

Coral Reefs in the Philippines

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With 44,000 sq km of coral reef surrounding its many islands and an ever-increasing population that depends heavily on fish for protein food, the damage being done to the Philippine reefs is of serious concern. Silting of the water (the result of erosion following forest clearing), modern fishing methods and the collecting mania all contribute to this. A long list of suitable areas for marine reserves has been compiled, and thanks to education programmes some communities are taking conservation measures for themselves.

The Philippines with its 7000 islands and 18,000-km coastline is estimated to have 44,000 sq km of coral reef to 80m of depth.²¹ Most of the small and medium-sized islands are bordered by fringing reefs – there is only one major barrier reef – but the larger islands lack coral where river inlets and estuaries inhibit reef growth through freshwater inundation, sedimentation and water turbidity. The diversity of reef corals, other invertebrates and fish is extremely high and over 400 species of hard coral have been described, which is comparable with the Great Barrier Reef in Australia.

Coral reefs are amongst the most productive marine ecosystems and many of their inhabitants have nutritional and other values for man. At a conservative estimate, reef-related fisheries make up 9 per cent of the world's total annual fish yield of 70 billion kilograms.²⁰ Coral reef fish catches represent about 10 per cent of the total recorded Philippine fisheries production,^{5,15} and possibly more since artisanal catches are not accurately recorded.¹ Estimates of coral reef fisheries productivity for the Philippines and west Sabah, Malaysia, suggest that if they were fully harvested at a sustainable level they would approach 20 per cent of the total.^{1,13} As it is, a large proportion of the population depends on coral reefs for their food and livelihood, and fish provide more than 54 per cent of the protein consumed in the country.¹⁹

Coral reefs are important in protecting the coastline and, although they suffer considerable damage from monsoon rains and typhoons, they still provide one of the most effective barriers to wave action which would otherwise cause soil erosion. Traditionally corals have been used as building materials, but this is now being discouraged. Current research continually reveals new reef species to contain medicinally useful compounds, and reefs are important ecosystems for scientists and students studying such processes as population dynamics, community interactions, species diversity and ecosystem stability.

Many reefs are still relatively pristine, despite being easily accessible, and are a major attraction for the rapidly developing tourist industry. Increasing numbers of diving and snorkelling tour operators cater for both wealthy Filipinos and foreign visitors.

Threats to Coral Reefs

The Philippine population of 49 million is increasing by about 3.7 per cent a year, and the population density of 412 per sq mile is nearly double the south-east Asian average. As 87 per cent of the population lives within 50km of the

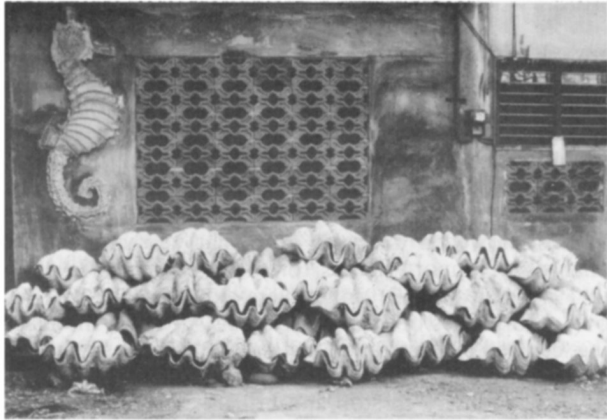
coast²¹ there is considerable pressure on the reefs. A survey by the Marine Sciences Center at the end of the 1970s⁸ revealed that more than half the reefs in the country are in stages of progressive destruction. In terms of live coral cover, 50 per cent of the reefs were described as being poor, 25 per cent as fair, 20 per cent as good and only 5 per cent as excellent; the poorest are those bordering the larger islands where the major cities are concentrated.

Many human activities are now known to damage coral reefs—for examples, see *Oryx* 15, 4. In the Philippines the most important are sedimentation, harmful fishing methods and direct exploitation. The greatest single threat is probably sedimentation resulting from unsound agricultural and forestry practices, mismanagement of watersheds, exploitation of mangroves, earth-moving for construction, oil drilling and the dumping of terrestrial mine tailings and effluents. Increased turbidity reduces the penetration of sunlight thus inhibiting photosynthesis in primary producers, including the symbiotic algae of coral polyps, which slows coral growth. Coral communities in deeper waters are at the margins of light penetration and may be the most sensitive. Sedimentation also smothers living coral and silt hinders the settlement of the planulae larvae.¹¹ Most siltation problems are a consequence of extensive deforestation leading to erosion and soil run-off. Timber is a major Philippine export and since the Second World War logging has greatly increased so that little undisturbed rain forest remains; in 1978 for example, commercial logging destroyed over 1000 sq km of primary forests.¹⁶

Use of Dynamite Still Common

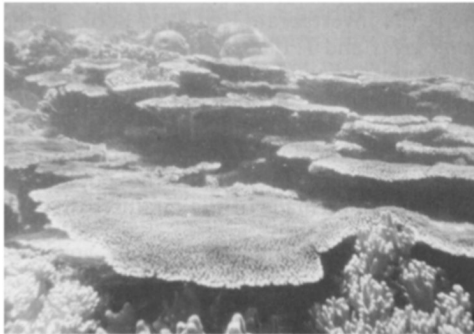
Many fishing methods cause considerable damage to reefs, especially the use of dynamite to stun or kill fish. This is now strictly illegal and of decreasing importance but is still common in remote areas, particularly around smaller islands far from law enforcement. Other common techniques are muro-ami and kayakas fishing, derived from traditional Japanese methods. Swimmers bang the bottom with poles (kayakas) and rocks (muro-ami) to scare the fish out into a net, disturbing the bottom habitat and breaking many corals, in spite of the fact that most of the species caught seem to be schooling types which could easily be scared by non-destructive noisemakers.^{6, 8} Judicious use of fish traps is legitimate and sound, but coral is frequently broken to make fish trap weights, abandoned traps continue to catch fish until they disintegrate, and large traps are often dropped on a reef ledge and retrieved by a line, smashing sizeable coral formations in the process. Bait and aquarium trade fishing often involves breaking off colonies of branching and foliose corals which are shaken in the boat to dislodge the fish, and some of the fish toxicants used (e.g. sodium cyanide) are detrimental to coral and other invertebrates. The aquarium trade concentrates on certain popular fish such as cleaner wrasses (Labridae) which have a particular ecological role in the reef community. A similar selective effect is caused by sport or traditional spearfishing for the larger, often territorial species, such as groupers (Serranidae), parrotfish (Scaridae) and acanthurids. Inshore reef fishermen normally use small- to medium-sized boats with anchors designed to hook corals or other substrates. The damage these do is very noticeable in popular fishing grounds and near coastal towns.²⁴ Increases in commercial trawling in the Philippines and declining stocks has led to an increase in reef-front trawling which damages large tracts of coral. The fine mesh nets catch many juveniles which probably further depletes stocks.¹⁸

Giant clams awaiting
export, Zamboanga,
Philippines
S. Wells



At least 30 years are required for a blast-damaged reef to recover to 50 per cent coral cover and reefs damaged by other fishing methods probably require similar recovery times. After ten years seriously disturbed reefs tend to be covered with a profusion of colonial sea anemones, filamentous and coralline algae and soft corals which probably impede recolonization by stony corals.²

The massive slow-growing corals such as *Goniopora* and *Porites*, which form the basic structure of the reef, are increasingly used for public buildings, particularly for airports, hotels and restaurants, despite efforts to halt this. The ornamental coral trade uses the smaller branching corals which are equally important in terms of the habitat they provide for fish and invertebrates. Throughout the early 1970s the Philippines was by far the largest exporter of such corals: exports increased from just over 200 tonnes in 1969 to over 1800 tonnes in 1976, about 60 per cent destined for the US and the rest going to Japan and Europe.²² It is also the main exporter of ornamental shells, about 4000 tonnes being exported annually.²³ Fishermen started coral and shell collecting as a sideline to augment their meagre incomes but it became so profitable, with the rapid



above: Philippine coral reef with *Acropora* coral
A. White

right: Stony corals bleaching in the sun,
Mactan Islands, Philippines
S. Wells



growth of shell collecting as a hobby in the 1970s and the accompanying demand for bleached ornamental stony corals, that many gave up fishing altogether to concentrate on this new source of income.¹⁴

Coral Export Ban but Trade Continues

In 1977 mounting concern over the condition of the reefs led to a presidential decree prohibiting the gathering and/or export of stony corals. Official export figures showed a dramatic drop that year and ceased altogether in 1978 but analysis of import figures for other countries reveals that exports continued: in 1978 at least 962 tonnes were exported and in 1980 the US alone imported over 236 tonnes of Philippine corals. In 1981 the illegal trade was still flourishing, centred on Cebu and Mactan Island in the Visayas.²²

The size and diversity of businesses dependent on the coral trade makes it a difficult industry to stop and bribery is common, particularly in Cebu. For the ban to be fully effective it is essential that importing countries also impose controls. Corals were recently added to the US Lacey Act which prohibits imports of wildlife obtained illegally in the country of origin. This should have a major impact on the trade since the US is the main consumer. Public awareness campaigns are also needed to deter people from buying ornamental corals and to educate the Philippine people regarding the value of their coral resources.

Eventually it may be possible to devise long-term management plans for stony corals as has been done for precious corals in Hawaii.⁹ Some branching species appear to grow relatively fast²⁷ but others are so slow-growing that any form of harvesting would be unwise, and a total ban on coral exploitation is the only way to prevent excessive damage. Since a number of people are dependent, at least for part of their income, on the trade alternative employment such as some kind of mariculture should be considered.

Little is known about the effects of exploiting molluscs. Some species can probably support a substantial harvest, but it appears that some of the more popular shells are becoming depleted in heavily collected areas.²³ The larger species of giant clam, Tridacnidae, have been overcollected in many areas of the Indo-Pacific and are to be listed in the IUCN Invertebrate Red Data Book. In the Philippines the largest species, *Tridacna gigas* and *T. derasa*, are now only found readily in the southernmost part of the country and in Palawan waters. The shell trade provides employment for large numbers of people but some form of control and management is required if shells are to continue to play a major role in the country's economy. The University of the Philippines is carrying out a market study of the shell trade, but research is needed on the population dynamics of some species so that estimates can be made of the numbers that can be safely collected.

Marine Reserves

Coral reefs will continue to play a major role in the Philippine economy and a strong marine park programme must be developed if representative areas of pristine reefs are to be preserved. Over the last 42 years an extensive catalogue of marine conservation areas has been made, covering marine, subtidal or coastal beach, reef, mangrove and estuarine areas. They include one Man and Biosphere reserve at Puerto Galera, Mindoro, designated in 1973; the Hundred Islands National Park, designated in 1940 and used as a beach park; Manila Bay Beach Resort National Park, designated in 1954; St Paul Subterranean Cave National

Park designated in 1971, and Sumilon Island, a marine park since 1974 and designated as a National Fish Sanctuary in 1980, as well as 44 sanctuaries and protected areas. In addition, a 1978 presidential proclamation declared many island and coastal areas reserved for tourism, implying conservation measures under the Philippine Tourism Authority.^{21,26,28} Active management occurs at only seven of the sites and none have been placed in the national park system within the Parks and Wildlife Division of the Bureau of Forest Development, in the Ministry of Natural Resources (MNR). This ministry provides no jurisdiction over marine areas and inevitably problems arise.

For example, the group of small islands that make up Hundred Islands National Park has picturesque beaches, but the underwater portion has not been protected and the reefs are now in poor condition. Manila Bay Beach Resort National Park consists of part of the foreshore of Manila Bay that is used for a variety of purposes, none of which coincide with the purposes of a national park.¹⁰ Of the sites designated as marine sanctuaries, the Turtle Islands in the Sulu Archipelago alone has self-imposed guidelines for protecting a few of the turtle egg-laying sites and, where biological stations occur, collecting marine organisms has sometimes had a deleterious effect. The Man and the Biosphere programme has done nothing towards implementing any kind of management plan at Puerto Galera where the reefs have deteriorated noticeably.³

The development of marine parks is the official responsibility of a Marine Parks Task Force in the Natural Resources Management Center (NRMC). Candidate sites are being surveyed and four have been selected for development: Sumilon Island (Cebu), Sombrero Island (Batangas), Apo Reef (between Mindoro and Palawan) and Balicasag (Bohol). Several surveys have been completed on Apo Reef to document the reef organisms and reef dimensions and to formulate plans for effective marine park management; this is to be managed by marine scientists from BFAR (Bureau of Fisheries and Aquatic Resources).

Involving Local People

Sumilon, a 23-ha island situated near the south-eastern tip of Cebu, has been successfully managed as a marine reserve since 1974 by Silliman University, in cooperation with the municipality of Oslob, Cebu, through the mayor and the town council.²⁵ This reserve provides a protected fish breeding ground for the island reef stock exploited by local fishermen using ecologically sound methods, a scientific research area, and a tourist diving and snorkelling park, and has done much to educate the public on coral reef ecosystems. In December 1980, Sumilon was declared a National Fish Sanctuary, a necessary step to insure the preservation of what is now the only established marine park in the Philippines.

In other areas education programmes, usually provided by extension workers, involving slide shows, informal discussion and filmed instruction, are helping local fishermen, village captains, and mayors to understand why marine resource management is desirable. Guindulman, a small town on the southern coast of Bohol, has taken on the responsibility of protecting nearby reef areas along a 5-km length of shoreline. All destructive activities are prohibited, and a no-fishing zone may be set aside as a fish breeding area. In Tagbilaran, on Bohol, an artificial reef of tyres for fish production has been built and recommendations put forward for preventing destructive fishing methods, coral extraction and bay pollution from sewage and boat discharges. Similar efforts are being made by local people at Apo, off Negros, and at Moalboal on Cebu.^{4,26}

Conclusion

In the Philippines, as in many countries, most traditional coastal management practices have disappeared leaving a haphazard assortment of approaches toward reef management and use. Fortunately, a few communities have recognized the problem of reef degradation and are adopting conservation methods based on both modern and traditional systems. One practice that is most successful involves a strictly protected area of reef, where nothing may be removed, with a surrounding buffer zone in which ecologically sound fishing methods are permitted.^{17,25} This basic reserve system, described as a municipal marine park,⁷ is simple and effective, providing a protected fish breeding ground, and fitting well with more traditional reef-tenure and community-resource use systems. Over recent years the fish catch on the unprotected side of Sumilon has increased, which suggests that the sanctuary is protecting a healthy breeding stock. Such reserves may play a vital role in the Philippines in providing breeding populations of commercial species that will recolonize exploited areas.^{1,12} Furthermore, the same reserves can generate income through the tourist industry, provided that tourists themselves do not damage the reefs they come to see and that legislation prohibiting activities such as spear fishing is effectively enforced. However, marine reserves are only a beginning in restoring health to isolated ecosystems. Greater attention must be paid to watershed management and the downstream effects of siltation on coral reefs.

Finally, the situation in the Philippines shows that conservation programmes are most effective when local communities understand their significance.²⁵ Education is more important than simply designating reserves, and it may be appropriate to combine the reserve concept with comprehensive educational programmes which reach both policy makers and rural people, so that a more balanced and participatory system can evolve.

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