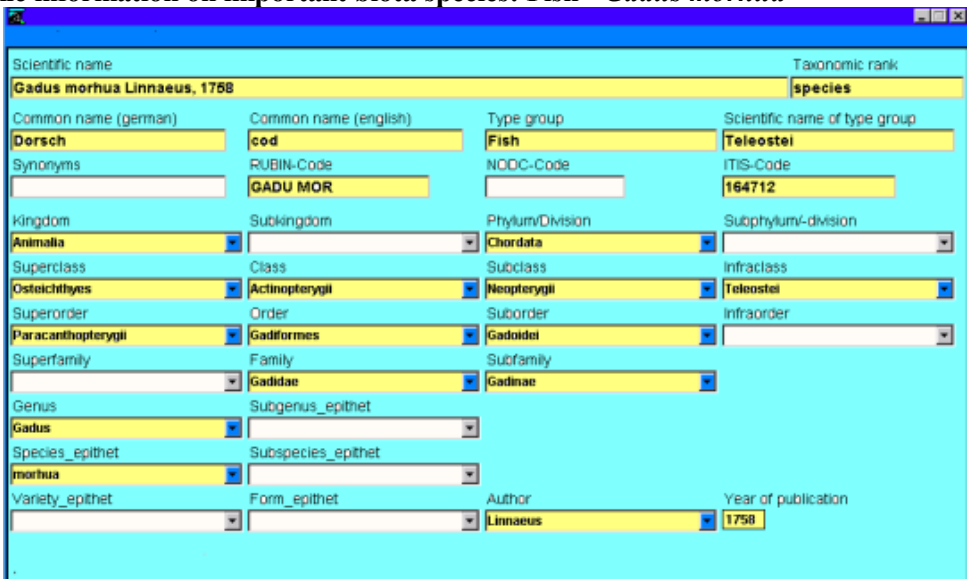
Additional important monitoring species: fish, seabirds, cetaceans, seals

subphylum	superclass	class	subclass	infraclass	superorder	order	suborder	infraorder	super family
Vertebrata		Mammalia	Theria	Eutheria		Cetacea	Odontoceti		
Vertebrata		Mammalia	Theria	Eutheria		Cetacea	Odontoceti		
Vertebrata		Aves				Ciconiiformes			
Vertebrata		Aves				Ciconiiformes			
Vertebrata		Aves				Ciconiiformes			
Vertebrata		Mammalia	Theria	Eutheria		Carnivora	Caniformia		
Vertebrata		Mammalia	Theria	Eutheria		Carnivora	Caniformia		
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Acanthopterygii	Scorpaeniformes			
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Acanthopterygii	Perciformes			
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Clupeomorpha	Clupeiformes	Clupeoidei		
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Paracanthopterygii	Gadiformes	Gadoidei		
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Acanthopterygii	Pleuronectiformes			
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Acanthopterygii	Pleuronectiformes			
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Acanthopterygii	Pleuronectiformes			
Vertebrata	Osteichthyes	Actinopterygii	Neopterygii	Teleostei	Paracanthopterygii	Gadiformes	Zoarcoidei		

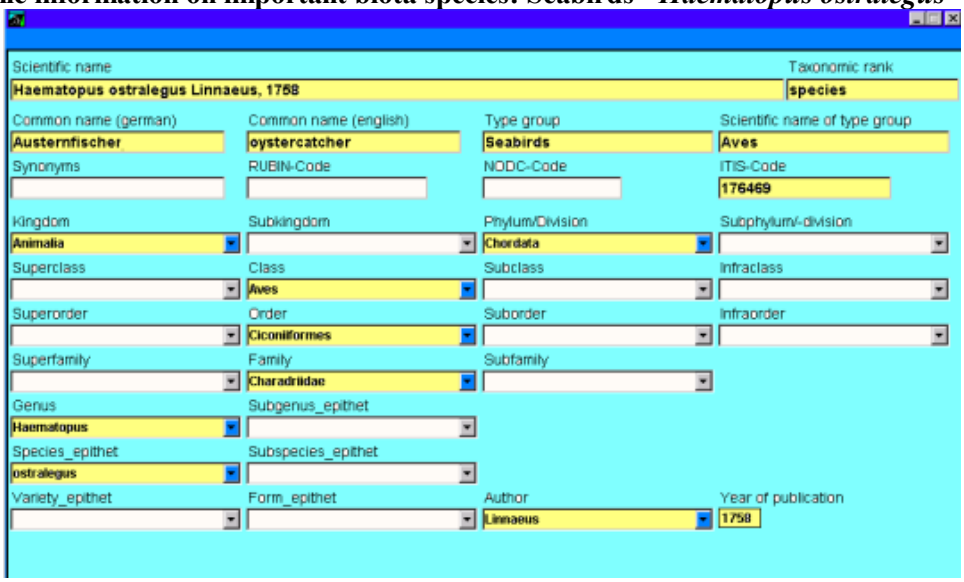
Additional important monitoring species: fish, seabirds, cetaceans, seals

family	sub-family	genus	subgenus epithet	species epithet	subspecies epithet	variety epithet	form epithet
Phocaenidae		Phocoena		phocoena			
Delphinidae		Tursiops		truncatus			
Charadriidae		Haematopus		ostralegus			
Laridae		Larus		argentatus			
Laridae		Sterna		hirundo			
Phocidae		Halichoerus		grypus			
Phocidae		Phoca		vitulina			
Agonidae		Agonus		cataphractus			
Ammodytidae		Ammodytes		tobianus			
Clupeidae	Clupeinae	Clupea		harengus			
Gadidae	Gadinae	Gadus		morhua			
Pleuronectidae		Limanda		limanda			
Pleuronectidae		Platichthys		flesus			
Pleuronectidae		Pleuronectes		platessa			
Zoarcidae		Zoarces		viviparus			

Taxonomic information on important biota species: Fish - *Gadus morhua*



Taxonomic information on important biota species: Seabirds - *Haematopus ostralegus*



Species lists and taxonomic information in the German NODC

- Main objectives:
  - harmonization of species lists / common species lists for data exchange and data evaluationlink to a widely accepted taxonomic data base / biodiversity facilitycommon tables on species characteristics: size classes, development stages, counting units
  - ecological characteristics of species: geographical distribution, red lists, regionally defined non indigenous species, salinity preferences, feeding habits

Guo Fengyi. Marine Biological and Chemical Data Management Activities in China and Proposals

1. Management

The issue of Marine Biological and Chemical Data Management is very important. Some management activities in China have been done. A set of specifications have been published and used. At the same time an automatic quality control system has been developed.

1.1 Specifications

- The Specification for Marine Biological Survey
- The Specification for Observation of Chemical Parameters in Sea Water
- The Specification for Ocean Monitoring
- The National Standard for Marine Bio-taxonomic Codes
- Modifying the above specifications

The Specification for Marine Biological Survey

- This specification includes the following 7 parts:
  (1) General Principles
  (2) Chlorophyll and primary production
  (3) Microbe
  (4) Plankton
  (5) Macro-benthon
  (6) Micro-benthon
  (7) Swim-organism

The Specification for Observation of Chemical Parameters in Sea Water

- This specification includes the following 9 parts:
  (1) General Principles
  (2) How to measure dissolved oxygen
  (3) How to measure pH
  (4) How to measure total alkalinity
  (5) How to measure phosphate
  (6) How to measure nitrate
  (7) How to measure nitrite
  (8) How to measure ammonia
  (9) How to measure chloride

The Specification for Ocean Monitoring

- This specification is used to monitor marine pollutants near China sea area. It includes the following information:
  (1) General Principles
  (2) Sample collection, storage and transportation
  (3) Data processing and analytical quality controlling
  (4) Water monitoring and analysis
  (5) Sediment analysis
  (6) Bio-analysis
  (7) Atmospheric analysis
  (8) Determination of radio-nuclide
  (9) Off shore pollution survey and biological monitoring
  (10) Flux of pollutants into the sea

The National Standard for Marine Bio-taxonomic Codes

- The marine bio-taxonomic codes are important for the management of biological data. This Marine Bio-taxonomic Codes only includes the marine organisms in China Sea area and the common species in oceans.
  (1) Taxonomic Grades
    - There are 6 grades in the Marine Bio-taxonomic Codes, which include Phylum, Class, Order, Family, Genus and Species. They consist of 18 numeric characters.

XXX Phylum

XXX XXX	Class
XXX XXX XXX	Order
XXX XXX XXX XXX	Family
XXX XXX XXX XXX XXX	Genus
XXX XXX XXX XXX XXX XXX	Species

(2) How to express the grade of every organism
- Two characters are used before the marine bio-taxonomic code for expressing the grade of every organism. For example:
  - P Phylum
  - SP Subphylum
  - C Class
  - UC Ultraclass
  - SC ubclass
  - O Order
  - UO Ultraorder
  - SO Suborder
  - F Family
  - UF Ultrafamaly
  - SF Subfamily
  - G Genus
  - S Species

Modifying the above specifications
- As the above specifications have been used for more than ten years, some of survey methods are not available. At the same time some new methods are used. Right now the new specifications are edited in China. By the end of next year these specifications will be finished.

1.2 Quality assurance and quality control
- Quality assurance
- Quality Control

Quality assurance
- The following procedures are accepted:
  (1) Application of "ISO9000"
  - "ISO9000" is an international regulation for standard operation. In order to insure the quality of data obtained by ocean survey, "ISO9000" is accepted in China. By this procedure the quality of each step processing biological and chemical data can be insured.

  (2) Staff
  - The staff who work for managing the biological and chemical data, must be qualified. They must suit with some conditions, such as educations and experiences.

  (3) Regulation for Service
  - The agencies or institutions, which provide marine data or productions to users, must be qualified also. They have to suit with the following conditions:
  - The agencies must hold a great quantity of observation data.
  - The agencies must hold a number of staffs working for data processing and management.

Quality Control
- In China an automatic quality control system has been established. The following procedures are used in the system:
  - # Data field verification
  - # Data relationship verification
  - # Statistical tests

(1) Data field verification

- The data field verification procedure performed a variety of automatic checks on individual data fields to assure that the characteristics of any given field matched characteristics defined as acceptable for that field. The tests were performed to assure that:
    - # Each field contains the expected data type.
    - # Data values were written within acceptable ranges.
    - # Fields containing code values contained acceptable codes
    - # Mandatory fields were present.

(2) Data relationship verification

- This procedure evaluates the appropriateness of the observed values in relation to other data values.

(3) Statistical tests

- This procedure is used to determine the acceptability of the observed values in comparison to existing values within relative model. The following formula is used:

  $M-3.5*SD<X<M+3.5*SD$

  Where M =Mean value
  SD = Standard deviation
  X = Observation value

2 Proposals

1. IOC has to establish reliable and effective exchange policy for marine biological and chemical data and information and to ensure these data serving to environmental protection, human health, social common, scientific research and educational purposes. The issue of the IOC Oceanographic Data Exchange Policy is of fundamental importance to the future of ocean sciences and service in all IOC Member States. China as an IOC Number State supports most existing IOC oceanographic data exchange policy and procedure.
2. As most historical marine biological and chemical data exist only in manuscript form, these data need to be digitized according to standard formats. Since these historical data sets are an extremely valuable and irreplaceable resource. It is essential to develop and implement a science ocean data management policy to ensure the preservation and enhancement of the data.
3. IOC has to establish standard exchange format for marine biological and chemical data and information in order to be easy for using the marine biological and chemical data.
4. The meta data of marine biological and chemical data should be full and open exchange. The IOC Member State can get it freely.

Cynthia J. Decker. The Ocean Biogeographic Information System

Background and Need

- Access to species-level, georeferenced information - survey data, museum data, national archives
- Access to taxonomic authority files - maintained by individual experts, many not digitized
- Environmental mapping for biogeographical analysis using physical, chemical, satellite data; model output
- Standards, protocols and analytical tools

OBIS History

- 2000 - NOPP funding for 8 OBIS Projects
- 2001 - Federation of species- & geo-referenced expert databases, Assoc. Member GBIF
- 2001 - NSF funding for global OBIS Portal
- 2001, 2002 - OBIS International Committee Meetings in USA (Rutgers U.), Netherlands (Leiden Museum)
- 2001 Distributed OBIS Projects interoperable

OBIS Portal (Rutgers U.)

- Is the proxy for the distributed network
- Handles data requests & searches
- Operates network tools & models
- Connected to backend database server for some expert databases
- Acts as a research & education center for ocean life

General Description

- *End products:* hierarchy of products ranging from raw and processed data, analysis tools, models, and visualizations
- *Data source:* multidisciplinary, includes classification of organisms, ecology, and environmental sciences
- *Data-processing subsystems:* diverse in system architecture and implementation
- *Participants:* experts from all fields of marine sciences and information technology
- *At a global scale, OBIS is intrinsically heterogeneous*

OBIS Databases

- The FISHNET Distributed Biodiversity Information System, Edward Wiley, Natural History Museum, University of Kansas
- Census of Marine Fishes: List of Species and Online Biodiversity Database (with FishBase), William Eschmeyer, California Academy of Sciences
- Expansion of CephBase as a Biological Prototype for OBIS, Phillip Lee, University of Texas Medical Branch
- A Biotic Database of Indo-Pacific Marine Mollusks, Gary Rosenberg, Academy of Natural Sciences, Philadelphia
- Biogeoinformatics of Hexacorallia: Geospatial, Taxonomic, and Environmental Data, Daphne Fautin, University of Kansas
- Diel, Seasonal, and Interannual Patterns in Zooplankton Composition in the Subtropical Atlantic, Deborah Steinberg, Bermuda Biological Station
- ZooGene, a DNA Sequence Database for Calanoid Copepods and Euphausiids: An OBIS Tool for Uniform Standards of Species Identification, Ann Bucklin, University of New Hampshire
- Development of a Dynamic Biogeographic Information System: A Pilot for the Gulf of Maine, Dale Kiefer, University of Southern California
- Development of a Marine Mammal, Seabird and Turtle Database, Andrew Read, Duke University,

Current development

- The world's principal databases on fish, octopus, squid, anemones, corals, zooplankton and seamount fauna integrated for the first time

- "One-stop shopping" among 430,000 occurrence records covering the oceans of the world through a single Web-based user interface
- Name and mapping services provided through the OBIS portal

Development of scalable OBIS

- *Protocol:* HTTP is used for communication between OBIS nodes and the portal server
- *Data exchange format:* XML, which is easily expandable, is used for the data exchange format
- *Common vocabulary:* is derived from the Open GIS standard
- *Programming level:* is concurrent; event-driven programming is used to develop the OBIS portal

Next Steps

- Develop a Taxonomic Name Service with Language support
- Integrate data from all CoML field projects at the OBIS Portal
- Develop a system to predict species distributions
- Work with national archives and global observing system to integrate environmental datasets
- Incorporate more analytical and modeling tools to provide network-wide automatic services

OBIS International Committee

- Mark Costello, Canada, Chair
- Neil Ashcroft, United Kingdom
- Geoff Boxshall, United Kingdom
- Daphne Fautin, USA
- Kim Finney, Australia
- Rainer Froese, Germany
- Dennis Gordon, New Zealand
- Fred Grassle, USA
- Yoshihisa Shirayama, Japan

The Census of Marine Life is:

- a research program that will examine changes in the diversity, distribution and abundance of marine organisms in time and space
- an international program that will involve experts in a variety of biological fields from around the globe
- an emerging program that will identify key questions and support observations and research over the next 5-10 years

The Census of Marine Life - Elements

- History of Marine Animal Populations, (P. Holm, Southern Denmark University)
- The Ocean Biogeographic Information System, (M. Costello, Huntsman Marine Science Centre)
- SCOR New Technologies Working Group, (D. Farmer, University of Rhode Island)
- Initial Field Projects, (Scientific Steering Committee; R. O'Dor, CORE)
- Future of Marine Animal Populations, (R. Myers, Dalhousie University)

The Census of Marine Life - Scientific Steering Committee

- J. Frederick Grassle, Rutgers University, USA (Chair)
- Vera Alexander, University of Alaska, USA
- Patricio Bernal, Intergovernmental Oceanographic Commission, France
- Donald Boesch, University of Maryland, USA
- David Farmer, Institute for Ocean Science, Canada
- Olav Rune Godoe, Inst. of Marine Research, Norway
- Carlo Heip, Netherlands Institute for Ecology, The Netherlands
- Poul Holm, Southern Denmark University, Denmark
- Ian Poiner, CSIRO, Cleveland, Australia
- Yoshihisa Shirayama, Kyoto University, Japan

- Andrew Solow, Woods Hole Oceanographic Institution, USA

The Census of Marine Life - Implementation Committees

- Canadian Workshop, February 2002 (Dept. Fisheries & Oceans/Sloan Foundation, Nova Scotia)
- Japanese Workshop, March 2002 (Japanese Oceanographic Society, Tokyo)
- Australian Workshop, May 2002 (National Ocean Office, Hobart)
- US Workshop (Funded)
- European Workshop (Organizing)
- Southeast Asia Region (IOC-WESTPAC Workshop, October 2001 (Phuket)
- South American Region, October 2002 (Concepcion)
- South Pacific Region (New Zealand Organizing)

History of Marine Animal Population - HMAP Case Studies

- Northwest Atlantic, D. Starkey, U. Hull (Gulf of Maine, Grand Banks, Greenland cod fisheries)
- Southwest Pacific, M. Tull, Murdoch University (Southeast Australian Shelf/Slope & New Zealand Shelf fisheries)
- White and Barents Seas, J. Lajus, Russian Academy of Sciences (Russian and Norwegian herring, salmon and cod fisheries)
- Norwegian, North and Baltic Seas, M. Bager, Southern Denmark U. (Multinational cod, herring and plaice fisheries)
- Southwest African Shelf, L. van Sittert, U. Capetown (Clupeid fisheries in a continental boundary current system)
- Worldwide Whaling, T. Smith, NE Fisheries Science Center (Historical & 20th Century whaling)
- California Current, R. Francis, U. Washington (Clupeid fisheries in a continental boundary current system)
- Caribbean Sea, J. Jackson, Scripps Institute of Oceanography (Historical growth of reef fisheries)

The Census of Marine Life - Initial Field Projects

- Natural Geography In Shore Areas (NaGISA), Yoshihisa Shirayama, Seto Marine Biological Laboratory, Kyoto University, Japan
- Census of Marine Life in the Gulf of Maine (GoMAP), Ken Foote, Woods Hole Oceanographic Institution, USA
- Patterns and Processes of the Ecosystems of the Northern Mid-Atlantic (MAR-ECO), Odd Aksel Bergstad, Institute of Marine Research, Norway
- Biogeography of Chemosynthetic Ecosystems (ChEss), Paul Tyler, Southampton Oceanography Centre, UK
- Pacific Ocean Salmon Tagging (POST), David Welch, Pacific Biological Station, Nanaimo, British Columbia, CanadaElectronic Tagging of Pacific Pelagics (TOPP), Barbara A. Block, Stanford University, USA

Contact Information

- Websites:
  - OBIS: *www.iobis.org*
  - Census of Marine Life: *www.coml.org*
- Contacts:
  - OBIS: Mark Costello, *costello@huntsmanmarine.ca*
  - OBIS: Fred Grassle, *grassle@imcs.rutgers.edu*
  - CoML: Ron O'Dor, *rodor@COREocean.org*
  - CoML: Kristen Yarincik, *kyarincik@COREocean.org*