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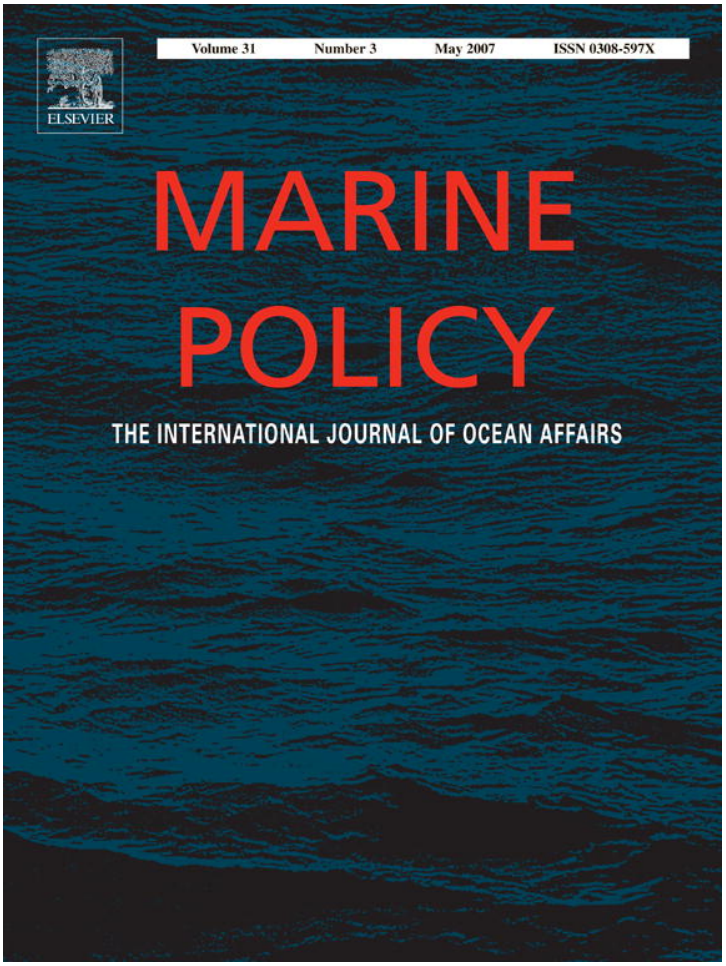

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Sea Grant in Latin America? Adapting the US Sea Grant model of linked applied research, extension, and education to a Latin American Context—Is there a fit?

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Abstract

This paper explores the application of the US Sea Grant model of applied research, extension, and education to two case studies in Latin America: Coastal Ecuador and the Gulf of Fonseca. The analysis is based on a series of meetings and roundtables with in-country partners and leaders of the US Sea Grant program. We conclude that the Sea Grant model provides an institutional structure that Latin America lacks and the model's features would improve governance of marine and coastal resources through more effective linkages between coastal communities, universities, and policy/decision makers at local, national, and international levels.
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Keywords: Sea Grant; Research; Extension; Governance; Latin American universities; Coastal management

1. Introduction

The US Sea Grant College Program operates on a simple premise—apply the intellect of US universities and research institutions to current problems and opportunities associated with the use of marine and coastal resources in order to provide timely research-based solutions. The linkage between applied research, extension and education is a fundamental attribute of the Sea Grant Program. It ensures that the results of research are disseminated back to stakeholders in a timely manner and conversely ensures that social and natural scientists are kept abreast of evolving coastal and marine resource issues. Today, the Sea Grant network has programs in 31 universities with over 300 affiliated universities and several thousand researchers, educators, extension professionals and students. The Program has promoted sustainable coastal development, created new technologies, products and services, enhanced coastal and marine resource management, and reduced the loss of life and property.

A similar system could be equally valuable in other regions of the world. Indonesia and South Korea, for example, have recently established University-based research, extension, and education programs focused on coastal and marine resources. Formal Sea Grant-like programs do not currently exist in the Latin American region. However, there are a number of universities that have some of the model's attributes. Establishing programs in Latin American countries might help reverse pervasive negative trends throughout the region such as vulnerability to natural hazards, pollution of coastal waters, decline of fisheries, poverty, and inequitable income distribution.

In 2003, the University of Rhode Island (URI) Sea Grant Program joined with the Coastal Resources Center (CRC) and the National Oceanic and Atmospheric

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Administration (NOAA) Office of Oceanic and Atmospheric Research International Activities (OAR/IA) in a collaborative effort to explore the feasibility of establishing a program modeled on the US Sea Grant program in LAC. This effort has been funded in part by the US State Department's Ocean, Environment and International Scientific Affairs Bureau (DOS). A series of activities were conducted in two case study sites: the mainland coast of Ecuador in South America and the Gulf of Fonseca in Central America (Nicaragua and Honduras). For each location, meetings, roundtables, and key informant interviews were undertaken to provide detailed information on the following key areas of inquiry:

- the coastal and marine context of each area and the key issues for applied science, social science and extension;
- the institutional landscape and efforts to address critical coastal and marine issues to date;
- university capacity in education, research and extension;
- program development strategies for structuring long-term programs of coastal and marine education, research and extension.

Fact-finding visits were conducted in January/February 2003 (Costa Rica, Guatemala, Nicaragua, El Salvador, and Honduras), June/July 2003 (Costa Rica, Nicaragua, Honduras, and El Salvador), and July 2003 (Ecuador). More than 100 governmental and non-governmental actors as well as representatives of regional and international organizations were consulted. The country visits and the institutional assessments were the beginning of an iterative process with key actors that served as the basis for the next phase of dialogue—national and regional roundtable discussions. Roundtables were convened in Ecuador, 16 October 2003 and Honduras, 21–22 October 2003. The Honduras roundtable was regional, with participants from the three nations surrounding the Gulf of Fonseca.

Three universities were selected for detailed capacity assessment of readiness to lead and execute a Sea Grant-like program: Escuela Superior Politécnica del Litoral (ESPOL) in Ecuador, University of Central America (UCA) in Nicaragua, and the University of Zamorano in Honduras. The assessment of these three universities is based on questions drawn from several guides on institutional capacity assessment (World Wildlife Fund's *Organizational Assessment Guide*, The Nature Conservancy's *Institutional Training Assessment*, and the Coastal Resource Center's *Organizational Capacity Assessment: Assessing Institutional Development of a Marine Center within a University*). The questions were grouped around the following topics: strategic design (vision, mission, and strategies), governance structure, financial resources, programmatic initiatives, and linkages with other actors in public, private, and civil society.

We begin with a description of the US Sea Grant College Program. This is followed by a review of the Latin American context in coastal and marine resource management and attributes of the Sea Grant model that are relevant to the challenges found in Latin America. We then review in more detail opportunities to transfer the Sea Grant model to the case study sites–Ecuador and the Gulf of Fonseca. The last section highlights conclusions from the work in the case study sites and raises broader issues in the transfer of the Sea Grant model to Latin America.

2. The Sea Grant model

The Sea Grant College Program was first proposed in the United States in 1963 as a means to "promote the relationship between academic, state, federal, and industrial institutions in fisheries" [1] and 3 years later this idea was formalized by the National Sea Grant College and Program Act. Sea Grant's legislative charge is to "increase the understanding, assessment, development, utilization, and conservation of the nation's ocean and coastal resources by providing assistance to promote a strong education base, responsive research and training activities, and broad and prompt dissemination of knowledge and techniques" [2].

Sea Grant was originally structured as a component of the National Science Foundation but in 1970 the program became part of the US Department of Commerce, NOAA. The National Sea Grant office in NOAA provides base funding for Sea Grant and coordinates activities for the network of thirty-one state programs. The national office provides administrative and programmatic support in the form of developing national program initiatives, federal budget requests, program monitoring and evaluation, and communicating program activities to other NOAA and federal offices.

Sea Grant's basic structure of a federal-state funding partnership is based on the time-tested paradigm of Land Grant Colleges—university-based research coupled with the transfer of science-based knowledge to communities and users through extension service. The structure was designed to allow for significant autonomy at the state level, which has resulted in a diversity of organizational schemes. Most programs operate through a single university. However, a few programs are structured as university consortiums (e.g., Mississippi–Alabama Sea Grant Consortium and the South Carolina Sea Grant Consortium), and single State consortia (e.g., Virginia). Each program maintains an administrative office, which manages the research, extension, and communication activities and distributes funds on an annual or biannual basis to a wide range of institutions (i.e., not limited to only researchers at the host university) via a competitive grants process. Programs leverage state university resources as matching funds to those disbursed by the national Sea Grant office.

The program has a dual governance structure that is both bottom-up and top-down. The National Sea Grant College Program is a collection of national associations, panels, assemblies, boards, and committees that have

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developed over the course of the program's history. Several of these are formalized in the Sea Grant legislation and others have developed on an ad hoc basis as necessary. The National Sea Grant Review Panel (NSGRP) is part of the original legislative structure of the Sea Grant program. The 15 appointed members of the panel set overall program policy, establish direction and conduct reviews of the national Sea Grant program. The Sea Grant Association (SGA) is bottom-up and is a non-profit organization comprised of a representative from each Sea Grant institution. The SGA provides the mechanism for state and national programs to coordinate their activities, to set priorities at the local, regional and national levels, and to provide a unified voice for these institutions on issues of importance to oceans and coasts.

The focus of individual Sea Grant College Programs must be both consistent with the overall vision and direction of the NOAA National Sea Grant Program, and be tuned to the environmental, social, and economic priorities and problems at the state level. State programs are designed to respond in a timely fashion to locally identified education, research, and extension needs. This top-down and bottom-up approach, built into the organizational and governance structure of Sea Grant, provides the inherent flexibility to ensure that focused long-term strategies for impacting national-level marine and coastal priority issues are addressed, while at the same time allowing each program to tackle important local issues.

The Sea Grant College Program has two overarching objectives: building resilient coastal communities and ensuring safe and sustainable seafood for Americans. Eleven theme teams have been created to achieve these objectives: (1) aquaculture, (2) aquatic invasive species, (3) biotechnology, (4) coastal communities and economies, (5) coastal natural hazards, (6) digital ocean, (7) ecosystems and habitats, (8) marine and aquatic science literacy, (9) fisheries, (10) urban coasts, and (11) seafood science and technology.

These cross cutting "theme teams" have been formed to coordinate activities on selected issues of national importance and disseminate information. The system of theme teams pulls together resources from throughout the national network, develops products, catalyzes sharing of information and ideas, and acts as a well-informed voice on specific topics of concern. Thematic areas are defined by the SGA, but ideas for themes can be brought forth to the SGA's Program Mission Committee by anyone within the Sea Grant network.

In 2001, the National Sea Grant Office managed funds totaling $112.3 million, highly inflated by congressional earmarks, with approximately 55% of the funds from federal appropriations and 33% matching funds from state partners. In Fiscal Year 2001, the breakdown for the use of federal Sea Grant funds was research (66.3%), outreach (29.7%), education (4.8%), and administration (8.7%) [3]. State Sea Grant programs are expected to provide a 2:1 match for federal funds but many programs actually leverage at a higher rate.

All Sea Grant related activities of applied research, extension, and education are subject to a scientific peer-review process similar to the review process of the National Science Foundation. Each state Sea Grant program solicits pre-proposals and full proposals for research within its geographic boundaries in interest areas guided by a 5-year strategic plan and a 2-year implementation plan. Short pre-proposals are solicited first by the state Sea Grant program. These are then reviewed by a panel of experts outside of the state. This panel balances the strategic plan of the Sea Grant program with the research ideas proposed, and makes recommendations on which pre-proposals should be invited to prepare and submit full proposals.

After full proposals are received, each state program's management team then convenes a Technical Review Panel selected from national experts outside of its geographic boundaries to discuss review findings, deliberate on each proposal, rank proposals, and decide on funding for selected proposals. Research and extension proposals approved at the state-level are then sent to the National Sea Grant Office for final approval.

2.1. Past experience with Sea Grant internationally

From the inception of the idea in the mid-1960s to the present, there have been varying levels of commitment to international collaborative activities and programs. Initiation of the Law of the Sea Convention in the early 1970s provoked concerns regarding international research access and data rights. This provided the impetus for the Sea Grant program in 1976 to adopt legislation for an international component to its mandate—the Technical Cooperation Assistance Program (under Section 3 of the Sea Grant Program Act of 1976). This program was redefined by Congress 2 years later as the Sea Grant International Program (SGIP). The goals of the SGIP were to:

- enhance cooperative international research and educational activities with foreign universities on ocean and coastal resources;
- encourage technology transfer that enhances wise use of ocean and coastal resources in other countries;
- promote the international exchange of information and data on the assessment, development, utilization and conservation of ocean and coastal resources;
- support other US international initiatives whose purposes are related to research, education, technology transfer and public service concerning the understanding and wise use of ocean and coastal resources.

Federally funded SGIP projects facilitated educational, research, and technical exchanges with universities and marine research institutions in other countries 1978–1983. The International Program involved 12 projects in 19

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countries with a total budget of $3 million. Their purpose was not to develop long-term Sea Grant-like programs in foreign countries with partner universities. Federal funding for SGIP was discontinued in 1983 and from that time onwards, there have been limited international partnerships between US Sea Grant programs and institutions in developing nations.

3. The need for Sea Grant-like programs in Latin America

The LAC region contains 60,000 km of coastline. Only two of its nations are landlocked. The coastlines and near-shore waters contain a rich diversity of ecosystem types ranging from the swampy estuaries in the tropics, to desert landscapes, upwellings of extraordinary fertility and the fjord-like coasts of the south. Yet the trends in the condition of these ecosystems are similar. The Inter-American Development Bank [4] describes the situation as follows:

- declining coastal water quality from land-based sources;
- impoverishment of coastal communities;
- depletion of commercial fisheries stocks;
- mounting land use and resource allocation conflicts in the coastal zone;
- increased risks associated with coastal erosion, flooding and shoreline instability.

Population pressure increasing, livelihood needs changing, and land scarcity mean that the traditional effects of primary activities, particularly changes in land use, are now being concentrated in smaller, more fragile areas that are more vulnerable to human forces. A growing percentage of landless people have settled in flood-prone coastal areas because those are the only lands available to them. Unsustainable use of coastal areas and resources may appear to be the only option short of migration to the cities.

The plight of the rural poor encourages migration to cities. Today, 76% of the region's population is urban [5] and 60% of the region's largest 77 cities are coastal [6]. Urban development is frequently rapid, spontaneous and disorganized, leading to uncontrolled growth and the transformation of natural areas of great ecological value (e.g., deltas and estuaries, mangrove wetlands, coastal lagoons). Despite this growth of coastal urban population, the total rural population has not declined, meaning that the degree of population pressure on natural resources is unlikely to subside.

Deforestation is the main cause of biodiversity loss in the region and has effects on water and soil quality. Of the 418 million ha of natural forest lost worldwide over the past 30 years, more than 40% was in Latin America [7]. The increase in erosion caused by deforestation in watersheds leads to accelerated sedimentation rates in reservoirs and marine ecosystems. Increased sedimentation, other effluents, and changes to fresh water flows greatly influence coastal and marine ecosystems, damaging coral reefs and other living marine resources.

About one-third of the region's reef areas are considered at high risk due to sedimentation caused by deforestation, runoff of nutrients from sewage and agriculture, and destructive fishing practices [8]. Mangrove deforestation is especially damaging to the productivity of near-shore areas as well as to shoreline flooding. Mangrove habitat is one of the LAC region's high value ecosystems. Nearly 40% of the more than 17 million ha of mangrove swamp that exist in the world are within the LAC region, and eight of that 40% are found in Central America.

All countries face difficult problems caused by the overexploitation and poor management of inshore fisheries [9]. Inshore fisheries, which are the most severely over-exploited, employ the largest number of fishers. Here, habitat degradation is most severe. In the region as a whole, fishing fleets are far larger than marine ecosystems can sustain.

In general, the pressure on exportable natural resources continues to be enormous in the region. The volume of exports from sectors with a recognized environmental impact—fishery, forestry, agriculture, and mining sectors—has increased over the past two decades and the region continues to be more reliant on primary commodities and raw material exports than other parts of the world with similar income levels [10].

Over the last two decades a number of measures have been taken to address these and the myriad other issues that confront the marine and coastal environments of Latin America. However, they have been insufficient to reverse the negative trends of deforestation, pollution of coastal waters, decline of fisheries, destruction of critical habitats, loss of biodiversity, natural hazards, and poverty. National institutions and governance capacity to regulate the environment and promote ecologically sustainable development are weak. Public sector investments in coastal and marine resource management are typically much smaller than the magnitude of international project funds. The result is a large number of short-term projects usually conducted in isolation of one another supported with millions of dollars from international donors and development banks. The Inter-American Development Bank, for example, estimates that it invested no less than US$60 million in coastal management in the Latin American and Caribbean region between 1993 and 1996 [11]. While ecosystem governance requires the sustained pursuit of unambiguous goals, few coastal and marine management initiatives persist for more than a decade, and subsequent efforts sponsored by other donors are rarely linked to earlier investments or benefit from what could have been learned from previous efforts. This reduces their cumulative impact and results in a constant reinventing of the wheel.

Another gap is the absence of university- and government-based extension and inadequate professional communication between the various disciplines such as

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oceanographers, marine biologists, and planners [12]. Coastal and marine science is interdisciplinary, but there is a lack of experience for exchanging views on the same subjects from different professional perspectives. This situation often leads to finding solutions through a mono-disciplinary approach when there is opportunity for inter-jurisdictional exchanges.

To meet challenges such as these, there is a need to find new mechanisms and management models such as the Sea Grant model of university-based education, research and extension. The following attributes of the Sea Grant model are particularly relevant to the challenges found in the Latin American and Caribbean context.

Continuity and permanence: Sea Grant is designed and implemented for the long term. This long-term commitment builds a community of coastal managers, policy experts, educators, researchers, and private sector partners dedicated to resolving priority coastal and marine issues. This permanence makes long-term strategic planning possible. A long-term program with a structure like Sea Grant would also provide a clearinghouse for information and institutional memory. LAC countries would benefit from this increase in efficiency, increasing the effectiveness of otherwise isolated coastal and marine resource management efforts.

Formulating agendas to address urgent needs. Sea Grant is a strategic program in the sense that it develops medium- and long-term goals and priorities in close collaboration with stakeholders and communities. This promotes participatory governance and channels resources to the most pressing social, economic, and environmental issues. Sea Grant provides an opportunity for diverse actors to coalesce around issues of common concern and focus on targeted strategies to address those issues.

Trust and objectivity: Continuity and long-term presence builds trust with stakeholder groups and creates a supportive constituency, which is critical to successful extension work. Sea Grant also adopts a non-advocacy role so that it is viewed as a transparent and neutral university-based forum to promote the exchange of reliable scientific information.

Catalyzing the strengths of multiple institutions: Sea Grant serves as a catalyst for bringing intellectual and physical resources to bear on the needs and opportunities of communities. Rather than create new institutions, the program mobilizes and sustains long-term connections with existing public, private and civil society institutions to address coastal and marine challenges. This minimizes duplication of effort, leverages resources, and reduces costs.

Standards of excellence: Sea Grant operates under a formal system of checks and balances with rules that define performance expectations and responsibilities. Program granting decisions are based on peer review. Funding is reduced or withdrawn from programs and individuals that do not meet standards of professional excellence in management, education, research, and extension. Excellence is judged primarily against the relevance of the activity to priority coastal and marine issues.

Representational governance and local ownership: Sea Grant promotes representational governance. It is designed as a decentralized system that responds to the priority issues posed by coastal conservation and development in a given place. Strategic plans, implementation strategies, and program assessments involving all coastal stakeholders are required of each State program.

Regional networks for learning and cooperation: Sea Grant functions as a learning network on common themes with national, state, and local links. Thematic focus areas gather the intellectual resources from throughout the national network, sharing information and ideas, and acting as a well-informed voice for responsible stewardship of coastal ecosystems at small and large geographic scales.

Latin America has not had great success with its regional integration initiatives despite a continuous coastline and relative linguistic uniformity [13]. Some Latin American countries have vast experience in certain coastal and marine technologies (such as Chile in marine culture of salmon) but other countries have no access to the experience. A coastal and marine initiative similar to Sea Grant across Latin American countries would facilitate inter-country cooperation and functioning connections between programs allowing different countries to share ideas and exchange information and technical expertize.

4. Case studies

This cursory review of the challenges of coastal and marine resource management in Latin America and the attributes of the Sea Grant model suggest that programs fashioned after Sea Grant would offer a useful new mechanism for long-term coastal and marine development. To explore this in greater detail, a series of activities and meetings were conducted in two case study sites. This section reviews the findings from this work.

4.1. Ecuador case study

Ecuador has a population of 12.9 million with almost half being located on the coastal plain (see Fig. 1) [5]. The coastal population has been increasing since 1950 both in absolute numbers and relative to national population. The migration toward the coastal region and rapidly increasing coastal population, poverty, growth in the area of shrimp ponds, and urbanization has had tremendous environmental impacts on the coastal region. The coastal city of Guayaquil is the country's largest city (about 2 million), principal port, and leading economic center. In the 1980s and 1990s, an expanding highway network opened formerly inaccessible and isolated coasts to residential developments that will bring further environmental change.

Shrimp farming, banana plantations, cutting of timber, and hunting of wildlife have had devastating effects on mangrove swamps and coastal ecosystems. Until recently,

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Ecuador was one of the largest producers in the world of shrimp grown in ponds with over 140 thousand hectares of ponds in production. Lately the industry has greatly declined due to disease problems. Much of the tropical dry forest in the coastal region has been cleared to create pastureland. Annual deforestation for the country overall is high relative to the rest of the LAC region. During the period 1990–2000 it was 1.2%. Annual deforestation was 0.5% for the LAC region overall.

National roundtable on the Sea Grant model: A national roundtable was convened in Guayaquil in October 2003 to explore interest and options for a program designed after Sea Grant. The roundtable brought together representatives from the National Government, Universities, and environmental organizations including: the Coastal Polytechnic University (ESPOL), National Fisheries Institute (INP), The Nature Conservancy, Conservation International, Universidad San Francisco de Quito, National Oceanic Institute (INOCAR), Ministry of Environment, Pontificia Universidad Católica del Ecuador, University of Guayaquil, National Coastal Resource Management Program (PMRC), US Peace Corps, and International Center for the Study of El Niño (CIIFEN).

Fig. 1. Coastal Ecuador is one of two case study sites.

The first outcome of the roundtable was the identification of priority coastal issues (Table 1).

Based on review of current priorities and further discussion, candidate applied research and extension themes for an Ecuador program modeled after Sea Grant include:

- conservation hotspots and marine protected areas,
- poverty reduction,
- sustainable mariculture and promotion of alternative species,
- enhanced management of artisanal fisheries,
- integrated coastal watershed management,
- climate change adaptation,
- zoning and shorefront use,
- social and economic causes and consequences of deforestation,
- public education,
- sustainable tourism.

There was universal agreement among participants at the national roundtable that the concept of Sea Grant has value for Ecuador. Participants found the following aspects of the Sea Grant concept particularly appealing:

Long-term planning, continuity, and national commitment: Currently, there is a lack of vision and an agenda for the coast. A Sea Grant-like program would promote the development of a national agenda and strategic plan for the management of the coastal and marine zone, and provide a structure for creating and improving national and municipal policies. It would also create conditions favorable for institutional collaboration and generation of leveraged funding.

Integration of research, education and extension: The application of the Sea Grant model would accelerate the development of extension services, currently an area of weakness. Extension services and carefully targeted applied research are needed to provide technical backup to a great diversity of coastal resource users along the coast. The connection of education and research with extension would

Table 1
Priority coastal issues in Ecuador

Environmental issues	Social issues	Legal and institutional issues
• Decline in coastal water quality • Decline in near-shore fisheries • Loss of habitat (especially mangroves) • Overexploitation of resources • Insufficient scientific knowledge and data • Extreme climatic events (El Nino)	• Lack of alternative livelihoods • Poverty • Population growth • Public health • Resource use conflicts • Weak systems of extension • Inadequate systems of extension • Inadequate education • Public awareness	• Overlaps in jurisdiction, responsibilities and mandates between government agencies • Conflicts between government agencies • Compliance and enforcement of laws and regulations • Institutional capacity

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ensure that information is available to those who need it and overall public awareness and education would be improved.

Neutrality and independence: The independence of Sea Grant encourages objectivity and decreases the swings in direction that result from political shifts. Program independence and decentralized operation are critical for continuity of effort.

Quality control: Sea Grant has a clear and transparent process, mechanisms of quality control, peer review, and periodic evaluation.

Discussions on how to structure a program like Sea Grant in Ecuador centered on a network of institutions with a lead university responsible for administration. Although the lead institution would be responsible for program administration, roundtable, and other in-country discussions emphasized that the program should be designed as a network involving multiple institutions. The program would thus be a mechanism to direct research and extension services on priority themes across professionals from many different institutions. In Sea Grant, organizations outside of the administering university may submit proposals for competitive and non-competitive grants. While all grants are not open competition, all proposals undergo peer review.

Funding for a new long-term program would be a critical challenge. An annual allocation from the government of Ecuador was not considered realistic, but a one-time government grant to establish an endowment might be possible. For example, the government of Ecuador made a $7 million grant to the National Aquaculture and Marine Research Center (CENAIM) and the grant is managed as a trust fund with interest supporting part of CENAIM's costs of operation.

4.2. Institutions of higher education

The Coastal Polytechnic University (ESPOL) has the greatest depth of academic and research programs in fields of coastal and marine science and would be a strong candidate to serve as a lead institution for a Sea Grant-like program. Faculty and university leaders at all levels up to University President confirmed interest in a coastal and marine program like Sea Grant.

ESPOL was founded in 1958 as a polytechnic institution with the basic goal of improving the use of natural resource and technological development of the country. ESPOL is a public university but the national government supports only about 51% of the budget with the rest generated by outside support.

One of the oldest colleges of ESPOL is the College of Marine Engineering and Marine Sciences, which offers five major degree programs and has three associated centers that could make significant contributions the development of a Sea Grant-like program—National Coastal Resources Center (CENAREC), National Aquaculture and Marine Research Center (CENAIM), and the Fisheries Oceanography Research Center (CIOP).

CENAIM is an aquaculture research center with an international reputation for excellence. It is a partnership of the State, private sector and ESPOL. The objective of the Center is to promote the sustainable development of aquaculture productivity and diversification in Ecuador through scientific research, technology development, training, and outreach. The National Coastal Resources Center (CENAREC) was created by ESPOL to partner with and provide training to technical staff of the Coastal Resources Management Program (PMRC). The Center is currently involved in extension activities that include working with coastal communities in biodiversity management, mangrove, and river basin management in Guyas Province, and strengthening environmental management capacity of the municipalities. The Fisheries Oceanography Research Center (CIOP) was created in December 2002 by the College of Marine Engineering and Marine Sciences to provide science and technology services and to develop research in support of fishing operations and fisheries development. CIOP has funding from the fishing industry, the National Science and Technology Foundation, and international donors. Current research projects are the development of atlases of the eastern pacific pelagic fisheries and development of fishing charts to improve the efficiency of the tuna fishing fleet.

4.3. Gulf of Fonseca case study

The marine environment of the Gulf of Fonseca is shared by Nicaragua, Honduras, and El Salvador (Fig. 2). The Gulf is a shallow depression with an area of approximately 3200 km^2 a coastal length of 261 km of which in the vast majority is in Honduras [14]. There are over 1 million people living near the Gulf, with some 600,000 in Honduras, 240,000 in Nicaragua, and 160,000 in El Salvador [15]. Most of these people are dependent on the Gulf's natural resources for subsistence and livelihood.

The three countries surrounding the Gulf are among the poorest in Latin America. Nicaragua and Honduras are the second and third poorest countries in Latin America with an average annual income of $430 and $730 per year, respectively. Unemployment is high around the Gulf, probably exceeding 40%. Out-migration from the region is high, but the overall birth rate is high as well. Those that remain in the area are usually women and children. Unemployment, low income, high birth rates, and poor social infrastructure make the majority of people living in the Gulf highly vulnerable to the issues affecting marine and coastal resources.

The Gulf of Fonseca is an area of great natural value. Due to its extensive wetlands, mangrove ecosystems, and importance for migratory waterfowl the entire area around the Gulf has been placed on the RAMSAR list of Wetlands of International Importance. One of the most distinct ecological features of this region is the extensive mangrove

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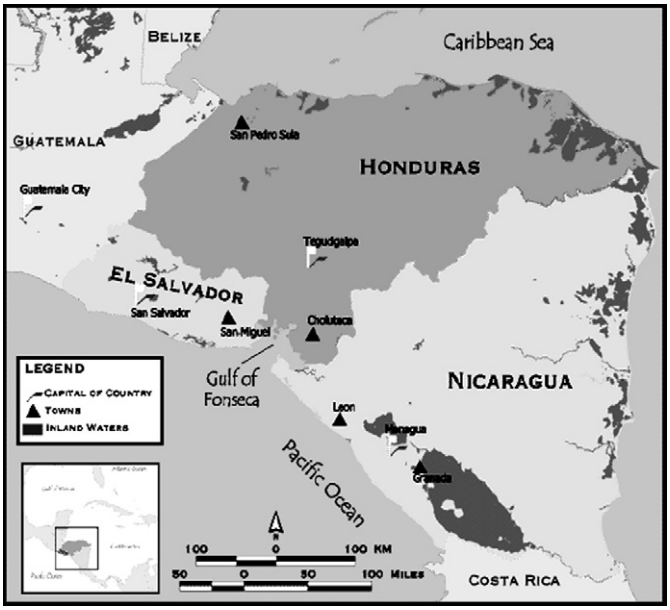

Fig. 2. The Gulf of Fonseca is the one of two case study sites.

ecosystem. The area contains some 22% of total mangrove area of the Pacific coasts of Central America (Guatemala to Panama) [14].

As in Ecuador, upstream deforestation is a critical problem confronting the marine and coastal environment of the Gulf of Fonseca. Upland deforestation, inadequate erosion prevention measures, agriculture, and the damming of major rivers (such as the Nacaome in Honduras) are the primary causes of changes to microclimate, desertification in the region, deposition of sediment loads in the Gulf, eutrophication, and reduced freshwater flow to the Gulf [16].

We found widespread interest in the concept of Sea Grant, as well as agreement that the model would be beneficial and feasible for application to the Gulf. Important benefits of a Gulf of Fonseca program highlighted at the roundtable discussions held in October 2003 included:

- creating common objectives for the Gulf region while maintaining national independence;
- providing an impartial vision between the community, government, and different actors;
- permanence and continuity;
- wide consultation and strong feedback loops between program activities and resource user groups;
- development of extension capacity in the region;
- transparency in decision making and information sharing;
- partnerships and cooperation across the region and across government, private, NGO, university and community groups;
- neutrality and high standards excellence;
- flexibility in implementation and administrative agility.

High priority topics that stood out at the roundtable that would be candidates for applied research and extension themes for the Gulf include:

- improved shrimp mariculture practices and promotion of alternative forms of mariculture;
- problems with microbiological water quality;
- high sedimentation levels;
- loss of mangroves and disappearance of dry forest;
- fisheries overexploitation and destructive practices;
- biodiversity inventory and restoration of critical ecological systems;
- public education and environmental awareness.

The suggested mechanism for implementation of a program in the Gulf was identified as a university-led, but decentralized regional program involving alliances between universities, government agencies, NGOs, internationally funded projects and communities. It was felt that a key objective of a program focused upon the Gulf of Fonseca would be to pool resources and efforts, furthering the capacity of higher education institutions in marine and coastal research, education, and extension.

In addition to a University administrative body, roundtable participants noted that the governance structure for a program in the Gulf should include a Scientific Committee to oversee peer review of proposals. Other program groups would include regional Committees that would provide the mechanisms for regional coherence, planning, and institutional connectivity and cooperation.

Key steps to begin the process of program development were identified at the roundtable. They include selection of the lead university for program administration, development of detailed program proposal, formal program incorporation within the university, formation of national and regional program support groups, definition of program priorities, consultation with government ministries, and fund raising.

4.4. Institutions of higher education

Comprehensive capacity assessments were conducted for two Universities in the region: the University of Zamorano in Honduras and UCA, Center for Aquatic Ecosystems Research in Nicaragua.

4.4.1. University of Zamorano

Zamorano (also known as the Pan American School of Agriculture) is a private, international technical college established in Honduras in 1941. Zamorano's mission is to prepare leaders for the Americas in sustainable agriculture, agribusiness, natural resources management, agro-industry, and rural development. Its broader vision is to transform the rural populations of Latin America into globally sustainable and competitive sectors.

The University is recognized throughout Latin America for its academic programs in agriculture, sustainable rural

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development, and natural resources management. Zamorano trains thousands of farmers, extension agents, technicians, educators, policy makers, and researchers each year, usually in the context of rural development projects that integrate good science with technology transfer. Many leaders in government in Honduras and other countries throughout Latin America are Zamorano graduates. As a result, Zamorano is often called on to provide information on important environmental and social issues that may influence decision making.

Zamorano actively builds partnerships with other institutions to tackle critical development challenges and advance its interests while achieving a common vision or strategy based upon the needs and interests of its user constituencies and partners. The University maintains programmatic and strategic relations with multilateral donor organizations, NGOs, civil society organizations, other universities and research institutions, the private sector, government agencies, and the media. The Dean of Outreach and the Director of Outreach are specifically responsible for maintaining these types of external relationships.

The University of Zamorano is one of the best-funded and stable universities in Latin America. The university has an endowment of some $42 million. In most years, the Board of Trustees has decided to reinvest most of the interest rather than use it to help finance Zamorano's operating budget. Some of the interest is used to support scholarships for Honduran students and environmental activities in Honduras. The Board of Trustees, the International Board of Advisors, and a Development Committee are active in fundraising. All trustees make personal contributions to Zamorano, and many of them facilitate the interaction of the overseas institution with US and international philanthropists, foundations, and donor agencies.

4.4.2. UCA, Center for Aquatic Ecosystems Research

The UCA of Managua was created in 1961 as part of the Jesuit University worldwide network. The main mission of the University is to focus on human and socio-economic development in Nicaragua. Currently, the University holds 114 full time professors and 275 part time professors. There are about 6500 enrolled students in five departments. UCA's mission is to contribute to the equitable and sustainable human development of Nicaragua and the region through high quality teaching, research, and social outreach, inspired by Christian values.

The Department of Science and Technology for the Environment (S&T) has 264 students. Currently, the department has several majors including fisheries engineering and aquaculture. The Department also has several research centers and among them is the Center for Aquatic Ecosystems Research (CIDEA). CIDEA was created in 1996 through an act passed by the University's Board of Directors. This act provides CIDEA with the authority to function as an independent unit within the university but provides no direct funding to CIDEA. The Center's original mission was focused upon the sustainable development of the aquaculture industry in Nicaragua with a specific focus on increasing productivity while reducing environmental impacts. In the year 2000, the Center adopted a program of research, education, and extension with assistance from the University of Puerto Rico Sea Grant.

CIDEA's first strategic plan has chosen to broaden its scope and begin focusing on wider marine and coastal issues. The center is interested in expanding its activities to areas such as marine fishing and agriculture in the Gulf region of Nicaragua. To date, the fisheries sector has received very little support in terms of technical assistance or training. CIDEA is working toward conducting more constituent-driven research and broadening its extension activities to solve local problems on the Pacific coast of Nicaragua as well as in the Gulf of Fonseca. CIDEA works with and has relationships with a wide variety of international and national NGOs, private industry, national and local government, external donors and multilateral organizations, and other Nicaraguan universities.

Primary research areas include water quality research of the Estero Real, a major source of freshwater to the Gulf; nutrition and pathology of shrimp; and shrimp production efficiency. The results of research are disseminated through a variety of mechanisms including workshops, training programs, environmental education programs, and direct technical assistance. The Center's education and training component is designed to extend information and research results to students, local user constituencies, and professionals.

Research and technical assistance are closely linked. Technical assistance has traditionally focused on the needs of small shrimp producers and farmer cooperatives in regions with high poverty levels. Meetings are periodically held with the presidents of the four shrimp cooperative unions, comprised of more than 150 cooperatives. At these meetings, CIDEA staff identified problems and needs and develop strategies for research, technical assistance, and training.

CIDEA also develops relationships with local municipal offices, schools, and health centers in the communities where its activities take place to ensure that its activities are aligned with development needs and goals or to take on new areas of assistance. The majority of the Center's projects are identified through the process of extension or by working directly with user constituencies to identify their needs.

5. Conclusions

This paper has looked at the overall coastal and marine context of the Latin American region, made a case for the benefits of applying the Sea Grant model to the region, and explored opportunities in two specific locations: Ecuador

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and the Gulf of Fonseca. The analysis leads to the conclusion that in both locations there is a need for programs modeled after Sea Grant. There are no other structures in the coastal and marine sector with precisely the same collection of attributes as Sea Grant—university-based network, competitive grants, systematic links of science and extension, local-national priority setting, and long-term continuity. We also conclude that the institutional capacity exists to execute Sea Grant-like programs.

Most individuals and institutions that participated in the assessment agree that a program modeled upon and linked to the US Sea Grant network could generate an operational South–South and North–South network of information sharing and learning across both Latin American programs and US Sea Grant College programs. Both the concept and execution of such a network would be novel and would provide unprecedented opportunities to advance sustainable coastal and marine development in Latin America.

There are three areas where we see the model as being particularly relevant. First, the model inherently provides the institutional flexibility needed to address issues in a sustained manner through inter-disciplinary means. Second, the model provides a mechanism to begin making the necessary linkages between institutions and experts with varying levels of capacity to address critical marine and coastal issues. Third, the model provides a type of institutional structure that can assist countries as they attempt to move away from short-term projects and toward longer-term planning. In turn, this could increase each country's commitment to address the issues in an inter-related fashion while building the institutional memory needed to sustain efforts over the long-term.

The roundtable discussions and other consultations have identified initial thematic priorities and important actors in coastal and marine issues. This type of program could catalyze greater public spending on education, science and technology, and extension to resource users—critical to increase productivity of coastal and marine sectors and to find innovative solutions to the most pressing problems facing each case study site. It was agreed that previous efforts over the last three decades have failed to deliver the type of results needed to address the issues the region confronts. There is undoubtedly a need to rethink concepts associated with institutional design and program implementation to effect change over the long-term. We conclude that the Sea Grant model provides an institutional structure that Latin America lacks and can be built upon to effect change. The model's features and institutional structure could go a long way toward improving the governance of marine and coastal resources by creating more effective linkages between coastal communities, universities, and policy/decision makers at local, national and international levels.

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References

[1] Miloy J. Creating the college of the sea: origin of the Sea Grant Program. Sea Grant College Program. Texas: Texas A&M University, College Station; 1983.
[2] National Sea Grant College Program Improvement Act of 1976, Pub L. no 94–461, Sec. 202(b)202.
[3] National Sea Grant College Program biennial report 2000–2001. Produced in cooperation with the South Carolina Sea Grant Consortium under NOAA Cooperative Agreement no. NA87RG0544. 2002.
[4] Coastal and Marine Resources Management in Latin America and the Caribbean, Technical study no. ENV-120. Washington, DC: Inter-American Development Bank; 1998.
[5] World Development Indicators 2003. Washington, DC: World Bank; 2003.
[6] Hinrichsen D. Coastal waters of the world: trends, threats and strategies. Washington, DC: Island Press; 1998.
[7] Armstrong A, Brandriss P. Environment matters, annual review, July 2002–June 2003. Washington, DC: World Bank; 2003. p. 48–51.
[8] Burke, L, Kura Y, Kassem K, Revenga C, Spalding M, McAlliste D. Pilot analysis of global ecosystems: coastal ecosystems. Washington, DC: World Resources Institute; 2000 ⟨http://marine.wri.org/publications.cfm⟩.
[9] Christy F. The development and management of marine fisheries in Latin America and the Caribbean. Policy research paper, ENV-110. Washington, DC: Inter-American Development Bank; 2000.
[10] United Nations Economic Commission for Latin America and Caribbean. Globalization and development. Santiago, Chile: United Nations Economic Commission for Latin America and the Caribbean, April 2002 ⟨http://www.eclac.cl/⟩.
[11] Olsen S, Christie P. What are we learning from coastal management experience? Coastal Management 2000;28:5–18.
[12] Tarifeño-Silva E. North–South educational partnership on marine sciences: the Latin American experiences and perspectives. Ocean and Coastal Management 2002;45:649–66.
[13] United Nations Economic Commission for Latin America and Caribbean. Una visión regional del desarrollo del capítulo 17 del Programa 21 en América Latina y el Caribe: 1992–1998, LC/R.1881, 1992–1998. Report prepared by Jairo Escobar, 1999.
[14] Sherman K, Tang Q. Large marine ecosystems of the Pacific Rim: assessment, sustainability, and management. Oxford: Blackwell Science Inc.; 1999.
[15] Varela J. The Human rights consequences of inequitable trade and development expansion: the abuse of law and community rights in the Gulf of Fonseca, Honduras'' Mangrove action project; 2002 ⟨http://www.earthisland.org/map/ineq-trd.htm⟩.
[16] Vergne P, Hardin M, DeWalt B. Environmental study of the Gulf of Fonseca, report prepared by tropical research and development. Inc. for USAID; 1993.

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