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Linking marine biodiversity research and
conservation in the Caribbean

Patricia Miloslavich
Eduardo Klein

ABSTRACT

This paper summarizes the goals and discussions held during the Caribbean Marine Biodiversity Workshop in Isla de Margarita, Venezuela, 15-17 June, 2004, under the auspices of the international program Census of Marine Life (CoML). Researchers from the Caribbean region prepared reviews of the status of knowledge of marine biodiversity in their countries (Colombia, Panama, Costa Rica, Mexico, Bermuda, Cuba, Puerto Rico, Dominican Republic, Jamaica and Venezuela). Other participants included CoML project leaders, Caribbean research organizations and programs as well as conservation organizations and oil companies with developmental interests and vast projects in the Caribbean.

New projects for CoML in the Caribbean will be focused on the early human impact on marine animal populations, coral reefs and coral taxonomy, biodiversity of the shore area down to 20-m depths and the consolidation of all Caribbean biodiversity information in a world-wide, open-access electronic database. Strong support was given by research programs either functioning in the region or aiming to establish broader links in the Caribbean such as the Smithsonian Research Institute (STRI), the Caribbean Coastal and Marine Productivity (CARICOMP), the Harte Research Institute for Gulf of Mexico Studies (HRI - Biodiversity of the Gulf of Mexico Project), FishBase, and the International Oceanographic Commission - Caribe (IOCARIBE) and organizations with conservation goals such as The Nature Conservancy and Conservation International, and the oil companies Petróleos de Venezuela (PDVSA), Chevron Texaco and ConocoPhillips.

INTRODUCTION

The Caribbean Region extends over about 2,754,000 Km² in which 36 to 40 politically independent countries and territories can be found, each with specific sovereignty claims and marine conservation management strategies. As such, research and conservation issues require integration and regional collaboration. The Caribbean is considered a unique biogeographic region with endemic species and is among the top five world hotspots for marine and terrestrial biodiversity [1]. Its complex geological history starting 130 millions of years ago and the involving emergence of the Isthmus of Panama in the Pliocene (around 3.0 to 2.8 Ma) had major effects on marine biodiversity. The isolation of the tropical American ocean into two different realms produced isolation and environmental change which resulted in increased evolutionary divergence and radiation of species living today in extensive coral reefs, mangroves, seagrass beds, deep-shelf ecosystems and partially isolated deep basins and trenches [2].

Historically, humans can be traced back in the Caribbean over six millennia. However it is in the last 3 to 4 decades that this region has suffered a tremendous impact from anthropogenic activities such as overfishing [3], pollution and eutrophication leading to the degradation of water and land resources [4], sediment run-off [1], diseases such as coral bleaching and mass mortalities of invertebrates [5–7], habitat loss by human destruction or alteration [8, 9], colonization by invasive species [10], and reduction of marine productivity due to the collapse of the coastal ecosystem [3]. These activities have led to a serious decline in marine biodiversity and to species extinction at an unprecedented rate [11]. The richness in marine biodiversity of the Caribbean, the continuous threats from tourism, maritime transportation and pollution, and the fact that human impact on biodiversity is poorly known [12], demands the international collaboration of the scientific community to encourage regional analysis of existing data and to pursue basic research in some areas and ecosystems.

On these bases the workshop "Caribbean Marine Biodiversity: the known and the unknown" sponsored by the Census of Marine Life (CoML), the Alfred P. Sloan Foundation and the Universidad Simón Bolívar, was planned in order to:

- Integrate researchers in marine biodiversity of the Caribbean region.
- Consolidate available information on marine biodiversity in the region.
- Learn and exchange ideas about national and regional plans, priorities and conservation policies.
- Explore the opportunities for regional and international cooperation in new developing projects related to marine biodiversity.
- Create a regional committee to support CoML projects and approaches in the Caribbean.

CENSUS OF MARINE LIFE - CARIBBEAN

The Census of Marine Life (www.coml.org) is an international science program with a growing global network of researchers in more than 70 nations

engaged in a ten-year initiative to assess and explain the diversity, distribution, and abundance of marine life in the oceans. The program is basically aimed to answer three questions: What lived in the oceans? What lives in the oceans? What will live in the oceans? It seeks to design and implement innovative biological sampling techniques for the marine environment and to incorporate a multitude of geo-referenced species and habitat information into a digital framework for visualization and analyses [13]. Finally, the CoML has an Outreach and Education component aimed to inform the public about its potential and actual contributions to knowledge. It provides information vital to science, management and policy through governments, commercial and recreational fishers, environmental groups, the research community, and other stakeholders in the oceans.

To accomplish these goals, the CoML is organized in five elements:

1. KUU (Known, Unknown and Unknowable) workshops such as the Caribbean Biodiversity Workshop that explore the structure of marine ecosystems at a regional scale.
2. OBIS (Ocean Biogeographic Information System), a dynamic, global 4-dimensional (space and time) digital atlas for explanation of relations in the oceans with identification of species and their location and abundance, integrated with environmental data, maps, and model outputs that links these marine databases worldwide thru Internet
3. HMAP (History of Marine Animal Populations) that answers the question of what lived in the oceans by documenting global marine biodiversity in the past, back to 500 - 1000 years before significant human impact.
4. Ocean Realm Field Projects that carry out global biodiversity research with calibrated technologies and protocols and answers the question of what lives in the oceans. It is focused on ocean realms, habitats defined by the methods and techniques required by their environmental conditions for biodiversity surveys and in many cases, sub-divided into zones (sea grasses, coral reefs, continental margins, abyssal plains, open ocean, ocean ridges, chemosynthetic ecosystems and the poles).
5. FMAP (Future of Marine Animal Populations) that answers the question of what will live in the oceans by predicting changes in global biodiversity in response to fishing, pollution, and climate change and will reveal patterns of biodiversity and model hypotheses regarding the effects of climate change or human impact on biodiversity.

Given the complexity of the Caribbean region in terms of its history, its ecosystem and species diversity, and its political and cultural richness, a CoML initiative in this region should include several elements: 1) an HMAP project that brings marine history and archaeology to collaborate with marine ecology and paleoecology to enhance our understanding of changes in the biodiversity, distribution and abundance of marine life in the region, 2) field projects that consider the most conspicuous, fragile and disturbed of the region's ecosystems, the coral reefs as well as the shore area and 3) an OBIS project that records the marine species and provides information on the distribution of marine species,

and integrates the existing databases and collections to the portal. Regarding the field projects in coral reefs and shore areas, CoML has already engaged in a "Coral Reef Field Project" focused mainly on the Indo-Pacific region, and in a "Natural Geography In Shore Areas (NaGISA) project", a collaborative effort aimed at inventorying and monitoring the biodiversity in the narrow inshore zone of the world's oceans at depths of less than 20m. The Caribbean reefs are built by more than 50 coral-reef building species. They extend from Bermuda to Panama and from Barbados to the Gulf of Mexico (with the best development in the central Caribbean) and constitute 12 % of the total reefs in the world.

The world's second longest coral barrier reef is off the coast of Belize, the largest reef in the northern hemisphere [14–16]. Since the Caribbean is among the regions where the most serious declines in reef area is occurring [17] and reef biodiversity is greatly influenced by the interaction with other conspicuous tropical marine ecosystems, the mangrove forests and seagrass beds, a regional research effort should include the study of both ecosystems with an integrated approach.

During the Caribbean Marine Biodiversity Workshop, the vision, goals and initiatives of the different projects to be pursued in the Caribbean were discussed (Table I). The HMAP group focused on the impact of early human populations on large mollusks. It took into account the Caribbean species *Strombus gigas*, traditionally used by early insular and continental native populations several large mollusks of other regions that have been used such as *Concholepas concholepas* in Chile, the 'sambaquies' in Brazil, the mesolithic shell middens in Denmark, *Haliotis* in South Africa, *Tridacna gigas* in the South Pacific Region and the Jomon culture shell in Japan.

The Coral Reef research group in the Caribbean has been consolidated through CARICOMP (Caribbean Coastal Marine Productivity) network and publication of *Latin American Coral Reefs* [18]. The Caribbean Coral Reef component of the CoML will examine patterns of diversity, distribution, abundance, and ecological function in the tropical West Atlantic, of which the endangered Caribbean coral reefs will be an important part.

The NaGISA group established as their first task to extend an invitation to join the NaGISA project to all the researchers and institutions currently performing investigations in marine biodiversity throughout the Caribbean. Contact information and possible sites will be gathered thru CARICOMP and in the recently developed Caribbean-branch of IODI (International Oceanographic Data and Information). The NaGISA group proposed two operational centers, a continental center at the Universidad Central de Venezuela and an insular center at the University of West Indies in Barbados.

The OBIS group composed most of the workshop participants. They agreed that this biogeographic information system would become a powerful tool for protecting biodiversity and managing ocean resources in a region heavily dependent on tourism and fishing. The process of creating the system would build capacity, international cooperation, and cooperation among stakeholders. In this sense, some notes were taken regarding the data of the biological collections at the participant institutions. Some data are electronic but many are

Table I: Vision, goals and initiatives of the CoML projects to be pursued in the Caribbean.

Project - Vision	Goals - Questions	Initiative in the Caribbean
HMAP		
Designed to illuminate the dynamic interplay of anthropogenic and natural factors in the evolution of marine ecosystems through collaboration between humanists and scientists	(1) How have the diversity, distribution, and abundance of marine animal populations altered over the last 2,000 years?. (2) Which factors have forced or influenced changes in the diversity, distribution, and abundance of marine animal populations?. (3) What has been the anthropogenic and biological significance of changes in marine animal populations?. (4) By what processes have marine ecosystems interacted with human societies?	Project: Early human impact on marine animal populations: the case of mega mollusks. Objectives: (1) To assess potential human impact on mollusk populations. (2) To assess response of marine animals on exploitation pressure. (3) To compare past and present marine animal population studies in order to improve management procedures. (4) To increase understanding of human perception and use of nature.
Coral Reefs		
Establish CoML Coral Reef - Caribbean as a sister group to the CoML Coral Reef Field Project (focused on the Indo-Pacific region).	Focused on four main themes: Systematics, Biogeography, Database Management and Accessibility, and Ecosystem Function and Processes. Develop widespread taxonomic expertise and incorporate authenticated information already available in museum collections. Undertake additional studies to verify the identities of specimens that are available but not authenticated. Undertake additional field studies to verify the extent and nature of species distributions	Project: Caribbean Coral Reef Taxonomy. Objectives: To update the knowledge and clarify the taxonomy of the major benthic coral reefs groups and to have the distribution of species diversity. These include all invertebrate phyla and algae, potentially to microbes. The project would be carried out by synthesizing the available knowledge in the region, making educational outreach to schools for procedures such as sorting samples and by producing a guide for identification of the major benthic groups.

Project - Vision

Goals - Questions

Initiative in the Caribbean

NaGISA

Designed to inventory and monitor the biodiversity in the narrow inshore zone of the world's oceans at depths of less than 20m.

To study hard bottom algal and soft bottom seagrass communities by using a series of well-distributed standard transects from the high inter-tidal zone to the depth of 20m covering the world (from pole to pole and around the equator), with standardized techniques that will provide a baseline for future biodiversity comparisons.

Project: NaGISA Caribbean, continental and insular.

Objectives: Implement a NaGISA protocol in the Caribbean. Continental base: Venezuela, Insular base: Barbados.

OBIS

To make marine biogeographic data on all species of marine life from all over the world freely available.

To provide online access to a global scale database of marine species data through a dynamic, global atlas of biogeographic information. Through an international federation of projects, it provides expertise in areas including: specific taxa (cephalopods, fish, marine mammals) regions (the Gulf of Maine) or habitats (seamounts) as well as projects that provide tools (c-squares Mapper) and many other areas.

Project: OBIS Caribbean

Objective: To create an open access, on-line system that will consolidate all existing information on marine biodiversity throughout the Caribbean region and provide a place where new information gathered can be assembled.

on specimen labels. Data in general are very good with many taxa covered and mostly georeferenced. Much of the data needs to be verified by taxonomic specialists.

CARIBBEAN RESEARCH INITIATIVES AND PROGRAMS

The Caribbean Marine Biodiversity workshop included the participation of several research programs, either functioning in the region or aiming to establish broader links in the Caribbean: the Smithsonian Research Institute (STRI), the Caribbean Coastal and Marine Productivity (CARICOMP), the Harte Research Institute for Gulf of Mexico Studies (HRI - Biodiversity of the Gulf of Mexico Project), FishBase, and the International Oceanographic Commission - Caribe (IOCARIBE) (Table II).

The Smithsonian Tropical Research Institute (STRI) in Panama is dedicated to understanding biological diversity. It began in 1923 as a small field station on Barro Colorado Island in the Panama Canal Zone. Since 1960 it has a permanent staff of scientists working in tropical biology. As such, it has developed into one of the leading research institutions of the world with research facilities for staff scientists, fellows, and visiting scientists. CARICOMP is a regional network of 25 marine laboratories, parks, and reserves established in 1986. Since 1990 it has been monitoring long-term variation in ecosystem structure and function in coral reefs, seagrasses, and mangroves in relatively undisturbed sites in the Caribbean according to standardized protocols. The Caribbean Coastal Data Centre at the University of the West Indies in Kingston, Jamaica archives the data and makes it available to the CARICOMP members and subsequently to the general research and management community. This program has involved institutions in 18 countries for over 10 years and has a web-accessible database on assessment and trends of critical coastal ecosystems in the Caribbean. CARICOMP contributes data to ReefBase, maintained by ICLARM in Malaysia, and has implemented the Global Coral Reef Monitoring Network (GCRMN) in sub-regions of the Caribbean. The Harte Research Institute (HRI) is a newly endowed and developing institute at Texas A&M University-Corpus Christi. Its mission is to support and advance the long-term sustainable use and conservation of the Gulf of Mexico. HRI encourages tri-national (United States, Mexico, and Cuba) responsibility and approach to understanding the Gulf of Mexico ecosystem, and promotes excellence and innovation in interdisciplinary scientific research, public policy initiatives, and education of the public.

FishBase is a global information system with taxonomic, biologic, ecologic, and biogeographic information about fishes worldwide. It contains practically all fish species known to science in a relational database with information available for research scientists, fisheries managers and zoologists. It was developed at the WorldFish Center in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and many other partners, and with support from the European Commission. Since 2001 FishBase is supported by a consortium of research institutions in the United States, Europe and Africa. The goal of FishBase in the Caribbean is to provide a reference model of a database

tool, involving the creation of a network of scientists, managers and coastal communities, and the consolidation of the information in digital standardized formats. Such initiatives will improve the conservation and management of marine biodiversity in the Caribbean avoiding redundant research.

IOCARIBE is the physical presence and the representation of IOC-UNESCO (Intergovernmental Oceanographic Commission) in the Caribbean and Adjacent Regions. This sub-commission was created in November 1982 as a Regional Subsidiary body responsible for the promotion, development and co-ordination of IOC marine scientific research programs, the ocean services, and related activities, including Training, Education and Mutual Assistance (TEMA) in the Caribbean. The IOCARIBE-UNESCO Sub-Commission deals with a wide range of scientific programs, dealing with collection, management and exchange of data on physical, chemical and biological properties of the ocean, coastal seas and estuaries; ocean mapping, research, and monitoring; survey and observation programs and systems at the regional level. The Sub-Commission follows three main lines of action: (1) Oceans and Climate, (2) Ocean Ecosystems Science and (3) Marine Science for Integrated Coastal Area Management.

CONSERVATION POLICIES

Since the Convention of Biological Diversity was agreed in 1992, the international agenda has clearly established the protection and management of biological diversity as a goal worldwide. However, it is more recently that marine biodiversity has come to be a concern since the effect of human activity on the seas and oceans is not as noticeable as that on land [19]. To protect marine biodiversity, all the measures included in the Biodiversity Convention must be addressed: establishment of protected areas, management of biological resources, rehabilitation of degraded ecosystems, protective legislation, prevention of the introduction of exotic species, management and regulation of activities leading to loss of biological diversity and encouragement of indigenous and local communities practices. The marine biodiversity reviews carried out by each of the participating countries of the Marine Biodiversity Workshop include the countries' conservation policies and legislation aimed to protect biodiversity as well as the extent of the protected areas. Discussion of conservation topics was very productive since the workshop also included participation of several organizations with conservation goals such as The Nature Conservancy and Conservation International, as well as the oil companies Petr leos de Venezuela (PDVSA), Chevron Texaco and ConocoPhillips, all with developmental interests and vast projects in the Caribbean (Table III).

The Nature Conservancy (TNC) works by joining together with communities, businesses, governments, partner organizations and individuals, and it is focused on a scientific planning process named "Conservation by Design" which identifies biodiversity hotspots for conservation. Conservation International applies innovations in science, economics, policy and community participation to protect the Earth's richest regions of plant and animal diversity in the hotspots, major tropical wilderness areas and key marine ecosystems. CI's conservation

Table II: Vision and conservation policies of the development and conservation organizations represented at the Caribbean Marine Biodiversity Workshop.

Research Program / Definition	Goals
<p>STRI</p> <p>A leading center for basic research in ecology, behavior and evolution in the tropics, based in Panama.</p>	<p>Further understanding of tropical nature for the welfare of humanity. Training students in tropical research. Promotion of conservation through public awareness of the beauty, importance and fragility of tropical ecosystems. Marine Sciences Program (MESP): monitors a variety of physical and biological parameters on the Caribbean and Pacific coasts of Panama</p>
<p>CARICOMP</p> <p>An international, regional, research project aimed at collecting long-term data according to standard protocols from three coastal ecosystems: mangroves, sea grass beds and coral reefs.</p>	<p>Measure the productivity of mangroves and sea grass. Study coral reef community ecology (percent cover of sessile organisms). Measure environmental data. Archive data (CARICOMP Data Centre at the University of the West Indies in Jamaica) and make it available to the scientific community.</p>
<p>HRI at Texas A&M University</p> <p>Its vision is to become a research center for excellence providing international leadership in generating and disseminating knowledge about the Gulf of Mexico ecosystem and its critical role in the economies of Mexico, Cuba and the US.</p>	<p>To determine the total biodiversity of the Gulf of Mexico. To update Bulletin 89 of the U.S. Fish and Wildlife Service in 1954: The Gulf of Mexico - Its Origins, Waters, and Marine Life, edited by Paul S. Galtsoff, the only census or inventory of species within the Gulf. To publish a series of 4 volumes: The Gulf of Mexico Volume I - Origins (history, archaeology, geology) Volume II - Waters (physical and chemical oceanography) Volume III - Biota (habitats, communities, flora and fauna) Volume IV - Anthropogenic Impacts.</p>

Research Program / Definition

Goals

FishBase

The premier information system and Global Public Good on all the world's fishes available on the web (<http://www.fishbase.org>), DVD and CD-ROM.

To network scientists, managers and coastal communities to uncover and consolidate current and legacy information in standardized formats making these permanently available in customized forms (languages, filtered data sets, specialized reports) to an array of users. To use as a reference model for the Caribbean: FishBase can be applied at various geographic scales, adapted to diverse fauna, provide personal connectivity, define research gaps, apply dynamic tools and used as a portal and data provider for biodiversity and ecosystem analysis. The use of web services, in particular, through XML (eXtensible Markup Language) technology provides a powerful tool to share and access resources not previously possible.

IOCARIBE

The IOCARIBE-UNESCO Sub-Commission deals with a wide range of scientific programs, dealing with collection, management and exchange of data on physical, chemical and biological properties of the ocean, coastal seas and estuaries; ocean mapping, research, and monitoring; survey and observation programs and systems at the regional level.

Through several projects it seeks: To provide information on the past, present and future state of the marine and coastal environment, on marine ecosystems and biodiversity, and on weather and climate variability. To develop indicators for Marine and Coastal Water quality and increasing capacity in the region. To develop training, capacity building and information networks as well as cooperative research, monitoring and resource protection. To support living marine resource assessment and management, incorporating fisheries environment and finance.

planning efforts are done by establishing targets for conservation outcomes at three scales of ecological organization: species, sites and land-seascapes. As indicators for success the outcomes for each scale are respectively the number of extinctions avoided, the number and size of protected areas and the number and size of consolidated corridors. Specifically in the Caribbean, CI has established the Caribbean Biodiversity Initiative (CBI) in order to develop collaborations in the region and to carry out research that can contribute guiding a regional conservation program (the Caribbean hotspot covers more than 431 million hectares of land and sea).

PDVSA, the Venezuelan oil company, holds as its environmental conservation policy to give special emphasis in the process of prevention, recovery and raising environmental conscious awareness. The organization takes full responsibility by restoring areas affected by oil-related activities and works thru institutional cooperation with the Ministry of Environment and Natural Resources (MARN) to optimize environmental management in relation to oil-production activities; it has also developed Intebios [®] technology aimed to treat biodegradable organic wastes. ChevronTexaco (CVX) is a major oil and gas company with operations in over 180 countries and on six continents. It is committed to protect the safety and health of people and the environment. CVX is working to integrate EBI (Energy & Biodiversity Initiative) principles and products into site selection for biodiversity conservation and management, and identification of potential impacts and their mitigation. ConocoPhillips is an international, integrated energy company. In Venezuela, they are focused on the east coast at the Gulf of Paria. Their strategy is focused on programs related to operations, sustainable growth for local communities, biodiversity preservation, and protection of the indigenous Warao culture and health.

PLANNING A CARIBBEAN INTEGRATED STUDY OF MARINE BIODIVERSITY

The Census of Marine Life - Caribbean Marine Biodiversity Workshop has provided the opportunity to synthesize and integrate the existing knowledge of marine biodiversity in 10 countries of the region (Venezuela, Colombia, Panama, Costa Rica, Mexico, Bermuda, Cuba, Jamaica, Puerto Rico and Dominican Republic). By doing so, it has set the baseline for a new research program. Basically, all manuscripts in this proceedings volume include information about the ecosystems found in the coastline, an evaluation of what is known about the taxonomy, biodiversity, distribution and abundance of the most representative marine taxonomic groups, the initiatives to preserve marine life such as laws, regulations, establishment of national parks or wildlife reserves and the major threats to marine biodiversity. Other aspects included in some reviews are the number of species known, names and contact details of taxonomists working in the region, datasets, key publications and location of museum collections.

The interaction between researchers, conservation agencies and oil companies has established a link for international collaboration and partnership that

Table III: Vision and conservation policies of the development and conservation organizations represented at the Caribbean Marine Biodiversity Workshop.

Organization / Vision	Conservation Policies
<p>The Nature Conservancy</p> <p>To preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.</p>	<p>Development of a comprehensive ecoregional conservation assessment for the marine, terrestrial and freshwater realms of the Caribbean: "Conservation by Design", the Conservancy's strategic, science-based planning process developed to identify the highest-priority places, landscapes and seascapes that, if conserved, promise to ensure biodiversity over the long term.</p>
<p>Conservation International</p> <p>To conserve the Earth's living natural heritage, on global biodiversity, and to demonstrate that human societies are able to live harmoniously with nature.</p>	<p>CI applies innovations in science, economics, policy and community participation to protect the Earth's richest regions of plant and animal diversity in the hotspots, major tropical wilderness areas and key marine ecosystems in more than 30 countries on four continents.</p>
<p>Petróleos de Venezuela (PDVSA)</p> <p>To move forward in a strategy of intense exploration of the maritime space oriented to the discovery of new hydrocarbon deposits in the areas off shore in attendance of the guidelines of the Ministry of Environment and Natural Resources (MARN).</p>	<p>Development of an Ecoregional Plan of the Venezuelan maritime spaces, oriented to identify the relevant and vulnerable ecosystems and species for conservation located in the areas with hydrocarbon production and exploration activities. The plan will allow the establishment of protection strategies including the redefinition of the boundaries of the exploration areas, guarantee the viability of the ecosystems and the sustained development of the regions under its influence.</p>

Organization / Vision

Conservation Policies

ChevronTexaco

Their goal is to be recognized and admired worldwide for health, safety, and environmental (HES) excellence by implementing Operational Excellence (OE), a strategic initiative to achieve world class HES and operational performance.

To follow EBI (Energy & Biodiversity Initiative) principles and products into site selection: biodiversity conservation and management and identification of potential impacts and their mitigation. Development of a protected areas exposure assessment, in which the nature and extent of operational impacts on nationally- and internationally-protected areas is evaluated. Collaboration efforts with international non-governmental research and conservation agencies and with global energy companies, with the goal of better integrating biodiversity conservation into oil and gas development.

ConocoPhillips

ConocoPhillips is committed to protecting the environment. The company provides leadership and support for numerous wildlife habitat projects.

Their goal is to conduct business by promoting economic growth, a healthy environment and vibrant communities. Environmental programs focused on establishing update and comprehensive baseline information, including data on marine biodiversity for its project area. Forge partnerships to pave the way towards biodiversity conservation goals in the Gulf of Paria and the Orinoco Delta, (including with Conservation and Sustainable Use of the Biological Diversity of the Biosphere Reserve of the Orinoco Delta, a MARN and UNDP program funded by GEF, development of AQUARAP and Initial Biodiversity Action Plan, in collaboration with Conservation International and the Gulf of Paria Deep Water Biodiversity Assessment, in collaboration with Fundación La Salle).

Table IV: Members of the Caribbean Coordinating Committee, including their representation on the CoML Caribbean Programs. CZMU - Coastal Zone Management Unit; INVEMAR - Instituto de Investigaciones Marinas; UCR - Universidad de Costa Rica; UWI - University of West Indies; STRI - Smithsonian Tropical Research Institute; UPR - University of Puerto Rico; UCV - Universidad Central de Venezuela; USB - Universidad Simón Bolívar

Country	Institution	Representation	Member
Barbados	CZMU	IOCaribe, NaGISA	Lorna Inness
Colombia	INVEMAR	OBIS	Luz Stella Mejía
Costa Rica	UCR	Coral Reefs	Jorge Cortés
Jamaica	UWI	Coral Reefs	George Warner
Panama	STRI	Coral Reefs	Juan Mate
Puerto Rico	UPR	Coral Reefs, OBIS	Ernesto Weil
Venezuela	UCV	NaGISA	Paula Spiniello
Venezuela	USB	HMAP	Andrzej Antczak
Venezuela	USB	Chair	Patricia Miloslavich

will allow further development and research within scientific and conservation parameters.

Discussion sessions aiming to incorporate the Caribbean community into the CoML projects thru new proposals (Table I) addressed the following points:

- HMAP: Define an HMAP Caribe project, its objectives, products and timeline, the leader and institution for the Caribbean and scientists who could be directly involved with the project.
- Coral Reefs: Explore the possibility of designing a global coral reef project for CoML and identify a leader and institution for the Caribbean. Since many participants in the discussion are also in the CARICOMP network, other questions raised were if CARICOMP could be part of the CoML Caribbean program and if CARICOMP database could be part of OBIS (species level).
- NaGISA: Explore the possibility of designing a NaGISA in the Caribbean, the key institutions and researchers, possible sampling sites, the group of taxonomic specialists available for de Caribbean, possible principal investigator and a possible responsible institution for a NaGISA-Caribe node.
- OBIS: Make a list of the capabilities of the involved institutions (computer department, computer facilities, internet connection, etc.), identify the national and/or regional databases potentially available thru OBIS (species oriented), the key persons (list with countries, institutions, emails), possible PI and responsible institution for a OBIS-Caribe node.

As the final objective of the workshop, members of the Caribbean Coordinating Committee (CCC) were elected (Table IV). Their duties and responsibilities are: (1) to coordinate the individual programs, (2) to link the Caribbean

projects with the international CoML programs and committees, (3) to link the CCC with other organizations and programs of relevance and (4) to participate in the raising of funds for regional activities, meetings and workshops.

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