

**CENSUS OF MARINE LIFE
RESEARCH PLAN
2008-2010
Revised version (Oct 2008)**

MISSION:

The mission of the CoML (www.CoML.org) is to describe and synthesize global patterns of biodiversity, distribution, and abundance across all taxa of marine species, from microbes to mammals, and to understand and predict the effects of human impact on some of those patterns.

This research is done across ocean realms, from the nearshore to the deep sea and the open ocean, with an emphasis on understanding past changes, present status, and predicting future scenarios.

RESEARCH QUESTIONS:

1. What are the global patterns and processes of marine biodiversity across different taxa and ocean realms?
2. Which are the major drivers explaining diversity patterns and changes?
3. What is the total number of known species in the ocean and an estimate of the unknown?
4. How has the abundance and distribution of some major species groups such as large mollusks, fish, reptiles and mammals changed over time?
5. How important is environment in determining the movement behavior of animals and what changes to these natural patterns is induced by man?
6. What are the range of ecosystem consequences of fishing and other human impacts in the longterm?

ORGANIZATION:

<p>International Scientific Steering Committee</p>	<p>Projects: Past (historic) / Present (exploration) / Future (modeling) and Integration (database)</p> <p>National and Regional Implementation Committees (NRICs): 7 national (Australia, Canada, China, Korea, Indonesia, Japan, United States) and 5 regional (Caribbean, Europe, Indian Ocean, South America, Sub-Saharan Africa) http://www.comlsecretariat.org/Dev2Go.web?id=247613</p> <p>Synthesis Group: Provides guidelines for synthesis products 2008-2010</p> <p>Education & Outreach: Liaison for education and outreach activities at different levels</p> <p>Mapping & Visualization: Facilitate the development of mapping and visualization capabilities to the projects and NRICs</p> <p>Science Council: To provide the scientific vision and outline of a research plan in marine biodiversity for beyond 2010</p>
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PROJECTS:

History	History of Marine Animal Populations
Exploration	<p>14 Field projects focused on the:</p> <p>(1) Coastal Zone: rocky shores, seagrass beds, coral reefs, regional ecosystems (Gulf of Maine), tracking of animals on continental shelves</p> <p>(2) Open Ocean: tracking of ocean predators, zooplankton, Mid Atlantic Ridge</p> <p>(3) Hidden boundaries: continental margins, abyssal plains</p> <p>(4) Active geology: seamounts, vents / chemosynthetic ecosystems</p> <p>(5) Ice oceans: the Arctic and the Antarctic</p> <p>(6) Microscopic Oceans</p>
Future	Future of Marine Animal Populations
Integration	Database: Ocean Biogeographic Information System

GOALS, LEGACIES, MAJOR CONTRIBUTIONS AND MILESTONES OF THE PROJECTS

History:

History of Marine Animal Populations (HMAP) (<http://www.hmapcoml.org/>)

Goal:

To improve our understanding of historical ecosystem change and the role of man in these changes.

Major legacies:

- Knowledge on aspects of human engagement and its impacts on marine life in different regions across the world over the last millennium
- Knowledge on the declines and recoveries of major marine animal populations, including the early history of intensive sea fishing

Milestones:

2008

Workshops

- February: AAAS (American Association for the Advancement of Science) Symposium - The Unnatural History of the Sea: New Insights and Baselines for Ocean Recovery
- April: New website featuring videos of the scientific research from HMAP
- 4-8 June: Cod and Herring: The archaeology and early history of intensive sea fishing, Workshop, Westray, Orkney
- November: HMAP session "what lived in the oceans? Shifting baselines in time and space" at the MarBEF conference in Valencia

2009

Workshops

- May 26-28: Oceans Past II conference, Univ. of British Columbia, Vancouver, Canada
- August 4-8: 1st World Congress of Environmental History, Copenhagen, Denmark

Publications / Data analysis / Exhibitions

- Uploading of data to the Human-Mollusk Interaction database
- Book release: Changes in the Sea: New England Fishermen and Marine Ecology in the Age of Sail
- Preliminary analysis of declines and recoveries analysis available
- Video productions presenting the HMAP sub-projects continue

2010

Publications / Data analysis / Exhibitions

- Data visualization from the HMAP synthesis team
- Four books to be released fall 2010:

1. Marine environmental history in the Russian North
2. Long-term aspects of human engagement and impacts on marine life
3. Taking Stock: human impact on New Zealand marine ecosystem over the last millennium
4. Oceans Past Synthesis Volume

Exploration:

(1) COASTAL ZONE

Natural Geography in Shore Areas (NaGISA) (<http://www.nagisa.coml.org/>)

Goal:

To assess the biodiversity, distribution and abundance from the coastal zone (littoral and circa-littoral) in rocky shores and seagrasses, and establish a standardized world monitoring system of these communities.

Major legacies:

- The creation of the first global baseline of coastal biodiversity in rocky shores and seagrass beds from the intertidal zone to up to 20 m in depth
- The improvement of benthic taxonomy
- The elucidation of the scales of temporal and spatial variability in near-shore habitats
- Knowledge on the interactive effects of multiple drivers, including human activities, on spatial patterns of biodiversity in marine coastal communities at the global scale
- The identification of hot spots of marine coastal biodiversity to be suggested as new Marine Protected Areas

Milestones:

2008

Workshops

- Steering Group meeting in Caracas, Venezuela (August) and in Valencia (November)

Publications / Data analysis / Exhibitions

- Dissemination of NaGISA products as publications and presentations at conferences (Biodiversity conference in Valencia and World Fisheries Congress, Japan)
- Update of NaGISA papers in the CoML bibliographic database and of the NaGISA web page

Field work / Cruises

- Field campaigns/ laboratory work (specimen identification) and data input from active sites
- Expansion into new sites (e.g., Caribbean, South America, Atlantic Ocean)
- Continued involvement of Elementary, High School, University students in NaGISA field work

2009

Workshops

- Steering Group meeting in Long Beach, California (February); NaGISA-HMAP synthesis workshop
- NaGISA-FMAP synthesis workshop (July)
- NaGISA-FMAP synthesis workshop (November)
- NaGISA-HMAP synthesis workshop (December)

Publications / Data analysis / Exhibitions

- Preparation of manuscripts for a special issue of PLoS-ONE journal
- Preparation of NaGISA chapter for CoML project synthesis
- Publication of field guides in the West Pacific region (Ex. Echinoderms)
- Footage for a short animation on 'how the nearshore works'
- Preparation of articles (Caribbean and South America): testing null models of latitudinal gradients of species distribution
- Synthesis projects:
 1. Nearshore biodiversity: what can the past reveal about the future?
 2. Interactions among multiple drivers of change of Marine Coastal biodiversity

Field work / Cruises

- Field collection, laboratory work (specimen identification) and data input from active sites

2010

Publications / Data analysis / Exhibitions

- Data input from active sites
- Contribution to the Encyclopedia of Life (possibly separate CD/DVD for coastal biota)
- Field guide: The Marine Flora from the Gulf of California funded by CONACYT-SEP (Mexican National Council of Science).
- Field guide: Fauna marina bentónica de la Patagonia Chilena. Huinay Foundation
- Publication of a series of articles in a special issue (PLoS-ONE)
- Publication of synthesis articles
- Publication of children's book on nearshore biodiversity

Coral Reefs (CReefs) (<http://www.creefs.org/>)

Goal:

To survey the biodiversity associated with coral reefs, expand tropical taxonomic knowledge and increase the exchange of coral reef ecosystem data dispersed throughout the globe.

Major legacies:

- A more precise prediction on the future of coral reefs diversity worldwide
- Knowledge on the patterns of species diversity for understudied reef-associated groups across gradients of human disturbance

- Provision of new taxonomic and ecological knowledge for the effective management of reefs
- Provision of effective tools to monitor and assess coral reef biodiversity (ARMS: Autonomous Reef Monitoring Structure)

Milestones

2008

Publications / Data analysis / Exhibitions

- Launch of newly populated Creefs website
- Outline of plans for Knowlton/Bouchet Philippine initiative
- Summary of Hawaii reef census

Field work / Cruises

- Australia reef census, Ningaloo Reef, Lizard and Heron Islands

2009

Publications / Data analysis / Exhibitions

- Draft of Coral Reef Book (December)
- Summary of 1st Australia reef census

2010

Publications / Data analysis / Exhibitions

- Global expansion of partnerships
- More reliable estimates of diversity and distribution
- Contributions to OBIS, CBoL (Consortium for the Barcode of Life) and EoL (Encyclopedia of Life)
- Contributions to the identification of patterns of species diversity for understudied reef-associated groups across gradients of human disturbance.

Gulf of Maine (GoMa) (<http://www.usm.maine.edu/gulfofmaine-census/>)

Goal:

To study how patterns of biodiversity of the Gulf of Maine system contribute to ecosystem function, and how management decisions affect biodiversity and function including long-term adaptability of the system when coupled with environmental variability and climate change

Major legacies:

- Provide the first comprehensive collation of current taxonomic and ecological data for the entire Gulf of Maine ecosystem, with multiple potential applications for complex marine management and conservation issues by:
 - Establishing an ecosystem-based management system for the Gulf of Maine based on its biodiversity patterns and related processes.
 - Reporting on the marine biodiversity and its patterns in the Gulf of Maine region, and how they determine the attributes and functioning of the ecosystem, including long-term adaptability to environmental variability and climate change

-Providing with a taxonomic and ecological information system of the Gulf of Maine useful in conservation and management plans

Milestones:

2008

Publications / Data analysis / Exhibitions

- Submit papers now in preparation
- Web visualization project completed
- Begin Synthesis in Four Theme Areas:
 1. Biodiversity in the Gulf of Maine Area (Workshops and Publications)
 2. Bioinformatics and Visualization (Web and Ocean Data Partnership)
 3. Biodiversity Attributes in Relation to Ecosystem Approaches to Management (EAM) (Collaboration with the Department of Fisheries and Ocean, Canada – DFO- and with the National Marine Fisheries Service – NMFS- National Oceanic & Atmospheric Administration, USA -NOAA)
 4. GoMA Lessons Learned and Ecosystem Comparisons (Meetings and Publications)

Field work / Cruises

- NaGISA sites: US and Canada
- Platts Bank—upper trophic level foraging and keystone species
- June: Discovery Corridor Cruise

2009

Workshops

- CoML Sessions at GoMa Science Symposium

Publications / Data analysis / Exhibitions

- Synthesis publications on biodiversity, EAM and ecosystem comparisons
- Databases—GoMa Register of Marine Species and final OBIS submissions
- Major education and outreach activities (documentaries, etc.)

2010

Publications / Data analysis / Exhibitions

- GoMa Biogeographic Information System handed off to GoMa Ocean Data Partnership and IOOS (Integrated Ocean Observing System)
- Web content to inheritor site
- Regional Policy Briefings
- Shepherd final publications
- CoML release activities

Pacific Ocean Shelf Tracking (POST) (<http://www.postcoml.org/>)

Goal:

To provide a tool to study the life history of marine and anadromous animals along the west coast of North America, by tracking the movement and estimating survival in a variety of species including Pacific salmon. POST aims to develop and promote the

application of new electronic tagging technologies, using implanted acoustic transmitters and a continental-scale array of acoustic receivers running in lines across the shelf.

Major legacies:

- A compendium of knowledge on aspects of the early freshwater and marine survival, and migration behaviour of Pacific salmon including how they may be linked to changes in the ocean environment
- The development and coordination of a large scale acoustic telemetry network along the entire length of the west coast of North America
- The development of a clearinghouse for Northeast Pacific acoustic telemetry data
- Providing a model for the global Ocean Tracking Network

Milestones

2008

Publications / Data analysis / Exhibitions

- January: Initiate baseline migration and mortality assessment of studied species
- September: Complete phase 1 of database redesign

Field work / Cruises

- Expansion of research program (geographically)
- Joint geographical expansion of POST array lines

2009

Publications / Data analysis / Exhibitions

- January: Begin producing synthesis report and products (including 10 yr summary video and migration/mortality maps/models)
- September: Complete database redesign
- December: Launch POST exhibit at Vancouver Aquarium and begin liaising with other East Pacific aquariums for display
- December: Complete visualization tools that will allow for graphic representation of the POST array and allow for the display of scientific results

Field work / Cruises

- Expansion of research program (geographically)
- Joint geographical expansion of POST array lines

2010

Publications / Data analysis / Exhibitions

- Publication of synthesis reports and scientific papers
- Education and outreach activities leading to a broader acceptance of POST by user community, making the infrastructure sustainable beyond the end of the first Census in 2010

Field work / Cruises

- Expansion of research program (geographically)
- Joint geographical expansion and fill-in of POST array lines

(2) OPEN OCEAN

Tagging of Pacific Predators (TOPP) (<http://www.topp.org/>)

Goal:

To obtain global biological and oceanographic information including migration patterns for large open-ocean animals by using electronic tagging technologies

Major legacies:

- Provide with the technology and with an analytical toolbox to model animal movement/oceanographic variables for distribution to other databases and related research programs
- A test of Pacific Ocean circulation models using oceanographic and animal-derived data
- Delivery of work plan guidelines to conservation and governmental agencies responsible for creating and maintaining place-based Marine Protected Areas (MPAs) and mitigating incidental fisheries by-catch in the Pacific
- Knowledge on hotspot regions and delivery of predictive models to evaluate future climate change based on animal movement and the effects of inter-annual variations in oceanic condition on top predators

Milestones

2008

Workshops

- Host 3rd International Biologging Conference with special symposium on animal tracking on September 1-5, 2008 at the Asilomar Conference Grounds in Pacific Grove, CA.

Publications / Data analysis / Exhibitions

- Launch redesigned TOPP website with new education component for K-12 (Kindergarten to Highschool)
- Test operational models for predicting habitat use, animal movements and biological hotspots in N. Pacific

2009

Publications / Data analysis / Exhibitions

- Complete animal movement/oceanographic analytical toolbox for distribution to other OBIS and TOPP-like research programs
- Test Pacific Ocean circulation models using animal-derived data
- Final quality assurance and control (QA/QC) of physical oceanography data for inclusion in World Ocean Database

2010

Publications / Data analysis / Exhibitions

- Fully operational forecasting model to predict animal distribution based on oceanography of the Pacific Basin

- Deliver work plan guidelines to conservation and governmental agencies responsible for creating and maintaining place-based Marine Protected Areas (MPAs) and mitigating incidental fisheries by-catch in the Pacific
- Complete population of TOPP animal tracking data into OBIS database
- Incorporate animal derived data into World Ocean Database
- Synthesis of the TOPP discoveries to include analysis of population use of Pacific wide hotspot regions and connectivity among populations; Species interaction and tropic overlap among TOPP predators; Inter-annual variations in oceanic condition and their effects on top predators; Based on above, create predictive models to evaluate future climate change
- Become fully functional partner with data delivery to the Global Ocean Observing System (GOOS), the Integrated Ocean Observing System (IOOS), the National Oceanic & Atmospheric Administration, USA (NOAA), the National Aeronautics and Space Administration, USA (NASA), and Google
- Publish 100 plus peer-reviewed papers and Pacific Ocean Top Predator Atlas

Census of Marine Zooplankton (CMarZ) (<http://www.cmarz.org/>)

Goal:

To produce a global assessment of marine zooplankton species diversity, biomass, biogeographical distribution, genetic diversity, and community structure

Major legacies:

- Knowledge on the global patterns of mesopelagic zooplankton diversity
- Knowledge on morphological-molecular mesopelagic zooplankton diversity
- Provision of an indicator of changes in ocean ecosystems over time related to climate change using estimations and analysis of pelagic size spectra (microbes to whales).
- Provision of local and regional taxonomic tools for zooplankton research
- Provision of DNA protocols and data standards for zooplankton
- Knowledge on the potential impacts of ocean acidification and climate change on zooplankton

Milestones

2008

Workshops

- March 2-7: Special Session, Global Patterns of Holozooplankton Biodiversity at the Ocean Sciences Meeting, Orlando, Florida (Sponsored by the American Society of Limnology and Oceanography – ASLO – and the American Geophysical Union – AGU)
- March 9-10: CMarZ Steering Group meeting, associated with the Ocean Sciences Meeting in Orlando, Florida
- June: Data management and synthesis workshop for CMarZ Steering Group members who are major data contributors

Publications / Data analysis / Exhibitions

- DNA barcoding of zooplankton - review paper (Oceanography magazine or 2nd Barcode of Life Conference Symposium volume)

Field work / Cruises

- March-April: S Atlantic Ocean cruise. Benguela Upwelling Region.
- March-June: SE Pacific cruise.
- August: “Lets study the Ocean”. An outreach activity for high-school students using a research vessel, including on-board practices in Suruga Bay and lectures/sample examination/analysis in the land laboratory), Co-sponsored by The Japan Science Society, Tokai Un
- August-September: R/V Tansei-Maru, KT-08-21 Cruise; Sea area: Kuroshio Region off southern Honshu
- October-November: R/V Tansei-Maru, KT-08-28 Cruise; Sea area: off Sanriku

2009

Workshops

- CMarZ Steering Group meeting to review of draft synthesis report
- Synthesis leadership team meeting, review and integration of regional reports, preparation of summary synthesis report.
- September: Partner with International Council for the Exploration of the Sea (ICES) for Special Session at ICES 2009 Annual Science Conference

Publications / Data analysis / Exhibitions

- CMarZ Special Symposium Volume, with compilation of papers from the Ocean Sciences 2008 symposium
- Target 90% data completion for CMarZ databases; 300 CMarZ Species Pages
- Americas, Asia, Europe, and Africa Regional synthesis reports completed

2010

Publications / Data analysis / Exhibitions

- Publication of a CMarZ book on marine zooplankton for children and/or general
- Second CMarZ Special Symposium Volume with compilation of papers from special session at ICES or other international scientific meeting

Mid-Atlantic Ridge (MAR-ECO) (<http://www.mar-eco.no/>)

Goal:

To describe and understand the patterns of distribution, abundance and the trophic relationships among the organisms inhabiting the waters over and around the mid-Atlantic Ridge (MAR), as well as to identify and model the ecological processes that cause variability in these patterns.

Major legacies:

- Provision of knowledge on species composition and distribution patterns of macro- and megafauna, population genetics and dispersal patterns
- Provision of knowledge on trophic interrelationships and models of food web patterns

- Provision of knowledge on production processes under the influence of a major hydrographic frontal zone traversing the mid-ocean ridge

Milestones:

2008

Workshops

- Synthesis workshop. Villefranche-sur-Mer 26 May-5 June
- Contributions to SYNDEEP workshops in September and November among other synthesis workshops
- Workshop for the South Atlantic MAR-ECO network, Uruguay (August)

Publications / Data analysis / Exhibitions

- Publication of special issues of Deep-Sea Research II (January) and Marine Biology Research (March, 2008)
- All decapod and amphipod crustacean samples from 2003-2005 sorted and identified
- Database 2003-2005 fully updated (December)
- Ship-time commitments and other resources for South Atlantic effort (in progress)
- Exhibition “Deeper than Light” in Oslo, Germany, Aberdeen, Bergen and Spain.
- Further data 2003-2005 in OBIS (fish, cephalopods, epibenthos complete, others pending).

Field work / Cruises

- July-August: ECOMAR cruise aboard RRS Discovery to MAR (cut short due to technical constraints)

2009

Workshops

- All-project workshop at venue to be decided. Presentation of draft report to an all-project workshop. Debate on conceptual models for patterns.

Publications / Data analysis / Exhibitions

- Publication and inclusion in synthesis of new results from UK ECOMAR
- Inclusion of food-web descriptions based on sub-projects (US NSF and student projects)
- Trophic ecology projects completed
- Conceptual models available and ready for inclusion in synthesis
- Submission of book chapter drafts.
- Exhibition “Deeper than light” in Washington DC, and hopefully Canada.

Field work / Cruises

- June-July. ECOMAR cruise aboard RRS James Cook to the MAR
- May-June, 2009: US Cruise on a NOAA Vessel RV Bigelow.

2010

Publications / Data analysis / Exhibitions

- Publication of MAR-ECO book by P. Boyle
- Publication of comprehensive article(s) in scientific journal(s).
- All data 2003-2005 in OBIS

- Website data visualizations of structure and processes associated with mid-ocean ridges implemented.

(3) HIDDEN BOUNDARIES

Continental Margins (COMARGE) (<http://www.ifremer.fr/comarge/en/index.html>)

Goal:

To describe the biodiversity patterns of benthic and benthic-demersal communities on continental margins, with a focus on multiple habitats and spatial scales, as well as to identify the contribution of environmental heterogeneities to these patterns.

Major legacies:

- Knowledge on large scale depth ranges of species and communities of continental margins.
- Knowledge on the roles of habitat heterogeneity in generating and maintaining continental margin biodiversity
- Provision of a landscape-scale classification and habitat maps
- Provision of an identification system of the types of anthropogenic impacts on continental margins, including mapping of their occurrence and intensities, and of an assessment of their unique effects on continental margins.

Milestones:

2008

Workshops

- Roles of Habitat Heterogeneity in Generating and Maintaining Continental Margin Biodiversity, Scripps, La Jolla, 7-12 September 2008
- Circum Atlantic Biogeography, National Museum of Natural History (NMNH), Washington, October 2008
- Biodiversity of deep continental margins: local to global patterns and processes. COMARGE session at the World Conference on Marine Biodiversity, Valencia, Spain, 11-15 November 2008

Publications / Data analysis / Exhibitions

- The hierarchical list of world species of Galatheidae, to be submitted to *Zootaxa*
- Special issue of *Deep-Sea Research II* on the Deep Gulf of Mexico Benthos Program (in press)
- Special issue of *Deep Sea Research II* "Deep Sea Benthic Ecosystems of the Equatorial African Margin: the multidisciplinary program BIOZAIRE, manuscripts submitted

Field work / Cruises

- Twelve cruises in the Mediterranean Sea, Arabian Sea, Gulf of Mexico, Gulf of Guinea, off Philippines, Western Europe and Western USA

2009

Workshops

- Human Threats on Continental Margin Habitats, special session of the Deep Sea Biology Symposium, Goa, India, September 2009
- South American and Southern Ocean Margins: The Antarctic Intermediate Waters Connection, Brazil, October 2009

Publications / Data analysis / Exhibitions

- Roles of habitat heterogeneity in generating and maintaining continental margin biodiversity- A special issue of *Marine Ecology* edited by Lisa Levin and Myriam Sibuet.
- Global-, basin- and habitat-scale patterns of distribution and diversity of deep-sea nematodes
- The mid-slope depth maximum in diversity revisited
- New species and biogeography of black corals (Antipatharia) in the Atlantic
- Contribution to CoML synthesis: SYNDEEP, « Fresh estimates of biomass », and others

Field work / Cruises

- Eight cruises in the Mediterranean Sea, off Philippines, New-Zealand, Chile

2010

Publications / Data analysis / Exhibitions

- A review of circum Atlantic biogeography
- A review on the impact of human activities on continental margins
- The magnitude of marine biodiversity – new analysis
- Implications for environmental policies arising from the COMARGE synthesis of continental marine biodiversity and distributions
- Handbook of deep-sea sampling and sample processing for the purpose of environmental surveys
- Handbook of invertebrate sampling and sample processing in the framework of national trawling programs
- Interactive keys for all 870 marine species of Galatheoidea
- Contribution to the Encyclopedia of Marine Life (EoL)

Census of Diversity of Abyssal Marine Life (CeDAMar) (<http://www.cedamar.org/>)

Goal:

To document actual species diversity of abyssal plans as a basis for global change research and improve our understanding of the historical causes and ecological factors regulating biodiversity.

Major legacies:

- Knowledge on the number of species in the abyss and how this diversity is distributed along latitudinal gradient; factors influencing abyssal diversity
- Knowledge on the species cosmopolitanism issue in the abyss
- Knowledge on the nodule fauna and the possible impacts of deep-sea nodule mining
- Establishment and continuous update of a CeDAMar open access database and website

- Journal “Marine Biodiversity” edited by Pedro Martinez and other CoML members
- Recommendations to the ISA for the installation of MPA’s

Milestones:

2008

Workshops

- International DIVA I + II result workshop (Santiago de Compostela, Spain)
- DNA Barcoding Workshop (Wilhelmshaven, Germany)
- Workshop on Cosmopolitan Species in the deep sea
- Cross-project workshop SYNDEEP (San Diego, USA)
- Joint Cedamar /Deepsets session at the World Conference on Marine Biodiversity (WCMB) in Valencia

Publications / Data analysis / Exhibitions

- Publication of book chapter on abyssal seafloor
- Synthesis paper in Trends in Ecology and Evolution (TREE)
- 2 Zootaxa CeDAMar special Volumes on abyssal biodiversity published
- Recommendation to the International Seabed Authority on the design of marine protected areas in the abyss
- Data bases of abyssal biological samples and species records online at www.cedamar.org and in Obis

2009

Workshops

- International Workshops on
 - Latitudinal gradients in the abyss
 - Southern ocean polychaetes (cooperation with CAML)

Publications / Data analysis / Exhibitions

- Production of “Deeper than light” additional exhibit
- Involvement in different cross-cutting project synthesis activities
- Publications of Workshop outcomes
- Taxonomic exchange and description of 500 most abundant species (ongoing)

Field work / Cruises

- DIVA 3 cruise (summer 2009)

2010

Workshops

- Workshop comparing efficiency of different sampling gears in the Abyss

Publications / Data analysis / Exhibitions

- January: Publication on book of deep-sea biodiversity
- Synthesis paper on Cosmopolitanism in the Abyss
- Synthesis paper on latitudinal gradients in the Abyss
- Synthesis paper on the efficiency of different sampling gears in the Abyss
- Complete data delivery to OBIS
- Submission of all barcodes of deep-sea species to the Marine Barcode of Life (MarBOL)

- Special session (in conjunction with CAML) at the IPY Open Science Conference in Oslo
- Description of 500 most abundant species

Field work / Cruises

- Cruise to the Porcupine Abyssal Plain Deep-Sea observatory (August 2010)

(4) ACTIVE GEOLOGY

Census of Marine Life on Seamounts (CenSeam) (<http://censeam.niwa.co.nz/>)

Goal:

To study the factors that drive community composition and diversity on seamounts, and their role in the biogeography, biodiversity, productivity, and evolution of marine organisms, as well as the impacts of human activities on seamount community structure and function. In doing so CenSeam will prioritise, integrate, expand, and facilitate seamount research efforts in order to significantly reduce the unknown and build towards a global understanding of seamount ecosystems.

Major legacies:

- Knowledge on the factors driving community composition and diversity on seamounts, including any differences between seamounts and other habitat types
- Knowledge on the impacts of human activities on seamount community structure and function
- Improved management of seamount resources and conservation of biodiversity and ecosystem function

Milestones:

2008

Workshops

- CenSeam Data Analysis Working Group (DAWG) meeting initiating Octocoral analysis in Australia (links to FMAP)
- CenSeam contribution to Pew funded workshop(s) on MPA planning
- SAR-ECO (South Atlantic Ridge – sister project to MAR-ECO and CenSeam)
- CenSeam participation in COMARGE habitat heterogeneity workshop
- CenSeam participation in CoML synthesis topic SYNDEEP planning/workshop
- Seamount session at World Fisheries Congress
- Co-chair CenSeam-ChEss session at World Conference on Marine Biodiversity
- CenSeam Steering Committee meeting
- CenSeam Seamounts session at International Deep sea coral Symposium

Publications / Data analysis / Exhibitions

- Launch of re-vamped SeamountsOnline
- Japanese book on deep-sea fauna (pending funding)
- Submit a progress report to International Seabed Authority (ISA) on biodiversity of seamounts with cobalt rich ferromanganese crusts
- Summary papers prepared on seamount fisheries, and fishing impacts on corals, to be published in Proceedings of the World Fisheries Congress

- CenSeam contribution to IUCN report (FAO guidelines)
- CenSeam contribution to the GOODS report
- Launch of deep-sea coral exhibition at the International Deep sea coral Symposium
- Work is in progress amongst members of the international seamount community to develop quantitative and non-extractive methods for biodiversity mapping and prediction e.g. Shortis et al. (2008) Stereo-video surveys of deep-water habitats; Foster et al. (in press) Analysis and prediction of faunal distributions from video and multi-beam sonar data using Markov models.
- Meta-analyses under way e.g. octocorallia, galatheids etc? (seeing as “data analysis” is a part of heading here)

Field work / Cruises (not all are “core” CenSeam but carry CenSeam linked researchers)

- January: RV *Aurora Australis* voyage to Antarctica
- January-February: Australian Marine Reserves
- March-April: CenSeam Macquarie Ridge seamounts voyage (joint New Zealand/Australia)
- February-March: CenSeam linked to IPY-CAML voyage on RV *Tangaroa* to the Ross Sea, including Scott and Admiralty Seamounts
- April- May CenSeam linked voyage to seamounts and ridges in the Drake Passage and Scotia Sea aboard RV Nathaniel B. Palmer
- May-June: Voyage with CenSeam linked researchers aboard RV *Alis*
- May 2008: BA BFAR voyage
- RV Natsushima Japanese Voyage
- August – September: Azorean seamounts
- December: RV *Tommy Thomson* with DSROV Jason to Australia
- Linkages to British Antarctic Survey in January-February to Bellingshausen and Amundsen Seas
- Dates: NOAA voyage in March-April to the Shackleton Fracture Zone and Sars seamount region
- Dates: *Polarstern* on the Maude Rise

2009

Workshops

- Seamount Biogeosciences Network (SBN) meeting
- CenSeam Standardisation Working Group (SWG) workshop on image analysis
- CenSeam SWG meeting/workshop
- International Seabed Authority on biodiversity of Cobalt Rich Crust seamounts and discussion of environmental guidelines for exploratory mining
- CenSeam DAWG special issue planning workshop
- CenSeam contribution to International Marine Conservation Congress
- CenSeam Steering Committee meeting

Publications / Data analysis / Exhibitions

- Re-submit CenSeam proposal to Sloan Foundation
- Submit proposal to the Ministry of Fisheries, New Zealand (MFISH) for continued seamount research in New Zealand

- Launch of re-vamped “Deeper than Light” exhibition (expanded MAR-ECO exhibition to incorporate all CoML deep-sea projects under the DESEO (deep-sea education and outreach) umbrella)
- CenSeam Seamounts Review Paper published (Annual Review of Marine Science)
- Continued and refined data analyses for special issue
- Paper on fish biodiversity of Tasman Sea seamounts for Special Issue of Deep-Sea Research
- Synthesis Chapter completed (MacIntyre volume)
- Prototype animations (still under discussion)

Field work / Cruises (not all are “core” CenSeam but carry CenSeam linked researchers)

- January: RV *Tommy Thomson* with DSROV Jason to Australia
- Northern Summer: RRS *James Cook* or *James Clark Ross* voyage to the Indian Ocean
- June 2009: Chatham Rise seamounts New Zealand (biodiversity and effects of fishing)

2010

Publications / Data analysis / Exhibitions

- CenSeam Seamounts Special Issue Published – paradigms challenged and erected to help guide future research and publications
- Synthesis Volume completed (MacIntyre volume)
- Re-vamped CenSeam protocols document launched
- DESEO “Deeper than Light” at London Grand Finale
- Thousands of new records in the new version of SeamountsOnline, and uploaded to OBIS. CenSeam Seamount community primed to continue populating SeamountsOnline post 2010.
- Well established barcoding database from 2008 minigrant
- Animations premièred at Grand Finale (tentative plans)
- Publication of seamount sampling protocols current consideration of developing to a book)

Field work / Cruises

- Continuation of voyages to under-sampled regions, as well as re-visiting previously sampled seamounts to examine changes over time e.g. recovery from disturbance

Biogeography of Deep-Water Chemosynthetic Ecosystems (ChEss)

<http://www.noc.soton.ac.uk/chess/>

Goal:

To determine the biogeography of deep-water chemosynthetic ecosystems at a global scale through the study of the diversity, abundance and distribution of marine species found in deep-water reducing environments such as hydrothermal vents, cold seeps, whale falls, sunken wood and areas of low oxygen that intersect with continental margins, and to understand the processes driving these ecosystems.

Major legacies:

- Discovery of new vents, seeps and whale falls
- Description of new species
- Knowledge on the global biogeography patterns for species from vents, seeps, whale falls and OMZx
- Knowledge on the role of deep-water circulation and geographical barriers in gene flow
- Knowledge on the environmental factors driving the patterns of biodiversity in reducing ecosystems

Milestones:

2008

Workshops

- Taxonomy workshops: bivalves, polychaetes
- SYNDEEP – CoML deep-sea synthesis project (2008-2009): Towards a first global synthesis of biodiversity, biogeography and ecosystem function in the deep sea (ChEss, CenSeam, COMARGE, CeDAMar, MAR-ECO & FMAP)
- ChEss invited to Nautilus Minerals Inc. workshop, Nov 2008 (in conjunction with the Underwater Mining Institute Annual Conference.
- RENEWZ (New Zealand field programme) workshop in Valencia. Nov 2008

Publications / Data analysis / Exhibitions

- Deeper than Light Book to be published in English, Spanish, French, Norwegian and German (2007-08) by the Deep Sea Education and Outreach Group (DESEO)
- Illustrated (comic) book about vent discovery and investigation – script finalised, illustration in progress
- Invited paper on mining issues at vents
- ESOF, Barcelona. July 2008

Field work / Cruises

- New sites 2006/08: South MAR, SW Indian Ridge, NZ, Chile margin, NW Africa margin

2009

Workshops

- AEB -Atlantic Equatorial Belt - synthesis workshop,
- Global patterns of biogeography in chemosynthetic ecosystems - ChEss session at the 4th Vent and Seep Symposium, June-July 2009, Okinawa, Japan.
- Morss Colloquium funded ChEss and InterRidge workshop: “Deep-Sea Mining of Seafloor Massive Sulphides: A reality for Science and Society in the 21st Century.

Publications / Data analysis / Exhibitions

- SYNDEEP – CoML deep-sea synthesis project draft products (2008-2009)
- DESEO expanded Deeper than Light Exhibition (originally MAR-ECO)

Field work / Cruises

- New sites (2009-2010): South Pacific, Arctic and Antarctic
- January-February: Cruise to Antarctic chemosynthetic sites (ChEsSo)

- November 2009: INSPIRE ROV cruise to vents and seeps on Chile Triple Junction and Margin
- October 2009 & other TBC: Exploration of the Cayman Rise. Two distinct cruises by teams from UK and USA.

2010

Workshops

- Taxonomy workshop: meiofauna
- SE Pacific (INSPIRE): International South East Pacific Investigation into Reducing Ecosystems, first discoveries workshop
- Antarctic first discoveries workshop

Publications / Data analysis / Exhibitions

- ChEss Special Collection – “Advances in biogeography and taxonomy within deep-sea chemosynthetic environments: patterns, processes and synthesis from the CoML ChEss Programme”. PLoS One online journal
- SYNDEEP products
- Illustrated Comic Book published
- ChEssBase – global database for vent, seep & whale fall

Field work / Cruises

- Cruise to Antarctic chemosynthesis sites (ChEsSo)

(5) ICE OCEANS

Arctic Ocean Diversity (ArcOD) (<http://www.arcodiv.org/>)

Goal:

To provide a species inventory of the Arctic marine ecosystems, identify bio-geographic affinities and barriers and their relevance within an historical perspective, and identify the relation between species richness and distribution patterns with environmental data to understand and predict about Arctic climate change

Major legacies:

- Knowledge on the biogeography and history of Arctic species
- A system to facilitate the identification of Arctic invertebrates and access to distribution data
- Knowledge on the role of environmental factors controlling current species and community distributions, biomass and abundance
- Scenarios and possibly predictions as to how the proposed Intergovernmental Panel for Climate Change (IPCC) scenarios will impact Arctic marine ecosystems on all levels

Milestones:

2008

Publications / Data analysis / Exhibitions

- Special issue in Deep-Sea Research on major findings in the Canada Basin, Arctic deep sea, and adjacent Chukchi Sea shelf

- Second minigrant round in progress including species descriptions and barcoding
- Adjust data portals of ArcOD and CAML to facilitate bipolar comparisons for 2010
- New web pages online, working on adding content (including ArcOD-IPY cluster information)

Field work / Cruises

- March-May: Bering Sea Ecosystem Study (BEST)
- June-August: ArcOD / AATBI Cruise aboard R/V Oceana to the Svalbard Shelf, Norwegian, Greenland and Barents Seas
- July-August: ArcOD / PATOB cruises aboard small vessels - Canada, Alaska, Russia
- July: ArcOD / C30 Cruise aboard CCGC Sir Wilfrid Laurier to the Canadian Arctic
- August: Zooplankton sampling on Louis St. Laurent (Canada Basin)
- August-September: ArcOD / AMF / ABPB cruise aboard R/V Prof Lavrentiev to the Chukchi Sea
- August-September: RUSALCA Cruise to Chukchi Sea
- October-November: ArcOD / PATOB cruises aboard small vessels to Greenland Uumannaq

2009

Publications / Data analysis / Exhibitions

- 2009-2010: Pan-Arctic Analysis (including contributions through planned 3rd round of minigrants)
- Aiming at 100 species pages online
- Special issue on Biogeography of the Arctic Ocean

Field work / Cruises

- March-May: Bering Sea Ecosystem Study (BEST) (Pending)
- June-August: ArcOD / AKMAP cruise to Chukchi Sea (TBD)

2010

Workshops

- Arctic Ocean Diversity Symposium (in Tromsø, add on to Arctic Frontiers Meeting)

Publications / Data analysis / Exhibitions

- 2009-2010: Pan-Arctic Analysis
- Arctic invertebrate identification keys (as many as possible)
- Public book on Arctic Ocean Diversity

Field Work / Cruises

- June-August: RUSALCA cruise to the Chukchi Sea (TBD)

Census of Antarctic Marine Life (CAML) (<http://www.caml.aq/>)

Goal:

To study the distribution and abundance of Antarctica's marine biodiversity across ecosystems and depths, including assessment of critical habitats for Antarctic top predators, and how this biodiversity is affected by climate change.

To investigate the distribution and abundance of Antarctica's marine biodiversity, how it is affected by climate change, and how change will alter the nature of the ecosystem services currently provided by the Southern Ocean for the benefit of mankind.

Major legacies:

- An active network of about 200 marine biodiversity researchers within the Antarctic community (particularly the seven nations of South America) – “the CAML crew”
- New knowledge of diversity: provision of “RAMS” an hierarchical list of over 8,600 validated species, species pages for EoL, barcodes for CBoL, microbe sequences, an updated evolutionary tree for marine life and trends of Antarctic biodiversity - past, present and future
- New knowledge of distribution: expansion of regional data coverage, provision of range distribution maps, zonation patterns, oceanographic features, habitat maps based on geomorphic data and a new biogeography; identification of processes in dispersal and colonization; information on bioregionalisation, biospots and MPAs
- New knowledge of abundance: Information on fresh estimates of biomass by trophic and/or species levels in all realms, as well as estimation of changes in size distribution of animals
- Long-term legacies include the development of a coordinated network of interoperable databases for all Antarctic biodiversity data (over 1 million georeferenced species records) through SCAR-MarBIN and OBIS, including collaborative rescue of Russian historical datasets; long-term legacy sites for assessment of environmental change; a robust baseline against which the effects of future change may be measured; improved knowledge for management of Antarctic living marine resources; biological contributions to the Southern Ocean Observing System.

Milestones:

2008

Workshops

- Post voyage workshops to co-ordinate processing of samples, analysis of data and publication of results (e.g. April: CEAMARC voyages of Australia, France and Japan). Identify papers for the special volume of *Deep-Sea Research II*
- July: Scientific presentations with results of voyages at Scientific Committee on Antarctic Research (SCAR) special session Polar Marine Ecosystems: Status and Change in St. Petersburg
- October: Workshop of Polar Synthesis Macroscope (with ArcOD, TOPP) in association with CoML Mapping and Visualisation Workshop, North Carolina
- November: Scientific presentations, CAML SSC meeting and SCAR-MarBIN dataportal workshop in association with the World Congress on Marine Biodiversity (MARBEF) meeting, Valencia, Spain

Cruises

- November 2007-April 2008: Completion of largest ever Antarctic marine survey with 18 research voyages
- November-December (TBD): Cruise to South America (Atlantic), Sub-Antarctica, Drake Passage, Elephant Island, Weddell Sea, Bellinghousen Sea aboard NAPOC "Ary Rongel"
- November 2008 –January 2009 Russian diving expedition to “Progress” station
- December 2008-January 2009: Cruise to South America (Atlantic), Sub-Antarctica, Drake Passage, King George Island aboard ROU 04 Artigas, SR/V Vanguardia

2009

Workshops

- International Polar Year publicity (with ArcOD, CoML), February
- Polar Synthesis Macrocope results at CoML Long Beach meeting, February
- Workshops on identification of samples from 18 research voyages, data to SCAR-MarBIN, barcodes to CBoL
- 10th SCAR Biology Symposium with CAML/ArcOD mini-symposium, Sapporo Japan, July
- Major CAML symposium, special volume *Deep-Sea Research II*, Genoa Italy, May
- Preparation of CAML Synthesis Chapter for McIntyre book, July

Field work / Cruises

- January-February: Cruise to Sub-Antarctic, Drake Passage, Bransfield Strait, Admiralty Bay, Elephant Island aboard BIC "Humboldt"

2010

Workshops

- Recommendations on “The Status of Antarctic Biodiversity” to Antarctic Treaty Meeting and Council for Environmental Protection

Publications / Data analysis / Exhibitions

- Special Volume of *Deep-Sea Research II*, October
- Chapter in CoML Synthesis Book, Mc Intyre
- Publications in journals, bibliography in SCAR-MarBIN

(6) MICROSCOPIC OCEANS

International Census of Marine Microbes (ICOMM) (<http://icomm.mbl.edu/>)

Goal:

To study and catalogue global marine microbial diversity (Bacteria, Archaea, Protista and associated viruses) within an ecological and evolutionary context

Major legacies:

- A global atlas on the distribution of Bacteria, Archaea and microbial Eukarya based on data from a global 454 rDNA tag sequencing survey

- A system to mobilize Legacy microbial marine molecular and morphological data
- A marine taxon-specific Lipidomic database

Milestones:

2008

Workshops

- May 2008: Akademie Meeting: ‘Assessing marine microbial diversity: problems and solutions’ in Amsterdam, the Netherlands followed by a PhD Master Class. The class included training on 454 data analysis.

Field work / Cruises

- Dec 18-Jan 18: ARCHIMEDES-3
- R/V Kay Kay II (several)
- R/V Otilia (several)
- Apr 5-May 7: R/V Melville ROV Jason
- Nov 28-Jan 10: Icebreaker Oden
- Nov 3- Dec 3: R/V Polarstern
- Jan 28; Apr 22; Aug 26-27: R/V Plymouth Quest Plymouth Marine Laboratory
- Establishment of a Microbial Biodiversity Survey and Inventory (MIRADA LTERS): across all 13 of the major aquatic (8 marine and 5 freshwater) Long Term Ecological Research (LTER) sites established by the National Science Foundation (NSF) US LTER Program. The long-term objective of this study is to document and describe baseline diversity and relative abundance data for both common and rare members of microbial communities located in aquatic LTER sites and to relate this diversity to the underlying physical and chemical environment.

Publications

- October 2008 SPO manuscript: “Origin and diversity of bacteria in marine sponges revealed by massively parallel sequencing” submission to Science by Michael Wagner
- October 30, 2008; BSP project manuscript submission by Stefan Bertilsson
- December 2008; ACB project manuscript submitted by Dave Kirchman
- December 2008; PML manuscript submission to PLoS Biology by Jack Gilbert

2009

Workshops

- Jan 2009: ICoMM Sponsored session at the ASLO meeting in NICE, France
- Feb 1-5, 2009: Long Beach Meeting for McIntyre Chapter and ICoMM SAC meeting
- March 9-11, 2009: 1st Roles of the Rare Synthesis Mtg (UCSD) RARE Synthesis Group
- April 6-9, 2009: ‘Global Survey of Marine Microbes Conference’ ICoMM 454 users meeting
- April 21-23, 2009: 2nd Roles of the Rare Synthesis Mtg (MBL) RARE Synthesis Group

Publications / Data analysis / Exhibitions

- Summer 2009: Marine Microbe image exhibit (MBL)
- Publications associated with Organizing themes: the “Photic Zone” ; “Blue Waters”; “Coastal Ocean”; “Dark Ocean”; “Oxygen Minimum Zones”; “Polar Ocean”; “Chemosynthetic Ecosystems”; “LTERs and Time Series”; “Subsurface Biodiversity”; “Animal-Microbe Associations”; “Short-Term Temporal and Spatial Interactions”.

2010

Publications / Data analysis / Exhibitions

- Synthesis products: Within ICOMM
 - Communication (conferences, workshops)
 - Public appeal (web page, 454 tag sequencing DVD, Google Ocean)
 - Data (MICROBIS and VAMPS)
 - Publications: more than 40 anticipated from individual projects related to

ICOMM

- Synthesis products: Cross projects
 - Roles of Rare Taxa Synthesis Group publication (lead by ICOMM with the participation of CMarZ, COMARGE, CReefs, CEDAMAR, CenSeam, OBIS).

Future:

Future of Marine Animal Populations (FMAP) (<http://www.fmap.ca/>)

Goal:

To describe and synthesize globally changing patterns of species abundance, distribution, and diversity across ocean realms, including the modeling of the effects of fishing, climate change and other key variables on those patterns

Major legacies:

To understand past changes and predict future scenarios by providing actual models related to:

- Biodiversity patterns in the ocean
- Animal distribution and movements
- Long-term trends in animal abundance and ocean ecosystems

Milestones:

2008

Workshops

- Collaborate with SYNDEEP on deep sea synthesis workshop (San Diego, September)
- Hold FMAP session at the World Conference on Marine Biodiversity (Valencia, November)
- Conduct FMAP/HMAP synthesis meeting on trends in diversity

Publications / Data analysis / Exhibitions

- FMAP databases to be merged with OBIS (where permissions exist)

- Work with TOPP on synthesis of marine predator movements
- Participate in CenSeam data analysis working group
- Collaborate with OBIS on estimating global species richness

2009

Workshops

- Participate in several synthesis workshops and writers meetings (SYNDEEP, NaGISA, TOPP, HMAP, Synthesis Group, etc.)

Publications / Data analysis / Exhibitions

- Toolbox and synthesis papers will be submitted for publication
- Continuing research on global species richness with OBIS
- Provide information for Google Oceans and National Geographic Maps
- Outline articles for popular science magazines

2010

Publications / Data analysis / Exhibitions

- Finalization of modeling 'toolboxes' for ocean animal tracking, species ranges, analysis of historical data sets
- Computer-animated visualizations for general audiences
- Proposed exhibition: Ocean Life Through Time (Past to Future)
- Produce and publish popular science articles and essays
- Establish the FMAP legacy website

Integration:

Ocean Biogeographic Information System (OBIS) (<http://www.iobis.org/>)

Goal:

To become a national, regional and international infrastructure for information and biogeographic data on marine species and their distribution and abundance

Major legacies:

- Contribution of data to WoRMS (World Register of Marine Species) which will be visible through the Encyclopedia of Life (EoL)
- A system to provide support synthesis activities of all other Census projects
- Provision of products based on scientific and societal relevance: education, conservation, global algal blooms, fisheries, biogeography

Milestones:

2008

- Data acquisition
 - All CoML programmes have data in OBIS
 - Collaboration with NRICS to identify priority regional datasets (Regional OBIS nodes - RONS)
- Technical

Change from Java- and Oracle-based platform to Open Geospatial Consortium tools (OGC) and deliver Web Map Services (WMS) and Web Feature Services (WFS)

- Information products
Support NRICs, CoML projects and others with information products

2009

- Data acquisition
All CoML programs data into OBIS as a matter of routine
Further upload regional data
- Technical
Expand functionality of OBIS as defined by User Needs Assessment
- Information products
As defined in Synthesis
On demand of CoML projects and NRICs

2010

- Data acquisition
New data coming in will no longer be included in Synthesis products
(Integration / quality control takes time)
New data will be welcome for future projects (as repository)
- Technical
OBIS capabilities extended
Community portals
In situ physical/chemical measurements
- Information products
Habitat maps, range maps, species pages, etc

STRATEGY 2008-2010

(1) SSC meetings:

2008		2009		2010	
February	Punta Arenas, Chile	February	Long Beach, California, USA	February	Goa, India
May	Hangzhou, China	June	Cape Town, South Africa	May-June (TBD)	(TBD), USA
November	Valencia, Spain	October	Paris, France	October	London, England Grande Celebration

(2) Research cruises and field work, expansion to new geographic areas:

Between 30 to 50 cruises to:

Atlantic	Pacific	Indian	Polar Seas
Benguela Azores Mid Atlantic Ridge Mediterranean Sea Arabian Sea Gulf of Mexico Gulf of Guinea Western Europe South Mid Atlantic Ridge NW Africa margin South America North Atlantic Deep Water from off Brazil to eastern basin of the Atlantic through the Romanche Fracture Zone Porcupine Abyssal Plain Deep-Sea observatory	Macquarie Ridge South East Pacific Kuroshio Region: off southern Honshu and off Sanriku Phillipines Western USA Australia New Zealand Chile margin South Pacific Bering Sea Canada Alaska Russia	Indian Ocean SW Indian Ridge	Arctic: Svalbard Shelf Norwegian, Greenland and Barents Seas Canadian Arctic Chukchi Sea Greenland - Uumannaq Antarctic: Sub-Antarctica Drake Passage Elephant Island Weddell Sea King George Island Bellinghausen Sea

(3) Synthesis activities leading to specific products, by project, among the projects and among the regions: integration and further collaboration

-Synthesis workshops: within and among projects and NRICs. Examples:
National and Regional Implementation Committee meeting, Washington, DC, May 2008
Synthesis of the Deep (SynDeep), San Diego, California, September, 2008
Mapping and Visualization Technical Workshop, October, 2008, Duke University
Long Beach meeting, California, February, 2009

-Publication of Synthesis books:

- *Seven Seas, One Ocean: Voyages of Discovery in the Census of Marine Life. A book about the Census of Marine Life (P. Snelgrove)
- *Increments of Knowledge: Advancing from the Known to the Unknown to the Previously Unknowable (A. McInthyre). Each field project of the CoML with contribute with one chapter of this book
- *Marine Biodiversity and Biogeography: regional comparisons of global issues (C. Griffith & M. DuRand). Each NRIC will contribute with at least one chapter/article of this compilation

(4) Participation in national, regional and international conferences, meetings and workshops interacting within the scientific community

Participation in 15-20 workshop/meetings in the next 3 years, some examples are:

- Ocean Sciences Meeting. Special Session: Global Patterns of Holozooplankton Biodiversity. Florida, USA, March 2008. <http://www.aslo.org/orlando2008/>
- Scientific Committee on Antarctic Research (SCAR), St. Petersburg, Russia, July 2008. <http://www.scar-iasc-ipy2008.org/>
- International Biologging Conference. Special symposium on animal tracking on September, 2008, Asilomar, Pacific Grove, CA. <http://biologging.wordpress.com/>
- World Fisheries Congress, Yokohama, Japan, October, 2008. <http://www.5thwfc2008.com/>
- World Conference on Marine Biodiversity, Valencia, Spain, November, 2008. <http://www.marbef.org/worldconference/>
- Ocean's Past II Conference, Vancouver, Canada, May, 2009. <http://hmapcoml.org/oceanspast/>
- 4th International Symposium on Chemosynthetic-Based Ecosystems: Hydrothermal Vents, Seeps and Other Reducing Habitats. Okinawa, Japan, June/July 2009.
- Deep Sea Biology Symposium. Reykjavik, Iceland, June 2010.

(5) Publications and communication of findings:

Scientific publications, special issues in journals, books (general, technical, scientific, comic), maps, web pages, educational resources, policy briefings, short movies and videos, gallery of pictures, databases, relation with National Geographic, public exhibits, video-game

-Publications: More than 100 articles in scientific journals including review articles in Science / Nature, special Issues in PLoS-ONE, Deep Sea Research II and Marine Ecology, 10-15 books

-Exhibitions:

“Deeper than light” exhibition: Germany, Aberdeen, Norway, Spain, USA

The Deep: An exhibit by Claire Nouvian

Galatee Film: Oceans. World Premiere in November 2009. Other premiers in March 2010. <http://www.coml.org/medres/galatee.htm>

-CoML Grande celebration: 10 years of the Census, London, October 4-7, 2010.