

Linking biodiversity research in South America's oceans

Organisation de la recherche sur la biodiversité dans les océans bordant l'Amérique du Sud

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Abstract

This article outlines the background and planning for a South American workshop on marine biodiversity in Concepción, Chile, 28–30 October, 2002. This first CoML/POGO effort in the Southern hemisphere, pursuant to the Sao Paulo declaration began with presentations in all major coastal states and brings together key South American researchers to take advantage of new research concepts emerging from the Census projects.

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Résumé

Cet article met en lumière les objectifs et l'organisation d'un programme de travail sur la biodiversité marine des mers bordant l'Amérique du Sud, mis au point lors d'un atelier tenu à Concepción au Chili en octobre 2002. Ce premier programme conjoint sur l'hémisphère Sud, suite à la déclaration de Sao Paulo, a d'abord permis de dresser un état des connaissances pour les principales aires côtières. Ensuite, il permit aux chercheurs sud-américains de se doter de nouveaux concepts dans le domaine du recensement de la vie marine.

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1. Introduction

Biodiversity is defined as the collection of genomes, species, and ecosystems occurring in a geographically defined region. There is a global agreement today that the diversity of life in the ocean is being altered increasingly by human activities and that their effects are potentially irreversible. The South American region is no exception to this trend. Among others, in this geographical setting, the most critical (current or potential) ways in which marine biodiversity is, or may be impacted, are: removal of exploited

species from the seas; introduction of exotic species; chemical pollution; localized eutrophication and alteration of coastal habitats; and global climate change. Increased UV radiation and rising temperatures are potential changes in the environment resulting from global change, which can lead to possible changes in the regional biota and their life cycles in the ocean. These stresses may be affecting or may yet affect life in the oceans from the intertidal zone to the deep sea.

The waters around South America are a very large marine region, for the most part still unexplored. Therefore, a regional biodiversity effort appears to be most timely:

1. to gain new insight on what is unknown;
2. to consolidate information available at present and to disseminate the information to a wider audience;

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3. to explore the potential for further activity regionally on the subject of biodiversity; and

4. to explore how the present effort could be enhanced through both regional co-ordination and the co-operation of scientists from elsewhere.

New approaches and resources must be integrated with scientific effort and financial resources already in place to create an effective programme.

1.1. *Planning a regional study of marine biodiversity*

In planning a South American initiative to study biodiversity in South American waters, Longhurst's (1998) classification of the world oceans into biomes and provinces provides a useful framework. In this system, the South American region encompasses large and important coastal and oceanic biomes, each with one or more provinces.

1. Within the Pacific Coastal Biome, the Humboldt Current Coastal Province extends along most of the west coast of South America and is in direct contact with the oceanic South Pacific Subtropical Gyre Province.

2. On the east coast of South America the Atlantic Coastal Biome consists of the (a) Guianas Coastal Province, (b) the Brazil Current Coastal Province and (c) the Malvinas Current Coastal Province. The latter are in turn linked with the oceanic Caribbean, the South Atlantic Gyral, the South Subtropical Convergence, and the Sub-Antarctic Water Ring Provinces, respectively. This diverse ecological geography suggests a most unique opportunity for a concerted study on functional marine biodiversity under very different and contrasting biogeographical, evolutionary, and ecological settings.

1.2. *Importance of marine biodiversity*

At this point it is worth recalling some of the objectives of the US national research agenda on marine biodiversity (NRC, 1995), which might be applicable in the South American region:

- to understand the patterns, processes, and consequences of changing biodiversity by focusing on critical environmental issues and their threshold effects, and to address these effects at spatial scales from local to regional and at appropriate temporal scales;
- to improve linkages between marine ecological and oceanographic sciences by increasing understanding of the connectivity between local, smaller-scale biodiversity patterns and processes and regional, larger-scale oceanographic patterns and processes that may directly impact local phenomena;
- to strengthen and expand the field of marine taxonomy through training, the development of new methodologies, and enhanced information dissemination, and to raise the standard of taxonomic competence in all marine ecological research;

- to facilitate and encourage the incorporation of (1) new technological advances in sampling and sensing instrumentation, experimental techniques, and molecular genetic methods; (2) predictive models for hypothesis development, testing, and extrapolation; and (3) historical perspectives (geological, paleontological, archaeological, and historical records of early explorations) in investigations of the patterns, processes, and consequences of marine biodiversity; and
- to use the new understanding of the patterns, and consequences of marine biodiversity derived from this regional-scale research approach to improve predictions of the impacts of human activities on the marine environment.

These may serve well as the starting point for defining the objectives of a new programme on marine biodiversity in the South American waters. But there are also new and emerging questions that must be addressed by a South American initiative to study marine biodiversity. For example, there is increasing awareness that the role of the oceans in climate change, and the impact of climate change on the ocean biota cannot be understood unless we understand the functional diversity of marine ecosystems. The role of the oceans in the cycling of green-house gases varies with the functional diversity of ecosystems. The other side of the coin is that the response of the marine ecosystem to global change, and consequent regime shifts may also depend on the structure of the ecosystem. These ideas raise another question: how do we establish the links between functional diversity and species diversity? From this perspective, it becomes important to ensure that the studies of species diversity do not stop short of understanding the functions of major species of marine biota in determining the pathways of greenhouse gases in the ocean. It also becomes important that the studies address the impacts of species diversity and functional diversity at large scales, ranging from regional to basin to global scales: it would not be sufficient to confine the studies to coastal and near-shore environments.

In the wake of collapsing fisheries in various parts of the world oceans, scientists have turned increasingly to an ecosystem approach to fisheries management. We now recognize the need to understand how the dynamics of the food web are affected as a consequence of exploitation of selected species. In this context also, it becomes paramount to understand the links between diversity and functionality of marine food webs.

2. **Organizational context**

The international programme Census of Marine Life provides the context and umbrella within which a new South American effort to study marine biodiversity may be initiated and co-ordinated. The dual strategies of the CoML to attain its goals are to develop key projects that explore unique marine habitats in particular regions and to create

Table 1
Organizers for the South American CoML/POGO workshop

Country	Institutions	City	Organizer
Argentina	Instituto Nacional de Investigación y Desarrollo Pesquero	Mar del Plata	Dr. Vivian Lutz; vlutz@inidep.edu.ar
Brasil	Universidade Estadual de Santa Cruz	Ilhéus	Dra. Erminda C. Guerreiro Couto; minda@uesc.br
Chile	Universidad de Concepción	Concepción	Dr. Rubén Escribano; resciban@uantof.cl
Colombia	Instituto de Investigaciones Marinas Costeras	Santa Marta	Dr. Juan Manuel Díaz Merlano; jmdiaz@invemar.org.co
Ecuador	Instituto Oceanográfico de la Armada	Guayaquil	Dr. Manuel Cruz; mcruz@inocar.mil.ec
French Guyana	U.R. "ELISA", IRD	Cayenne	Dr. Felipe Artigas
Peru	Consejo Nacional de Ciencia y Tecnología Universidad Mayor de San Marcos	Lima Callao Lima	Dr. Juan Tarazona; jtarazona@concytec.gob.pe
Uruguay	Universidad de la República	Montevideo	Dr. Danilo Calliari; dcalliar@fcien.edu.uy
Venezuela	Universidad Simón Bolívar	Caracas	Dra. Patricia Miloslavich; pmilos@usb.ve

regional committees to support these projects and encourage CoML approaches to other habitat zones. So far, the only CoML activities in the Southern Hemisphere are in the Western Pacific. This leads us to the final objective: to identify possible new projects addressing problems of either regional (such as the Humboldt biome, and the Sub-Antarctic biome) or global (for example marine mammal migrations and South Pacific jack-mackerel migrations) relevance.

A second element of a new research programme should be to synthesize existing knowledge on biodiversity of the region. Traditionally, studies of biodiversity have been one of the strengths of the South American scientific community. However, many of these studies tend to be carried out in relative isolation, and it is at present very difficult to collect information on what is already known about the marine diversity of the region. Such a synthesis would also form the basis on which plans for future studies to unveil the unknown can be founded.

2.1. Partnership

The Partnership for Observation of the Global Oceans (POGO), an international organization that brings together major oceanographic institutions of the world, recently produced a declaration known as the Sao Paulo Declaration that highlights the need to enhance oceanic observations of the Southern Hemisphere. The oceans of the Southern Hemisphere are grossly undersampled, and this would be particularly true from the perspective of marine biodiversity. Efforts of POGO have also helped enhance the links

between South American oceanographic institutions, which should also facilitate co-ordination of efforts at the regional scale to study marine biodiversity.

2.2. Participation

Table 1 lists the marine institutions in coastal countries in South America that hosted VAG for presentations discussing the CoML/POGO Workshop in March–May 2002. The organizers for each country and their contact information are also listed. These organizers will be key contacts for linking researchers and programmes following the Workshop.

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