

countries to adequately assess reef status for effective resource management. Monitoring has commenced in Brazil since the last report. The rate of coral reef decline will not be reversed until there is more effective government intervention and the recognition that policies and laws need to be implemented and enforced. This will require the establishment of more marine natural parks and reserves with adequate funds to develop sustainable management backed up with coral reef research and monitoring. These funds must be sourced from national governments and international agencies, and supported by stable government infrastructure that recognises the economic and heritage value of coral reefs throughout the STA.

INTRODUCTION AND BIOGEOGRAPHY

The Southern Tropical America (STA) Node of the GCRMN includes Costa Rica, Panama, Colombia, Venezuela and Brazil, with reefs in Pacific, Caribbean and Atlantic waters. The Node is coordinated by the 'Instituto de Investigaciones Marinas y Costeras' (INVEMAR) in Colombia and is also supported by UNEP-CAR/RCU in Jamaica. The STA Node has been operating since late 1999, has carried out two workshops in Costa Rica and Colombia, and has supported the expansion of monitoring activities in several countries. Letters of agreement have already been signed between INVEMAR and other institutions from Costa Rica (Universidad de Costa Rica-CIMAR), Panamá (Smithsonian Tropical Research Institute) and Venezuela (Universidad Simón Bolívar-INTECMAR) to continue collaboration for Node development.

Most of the reefs in the STA region are strongly influenced by continental runoff, with large amounts of sediments and often high concentrations of nutrients flowing out of some of the largest rivers in the world - the Amazon, Orinoco and Magdalena rivers. This high turbidity and sedimentation reduces coral growth in most coastal areas and also occasionally impacts on offshore reefs. Cold-water upwellings along the Pacific coasts of Panama and Colombia, and off eastern Venezuela also reduce reef growth. The reefs in Brazil are far removed from those in the Caribbean and hence contain a large proportion of endemic species. Special emphasis is given in this report to Brazil, as they have only recently started monitoring. The best developed coral reefs are on the Caribbean coasts of Panama, and on islands off Colombia and Venezuela. Corals are less developed and diverse on the Pacific side, with the best reefs on the Costa Rica-Panama coast.

Brazil

There are sparse, discontinuous coral reefs and with low species diversity (18 hard coral species, with 6 endemics) along the Atlantic coastline in 5 five major areas: Touros-Natal with extensive coastal knoll and patch reefs; Pirangi-Maceió with linear coastal reefs and higher species diversity; and Bahia de Todos os Santos-Camamu, Porto Seguro-Cabrália, and Abrolhos Region to the east and south. The National Marine Park of Abrolhos of 900km² contains the richest coral reefs of Brazil with the Timbebas Reefs (isolated coastal bank reefs), and fringing reefs on offshore volcanic islands of the Abrolhos Archipelago, and the 'chapeirões' (giant mushroom-shaped coral pinnacles 70km offshore).

Colombia

Coral reefs are present along both Caribbean and Pacific coasts. There are more than 1,000km² of Caribbean reefs scattered over 21 areas in 3 groupings: fringing reefs on rocky shores of the mainland coast (e.g. Santa Marta and Urabá); continental shelf reefs around offshore islands (e.g. Rosario and San Bernardo archipelagos); and the San Andrés Archipelago oceanic reef complexes in the Western Caribbean. These complexes include atolls, banks, barrier reefs, fringing reefs and patch reefs. In contrast, Pacific reefs are poorly developed, with only Gorgona Island having large coral formations.

Costa Rica

There are less than 50km² of coral reefs on the Caribbean (with 40 hard coral species) and Pacific (18 species) coasts. Along most of the Caribbean coast there are high energy sandy beaches, but the southern section of the coast has coral reefs growing over fossil reefs. There are fringing reefs: Moin-Limón, which has a large port; Cahuita Natural Park with the largest and best studied fringing reef; and Puerto Viejo-Punta Mona. The Pacific reefs are found almost all along the 1160km coast, but are relatively small and have low coral diversity, e.g. near Santa Elena, Bahía Culebra, Isla del Caño and Golfo Dulce, and around Isla del Coco, 500km offshore.

Panamá

There are 290km² of reefs along both Caribbean and Pacific coasts, with much higher diversity (68 hard coral species) reefs in the Caribbean, and lower in the Pacific (25 species). The major Caribbean areas are: Bocas del Toro on the western coast with the highest average coral cover; Colón-Isla Grande on the central coast where the corals are degraded because of major industrial activities and runoff; and San Blas or Kuna-Yala territory on the eastern coast, with the most extensive and diverse reefs. The Pacific reefs are mostly on islands near the coast, notably the Gulf of Chiriqui, with the best fringing reefs, and the Gulf of Panamá, including Las Perlas archipelago, Taboga and Isla Iguana.

Venezuela

Venezuela has 2875km of coastline; approximately 67% are in the Caribbean Sea and 33% in the Atlantic Ocean. Despite this, the area covered by coral reefs has not been determined accurately, and it is known that the best reef development occurs around the oceanic islands, specifically at Archipelago de Aves, Archipelago Los Roques, La Orchila and La Blanquilla. Coral communities are common on the Venezuelan continental shelf, but development is limited by high sedimentation, terrestrial runoff and upwelling. Major changes in coral reef structure have been reported along the continental shelf, where coral reefs have declined in the last decade (e.g. Morrocoy National Park).

STATUS OF THE CORAL REEFS

There has been major damage to coral reefs of this region in the last 35 years. The damage has been caused by a mix of 'natural agents' (coral disease outbreaks, bleaching, El Niño events), and direct human impacts. This is evident as considerable losses of live coral cover, poor recovery of damaged areas, significant increases in the cover of marine algae, reduced fish populations, and the incidence of disease in corals, gorgonians and sea urchins appears to have increased dramatically. The appearance of some reefs has changed

considerably, with much lower populations of the branching, and previously dominant, species (e.g. *Acropora* spp.), which are now replaced by other corals and benthic organisms.

Brazil

Coral reef monitoring programs started in 2000 using the AGRRA protocols, in the Abrolhos National Marine Park on the fringing reefs and offshore 'chapeirões'. Corals, algae and fishes were assessed on 13 reef sites. This monitoring program was extended in 2001 and 2002 to the coastal arc in the Abrolhos region adding 22 more sites, including measuring sediment inputs on the nearshore reefs. The reefs are in rather good condition on the offshore 'chapeirões', but there were signs of degradation in parts of the Abrolhos Islands where tourism diving and snorkelling is allowed. Nearshore reefs are most affected, particularly by exposure of reef tops during low tides, re-suspension of muddy sediments during winter storms, and overfishing. There was extensive coral bleaching in 1998 in North Bahia and the Abrolhos region, with levels of 80% reported in important species such as *Agaricia agaricites*, *Mussismilia hispida*, and *Porites astreoides*, but all corals recovered after 6 months. AGRRA monitoring in 2000 to 2002 showed the offshore chapeirões had consistently more coral recruits (34.0-38.8 recruits per m²) with coral cover around 20%, comparable with the fringing reefs on the North coast of Santa Barbara Island. The South Santa Barbara fringing reefs, however, had lower coral cover (6.0-12.7%) and fewer recruits (10.0-16.5 per m²), probably as a result of strong storm waves in winter and intense recreational use of these reefs in summer. No major disease and mass mortalities have been seen on these reefs. Similarly, reef fish species were more common on the chapeirões (39-40 per site) than on the Santa Barbara fringing reefs (13-37 per site). Future monitoring will assess tourism impacts by comparing open with restricted areas in the Abrolhos Park.

ITACOLOMIS MONITORING

Monitoring of the Itacolomis Reefs (South of Porto Seguro) began in 2001 and indicated stressful levels of sedimentation. The average coral cover of between 2.2 and 22.5% was similar to the Abrolhos coastal reefs and cover of coralline algae was between 3.4 and 43.5%. Sediment inputs in other areas that are perceived as 'normal' for coral reefs are up to 10mg/cm²/day, those that have resulted in moderate to severe stress range from 10 to 50mg/cm²/day and those above 50mg/cm²/day tend to result in severe to catastrophic impacts. These data illustrate sediment inputs of 34.5mg/cm²/day in the protected area but 78.4mg/cm²/day in areas open to fishers. According to these data, the Itacolomis Reefs exist in relatively stressful conditions. The continuation of this monitoring program will provide insight into whether Brazilian corals are adapted to high sedimentation rates or become degraded as a result. From Emiliano Calderon, Bárbara Segal and Clovis Barreira e Castro, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; encalderon@imagelink.com.br, bsegal@acd.ufrj.br, cbcastro@pobox.com.

REEF CHECK MONITORING IN BRAZIL

Until recently there has been a gap in our knowledge about the coral reefs of Brazil because they have not gained government attention. On Earth Day 2001, 65 volunteer divers, students, researchers, fishermen, and community members conducted Reef Check surveys at 5 reefs in the Coral Coast MPA, as well as cleaning the beaches. In 2002, the Ministry of Environment assisted with the establishment of a National Monitoring Program for Brazil. This time surveys were conducted at popular tourist destinations inside MPAs: Maracajaú reef in the northern Touros-Natal area; the Coral Coast reefs in the Pirangi-Maceió area; Fernando de Noronha, an archipelago located 225 nautical miles off the NE coast of Brazil; and the Abrolhos reefs in eastern Brazil. These surveys were designed to provide a baseline of information and compare reefs in Marine Parks and adjacent reefs where there is no protection. All these activities involved scientists who trained dive operators, park rangers, and environmental managers to gather data for the Government and funding agencies. Reef Check in Brazil is coordinated by Beatrice Padovani Ferreira, from the Universidade Federal de Pernambuco, Recife, beatrice@ibama.gov.br or www.reefcheck.org

Coral condition of selected sites of the Abrolhos National Marine Park in 2000-2002 based on AGRRA monitoring.

SECTOR	Variables	2000	2001	2002
North Santa Barbara	Coral Cover	9.5%	25.9%	26.0%
	Species #	7	7	6
	Recruits m ⁻²	16.4	31.0	16.5
South Santa Barbara	Coral Cover	6.0%	12.7%	7.6%
	Species #	8	6	5
	Recruits m ⁻²	10.0	13.0	16.5
Offshore chapeirões	Coral Cover	20.4%	20.8%	19.0%
	Species #	11	8	13
	Recruits m ⁻²	38.1	38.5	34.0

Costa Rica

Coral reef monitoring has continued only in Bahía Culebra, and not at other sites, due to funding and personnel constraints. The last assessment in Cahuita (September-October 2000) showed coral cover at 13-15% and algae at 53-63%, while coral disease incidence was around 6%. Isla del Coco was visited and data collected in 2002, which will be compared to data collected in the late 1980s and early 1990s. Monitoring will recommence at Cahuita and Manzanillo in the Caribbean, and at Bahía Culebra and Isla del Caño in the Pacific if new funds are received in 2002. There was low coral mortality (5-6%) in Isla del Caño, Culebra Bay, Murciélagos Island and Golfo Dulce in the Pacific during the 1997-98 El Niño warming, indicating that the remaining populations of massive and branching corals may have been more tolerant to thermal stress than during previous events. There are signs of recovery at Isla del Coco after the strong El Niño events of the 1980s and late 1990s.

Colombia

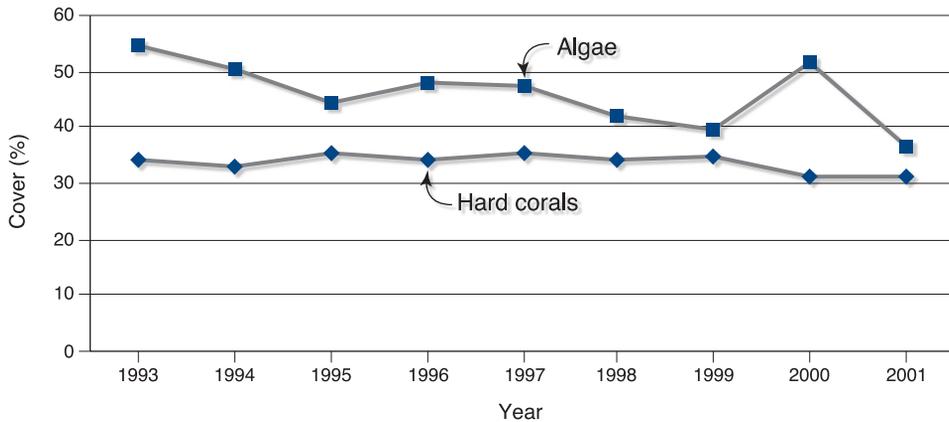
No clear signs of either decline or recovery have been observed in Colombian Caribbean reefs following major degradation of the 1980s. Coral cover has fluctuated during the last 4 years (1998-2001) within small ranges of 31-35% in Chengue Bay, 28-32% in Rosario Islands, and 22-28% in San Andrés island. Algae continue to be the dominant component of the reef surface (36-39% in 2001). Coral communities in Chengue were damaged in late 1999 during Hurricane Lenny, which reduced coral cover from 35% to 31%. The 1997-98 El Niño event had little effect on Colombian Caribbean reefs. Coral bleaching between 1998-2001 was lower than 5% in the monitored localities, except in Chengue where it was 10%, but related coral mortality was insignificant. The incidence of coral disease has been below 5% in 1998-2001, except in San Andrés in 1999 (9.1%) and 2001 (6.3%). Dark spots and white plague continue as the most frequent diseases. Coral cover at Gorgona Island on the Pacific coast has remained high (67% in 1998, 74% in 2001), while algae are a minor component (10% in 2001). The 1997-98 El Niño caused 21-24% coral bleaching in Gorgona, but mortality was very low. Bleaching at other localities of the Colombian Pacific in 1998 (Utría, Tebada and Malpelo) was much lower (about 1%). No more bleaching, nor coral diseases, have been observed in Gorgona since 1997-98.

Panamá

As reported previously, coral cover has declined on Caribbean coast reefs in the central and eastern areas, whereas coral cover may be as high as 75% on western reefs, and there is an average above 25% on Bocas del Toro archipelago. There has been a general decline in cover (6-10%) at Bocas del Toro associated with tourist development, and central coast reefs have less than 6% coral cover at Bahía Las Minas and 13% at the Parque Nacional Portobelo due to industrial and urban development. Recruitment has increased in these areas since 1998, mostly *Siderastrea siderea* and *Agaricia* spp. Coral cover dropped from 40% to 15% in 1997 at San Blas (eastern coast) following coral mining and natural causes. Average coral cover on 56 reefs in the Kuna-Yala Reserve is now 23%. Many reefs in the

ADVANCES OF 'SIMAC' MONITORING IN COLOMBIA

The National Monitoring System for the Coral Reefs of Colombia (SIMAC) has continued monitoring activities since 2000, despite a low budget. Most coral reef areas established in 1998 were monitored in 2000 and 2001, with support from UNEP-RCU/CAR and several Colombian institutions (INVEMAR, UAESPNN, CORALINA, CEINER, U. del VALLE). A new phase began in 2001 sponsored by the Colombian Ministry of the Environment ('Convenio Programa Ambiental'-BID-774OC/CO) to consolidate and expand SIMAC. Data were collected at the established SIMAC areas (San Andrés, Chengue, Rosario, and Gorgona) plus 3 new areas (San Bernardo Islands and Urabá Chocoano in the Caribbean, and Ensenada de Utría in the Pacific). Thus SIMAC covers 7 of the 30 principal coral reef areas of Colombia, with several different stations in each area. Monitoring data are particularly important for the management of some sites that show clear trends. However, the monitoring cannot provide a reliable picture of the status of all Colombian reefs. This GCRMN Regional Node has received additional funds from UNEP-RCU/CAR to continue SIMAC activities during 2003, which is particularly valuable considering the economic and political problems in Colombia.



Chengue Bay

Pacific lost up to 90% of corals in the 1982-83 El Niño event, and signs of recovery have been seen since 2000. Mortality was 50 to 100% in the Gulf of Panamá, such that some reefs in Las Perlas archipelago have less than 2% coral cover, while the highest (30%) on the Pacific coast is at Isla Iguana (west from Las Perlas). Coral mortality after the 1997-98 El Niño was minimal in the Gulf of Panamá, but reached 13% in the Gulf of Chiriquí.

Venezuela

There have been new efforts during 2000–2002 to assess the status of coral reefs, with most surveys conducted in the Los Roques National Park. The reefs continue to be almost pristine compared with other Caribbean reefs monitored by CARICOMP. Live coral cover ranges from 18-44%, dead coral cover from 31-64%, and algal cover between 0.1-11%. Coral diseases (yellow blotch, dark spots, white plague and white band) are rare (below 6%), although in some places, white plague disease has affected up to 24% of the major reef builders. The only reef being monitored regularly on the continental coast is Sombrero Key (Morrocoy Natural Park) with coral cover dropping from 40% in 1997 to less than 30% in 2000; this trend might be attributed to increasing sedimentation, tourism pressures, and coral diseases.

STATUS OF CORAL REEF FISHES

Information on reef fish populations continues to be extremely scarce in the STA region. The SIMAC program in Colombia has monitored densities of important reef fishes during 1998-2001 in several Caribbean and one Pacific location. At Chengue Bay, Rosario Islands and San Andrés Island (Caribbean) the abundance of snappers, groupers, jacks or other target fish in 2001 continued to be very low (absent or less than 3 fish per 60m²), with comparable surveys at Gorgona Island in the Pacific showing densities greater than 10 fishes per 60m². Damselfishes are still very abundant on Caribbean reefs (7-31 fish per 60m²), particularly the three spot damselfish (*Stegastes planifrons*) with densities of 26 fish per 60m² at Islas del Rosario. AGRRA surveys performed in 2000 at Caribbean localities (Cahuita and Gandoca-Manzanillo) in Costa Rica, also showed low densities of

snappers or groupers on the coral reefs (usually less than 2 fish per 60m²). Reef fish monitoring in Brazil started recently at the Abrolhos area (2000) and the Itacolomis reefs (2001) using the AGRRA and Reef Check protocols.

ANTHROPOGENIC THREATS TO CORAL REEF BIODIVERSITY

The coral reefs of the southern tropical America region are suffering from the same range of threats that is damaging reefs around the world. The most significant threats to the reefs in these countries are sedimentation, sewage pollution, resource extraction, tourism, oil pollution, mining and coastal development. The most serious threat comes from increased sediment runoff from logging, land clearing and agriculture, particularly in the inland forests and on mountain slopes. This has resulted in losses in coral cover, and reduced reproduction and growth on the Caribbean and Pacific coasts of Costa Rica, in the Santa Marta area in Colombia, and Morrocoy Natural Park in Venezuela. These threats to reefs are predicted to continue. Untreated sewage from high population growth is adding excess nutrients to most coastal ecosystems with anecdotal evidence of reef damage. However, coral and fish exploitation is causing direct and observable damage to many coastal reefs, in some cases through the use of damaging methods such as dynamite. Most commercial species are clearly over-exploited, with increasing reef tourism adding to the pressures. Tourism is bringing huge economic benefits with massive increases in some marine parks, but most of this is uncontrolled with increases in coral collection, over-fishing, direct damage to corals by divers, anchors and boats, sewage pollution and sedimentation. This is currently being seen in Bocas del Toro, Panama. In Venezuela, diving and snorkelling are resulting in localised impacts on the reefs at Los Roques National Park, but damages are not enough to cause reef decline. Oil pollution has caused major impacts at Bahía Las Minas on the Caribbean coast of Panamá with coral cover is now down to 4%. Coral has traditionally been used for construction and landfill in several countries (e.g. at San Blas, Panama), and this is continuing during the construction of tourists resorts in Brazil. There have been major river modifications and building of canals in Colombia, which have resulted in considerable degradation of some coral reefs. Unfortunately, there are insufficient baseline studies to fully document these damaging impacts. Major anthropogenic impacts on Venezuelan coral reefs seem to be localised near the mainland, where industrialisation, urban development and populations have increased recently. Oceanic areas appear to remain relatively pristine compared to reefs on the continental shelf; nevertheless, it is difficult to draw accurate conclusions because there are few data for many of these islands.

CURRENT AND POTENTIAL CLIMATE CHANGE IMPACTS

The impacts have been poorly assessed in the region, with the most serious damage now associated with coral bleaching and mortality from the early 1980s. Bleaching appears to have increased in frequency, but not in severity throughout the 1990s. The most bleaching was along the Pacific coast during the severe El Niño of 1982/83 with 50-100% coral mortality on most reefs, and coral bleaching was moderate, with low mortality during the strong 1997/98 El Niño. In the Caribbean, the most severe bleaching with high coral mortality was also in 1982/83, but this was poorly documented. There was mild bleaching (less than 10%) in 1997/98 in the Caribbean and on the Brazilian coast, but mortality was insignificant. The predictions of increased global warming suggests that

The status of MPAs in Southern Tropical America showing progress in some countries, particularly in Brazil.

COUNTRY	NO. OF MPAs	STATUS OF MPAs	PROGRESS SINCE 2000
Brazil	8 MPAs	All have management plans, but enforcement is still weak in most MPAs	AGRRA monitoring in Abrolhos National Marine Park in 2000 at 13 sites; 2001 at 30 sites; 2002 at 35 sites; corals, fishes, sediment rates monitored in 2001 in Corumbau. Reef Check in 2002, northeastern Brazil & Abrolhos.
Colombia	4 on Caribbean side; 3 on Pacific side	Many have management plans; poorly implemented; Pacific MPAs fewer problems, better managed; Caribbean MPAs poorly enforced, some blast fishing; SIMAC & Reef Check monitoring in 5; others none.	New monitoring in Utría Natural Park in 2002. Coral reefs of San Andrés & Providencia archipelago included in Seaflower Biosphere Reserve.
Costa Rica	2 on Caribbean side; 7 on Pacific side	Some active management, artisanal fishing permitted; Tourism in some MPAs; 2 on the Caribbean & one on Pacific have monitoring.	CARICOMP monitoring in 2002 at Gandoca-Manzanillo Refuge.
Panama	5 on Caribbean side, mostly Indian reserves; 5 on Pacific side	4 on Caribbean side & 3 on Pacific were monitored. Management plans either ineffective or don't exist.	Monitoring implemented in 2000-2001 at 3 MPAs on Pacific coast.
Venezuela	4 on Caribbean	Only Morrocoy monitored by CARICOMP; management Instituto Nacional de Parques INPARQUES.	Several assessments of reef status at Los Roques national park, Turiamo Bay, Mochima & Margarita in 2000-2002.

coral bleaching will become a more frequent event, although the level of bleaching and related mortality will probably be low during the next decade.

CURRENT MPAs AND MANAGEMENT CAPACITY

The 23 MPAs in the Caribbean-Atlantic and 15 in the Pacific were designated for a variety of reasons under several protected categories, however, most are 'paper parks' with little management planning, operational capacity, and enforcement. Most are managed by government agencies and lack reef monitoring programs, usually due to the poor economic status of governments and communities. There is a need for education and awareness raising to reduce conflicts between traditional users and governments over fisheries and tourism activities. In Brazil, the Itacolomis Reefs south of Porto Seguro have recently been included in the Corumbau Marine Fisheries Reserve, where parts are closed for fisheries, and the rest is only for artisanal fishermen. Open and closed areas have been monitored in a program that includes coral cover, sediment deposition, fish populations, and socio-economic aspects.

CORAL COAST MPA MANAGEMENT INITIATIVE – NE BRAZIL

The MPA was set up to implement local integrated coastal management and ensure sustainable economic benefits from the reefs. This was set up in 1997 as the first national conservation area for coastal coral reefs of Northeastern Brazil, between the cities of Recife and Maceió. The Tamandare-Paripueira reef system is an Area of Environmental Protection in the 'Costa dos Corais', and covers 413,563ha from 33m on land to 33km offshore. The local communities of 130,000 people rely on sporadic work in tourism and agriculture, and exploitation of reef resources. The traditional and subsistence fishery is intense, targeting a large variety of fishes, lobsters and octopuses with an average daily catch of 2.18kg. Their initial tasks involved environmental assessments to characterise the coral reefs through mapping, biodiversity evaluation, fisheries assessment, population assessments of important species, as well as socio-economic assessment. In addition to subsistence fishing, there is the commercial capture of prawns, lobster and reef and pelagic fishes. However, the reefs have been damaged through poor land use practices that increase sedimentation, domestic and agricultural pollution, overexploitation of reef resources, uncontrolled tourism and urban development. Coral mining had been intense until the 1980s, when it was banned throughout Brazil. Collection of all ornamental marine life has been banned at the 'Costa dos Corais' MPA as well. This is a multiple use MPA that permits subsistence and commercial activities, however Fully Protected Zones were included in 1998, and preliminary results indicate significant increases in exploitable resources, and spill over effects, with increased catches in adjacent areas. These are being monitored with the help of fishers, and hopefully will encourage the communities to support the protected area as a management tool, both for tourism and fisheries. The Project has been funded by the Inter-American Development Bank from 1998 to 2003. From: Beatrice Padovani Ferreira and Mauro Maida, Universidade Federal de Pernambuco, Recife, Brazil, beatrice@ibama.gov.br or www.recifescosteiros.org.br

GOVERNMENT POLICIES AND LEGISLATION

These countries have enacted few specific government laws to promote the study, sustainable use and conservation of their coral reef resources. Many of the 'protected' reef areas are within natural parks and reserves, but few are achieving their objectives of sustainability. Colombia and Panamá have developed specific regulations prohibiting the harvesting of hard corals and reef fishes for the aquarium trade. However, those regulations are not enforced and there has been an increasing demand in Panama for 'live rock' to be exported to Florida. Brazil has a specific local law to declare permanent protection for the coral reefs of Bahia. Important environmental conventions (CITES, FCCC, and CBD) have been ratified by most of the countries, and other region-specific treaties such as the Convention for the Protection of the Marine Environment in the Southeastern Pacific Coastal Zone the Convention for Protection and Management of the Marine Environment in the Wider Caribbean Region have also been ratified. Colombia, Panama and Venezuela have attempted to organise national systems and legislation for the management and conservation of the environment and biodiversity.

MAPPING REEF MONITORING IN TROPICAL AMERICA

A major problem in attempting summaries of reef status in a region is knowing where monitoring has occurred and who has the data. Thus, the Instituto de Investigaciones Marinas y Costeras (INVEMAR) in Colombia was requested to assemble all the known information on coral reef monitoring in the Wider Caribbean but also in the far Eastern Pacific and the Western Atlantic. The goal was to produce maps of all such coral reef activities and make these available to reef managers and decision-makers. The principal support came as a grant from the National Oceanic and Atmospheric Administration (NOAA) of USA, with additional assistance from the Colombian Ministry of the Environment and the GCRMN. A short electronic questionnaire was sent to persons in charge of monitoring activities in all localities in tropical America.

Respondents provided information on locality, geographic coordinates, type of reef, reef zones, depth, years of monitoring, MPAs, variables measured, methods, periodicity, monitoring program and contact information. The preliminary GIS maps were displayed at the ICRI Regional Workshop for Tropical America in June in Cancun, Mexico in order to gather more information and correct errors. The results of this project were produced as a CD, which includes the complete database, the final GIS maps (in shape and coverage formats), graphic outputs of the maps (in ARC and PDF formats), summary tables and graphics. Maps were drawn for the whole region, but also in more detail for each GCRMN Node. There were 25 monitoring programs in 562 localities, distributed along the coasts of 27 countries in tropical America. About 50% of the localities have been monitored for less than 5 years, and only 3% for more than 10 years; in more than 40%, there are only evaluations of biological variables and 50% are restricted to depths of 0-10m. MPAs are being covered by 87% of the monitored localities. There is ongoing analysis and a more comprehensive report will be published in late 2002. From: Jaime Garzón-Ferreira and Sonia Bejarano, INVEMAR, Santa Marta, Colombia, jgarzon@invemar.org.co or simac@invemar.org.co.

GAPS IN CURRENT MONITORING AND CONSERVATION CAPACITY

Although there has been reef monitoring for 30 years and all countries recognize the need for national monitoring programs, the level and coverage of monitoring is very limited and high quality monitoring is restricted to a few sites. Lack of funding and poor infrastructure are major impediments for an effective control and conservation of marine resources in the region. CARICOMP has stimulated considerable monitoring in the Wider Caribbean, but usually in only 1 or 2 sites per country. The Reef Check program has contributed to some expansion of volunteer, non-professional monitoring in Colombia, Panamá and Brazil. All countries have well trained professional scientists and reasonable logistics to implement monitoring, but few have allocated sufficient funding to maintain national monitoring programs. INVEMAR in Colombia has been developing an integrated national reef monitoring program (SIMAC) since 1998 but the current economic and political problems pose threats to its continuity and expansion. The Smithsonian Tropical Research Institute in Panama has supported the implementation of the Panamanian Coral Reef Monitoring Network (PCRNM) using minimal funds to cover over 15 reef sites. A

workshop is planned for early 2003 in Costa Rica, to establish a National Coral Reef Monitoring Program with the participation and funding of the government, private enterprise, local communities and academics.

CONCLUSIONS

- Five countries continue collaborating to consolidate the Southern Tropical America Node of the GCRMN and institutions from Colombia, Costa Rica, Panamá and Venezuela have signed letters of agreement.
- Most coral reefs in the region have undergone major changes during the last 30 years, but particularly during the 1980s, with considerable losses of live coral cover. Nevertheless, significant coral cover can still be found at several reef locations of both Caribbean (averages of 20-40%) and Pacific (averages above 40%) coasts.
- The coral reefs of this region are suffering from the same range of threats that is damaging reefs around the world. The most significant threats in these countries are sedimentation, sewage pollution, resource extraction, over-fishing, tourism, oil pollution, mining and coastal development.
- The second strong El Niño event of 1997/98 caused only moderate bleaching and low coral mortality on the Pacific side. Mild bleaching (extensive in some locations of Brazil), but insignificant coral mortality, occurred also in 1997/98 in several Caribbean and Atlantic localities.
- There are about 40 protected areas and reserves that include coral reefs in the region, but most remain as 'paper parks' because of limited funding to implement management plans and enforce regulations.
- Despite the importance of coral reefs in the region and their accelerating degradation, there are few specific government policies and laws to promote conservation of these ecosystems. Most protection is intended through the inclusion of reef areas within national parks and other reserves, however, law enforcement is not working properly in most of the countries.
- Reef monitoring in the region has been carried out for 30 years. Although considerable expansion has occurred over the last two years, geographic coverage is still low in most countries. The current level of monitoring and a modest expansion cannot be supported without continuous funding.

RECOMMENDATIONS

- It is necessary to complete the baseline characterisation of coral reefs in the region, including: mapping; biodiversity evaluations; population assessments of important species or groups of species; coral health and socio-economic assessments.
- Reef monitoring in this region must be maintained in the long term and significantly expanded through the development of national monitoring programs in each country, including the integration of these into the regional and global initiatives. National programmes need to address both protected and non-protected reef areas.
- Extraction of all reef organisms, including so-called 'live rock' must be completely prohibited within the protected areas.

- Tourism in coral reef areas needs to be regulated, including the designation of dive sites based on scientific criteria to establish carrying capacity limits.
- New reef conservation programmes must include the surrounding areas, in particular adjacent and upstream large watersheds in order to minimise the input of sediments and pollutants into reef areas.
- Specific government policies and laws for coral reef sustainable management need to be developed during the next few years, as well as effective protection of natural parks and reserves through implementation of management plans and law enforcement.
- National governments need to increase regular budgets for institutions that have responsibilities for monitoring and conserving coral reefs, but also the funding for scientific research on these ecosystems. At the same time, international programmes and funding agencies must provide important matching support for developing countries and for regional cooperative initiatives.

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WHS

COCOS ISLAND NATIONAL PARK, COSTA RICA – WORLD HERITAGE SITE

Situated 535km off the southwest coast of Costa Rica, Cocos Island provides critical habitat for marine wildlife, particularly large pelagic fish and sharks. The park includes the main island and 10 nearby offshore islets. Underwater habitat consists of a shallow coral reef with almost no intertidal zone, culminating in sand and rubble at the edge of the several hundred meter deep trench. Studies of the coral fauna organisms have resulted in the identification of 32 species, 9 of them in deep water. The diversity of coral organisms places Cocos Island as one of the areas of major biodiversity in the Tropical Eastern Pacific. The coral fauna group has similarities to that of the Indo-Pacific.

Cocos Island National Park was declared a National Park in 1978, but this status alone was not adequate in protecting the marine resources. There have been numerous reports of illegal shark-fin collection. The area was inscribed on the World Heritage List in 1997 and due to the continued illegal fishing, conservation organizations rallied for an expansion of the boundaries of the marine reserve. In October 2001 the marine reserve surrounding Cocos Island was officially extended from 15km to 22 km in order to increase the protection of the marine resources. This was also accepted as an extension to the World Heritage site in 2001. A partnership is being negotiated with the National Coast Guard Service and Sea Shepherd Conservation Society for patrolling the marine area and prosecution of illegal fishing boat owners.

Ecological Monitoring: The coral reefs of Cocos Island suffered declines as a result of the 1982-83 and 1997-1998 El Niño disturbances. There are no data from area after the El Niños between 1992 and 1995. The reefs will be evaluated again in late 2002.

Socio-economic Monitoring: No information reported.

Coral reefs are 40% the natural resources.

Ecological Monitoring is occasional.

Socio-economic Monitoring is not planned.


 WHS

THE GALAPAGOS ISLANDS, EQUADOR – WORLD HERITAGE SITE

The Galapagos were made famous by Charles Darwin who visited these remote and apparently inhospitable volcanic islands in 1835. The islands were granted World Heritage status in 1978 in recognition of their unique wildlife on land, but only recently has the marine biodiversity received attention. There are over a million sea birds of 19 different species, thousands of coastal birds, 100,000 sea lions, hammerhead and Galapagos sharks, and the flightless cormorant, penguin, and the Galapagos albatross. Green and hawksbill turtles are common and nearly 300 fish species have been recorded, with 23% being endemic. The Galapagos are far from Ecuador in the eastern Pacific. Resource access disputes are causing increasing problems for management as most of the 15,000 people live on 3% of the land and are either fishers, farmers or tourism operators. The 70,000 tourists generate over US\$55 million per year, but the impacts are minimised because they live on large cruise ships, or arrive by air and use smaller boats. Tourist scuba diving is increasing. The local population expanded dramatically in the 1970s and 80s due to tourism and to exploit the fishing resources of sea cucumber, shark, tuna and lobster. Biologists and conservationists agree that the Galapagos over-fished and that marine biodiversity is under threat.

The first management plan for the Galapagos Marine Reserve in 1992 was largely ignored and social unrest increased over attempts to ban fishing for sea cucumbers. New legal, administrative and community participation structures are being designed to improve conservation of marine ecosystems. The Charles Darwin Research Station was established in 1959 and advises the National Park Service of the Galapagos on protective programs for the marine ecosystem, tourism policies and environmental education programs.

Ecological Monitoring: The first surveys of the coral reefs were in 1983 after there was 97% mortality of the corals during the severe El Niño of 1982/3. It was considered that the event may have resulted in localised extinctions of *Pocillopora* species of hard coral. After re-growth, the 1997/1998 bleaching event devastated the *Porites* and *Pavona* species down to 30m, with extensive bleaching in 10 to 15 m depth. The re-growth of *Pocillopora* seemed to be largely resistant during the 1998 event.

Socio-economic Monitoring: The Charles Darwin Research Station has participatory fisheries monitoring of catch, by-catch, consumption, market prices etc. to use in adaptive management of the Galapagos Islands.

Coral reefs are 5% the natural resources.

Ecological Monitoring is occasional.

Socio-economic Monitoring is occasional.


 MAB

SEAFLOWER, COLOMBIA – MAN AND THE BIOSPHERE RESERVE

The Seaflower Biosphere Reserve is in the Southwest Caribbean, about 1000km northwest of Colombia. It is a large reserve, covering about 300,000km² of island and sea territory. It contains the archipelagoes of San Andrés, Providencia and Santa Catalina, with 3 small populated islands (only 57km² but 60,000 inhabitants), several sand cays and numerous banks, atolls and complex coral reef areas.

The reserve is principally oceanic; however, it includes at least 2,200 km² of reef environments, with 826 km² of coral reefs. The three major islands also have large mangrove forests and seagrass beds. The oceanic reefs of the archipelago are mostly bank-reef type with wide fore-reefs; almost continuous peripheral reefs on the windward side; and poorly developed reef tracts and lagoons on the leeward side. There is high biodiversity of hard corals (57 species), gorgonians (40), sponges (118), algae (163), and fishes (273).

Ecological Monitoring: There has been long-term coral reef monitoring by CORALINA and INVEMAR under the CARICOMP and SIMAC programs since 1998 in San Andrés island (5 stations), and more recently in Providencia island (4 stations). There has also been some monitoring of the mangroves, seagrasses and beaches of these major islands and the potential impacts of global climate change on these ecosystems.

Socio-economic Monitoring: There have been socio-economic studies of the interactions of fishing and other communities with the biosphere reserve.

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Coral reefs are 60% of the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is effective.

WHS

MAB

LA AMISTAD, PANAMA /COSTA RICA – MAN AND THE BIOSPHERE RESERVE

The La Amistad Biosphere Reserve and International Peace Park spans the Talamanca Mountains from southern Costa Rica to western Panama. The Costa Rican part of La Amistad, which forms most of the core area of the Reserve, was designated in 1982 and the Panamanian side was inscribed in 2000. They are also jointly inscribed on the World Heritage List. UNESCO/MAB is considering proposing a further trans-border biosphere reserve consisting of the two coastal/marine elements on the Atlantic side, possibly together with adjacent terrestrial and/or marine areas.

La Amistad includes lowland rainforest, cloud forest, and montane forest to extensive Caribbean and Pacific ecosystems, and also includes coral reefs, seagrass beds and some of Central America's most extensive mangroves. Coral reefs in La Amistad contain 25 species of soft corals and 54 species of hard corals. Habitat destruction is possibly the greatest threat to the diverse terrestrial and aquatic flora and fauna in this biosphere reserve. To control this threat, management plans for the reserve are currently being developed and updated. In collaboration with the Costa Rican government, the Organization of American States (OAS), and several local groups, Conservation International helped produce the official management strategy for La Amistad that was adopted by the Costa Rican government in 1990. Since then, efforts have been undertaken by the Panamanian government, OAS, and grassroots organizations to draft a similar strategy for the portion of La Amistad that lies in Panama. There is a need to further strengthen logistic function of the Reserve and facilitate cooperation between Costa Rican and Panamanian management authorities.

Ecological Monitoring: It is understood that substantial monitoring and resource assessment has been undertaken but the information was not available.

Socio-economic Monitoring: No information was available

Coral reefs are 20% of the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is unknown.