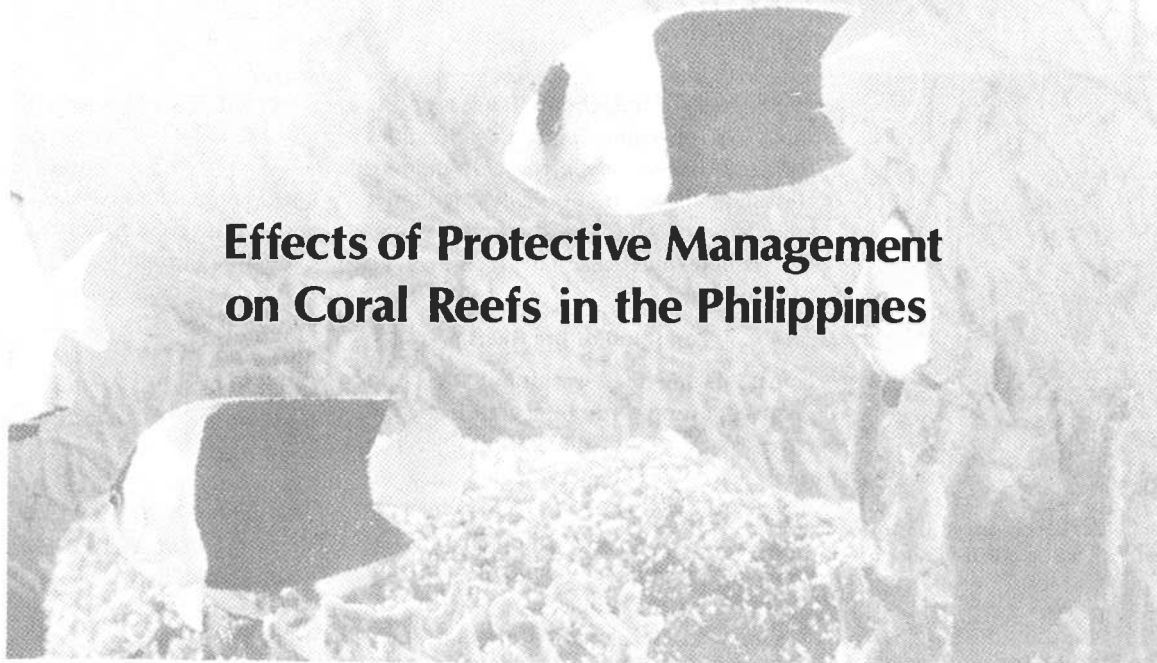


## Effects of Protective Management on Coral Reefs in the Philippines



**C**oral reefs rank among the most productive marine ecosystems. In view of the significant contributions of coral reefs to the productivity of coastal waters in Southeast Asia and the vulnerability of these ecosystems to increasing rates of degradation, there is an immediate need for rational management of these resources. The United Nations Environment Programme through the Regional Seas Programme for Southeast Asia has initiated a study of coral resources and the effects of pollutants and other destructive factors on coral communities and related fisheries in the east Asian seas.

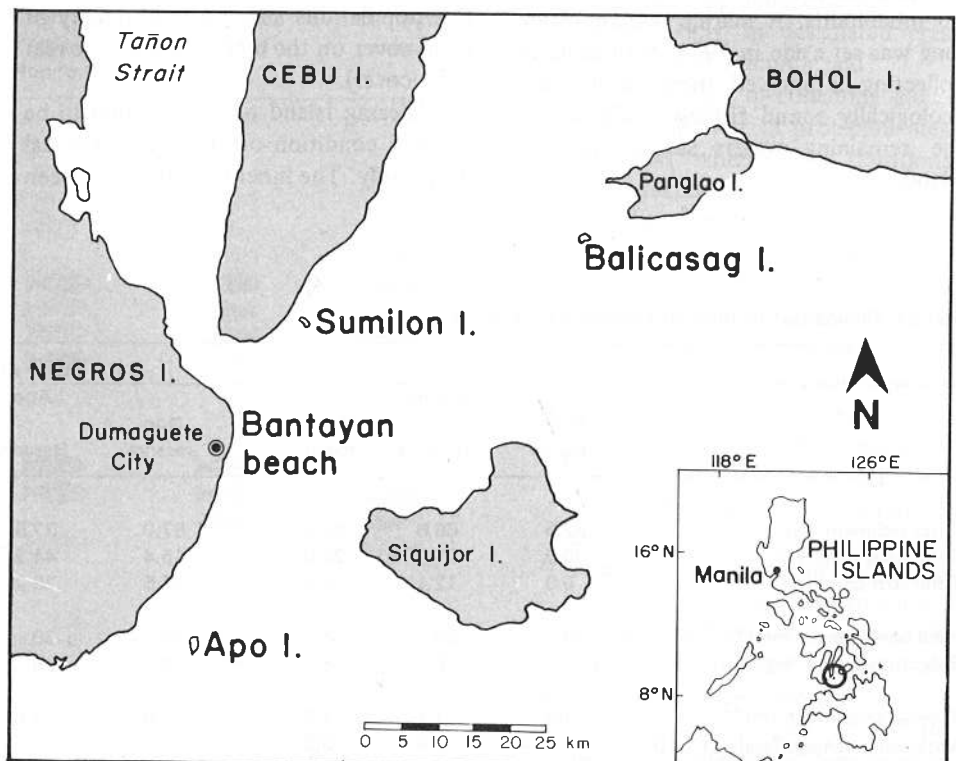
Silliman University Marine Laboratory in Dumaguete on Negros Island in the Philippines was selected to implement a component on the Effects of Fishing and Protective Management on Four Coral Reef Study Sites (see map). The goals for this study were to: a) identify options for marine reserve management and their advantages and disadvantages; b) quantify the environmental impact of marine reserves and their potential to augment reef longevity and fishery yields; c) assess the impact of fishing and reef-related activities on reef areas where some coastal management exists; and d) observe the problem of communicating and implementing the reserve concept from a community perspective. These goals were to be met by Phase I (this article) and Phase II (see p. 12) of the project.

### ALAN WHITE

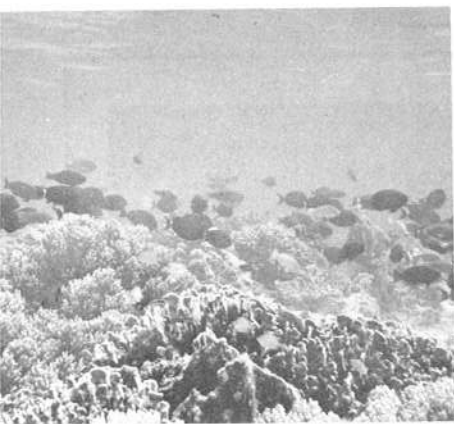
Research Associate  
Silliman University Marine Laboratory  
Dumaguete, Philippines  
Department of Geography  
University of Hawaii

There were three aspects of field data collection in Phase I. The reef environment was monitored qualitatively and quantitatively by means of transects,

point quarter sampling and systematic snorkeling. The people who utilize and/or manage the reef environment were interviewed and their general activities observed. The management scheme and the implementing organization(s) were documented. Observations had been made over a 3-year period but most data were collected during the 6-month project, July-December 1983.



The central Philippines, showing the study sites in the Protective Management Project—Apo Island, Bantayan Beach, Sumilon Island and Balicasag Island.



Alan White

School of surgeonfish (acanthurids) on the shallow reef flat of the protected side of Sumilon Island.

### The Study Sites

Apo Island is 72 ha in area with 900 inhabitants. There are some 80-100 fishermen, using hand lines, bamboo traps, gill nets and spearguns. Reef area is about 1.50 km<sup>2</sup>. A small portion was set aside as a reserve in 1982 but some fishermen have continued to fish there.

Bantayan Beach is a heavily used area, some 2 km long with no effective regulation. The reef just offshore is deteriorating in the face of human use in this densely populated area.

Sumilon Island covers 23 ha. There are no inhabitants. A marine reserve 750-m long was set aside in 1974. No fishing or collecting is allowed there, while only ecologically sound fishing is allowed in the remaining waters surrounding the island.

Balicasag Island, about 30 ha, supports some 600 persons, and most families fish and collect shells for a livelihood. Outsiders have traditionally exploited and damaged the reef through destructive fishing practices. The reef may be deteriorating.

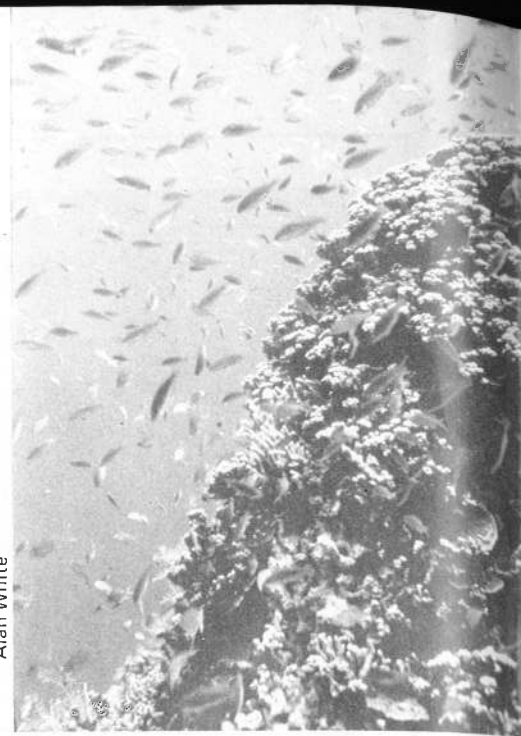
### Condition of the Reefs

Apo Island reef was found to be in good condition with an overall live coral cover of 32% and only 6% rubble. The small, two-year old, protected area on the southeast side of Apo which is sporadically enforced, is topographically varied and aesthetically pleasing with 44% live coral and 9% rubble.

Bantayan Beach has been well documented for three consecutive years. The coral cover shows an average yearly decrease of 6.7% while sediment cover is increasing at 7.7% per year. Bantayan Beach is heavily populated and the reef is used by many people for fishing, spearing, reef gleaning and walking, boat anchoring and various forms of recreation. The reef is under heavy stress and is threatened with extinction within five to ten years if present trends continue.

Sumilon Island reef has been protected on the western side since 1974. This area is notable for its dense and diverse fish populations and the good quality of coral cover on the reef crest and fore reef (45% cover).

Balicasag Island reef was found to be in good condition on the deeper vertical drops only. The inner reef flats have been



Alan White

Dense fish on the Balicasag reef drop-off.

damaged by destructive fishing and the presence of boats. The average coral cover of 21% reflects this destruction and indicates the consequence of neglect to a potentially rich coral reef when overexploited. This site has been recommended for a national marine park and is frequented by scuba divers because of its impressive vertical walls, gorgonian corals and some large fish.

Table 1 compares the transect data collected for each site. Clearly, Apo Island reef has the highest coral cover and topographic index, especially in the reserve area. Bantayan Beach has the lowest coral cover, reflecting the many

Table 1. Comparison of the four Philippine study areas.

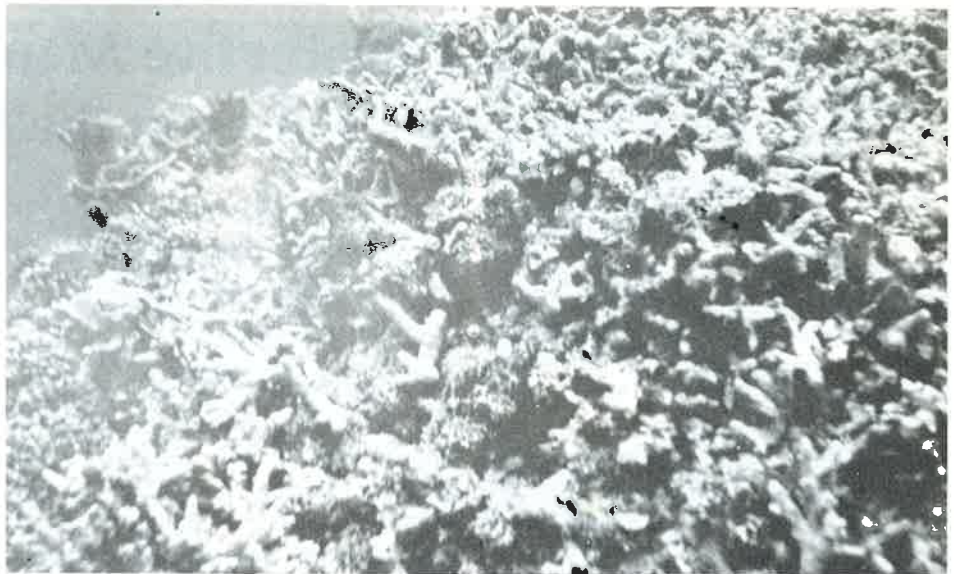
	Study sites							
	Non-reserve	Sumilon Reserve	Reef mean	Non-reserve	Apo Reserve	Reef mean	Balicasag Reef mean	Bantayan Reef mean
Total sediment (%)	62.5	66.6	64.6	57.0	37.5	47.3	67.5	81.1
Total hard coral (%)	30.7	21.2	26.0	15.4	44.2	29.8	21.2	17.6
Total soft coral (%)	6.0	12.1	9.0	27.5	18.2	22.8	11.3	1.3
Hard coral genera (no.)*	32	36	36	26	30	30	44	22
Soft coral genera (no.)	7	8	8	10	8	10	9	4
Topographic index (m)**	1.4	1.1	1.3	2.0	2.6	2.2	1.4	0.7
Noticeable damage (scale of 1-10)	4.7	2.9	3.8	—	—	—	—	5.6

\*Hard and soft coral genera numbers in the "reef mean" column actually reflect a reef total, not averages.

\*\*A measurement of degree of contour of the substrate (due to coral cover).

disturbances which influence the area. Coral genera diversity is highest in the Sumilon Island reserve.

Table 2 summarizes the impact and frequency of reef influences for these sites. The two sites, Balicasag and Bantayan, without active management are suffering most from detrimental fishing techniques. Balicasag is the only site where blast fishing is still known to occur. Bantayan Beach reef suffers from the intensity of small users who overfish the invertebrates and fish, and systematically break shallow coral by walking over the reef and anchoring small boats. In contrast, the two sites where management has begun via education and active protection have reef areas of very good quality. Education on Apo Island has effectively stopped most destructive fishing and a small reserve has begun, enforced by local residents. The intensive, but ecologically sound, fishing on the non-reserve area of Sumilon reef has not endangered the reserve and allows local fishermen to coexist with a strictly protected area nearby.



Broken branching coral on Bantayan reef from reef walking and gleaning at low tide by local residents.

### Recommendations

The results of the project have led to the following recommendations on reef fishing methods:

- blast fishing should be eradicated;
- muro-ami fishing should be limited

- to use of non-destructive noise-makers;
- bottom nets should not be dragged over coral reefs;
- only traditional spearfishing (not using scuba) should be allowed;
- reef gleaning and boat anchoring should be prohibited over shallow areas of fragile coral growth;
- fish traps should not be dropped over or on steep reef slopes;
- aquarium fish collecting should be allowed only in designated areas for regulated amounts; and
- tourist shelling or collecting should not be allowed in protected areas or areas where only traditional fishing is encouraged.

Table 2. Impact and frequency of various factors affecting the coral reefs.

Reef influences	Apo Island (Non-reserve)	Sumilon Island (Non-reserve)	Balicasag Island	Bantayan Beach
<b>Fishing</b>				
Blasting			3 (Frequent)	
Muro-ami	2 (Occasional)	1 (Occasional)	3 (Frequent)	3 (Frequent)
Bottom nets				3 (Frequent)
Hook and line	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)
Spearfishing	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)
Gleaning	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)
Traps	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)
<b>Recreation</b>				
Scuba diving	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)
Snorkeling	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)
Spearfishing	2 (Occasional)		2 (Occasional)	2 (Occasional)
Collecting	2 (Occasional)		2 (Occasional)	2 (Occasional)
<b>Management</b>				
No destructive fishing	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)
Education	2 (Occasional)	2 (Occasional)	2 (Occasional)	2 (Occasional)

<p>Frequency:</p> <p>3 (Frequent)</p> <p>2 (Occasional)</p>	<p>Impact:</p> <p>3 (Negative)</p> <p>2 (Neutral)</p> <p>1 (Positive)</p>	<p>Implementation:</p> <p>2 (Enforced)</p> <p>1 (Partially enforced)</p>
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It is further suggested that:

- small reserves be implemented wherever good coral reefs still exist and where local people or communities are responsive and can benefit from such reserves;
- implementation of reserves be done through local users with initial aid from outside agencies at the provincial, national or international level;
- reserves incorporate the concept of a strictly protected core area and a buffer zone where only ecologically sound activities are allowed; and
- education using non-formal techniques be an integral part of any program either local, provincial or national to implement management/reserve areas.