

7. STATUS OF SOUTHEAST ASIA CORAL REEFS

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ABSTRACT

Most of Southeast Asia's coral reefs continue to remain under threat, mainly from anthropogenic impacts. Weak management capacity contributes to the further degradation of reefs, particularly from destructive and over-fishing. The lack of monitoring capacity in some areas adds to the difficulty of reaching more accurate assessments. Amid the general widespread trend of declining health are isolated instances of effective management and successes in reef protection. The reefs of Indonesia that were monitored under COREMAP showed improvements in live coral cover. Active management resulted in improved reef health from monitoring reports in Thailand and Vietnam. Also evident is the recent and renewed expansion of reef monitoring and management activities supported by international agencies. The transfer of lessons learned from successfully managed reefs and the overall enhancement of management capacity are strong requirements to overcome the general decline of reef health in the region.



TURNING A BOMB FISHER INTO A RESOURCE MANAGER IN INDONESIA

In North Suluwesi, Indonesia, awareness raising within the Blongko community transformed the life of Salindeho (Pak Deho) Adilang, who once gained his livelihood from bomb fishing on coral reefs. Now he is a member of the community sanctuary management board and firmly on the side of reef conservation. A theme in Proyek Pesisir (a USAID funded project) was to teach community members how to assess and monitor reefs to prepare maps of the resources as a prelude to management. They trained Pak Deho how to assess reefs over a large scale using the manta tow technique (a method recommended by the GCRMN) and took him to an area where blast fishing was rampant. When he saw the damage that the bombs were causing to the corals, he reformed his illegal behaviour to become a supporter of the reefs. He subsequently joined the sanctuary management committee, and when a Canadian film crew asked him about the change, he replied that he started bomb fishing when he was young and did not know what he was doing.

Proyek Pesisir recommend seeking out the bomb fishers and involving them in monitoring training, thereby complementing their expertise on the water. Some can take up a leadership role in further training and eventually resource management. This approach is a start, but cannot tackle the problems of bomb fishers from outside the community. The value of involving community members in monitoring and mapping activities has been in transforming many stakeholders into stewards – ‘when you start mapping, things happen’. After training in assessing coral reef quality, the community generated their own coral reef map. The head of the nearby Talise marine sanctuary management committee stated that the map produced by the exercise was the catalyst for the community to establish a sanctuary; ‘the project did a survey of the resources here, and the villagers thought it was important to keep it’. From Proyek Pesisir. Johnnes Tulugen (tulungen@manado.wasantara.net.id) or Brian Crawford (crawford@gso.uri.edu)

INTRODUCTION

Southeast Asia's 100,000km² of coral reefs is 34% of the world's total, and also contains the highest coral biodiversity. The recent Reefs at Risk analysis estimated that 88% of the region's reefs were at risk, with half at ‘high’ or ‘very high’ risk. Over-fishing threatens 64% of the reefs while destructive fishing threatens 56%. Coastal development affects 25% of the reefs, and a further 20% face the impact of agriculture and deforestation. Over 90% of the reefs of Cambodia, Philippines, Vietnam, and Singapore are threatened, as are the Spratly Islands in the South China Sea. For Malaysia and Indonesia, over 85% of the reefs remain under threat. It was further noted that the region's 646 Marine Protected Areas (MPAs) covered only 8% of its reefs. This inadequacy in management is further emphasised by the fact that only 14% of the 332 MPAs where management effectiveness could be assessed were considered to be well managed.

Increased attention from international agencies was more evident in the past two years. A UNEP/GEF regional project ‘Reversing Environmental Degradation Trends in the South China Sea and Gulf of Thailand’ was implemented in 2001 with coral reefs as one of its

focus ecosystems. In an ICRAN (International Coral Reef Action Network) project, also implemented this year, capacity transfer in reef management was targeted. Reefs under different but successful management regimes were identified to serve as demonstration sites to benefit identified target sites through transfer of learning experiences and expertise. Three management regimes were selected: integrated coastal management; ecotourism; and community-based management. UNEP's Regional Coordinating Unit for East Asian Seas (RCU-EAS) is currently managing a small grants initiative to enhance coral reef monitoring in the region. At an international workshop on World Heritage sites held in Hanoi early this year, over 20 reef sites throughout Southeast Asia were identified as having outstanding universal value and feasible for nomination for World Heritage status. The Sulu-Sulawesi seas are identified as one of the world's marine ecoregions by WWF, based on its marine biodiversity. A Biodiversity Conservation Vision for the Sulu-Sulawesi Marine Ecoregion has been formulated and joint activities between the three countries sharing those seas (Philippines, Indonesia, Malaysia) are being developed.

In October 2001, the Universiti Malaysia Sabah, conducted the 'Regional Workshop to Establish a Network of Marine Protected Areas in the East Asian Seas Region' with funding from the UNEP/ RCU-EAS and ICRAN, and in May this year, The World Commission on Protected Areas, Nature Conservancy, and U.S. National Oceanic and Atmospheric Administration collaborated in a joint project to develop a Regional Action Plan (RAP) aimed at strengthening and improving the effectiveness of a network of 'marine reserves' in Southeast Asia. A WCPA-SEA Marine Working Group was established to further develop the RAP.

A more coordinated approach was adopted in the preparation of this regional report. National coordinators were identified and participated in a meeting in Ishigaki, Japan in March 2002, hosted by Japan's Ministry of the Environment. It was agreed that national coordinators contribute directly to the present report as co-authors. National workshops of Malaysia and the Philippines were supported by Japan's Ministry of the Environment, while those of Thailand and Vietnam were supported by the Regional Coordinating Unit (East Asian Seas) of UNEP. Summarised data of reef status derived from the national reports appear in this paper. In addition, reports were received from a number of people in response to the call for additional information. Relevant pieces of information from these reports are incorporated.

STATUS OF CORAL REEF BENTHOS AND REEF FISHES

This section provides updates to the 2000 report. National reports containing more detailed information are being prepared by participating country coordinators. While monitoring of reef benthos remained at an active level, a paucity in information on reef fish was evident.

Cambodia

Rocky bottoms along the 435km coastline support variable development of coral communities. Fringing reefs are found on some of its 64 islands. An assessment of the reefs in the Koh Sdach group of islands in the Koh Kong province was carried out in March and December of 2001 by a volunteer group from Singapore organised by the

Singapore International Foundation and the National University of Singapore. Both Line Intercept Transect (LIT) and Reef Check surveys were conducted. Live coral cover of 10 fringing reefs from LIT data ranged from 4.1 to 72.1% while dead coral cover was between 5.6 and 78.8%. A couple of reefs showed clear evidence of bleaching, but recovery was vigorous from the large number of growing coral recruits.

Indonesia

Data from 2002 indicated that 520 stations from 56 locations throughout Indonesia have been surveyed with LIT. The results showed that 32.3% of the reefs were in poor condition, 35.3% fair, 25.5% good and 6.7% excellent. Compared to the 2000 data, there is a shift towards improvement. Reefs classified as poor decreased from 34.7 to 32.3% and those in the fair category decreased from 35.3 to 33%. Reefs in the good and excellent categories increased by about 2% each. The monitoring programs in Banda Islands, Wakatobi Islands, Komodo Island, Bangka Islands, Belitung Islands, Taka Bone Rate Islands and Senayang-Lingga Islands all showed improved reef condition. For example, live coral cover in Taka Bone Rate increased significantly by 6.3% from 23.8 to 30.1% over the two-year monitoring period. The increase was attributed to a 4.0% rise in non-*Acropora* and a 2.3% improvement in *Acropora*. In Senayang – Lingga (Riau province), live coral cover increased by 11%. Both, Taka Bone Rate Islands and Senayang-Lingga Islands, are representative locations of the Coral Reef Rehabilitation and Management Programme (COREMAP). The improved reef condition provides encouraging evidence that COREMAP is positively benefiting the reefs. During 2001-2002, new locations surveyed were Anambas Island (South China Sea), Malaka Strait and Raja Ampat Islands (West Papua). Reefs in western Indonesia are subjected to greater anthropogenic impact than those in central and eastern Indonesia. For example, 70% of reefs in the Seribu Islands near Jakarta are in poor condition.

Malaysia

Coral reef surveys have continued in both East and West Malaysia during 2000 to 2002. In East Malaysia, the Universiti Malaysia Sabah and Greenforce conducted surveys of reefs and associated marine organisms in the islands off Kudat, Sabah. Rangers in the Turtle Islands Park, managed by Sabah Parks, maintain a continuous survey programme for coral reefs and fishes and the sandy beaches for turtle hatchings. In West Malaysia, the Marine Parks, Department of Fisheries- Malaysia, conducted surveys with the assistance of Coral Cay Conservation. Detailed analysis of the data is being prepared and will be included in the National Report. A volunteer group from Singapore (organised by the Singapore International Foundation and National University of Singapore) conducted additional Reef Check surveys of the reefs off Kudat (Pulau Molleanean and north Pulau Banggi) in June this year and found live coral ranging from 27.5 to 71.3% at the reef crests and from 10.6 to 60.6% at reef slope depths between 3 and 6m.

Philippines

The Philippines report contains an update on time-series data of over 50 coral reef sites along the length of the archipelago, most of which started in the 1990s. Unfortunately, this is a biased data set since an overwhelming majority of these time series data focused on managed (protected) reef sites. Despite the data bias towards managed reef sites, Philippine reefs still exhibit an overall declining trend. In the South China Sea, hard coral

MANAGEMENT, TOURISM AND CONSERVATION AT MABINI AND TINGLOY, BATANGAS, THE PHILIPPINES

There are diverse and abundant coral reefs in the Mabini and Tingloy area in the Province of Batangas. These reefs have become famous for providing tons of fish to local communities and for attracting thousands of tourist scuba divers and snorkellers. This mix presents a problem of balance for reef managers. The history of management of these coral reefs is closely linked to tourism. Scuba divers called for protection of their best dive sites, when one of the first diving resorts in the Philippines started in 1975. The tourist operators were concerned about the rampant illegal and destructive fishing and proposed a national marine park for Sombrero Island and parts of Caban and Maricaban Islands in 1982, after the first surveys in 1980. Since then a series of NGOs (Haribon Foundation; 5 Earthwatch expeditions; Biodiversity Conservation Network; World Wildlife Fund; Mabini Tingloy Coastal Area Development Council; The Friends of Balayan Bay Association; and Coastal Conservation and Education Foundation, formerly Sulu Fund) have worked with the local communities to promote conservation of the reefs and develop alternative livelihoods. These NGOs have also monitored the reefs, including observations on human uses e.g. number of fishing boats, dropping of anchors, divers, shoreline development and any other human activities likely to damage the reefs.

Destructive (bomb and cyanide) fishing has decreased markedly in recent years, but damage continues from anchors, fishing and novice scuba divers. Sediments from deforestation and building on land are deposited during heavy rainfall and there is increasing construction along the shoreline, irrespective of the Land Management Act order for a setback of at least 20m from the high tide level. There was also major storm damage in the late 1980s, but many of the corals are regrowing. Despite all this, the reefs continue to grow and now appear healthy.

The condition of the reef sites surveyed has been stable since 1997, with an abundance of new coral growth and little evidence of physical damage. The White Sand Reef near El Pinoy Resort is an exception, because a crown-of-thorns starfish infestation caused severe damage in 1999 and 2000, killing most of the shallow branching corals.

| Major bottom cover | Deep sites – 5-9m | | | | Shallow sites – 2-5m | | | |
|--------------------|-------------------|-------|-------|-------|----------------------|-------|-------|-------|
| | 1993 | 1995 | 1997 | 2001 | 1993 | 1995 | 1997 | 2001 |
| Hard Coral | 28.1% | 38.1% | 32.3% | 29.9% | 35.8% | 49.0% | 53.7% | 53.7% |
| Soft Corals | 16.6% | 19.2% | 19.9% | 14.1% | 10.9% | 12.4% | 12.5% | 8.4% |
| Recent Dead Coral | 2.2% | 1.4% | 4.6% | 0.2% | 1.3% | 2.4% | 4.7% | 1.1% |

Mean percent cover of living and recently dead coral at 9 sites in the Mabini-Tingloy area, Batangas.

It is important that management in the Batangas area be continued and expanded, to build on the activities that are showing encouraging results. The Barangay Sto. Tomas has recently declared the Batalang Bato Reef (known as Pulang Buli Reef to divers) as a

marine sanctuary which is off-limits to diving and fishing activities. CCE Foundation started a Community-based Coastal Resource Management project in Tingloy in late 1999. The local community increased their interest in conservation which is now assisting in the management of the marine sanctuary. The conservation was initiated by the tourism sector, and now the community and the municipality are showing concerns about their environment accepting responsibility in caring for their surroundings.

The problems have remained the same over the last 10 years, but the communities and managers have a better understanding of what is required for effective and sustainable conservation. Many problems remain which need to be addressed, but there has been good success in reducing overfishing and illegal fishing. The communities have formulated their own recommendations: The reserve and sanctuary project and the involvement of the dive industry can be used to spread the idea of sustainable use of the reefs to surrounding communities; Destructive fishing and spear fishing using compressed air needs to be totally stopped in the area; More anchor buoys are needed at every site, and a small fee for their use can provide some revenue; Raising awareness about waste disposal is needed, and all partners from local communities to large ship owners should assist; While the Friends of Balayan Bay Association can assist in conservation, they need guidance, assistance and coordination with government agencies; An integrated management plan for the area is needed, along with workshops and educational programs for stakeholders; Guidelines are needed for shoreline developments that cause erosion or increase pollution; User fees need to be collected in a transparent way and used to support sanctuaries, anchor buoys and conservation costs. From:

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cover is stable for Ilocos Norte and La Union, variable for Pangasinan, stable to slightly increasing for Zambales, stable to slightly decreasing for Batangas, and decreasing for Mindoro and Palawan. Reef fish abundance is increasing for Ilocos Norte and La Union, stable for Palawan, and decreasing for Zambales, Pangasinan and Batangas. In the Visayan Seas, hard coral cover and reef fish abundance in the sites monitored are generally improving. In the Philippine Sea, hard coral cover is decreasing and reef fish abundance is stable to decreasing. Hard coral and reef fish abundance trends are variable across sites in the Sulu Sea. In the Celebes Sea, hard coral cover increased at 21% of sites, but decreased at another 33% of sites. There was no clear trend for the remaining 46% (although these tended to decline). Reef fish abundance was stable to decreasing.

Singapore

The coral reefs continue to suffer from the impact of sedimentation. A renewed survey program was initiated recently and data for 2 of the 10 permanent reef sites being monitored indicated an extension of the trend of steady, but small decline in live coral cover. A mass spawning event was confirmed in April this year, and further observations are being prepared for October to determine if mass spawning coincided with the inter-

monsoon period. Many coral recruits were recently discovered on coral rubble covered by calcareous algae and a project is currently planned to examine the potential of exploiting this phenomenon for coral culture and reef rehabilitation.

Thailand

The coastal areas of Thailand between latitudes 6° and 13°N, offer suitable environmental conditions for coral reef development. There are an estimated 153km² of coral reefs along the total coastline of 2,614km and around 300 islands. These are classified in 4 distinct areas with different oceanographic conditions: the inner part of the Gulf of Thailand (Chonburi); the east coast of the Gulf of Thailand (Rayong, Chanthaburi and Trad); the west coast of the Gulf of Thailand (Prachuab Kirikhan, Chumporn, Surathani, Nakhon Si Thammarat, Songkhla, Pattani and Narathiwat); and along the coastline of the Andaman Sea (Ranong, Phuket, Pang-Nga, Krabi, Trang and Satun). Three reef types can be recognized: coral communities with no true reef structure; developing fringing reefs; and early formation of fringing reefs. A comprehensive reef survey program covering 251 sites in the Gulf of Thailand and 169 sites in the Andaman Sea was conducted by the Department of Fisheries between 1995 and 1998. In the Gulf of Thailand, 16.4% of the reefs were rated excellent, 29% good, 30.8% fair, and 23.8% poor. Reefs in the 'poor' category increased considerably after the severe 1998 bleaching event. For instance, certain areas of Trad Province showed reduction in live coral cover of 80-90% from previous levels. In the Andaman Sea, 4.6% of reefs were excellent, 12% good, 33% fair, and 49.8% poor. The 1998 bleaching event affected coral reefs in the Andaman Sea to a much smaller extent than in the Gulf. Some reefs showed a declining trend in live coral cover, but other sites registered slight increases of live coral cover. In general, coral reefs in the Andaman Sea were relatively unchanged. Monitoring of reef fish was less extensive and it is difficult to provide a clear indication of reef fish status because of high temporal variations. However, fish communities were more abundant on reef slopes than on reef flats. Reef fish abundance gradients from nearshore to offshore were influenced by reef types and environmental factors. Most Thai coral reefs are used for fisheries but no records are maintained of reef fish harvesting. Many reefs in rural areas are used by small-scale fishermen and for the collection of shells and ornamental fish. The reefs provide fishery products as important sources of both food and income.

Vietnam

The extensive coastline stretches north to south across more than 15° of latitude and the 3000 islands all contain a wide range of reef diversity and structure. The marine environment is classified into 5 distinct areas: the western Tonkin Gulf; middle-central; south-central; south-eastern; and south-western Vietnam. The reefs support over 350 species of hard corals. The greatest coral diversity lies in the south-central area with more than 300 species belonging to 65 genera. Data from 30 transects monitored in 2000 and 2001 showed 60% of reefs as fair (live coral cover of 26-50%), 20% as poor (0-25%), 17% as good (51-75%) and only 3% as excellent (>75%).

MONITORING THE HON MUN MPA IN VIETNAM FOR IMPROVED MANAGEMENT

Hon Mun in Nha Trang Bay is the first MPA in Vietnam and is recognised for its rich biodiversity with strong biogeographic links to the Indo-west Pacific centre of diversity. There are 9 islands with about 6,000 local villagers who rely on the reefs and waters for subsistence fishing, but the area is also the focus of rapidly developing commercial fisheries, aquaculture, shipping and tourism. These provide both threats and opportunities for successful management. For these reasons, the Government of Vietnam and the World Conservation Union (IUCN, with support from Global Environment Facility - World Bank and Danish Government) established Hon Mun as a model for an integrated MPA network in Vietnam. Ecological and socio-economic monitoring programs were established to assist management through collaborations among the MPA Project, the Institute of Oceanography and the local villagers. They are documenting the present status of the resources to be used to detect trends and management effectiveness. The ecological monitoring has three tiers based on GCRMN protocols: habitat assessment using manta-tow; community-based resource assessment by local villagers using Reef Check and local indicators; and more-detailed scientific assessment of diversity and coral cover, abundance of demersal fish, molluscs, echinoderms and algae and the quality of the water. The socio-economic assessments use participatory rural appraisal (including village mapping and interviews) to identify local concerns and aspirations, and fisheries logbooks, surveys and government statistics to define trends in demography, employment, living standards and resource-use. Initial results indicate that coral cover and diversity in a few small areas remain in excellent condition, with up to 100% cover and 350 hard coral species. However, many other reefs in the MPA have suffered severe damage from blast and poison fishing, crown-of-thorns starfish (COTS) outbreaks, careless anchoring and river runoff. The villagers report that fisheries resources are heavily over-exploited with declining catches and some local extinctions. The findings are the basis for education and awareness campaigns to improve compliance with MPA regulations, especially enforcement, and in refining the MPA zoning plan. These findings have also fostered new community-based management initiatives, including a COTS control program by local villagers and dive clubs.

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IMPACT OF THE 1998 EL NIÑO EVENT

Indonesia

No bleaching was reported for Indonesia during the 1987-88 or 1991-92 events, which were severe elsewhere in the world. During the 1998 bleaching event, however, there was moderate to severe damage reported from number of sites throughout Indonesia. In early 1998, bleaching was first observed in west Sumatra centred on the Mentawi Islands, which resulted in over 90% mortality. Towards mid 1998, bleaching occurred at several sites: North Sulawesi; Togian and Banggai Islands; Taka Bone Rate and Lombok Islands; Bali;

REEFS AT RISK IN SOUTHEAST ASIA

The coral reefs of Southeast Asia are severely threatened, however, there is insufficient specific information on the status and nature of threats to specific reef areas for effective decision making to conserve coastal resources. The *Reefs at Risk* project has developed standardised indicators to raise awareness about specific threats to coral reefs and highlight the linkages between human activities and coral reef condition. The World Resources Institute and 20 other partner institutions consolidated available information on the location, status and protection of coral reefs across the region, and estimated threats from human activities. The project developed standardized indicators of threats from coastal development, marine-based pollution, watershed-based pollution and sedimentation, over-fishing and destructive fishing in Southeast Asia. Coral reef area and threats were estimated to compare the sustainable economic value of healthy reefs and the losses from damaging activities. The key findings, maps of threats to coral reefs, and downloadable GIS data sets, are at www.wri.org/reefsatrisk.

Biological Endowment: Southeast Asia has nearly 100,000km² of coral reefs (34% of the world total) with the world's highest marine biodiversity (over 600 hard coral species). This is also the global center of biodiversity for coral reef fishes, molluscs, and crustaceans, mangroves and seagrasses.

Threats to Coral Reefs: Population growth, associated development, and resource demands are threatening the coastal resources of Southeast Asia, via over-exploitation and degradation of many coral reefs, particularly those near the cities. The main threats are as follows:

Coastal Development: Dredging, landfilling, mining of sand and coral, coastal construction, and discharge of sewage threaten 25% of the coral reefs at medium to high threat. Reefs of Singapore, Vietnam, Taiwan, the Philippines, and Japan are the most threatened by coastal development, each with over 40% at medium or high threat;

Marine-based Pollution: Pollution from ports, oil spills and leakage, ballast and bilge discharge, and dumping from ships threaten 7% of the coral reefs, with Japan and Taiwan having the highest threats at 15%. Cambodia and Singapore have few coral reefs, but most of these are threatened (medium or higher) by marine pollution (30 and 100%, respectively);

Sediment and Pollution from Inland Sources: Over 20% of coral reefs are at risk from land-based sediment and pollution. Many reefs in Vietnam, Taiwan, and the Philippines are threatened by sedimentation - 50% threatened in Vietnam and Taiwan and 35% in the Philippines;

Over-fishing: This is the most pervasive threat and 64% of coral reefs are at risk (medium threat or higher) from over-fishing, with 20% at high risk. In most countries, more than 50% of reefs are threatened by over-fishing. Cambodia, Japan, and the Philippines have even higher pressures from over-fishing, with over 70% of their reefs threatened and over 35% at high risk;

Destructive Fishing: Over 55% of the coral reefs are at risk from destructive fishing practices. Poison fishing for the live reef fish trade targets the most pristine and isolated coral reefs, where observations are limited. The threat from destructive fishing is particularly high in the Spratly and Paracel Islands and in Vietnam. In the South

China Sea, almost all reefs are under medium threat from destructive fishing, and this is the only significant human threat. Over two thirds of reefs in the Philippines, Malaysia, and Taiwan as well as over 50% of the reefs in Indonesia are threatened by destructive fishing.

When these threats are aggregated, human activities threaten 88% of coral reefs in Southeast Asia, jeopardizing their biological and economic values. Nearly 50% of these reefs are under high or very high threat, with only 12% of reefs at low threat.

Coral Bleaching: Global climate change is an additional threat to coral reefs, which was not included due insufficient information on the most vulnerable areas for bleaching. Elevated sea surface temperatures are an important threat and have resulted in severe and frequent coral bleaching.

Economic Value: The value of the coral reefs in Southeast Asia is staggering e.g. sustainable coral reef fisheries are worth US\$2.4 billion per year. Coral reefs are vital for food security, employment, tourism, pharmaceutical research, and shoreline protection. The coral reefs of Indonesia and the Philippines provide annual economic benefits of US\$1.6 billion and US\$1.1 billion per year, respectively. However, over the next 20 years, blast fishing, over-fishing, and sedimentation could cost Indonesia and the Philippines more than US\$2.6 billion and US\$2.5 billion, respectively.

Management: Protection of coral reefs is inadequate in the region. The 646 MPAs cover only 8% of the coral reefs, and management effectiveness was determined for 332 MPAs. However, only 14% have effective management, 48% have partially effective management, and 38% have inadequate management.

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Riau; Seribu; and Karimunjawa Island. This resulted in live coral cover decreases between 30 and 90%. Recovery has been variable, however, for west Sumatra and Lombok Islands, live coral cover remained depressed at less than 10% cover, but in the Seribu islands, live coral cover has reached 40%.

Philippines

Recovery from the 1998 mass bleaching has been documented in Tubbataha. Mean live coral cover decreased by 19% after bleaching, but remained constant from 1999 to 2001. No immediate decline in fisheries after the bleaching event was seen. Fish biomass and density increased in 1999 and 2000 after the bleaching event and subsequently declined in 2001, accompanied by a drop in species richness. A two-year study at Danjungan Island, Negros Occidental where coral mortality was high in the first few months of the 1998 bleaching, showed that recovery of *Pavona clavus* was related to depth. The species recovered better in medium depths (12m) than in shallow water (6m).

REEFS AT RISK SUMMARY BY COUNTRY

| Country | Reef Area (sq. km.) | Reef Area as % of total in region | Percentage of Reefs by Threat Index | | | |
|---|------------------------|---|-------------------------------------|--------|------|-----------|
| | | | Low | Medium | High | Very High |
| Indonesia | 50,875 | 51.1% | 14% | 39% | 46% | 1% |
| Philippines | 25,819 | 25.9% | 2% | 27% | 63% | 7% |
| Spratly and Paracel Islands | 5,752 | 5.8% | 0% | 100% | 0% | 0% |
| Malaysia | 4,006 | 4.0% | 13% | 44% | 38% | 4% |
| India (Andaman & Nicobar Islands) | 3,995 | 4.0% | 45% | 53% | 2% | 0% |
| Japan | 2,602 | 2.6% | 22% | 38% | 37% | 3% |
| Thailand | 1,787 | 1.8% | 23% | 24% | 51% | 1% |
| Myanmar | 1,686 | 1.7% | 44% | 36% | 20% | 0% |
| Vietnam | 1,122 | 1.1% | 4% | 22% | 49% | 25% |
| China | 932 | 0.9% | 8% | 14% | 76% | 3% |
| Taiwan | 654 | 0.7% | 0% | 29% | 56% | 15% |
| Brunei Darussalam | 187 | 0.2% | 79% | 16% | 5% | 0% |
| Singapore | 54 | >0.1% | 0% | 0% | 100% | 0% |
| Cambodia | 42 | >0.1% | 0% | 0% | 90% | 10% |
| Regional total | 99,513 | 100.0% | 12% | 39% | 45% | 3% |

Source: *Reefs at Risk in Southeast Asia*, World Resources Institute, 2002.

Note: The analysis was performed on 1km resolution grid cells . Reef area estimates presented are summaries of grid cells of mapped coral reefs.

Thailand

The first extensive coral bleaching phenomenon in the Gulf of Thailand occurred in April-June 1998, and there were clear spatial variations in the extent of coral bleaching. Observed corals exhibited varied degrees of bleaching, and bleaching of coral recruits was observed at many sites. Bleaching was widespread on shallow reefs, however, certain coral communities on deeper pinnacles, such as Hin Luk Bat in Trad Province, approximately 10-15m in depth, showed no signs of bleaching. From long-term studies, *Acropora* and *Pocillopora damicornis* were severely affected. Several species of *Acropora* showed local extinction in certain locations, while *Goniopora* showed complete recovery after the bleaching event. Coral recovery in the inner Gulf of Thailand will require a longer period due to low coral recruitment. However, on the east and west coasts of the Gulf, large numbers of coral recruits, mainly *Pocillopora*, *Acropora*, *Fungia* and faviids are present.

Vietnam

The 1998 bleaching event resulted in bleaching of 37% of the coral colonies in the Con Dao islands. This was additional to the 10% of corals killed previously. The soft coral, *Simularia* and fire coral, *Millepora* were most affected with almost 100% and 83% of colonies bleached respectively. Hard corals that were most affected included *Porites* (57%), *Symphyllia* (42%), *Leptastrea* (40%), and *Acropora* (19%, many newly killed). Bleaching also caused decreased fish diversity especially among butterflyfishes, illustrating the relationship between reef fish and coral health. Surveys from 1998 to 2001 have indicated a slow recovery. In many places, coral bleaching exacerbated anthropogenic stresses and have resulted in continued reef decline since the El Niño event. Continued coral loss from sedimentation is evident in Ha Long Bay and the Cat Ba Islands. However, reefs of Binh Thuan and Ninh Thuan provinces, which are near an upwelling, recovered well. Recovery from bleaching was slow in the Con Dao islands, but restoration of fish density was better than elsewhere based on monitoring data from 1999 to 2001.

ANTHROPOGENIC THREATS TO CORAL REEF BIODIVERSITY

Indonesia

Human impacts, direct and indirect, are the greater threat than natural impacts. The major causes of coral reef degradation in Indonesia are blast and cyanide fishing, increased sedimentation, and sewage and industrial pollution. The majority of the human population is concentrated in the coastal area. Rapid economic development, particularly around major population centres results in large amounts of sewage and industrial pollution, causing the decline of many reef areas especially those near growing cities such as Jakarta, Ambon and Ujung Pandang. Two coral species of the Genus *Montipora* used to occur in Jakarta Bay, but not any more. Average live coral cover in Jakarta Bay is 2.5% and in Ambon Bay, 24.0%. Muro ami fishing (driving fish into set nets by bashing the corals) and blast fishing are considered the major factors contributing to physical damage of reefs. These fishing techniques break corals and damage the bottom habitat. At least two groups of fishers engage in blast fishing. Small-scale fishers use self-made bombs from fertiliser to blast small areas in shallow reefs near their homes. There are however, medium to large-scale fishers using stronger blast devices with detonators. They fish in remote areas (about 7 to 10-day trips), destroying vast areas of reef, from the reef slope to about 20m depth. They also use compressors to supply air to divers sent down to collect the fish. The demand for reef dwelling grouper and humphead (Napoleon) wrasse has risen dramatically over the past few years and Indonesia is now the largest supplier of live reef food-fish to the Asian market. It is estimated that more than 50% of the total wild-caught live reef fish are currently supplied to Hong Kong and Singapore. Cyanide is a broad-spectrum poison causing damage to the liver, intestine and reproductive organs of the fish and also causing extensive damage to corals. Blast and cyanide fishing have caused irreversible damage to many Indonesian reefs. These destructive fishing techniques continue throughout Indonesia. Some of the traditional fishing methods may have also contributed to the degradation of marine resources. It becomes imperative therefore to introduce new, more environmental-friendly fishing techniques as part of the management of a sustainable coastal fishery. Lift net fishing 'Rompong' and hand line fishing are currently considered non-threatening to demersal and sedentary marine

A GOVERNMENT-NGO PARTNERSHIP IN KOMODO, INDONESIA

In 2000, at the International Coral Reef Symposium in Bali, the director of marine activities at the Indonesian Institute of Sciences proclaimed that Indonesia was losing between 3 and 6% of their coral reefs per year. These are the reefs that are the most diverse aquatic ecosystem in the world. This was an alarm call to government. Much of the losses were due to over-exploitation and destructive fishing practices such as blast fishing. Unfortunately, there is no silver bullet magic solution, because over-exploitation and destructive fishing are caused by many different and widely varying factors. A lack of education, a lack of alternatives, and sometimes greed can turn a 'traditional' fisher into a blast fisher, and usually the local law enforcement agencies do not have the capacity to apprehend offenders. The increasing demand for fish and a lack of management results in too many fishers who catch more fish than nature can provide over the long-term. Fortunately, there are examples of conservation partnerships that are making a difference. In Komodo National Park, the Indonesian Park Authority is collaborating with The Nature Conservancy to implement a conservation program that has virtually stopped blast fishing throughout the 200,000ha Park, resulting in a clear increase of live coral cover. For example, in one of the most heavily damaged areas of the Park, the live hard coral cover increased from 13% to 22% between 1996 and 1998 and has since stabilised. Coral cover has increased significantly by 4% in 2 years averaged over 185 sampling sites. The partners have endorsed a zoning system that addresses over-exploitation, and is now being implemented. These results were achieved not by a silver bullet approach, but through a strategic combination of activities that focused on planning, policy-making, awareness raising, surveillance and community development. Dedicated staff and the formation of a growing conservation coalition, that includes the local people were the critical factors for the success of the program. The Park Authority and The Nature Conservancy are now working to establish an innovative financing mechanism to sustain this success and use this site as a model to show to other communities (see Komodo ICRAN Site). From Rili Djohani, The Nature Conservancy, Bali, Indonesia; rdjohani@attglobal.net or www.komodonationalpark.org

resources. Lift net is mainly used to catch squid and anchovies. 'Rompong' or fish aggregating devices are made from palm leaves and bamboo rafts anchored in deep water, which attract pelagic fish. These fishing methods have already been established among reef fishing coastal communities to catch Spanish mackerel and tuna and therefore shift fishing pressure away from coral reefs.

Philippines

Over-fishing and destructive fishing (blasting and poisons) continue to top the list of anthropogenic impacts on Philippine coral reefs. Poaching (including the weakness of local communities and poor governance) and fishing-related threats were identified as the worst threats to reefs in the Visayan Seas (particularly in protected areas). Sedimentation, tourism-related activities and crown-of-thorns starfish (COTS) infestations were next in rank. In the Sulu and Celebes Seas, destructive fishing, over-fishing, sedimentation, pollution and climate change were identified as the most common threats to coral reefs. The estimated threats

DETECTING BLAST FISHING

A system for detecting and monitoring underwater explosions is being developed as a tool for reef managers. A triangular array of hydrophones separated by 1m is linked to a computer that can accurately determine the direction of travel of the shock wave coming from a blast, and the origin of a blast can be pinpointed using two or more arrays. When this was tested in mid-2002, it could calculate the direction to within 0.2°, which is an accuracy of ±30m at a range of 10km. When a bomb goes off underwater, a high proportion of the chemical energy is converted into acoustic energy, which can be detected from a distance of at least 30km. The sensitivity and range of the system has been improved using algorithms that filter out background noise, particularly the tiny shock waves from nearby snapping shrimp. This tool can be used for real-time fisheries surveillance and enforcement, and particularly the monitoring of management projects aimed at preventing coastal communities from blast fishing. From: Simon Wilson and George Woodman, simon.wilson@adelphi-env.com

mapped in Reefs at Risk in Southeast Asia provide probably the most updated national picture of coastal development, marine-based pollution, over-fishing, destructive fishing and climate change impacts. However, the sedimentation map reflects a modelled risk, the impact of which may either have already occurred in the past, is happening now or is yet to occur. A large proportion of the impacts on Philippine reefs stem from the very high population density of the nation (and associated food and income requirements).

Thailand

The reefs support a variety of human activities that can be categorised into three main groups: tourism and recreation; fisheries-related uses; and other uses. A clear pattern of change in reef use is evident, as small-scale or traditional fisheries are gradually being replaced by tourism activities. Locals convert their fishing boats into tour boats and also collect shells for the souvenir trade. This is seen in several provinces, such as Trad, Surathani, Pang-Nga, and Trang. Tourism and recreational activities include diving, underwater photography, glass-bottom vessels, sea walkers, and sport fishing. Poorly managed tourism affects reefs through anchor damage, garbage accumulation, diver damage and wastewater discharge from coastal hotels and resorts. Live coral coverage on Nang-Yuan Island in Surathani, one of the most popular snorkelling sites has declined 17% within a 5-year period. Reefs close to beach resorts are used intensively for tourism-related activities. Chanthaburi, Rayong, Surathani, Phuket, Trang, and Krabi are the major provinces for reef-related recreation. Reefs in several localities such as Pattaya, Koh Samet, Koh Hae and Mu Koh Phi Phi group face the impact of conspicuously heavy tourism demand. Many localities are also facing a rapid and steady growth in tourism, with obvious increases in coral reef-related activities. A project to establish mooring buoys at reef sites in the Andaman Sea has successfully reduced anchor damage. Shell and ornamental fish collection with the use of chemicals is among the serious problems causing coral reef degradation in the Gulf and the Andaman Sea. Dynamite fishing is rarely observed, even at remote islands. Sedimentation and wastewater pollution associated with rapid coastal development are recent and increasingly severe problems in

PROYEK PESISIR, NORTH SULAWESI, INDONESIA

This is an area of exceptionally high biodiversity where, however, the coral reefs are being degraded by unsustainable human activities. Proyek Pesisir is a partnership between the U.S. Agency for International Development (USAID) and the Coastal Resources Center at the University of Rhode Island to implement community-based integrated coastal management to conserve the marine resources of a part of North Sulawesi. The first major activity was to create a marine sanctuary in Blongko, a small village of 1,250 people who depended on fishing for a living. The project used Apo Island in the Philippines as a model, and asked the community to collect data, identify a proper site, and develop a local ordinance to regulate fishing in the proposed protected area. The village government also received support from the regional and national governments to implement the ordinance. The sanctuary is now paying dividends for local villagers because of income from tourism. This model is now being replicated in the Likupang vicinity in North Sulawesi, where 18 local communities are initiating marine sanctuaries. These community efforts were given a major boost when the legislature of the Minahasa District passed a landmark law to support locally approved plans and village ordinances. This legal framework demonstrates an institutional commitment to uphold local regulations and assist communities that want to establish marine sanctuaries. Potentially 150 villages in the Minahasa District can benefit as they work to protect their coral reefs. The process has been assisted by publishing a number of manuals in Indonesian (Bahasa), including a monitoring manual, a guide for organising community controls the crown-of-thorns starfish, and a manual on establishing community-based marine sanctuaries is planned. Contacts: Lynne Hale, lzahale@gso.uri.edu; Richard Volk, rvolk@USAID.gov

many provinces along the coastline. Jetty construction in several locations, especially in the west coast of the Gulf of Thailand, resulted in coral reef and seagrass degradation.

Vietnam

These coral reefs continue to be stressed by a variety of threats, particularly in high human population areas. From interviews conducted in early 1999, over-fishing and the decline in marine resources were cited as problems in all of the 29 provinces surveyed. Local communities identified destructive fishing as a problem in 21 of 29 provinces. Poison fishing for the live food fish and ornamental trades is particularly acute in the northern and central parts of Vietnam even around Con Dao National Park. Illegal trade and collection of endangered species is still largely uncontrolled. A strong correlation exists between reef quality and distance from human developments. The pristine reefs are generally the most remote. Almost all of Vietnam's reefs were reported as being threatened by human activities during the Reefs at Risk analysis, with 50% facing high threat and 17% at very high threat. Destructive fishing is the most pervasive and significant threat, with over 85% of the reefs at medium or high threat. Over-fishing threatens about half of Vietnam's reefs.

PUBLIC AWARENESS RAISING IN INDONESIA

A public communication program under COREMAP (Coral Reef Rehabilitation and Management Programme) has demonstrated positive results, although it has not reached the desired levels because of the vast expanse of Indonesia. Activities and materials were developed or supported as part of the public communication program and included television and radio messages, and a variety of outreach techniques such as special education programs, posters, stickers, campaign songs, billboards, children's games, exhibitions, field guides to coral reefs, newsletters, press releases, web sites, interpersonal contacts, entertainment-education events, community meetings and workshops. A communication impact evaluation conducted in the main COREMAP areas showed that 63% of the general public and 71% of coastal community residents were aware of the immediate need to save coral reefs. People more exposed to COREMAP outreach were more likely to recognise the serious issues and be able to participate in reef protection. They were also more aware of how reef destruction affects them personally. All COREMAP locations registered positive response from the public and coastal communities. COREMAP is useful in helping to reinforce the urgency of reef management and to support community-based resource management. These positive attitudes on the part of concerned communities should spread out to others over time. From Suharsono.

CURRENT MPAs AND CONSERVATION MANAGEMENT CAPACITY

Malaysia

More reefs are being managed and protected in East Malaysia in the last two years. The *de facto* marine park in the Semporna Islands is expected soon to be declared as a marine park under the management of Sabah Parks. Another group of islands in the northern part of Sabah in the Balabac Strait will be managed as the North Borneo Marine Managed Area. The Langkayan-Bilean Islands, off Sandakan in the east coast of Sabah, are now established as a conservation area under the Wildlife Conservation Act. Several coral reef areas in East Malaysia, particularly Sabah, were given international recognition. A team of experts from Indonesia, Malaysia, and Philippines under the auspices of the WWF Sulu-Sulawesi Marine Ecoregion Programme has identified three Priority Conservation Areas (PCAs), namely: Semporna-Tawi-Tawi Islands; Turtle Islands; and the Balabac Strait Islands (including Banggi-Balambangan Islands off Sabah). The two PCAs that were identified were proposed to the World Heritage Area Workshop in Hanoi in March 2002 for consideration for WHA listing; Semporna Islands (and the Tawi-Tawi Island chain) and the North Borneo-Balabac Islands were ranked with high priority.

Philippines

Conservation International and the Worldwide Fund for Nature have both conducted geographic priority-setting exercises for management/protection of Philippine marine biodiversity. Management is still clearly inadequate for the Spratly Islands, the Babuyan Channel, the Sulu Archipelago and the San Bernardino Strait. Community-based management, while sometimes very effective, continues to be successfully implemented only in very small areas. Management in conjunction with local government (including coastal law enforcement) continues to rapidly gain ground but its conservation

CON DAO NATIONAL PARK, VIETNAM

The 14 islands of the Con Dao Archipelago are 220km offshore, south of Vung Tau City and 60 km to the mouth of the Mekong river on mainland Vietnam near 8°40'N and 106°40'E. The National Park includes all the islands and surrounding waters with an overall area of 20,000 ha. Forest covers more than 80% of the islands and some forests are in pristine condition, especially the original humid hill forest growing above 500m. The Con Dao Islands are representative of the southeastern marine waters of Vietnam and are close to the centre of marine biodiversity of the Indo-West Pacific Region. The shallow waters of the archipelago include 1000ha of coral reefs, over 200ha of seagrass beds and some mangroves. The ocean currents favour the great diversity of marine biota in the archipelago, such that the species list includes 200 hard corals, 202 fishes, 130 polychaetes, 110 crustaceans, 46 echinoderms, and 153 molluscs. There are also populations of rare species such as the dugong and hawksbill and green turtles, and 17 beaches in the park are nesting sites of marine turtles, with 4 of these having thousands of nesting turtles annually. Con Dao National Park is one of the most pristine natural areas in the country, and has significant values for conservation and eco-tourism activities such as snorkelling, scuba diving, catch-release sport fishing, and nature viewing.

The Management Unit of the Con Dao Special Use Forest focused largely on forest protection from 1984 to 1993. Since 1993, management activities were expanded to cover the marine environment and protection and patrolling form the bulk of the marine activities. Con Dao National Park is considered as the best marine reserve in Vietnam with effective regulations to protect marine ecosystems, limit fishing activities, and prohibit destructive fishing. The Park's staff have implemented a marine turtle rescue program with the support of WWF. Recently, a marine zoning plan was developed based on the biological assessments by scientific institutions and was approved with the cooperation of the district government. Coral reef monitoring since 1998 has provided information to improve understanding of reef changes after the coral bleaching and for formulating management plans. The success of the Con Dao National Park is a good lesson for developing more marine protected areas in Vietnam. From Vo Si Tuan.

effectiveness is not yet evident from the reef data. A new and relevant legislation is the Wildlife Resources Conservation and Protection Act of 2001 (Republic Act 9147) that aims to (a) conserve and protect wildlife species and their habitats to promote ecological balance and enhance biological diversity; (b) regulate the collection and trade of wildlife; (c) pursue, with due regard to the national interest, the Philippine commitment to international conventions, protection of wildlife and their habitats; and (d) initiate or support scientific studies on the conservation of biological diversity. The Coastal Environment Programme of the Department of Environment and Natural Resources (DENR) was institutionalised in 2002 as the Coastal and Marine Management Office.

There is a need to form alliances between individual and isolated protected areas and link them into larger national and international frameworks to address large-scale economic

and political forces beyond the protected area. The requirement for widespread replication must be addressed alongside the need for sustainability of human and financial resources. The Philippines does not yet have a nationally recognised national coral reef action plan. Reef monitoring still needs to be better coordinated to overcome uneven sampling distribution and unnecessary re-establishment of new transects (as opposed to re-sampling old transect sites). Some capacity for socio-economic assessments is available but not yet been used specifically for monitoring.

Singapore

There are no marine protected areas in Singapore. The Labrador Nature Park, a coastal park with a rocky shore and reef communities was gazetted in 2001. Many of the initiatives by non-government groups can be considered effective in contributing towards management within the limitations of the lack of government intervention. These efforts have raised public consciousness and government agencies responsible for development now direct more attention to reef protection.

Thailand

Close to 42% of Thailand's reefs lie within its 21 Marine National Parks and several Fisheries Sanctuaries. In addition, many islands are under the control of the Thai Royal Navy and bird nest concession holders, who strictly prohibit visitors. The reefs of these islands are in good condition as they serve essentially as protected areas. Over 50% of Thai coral reefs are under some form of protection. Many government and non-government institutions are involved in coral reef monitoring, and the monitoring methods used are the manta tow survey, line intercept transect, permanent quadrat, fish visual census, and Reef Check.

Coral reef management in Thailand rests on laws and regulations that apply to all coral reefs and additional measures applicable only to marine protected areas. In recent years, central agencies, provincial governments and the private sectors have undertaken non-regulatory action aimed at improving coral reef conditions through restoration, preventive measures and education. Several laws are used to protect coral reefs in Thailand, e.g. the Fisheries Law of 1947, the National Park Act of 1961, the Enhancement and Conservation of National Environmental Quality Act (NEQA) of 1975, etc. These regulations are mainly enforced by the Department of Fisheries (DOF) and Royal Forestry Department. There have been problems in enforcing coral reef protection regulations. A National Coral Reef Strategy was adopted by the cabinet in 1992. However, there were no signs of reversing coral reef degradation because the strategy did not function at the local level and it is under revision.

Vietnam

There are positive signs of the effectiveness of management in some locations, such as at Con Dao National Park and some of the tourist sites in Nha Trang Bay. In the Hon Mun Marine Protected Area pilot project, various agencies have initiated a programme among local island villagers and the recreational dive clubs of Nha Trang to control the crown-of-thorns starfish, which have increased in recent years.

GAPS IN MONITORING AND CONSERVATION CAPACITY

The importance and significance of monitoring are not fully appreciated by government agencies resulting in inadequate resources to support effective monitoring and data management. Many monitoring programs are not supported over a long term and the information derived lacks the foundation to support good management decisions. Monitoring data are also not analysed in a timely manner to be useful to management. Some countries lack reef monitoring capacity altogether. There are also obvious information gaps of coral reefs from Myanmar and Brunei Darussalam that need to be addressed to provide a more complete regional assessment.

The common problems associated with the lack of management capacity such as inadequate legislation, inadequate public education, inadequate manpower, limited financial support and agency conflicts all point to the political unwillingness to invest in the management of coral reefs for sustainable development. In most cases, there is a lack of a national or provincial policy on coral reefs.

In Thailand for example, most of its coral reefs are being used for ecotourism. Lessons learnt from the past showed very obviously that protection measures against reef degradation were mostly delayed. In order to avoid or minimise coral reef degradation in the future, a more effective action plan is absolutely required. Public awareness and participation are also important for coral reef conservation, and they require long-term support from several agencies.

CONCLUSIONS AND RECOMMENDATIONS

The disparity in reef monitoring capacity among the region's countries has to be addressed, and the present level of monitoring enhanced to make monitoring more relevant and useful to management. Monitoring must be long-term to avoid the decisions based on short-term and temporary phenomena. Efforts should be increased to ensure that reef monitoring data are analysed and presented quickly to influence policy responses for reef conservation. In addition, better policy actions can lead to enhanced monitoring. The Philippines is developing a quality control certification process to assist in reef management, which is also linked to funding from the government. Scientists must also be responsible for giving proper interpretation of reef monitoring data to prevent sending misleading messages to the public, which may lead to further deterioration of reefs.

A review of different management regimes which have proven effective in conserving or protecting reefs should be conducted and publicised, as these will serve as effective learning lessons that can be replicated across the region to suit different localised conditions and settings. A clear expansion of such efforts will help to increase management of more reefs and help to alter the trend of degradation. This will help governments realise and appreciate the full economic benefits that can be derived from well managed reefs. The coral reefs of the Philippines for example, are estimated to have a potential sustainable economic value of approximately US\$9 billion (net present value) and net annual benefits of US\$1 billion per year.

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LOCAL COMMITMENT TO CONSERVATION: A PHILIPPINE SUCCESS STORY

The Danjungan Island Marine Reserve in Negros, Philippines was awarded the '2002 Best Managed Reef Award' by the Philippine Council for Aquatic and Marine Research. In 1994, the community near Danjungan Island, Barangay Bulata, was suffering increasing poverty because their marine resources were deteriorating, and fish catches were declining due to over- and destructive fishing. A local NGO was established to acquire and manage the island in partnership with Coral Cay Conservation Ltd. and the World Land Trust. The community, with help from the NGOs, developed short-term and long-term projects to conserve the environment. They set up their own self-governing organisations, developed alternative livelihoods, and encouraged conservation through education and awareness raising. They held marine camps for the youth, had shore clean-ups, and planted mangroves, with the goal of developing a conservation ethic in the community. Fishers were trained in mud-crab farming and pig raising, and the community participated in fish catch monitoring and underwater surveying of corals and fish. The best indicators of a successful marine reserve are committed and satisfied communities; and this success has triggered curiosity in neighbouring villages who want to establish their own marine reserves. These community-based management processes may not be perfect, but each one nurtures change, transforms attitudes and paves the way for long-term ecological benefit and sustainability. From: Kristin Sherwood, James Cook University, Australia, kristin.sherwood@jcu.edu.au; and Philippine Reef and Rainforest Conservation Foundation, Negros Occidental, Philippines prrcfi@mozcom.com

ICRAN

BUNAKEN NATIONAL PARK, INDONESIA – ICRAN DEMONSTRATION SITE

Bunaken National Park is on the northern tip of Sulawesi Island in Indonesia. Designated in 1991, it covers 900km² of diverse reefs and particularly large mangrove forests. The park focuses on the promotion of ecotourism and is exclusively financed through user fees, and managed by the Bunaken National Park Management Advisory Board, with advice from local communities, NGOs, academia and dive operators. A management plan and marine zoning plan was created for the park using a consultative process. The park management is currently involved in improving garbage and sewage management, improving enforcement and surveillance, promoting sustainable use of the park’s resources, and researching alternative income opportunities.

Ecological Monitoring: The Bunaken National Park Office has monitored reefs for the last 5-6 years, and management is interested in conducting further training on coral identification, monitoring and mapping

Socio-economic Monitoring: There has been some monitoring of villager income.

Monitoring Effectiveness: There is a need for additional benthic, fish and spawning site monitoring.

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Coral reefs are **60%** of the natural resources.
Ecological Monitoring is **occasional**.
Socio-economic Monitoring is **occasional**.

ICRAN

WHS

MAB

KOMODO NATIONAL PARK, INDONESIA – ICRAN DEMONSTRATION SITE

Komodo National Park, between the islands of Sumbawa and Flores in the Lesser Sunda Islands of Indonesia, is a site of both terrestrial and marine significance. It encompasses a number of islands, the largest of which are Komodo (34,000ha) and Rinca (20,000ha). It is best known for the large endemic lizard, the Komodo dragon, but the reefs surrounding the islands also deserve special recognition. These waters are some of the richest in the world, possessing over 200 hard coral species, seagrasses, mangroves, manta rays, 16 species of cetaceans, turtles, and over 1000 species of fish. Nearly 113,500ha of surrounding waters are under the jurisdiction of the park.

Komodo National Park was established as a Biosphere Reserve by the United Nations in 1977, pronounced a National Park in 1980 and declared a World Heritage Site in 1991. A 25-year management plan was developed for the park in 1995 by the Directorate General of Forest Protection and The Nature Conservancy. The goal management was a well-managed, self-sustaining park i.e. effectively protecting the biodiversity in the park, enhancing fisheries around the Park, maximizing benefits to the local communities, and ensuring the use of park's resources for tourism and education in a sustainable way.

The park is still threatened by over-exploitation of the natural resources and destructive fishing. In an effort to reduce these threats, managers of Komodo are planning comprehensive community outreach and conservation awareness campaigns, promotion of sustainable livelihood activities, a strong cross-sectoral patrolling and enforcement program, and ecotourism development.

Ecological Monitoring: The Nature Conservancy conducts monitoring every 2 years at 185 sites. Included in the monitoring schedule are coral and fish monitoring programs and monitoring of grouper and wrasse spawning aggregation sites.

Socio-economic Monitoring: The Nature Conservancy also conducts socio-economic studies and assessment.

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Coral reefs are 40% the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is effective.






ICRAN

APO ISLAND, PHILIPPINES – ICRAN DEMONSTRATION SITE

Apo Island is one of the earliest community-based marine reserves. Reef protection began informally when Silliman University initiated the Marine Conservation and Development Program in 1982. Three years later, the island community and the local council formally agreed to the establishment of a marine reserve surrounding the entire fringing coral reef of the island and a smaller (0.45km²) 'no take' fish sanctuary at the southern end of the island. The island is now protected under the municipal law and managed by the Marine Management Committee of the Apo Island community with support from the Municipal Government, the Department of Environment and Natural Resources and Silliman University.

The sanctuary is a renowned success story. Reef monitoring during the 1990s indicated that live coral cover and fish populations within the sanctuary have increased substantially. The biomass of large predators increased 8-fold in the reserve and mean density and species richness of large predators in fishing grounds also increased. To emphasize these results, the community testifies that their fish catch has increased and their fishing time has decreased since the establishment of fish sanctuary on the island. Apo Island's success was no easy battle. When reserve status was declared at a national level, Apo lost much of its hard won community management to government control. This meant that all the revenue collected from tourism in the fish sanctuary went straight into the government for 'planned' distribution to the community. The problem was recently settled and a 1.2-million Philippine peso (US\$24,000) fund was released to the island in 2001.

The community management committee also plans to improve quality of life on Apo and further improve management of the sanctuary. Increased tourism management is a primary objective, as unregulated numbers of snorkellers and divers and anchor damage from boats threaten the health of the reef. The committee also seeks to enhance alternative livelihood options, work towards financial sustainability and refine the current management plan.

Ecological Monitoring: A fish monitoring program is in place and Reef Check surveys have been undertaken since 1998. The major studies have been done by Silliman University.

Socio-economic Monitoring: A monitoring program that examines the impacts of tourism on the coral reef is planned to commence in 2003.

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Coral reefs are 70% of the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is planned.






ICRAN

MO KOH SURIN, THAILAND –ICRAN DEMONSTRATION SITE

Mo Koh Surin National Park is in the Andaman Sea, about 50km off of Thailand's west coast. The Surin Islands are the southerly extension of the Mergui Archipelago and are surrounded by extensive reefs, mangroves and seagrass beds. A population of sea gypsies inhabit the islands and are responsible for much of target species fishing. The primary resource users, however, are tourists and the Park fees, dive fees and boat permits contribute significantly to the Park budget. The Marine National Park Division and the Royal Forestry Department jointly manage the park. They developed a 5-year strategic plan, which ends in 2002, and contains zoning plans, mooring buoy installations, ranger patrols and reef closures. The strategic plan designed for Surin was also adopted by neighboring Similan Marine National Park. Institutions that are involved in research and planning for the marine park include regional universities, Marine National Parks, Phuket Marine Biological Center, Office of Environmental Planning, Chulalongkorn University and the Phang-Nga Province. The site is currently under consideration for World Heritage status.

With the help of ICRAN, there is the intention of revising the management to include zoning, maintaining mooring buoys, conducting legislation and enforcement training, and providing decision support analysis. Plans are also in progress to improve tourism and public awareness, build local capacity and evaluate program success.

Ecological Monitoring: The Phuket Marine Biological Center and Reef Check are responsible for much of the ecological monitoring in Surin. Current research priorities include updating reef data, reef mapping, carrying capacity and biodiversity research.

Socio-economic Monitoring: There has been socio-economic evaluation of indigenous sea gypsy livelihood, but there are no established monitoring programs.

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Coral reefs are 60% of the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is planned.

WHS

RAMSAR

TUBBATAHA REEF MARINE PARK, PHILIPPINES – WORLD HERITAGE SITE

The Tubbataha Reef National Marine Park consists of two uninhabited coral atolls in the Sulu Sea, 150km southeast of Puerto Princesa City, Palawan. The coral reef biodiversity is outstanding, which makes this location important ecologically as well as a popular site with divers. The park covers 33,200ha and has many species: 372 corals; 417 fish; 6 sharks; 7 seagrasses; 79 algae; and 6 cetaceans. The islets are nesting sites for sea birds and marine turtles. Despite being remote, the Tubbataha reefs deteriorated in the late 1980s because of destructive fishing by local and migrant fishermen from the South and Central Philippines, Taiwan and China. Although fishing was limited by the monsoons, living coral on the reef-flats decreased by 24% in 5 years. The introduction of seaweed farming in 1989 and El Niño bleaching in 1998 also damaged the reefs. The Tubbataha Reef Strategic Environmental Plan is managed by the Palawan Council for Sustainable Development, and technical assistance is provided by research institutions and NGOs, with financial support from the government, external grants, and user fees.

Long-term collaboration by the stakeholders reversed the damage from illegal fishing, anchors, and collection of marine animals. Dedicated NGOs conducted research, installed mooring buoys, and built field stations, and now are 'responsible' for park management, in association with the Philippine government. Tubbataha is the only MPA in the Philippines where the Philippine Navy routinely patrols the park and the Philippine Coast Guard controls illegal fishing. Private tourism operators assist in law enforcement and management decision-making. This strong collaboration between government, NGOs, and the private sector is critical for the conservation of this valuable marine resource.

Ecological Monitoring: There has been annual ecological monitoring since 1997 by WWF-Philippines. Rangers collect data on water temperature, rainfall and coral populations. Training on seabird censuses for the rangers is scheduled for 2003. Ecological monitoring is substantial and included in the annual and financial plans of the management board.

Socio-economic Monitoring: The Tubbataha Management Plan stipulates socio-economic monitoring in the areas surrounding Tubbataha, including sustainable resource management initiatives on Cagayancillo island, 80 nautical miles northeast of Tubbataha, which has political jurisdiction over the Park. Information, education and communication activities have strengthened local law enforcement, developed training packages, and established a micro-credit facility; all in partnership with the local government, which conducts socio-economic monitoring in partnership with WWF-Philippines.

Monitoring Effectiveness: Ecological monitoring has been effective in management decision-making. Baseline data were gathered in 1997 and used to compare with recent surveys. Socio-economic monitoring has identified the community interventions that are expected to improve the standard of living in Cagayancillo.

Coral reefs are 90% the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is effective.



WHS

UJUNG KULON, INDONESIA – WORLD HERITAGE SITE

This world heritage area is located in the extreme southwest tip of Java on the Indonesian Sunda Shelf. It includes the Ujung Kulon peninsula and several offshore islands, and it encompasses the natural reserve of Krakatoa. Ujong Kulon is the last stronghold of the rare Javan rhinoceros and is home to a variety of other endangered animals and plants. In addition to its terrestrial beauty and geological interest, the park contains an array of diverse and threatened coastal habitats.

In February 1992, the Ujung Kulon National Park complex and the Krakatoa Nature Reserve were declared a World Heritage Site under the authority of the Minister of Forestry. The terrestrial area of the park encompasses 76,214ha (Krakatoa Nature Reserve: 2,500ha) and the marine component contains 44,337ha. The coastal areas of the park include coral islands and their associated fringing reefs to the north, sand dune formations and areas of raised coral reef to the south, and the exposed west coast boasts extensive coral reefs and spectacular volcanic formations. The coral reef environments of the Ujung Kulon coast rank among the richest in Indonesia.

Management in the park is focused primarily on the terrestrial environment. The coastal environments, however, are under threat from siltation due to deforestation activities, oil pollution from passing tankers and overfishing. The managing bodies aim to strengthen coastal management by improving the capabilities of the guard force by provision of equipment such as radio communication and coastal patrol boats and implementing a buffer zone to reduce the effects of siltation.

Ecological Monitoring: No information received.

Socio-economic Monitoring: No information received.

Coral reefs are 10% the natural resources.

Ecological Monitoring is unknown.

Socio-economic Monitoring is unknown.

MAB**SIBERUT ISLAND, INDONESIA – MAN AND THE BIOSPHERE RESERVE**

Siberut Island, lying 130km off the western coast of Sumatra, is the home of Mentawai indigenous people and an ecosystem with remarkable conservation value. The Mentawaiian chain of islands has been separated from the mainland for around 500,000 years, allowing wildlife to evolve in isolation from that of the rest of Asia. The result is a high level of endemism, particularly among mammals. Siberut was declared a Man and Biosphere Reserve in the early 1980s in an attempt to preserve the region's unique wildlife and human culture.

Despite the island's biological prominence as a Biosphere Reserve, many elements of the ancient way of life of the Mentawai people have disappeared, due to the activities of missionaries and government officials, and through logging company involvement. A large part of the remaining mangrove forest in Siberut is not under any conservation management and coral reef fish are reported to be over-harvested. Thus the UNESCO Man and the Biosphere Reserve started a new program in 1998 to empower the indigenous people through participatory rural appraisal, training and promoting traditional knowledge of the use of natural resources.

Monitoring: A significant amount of both social and biological research occurs in Siberut, and current projects include research on marine resources along Saibi Sarabua (proposed as a marine recreation park), ecotourism development, and investigation of the empowerment of local communities in the sustainable use of medicinal plants. Coral reefs are indicated as habitats of special interest on the southern and eastern coasts of the island, but there is little long-term monitoring.

Coral reefs are 30% of the natural resources.

Ecological Monitoring is occasional.

Socio-economic Monitoring is occasional.


 MAB

PALAWAN, PHILIPPINES – MAN AND THE BIOSPHERE RESERVE

The Palawan Biosphere Reserve includes the entire Province of Palawan, in the Philippines, covering around 14 000km² and populated by 750,000 people. Palawan has 1,700 islands and islets, and was declared as a Biosphere Reserve, one of only two in the country, by UNESCO in 1991. Within its territory is the Tubbataha Reef which was listed as a World Heritage Area in 1994. The province has a unique and diverse fauna and flora and is known as a 'last ecological frontier'. Palawan has some of the best developed coral reefs in the country, with fringing and patch reefs along most of the coast and live coral cover reaching between 50 - 90% in some places. However, agriculture, fishing (especially with explosives and poisons), mineral extraction and offshore oil and natural gas, as well as tourism, threaten the environment.

In 1992, a 'Strategic Environmental Plan' for Palawan was adopted and through it an 'Environmentally Critical Areas Network' is being implemented. The Environmentally Critical Areas Network is a system of management zones graded from strictly protected to development areas. The terrestrial component has a core zone, a buffer zone (divided into a restricted, controlled and traditional use areas) and a multiple /manipulative use area. The coastal/marine component also has a core and multiple use zone.

Ecological Monitoring: Reef Check has been conducted in Palawan since 1997 and the Marine Science Institute of the University of the Philippines has included Palawan in their occasional nation wide surveys of coral reef health.

Socio-economic Monitoring: Rapid Rural Assessment (RRA) of the coastal areas of in Palawan is on going.

Coral reefs are 30% of the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is effective.

MAB**PUERTO GALERA, PHILIPPINES – MAN AND THE BIOSPHERE RESERVE**

The Puerto Galera Biosphere Reserve is in the central part of the Philippines on the island of Luzon, and contains both a terrestrial component and a substantial coastal and marine component. Coral reefs, seagrass beds and mangrove forests irregularly border the shoreline of Puerto Galera. The entire area is facing increasing pressure from growing numbers of both residents and visitors, as well as from rapidly expanding development. Deforestation and cutting of mangrove trees for fuel and housing material have substantially reduced the mangrove area. Coral reef and seagrass ecosystems are suffering from reduced water quality, unsustainable fishing and increased sedimentation and eutrophication. These are obvious indications that the status of Puerto Galera as a Biosphere reserve is being jeopardized.

Conservation measures have been undertaken at the national, local, and community levels in the Puerto Galera area, for example the establishment of a marine sanctuary and underwater nature trail in 1987. The majority of projects such as this, however, have met with limited success. These challenges necessitate a strong management plan if Puerto Galera is to survive as a Biosphere Reserve.

Ecological Monitoring: The Marine Science Institute of the University of the Philippines has maintained a biological station in the area and MAB interagency members have carried out inventory work and environmental monitoring. The status of the reefs is fair with an average of 31% live coral cover.

Socio-economic Monitoring: No information was provided

Coral reefs are 40% of the natural resources.

Ecological Monitoring is effective.

Socio-economic Monitoring is unknown.