Sumilon Island Reserve: 20 Years of Hopes and Frustration

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The year 1994 marks the 20th anniversary of the establishment of the Sumilon Island Marine Reserve in the central Philippines. It also marks almost 18 years of scientific research on this reserve. This makes Sumilon Reserve one of the oldest and most extensively studied marine reserves. It represents a symbol of the hopes and yet the frustrations of marine conservation. Over the 20 years, successive openings and closures of the reserve to fishers have provided unique opportunities to examine the effects of marine reserves on populations and communities of fishes and upon local fisheries. The history of the reserve also highlights the problems and frustrations of educating and convincing people of the need for rational management of renewable marine resources. Yet, it is a symbol of hope in that it has provided a unique example of the potential benefits of marine reserves in fisheries management, particularly in the developing world.

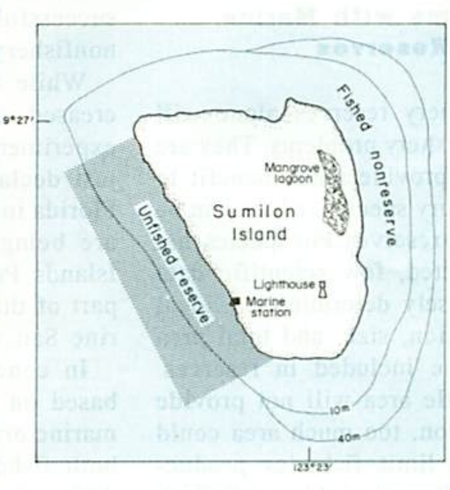


Fig. 1. ***Map of Sumilon Island, central Philippines, showing the reserve and nonreserve areas.***

Sumilon Island is a small coralline island about 2 km from the southern tip of the large island of Cebu in the central Philippines. Approximately 25% of the subtidal coral reef of Sumilon Island (total reef area to 40 m isobath = 0.5 km^2) has been "officially" protected from all forms of extractive exploitation since December 1974 (Fig. 1). The nonreserve area was regularly fished by about 100 small-scale fishers from Oslob and Santander, southern Cebu, using hook and line, gill nets, traps and spears.

Management History, 1974-1994

Sumilon Reserve was established in December 1974 under an Oslob Municipal Resolution (essentially a local government ordinance). This resolution was the result of an agreement reached between Silliman University (in Dumaguete City, Negros Island) and the Oslob Municipal Council (Oslob, Cebu Island). At the time of the initial negotiations, biologists and social scientists from the university spent considerable time convincing the residents of Oslob and Santander that benefits of increased fish yields may be expected in 3-5 years time. Silliman University established a caretaker on the island to ensure that no fishing occurred in the reserve area and to monitor fish yields from areas adjacent to the reserve (i.e., the rest of the island - see Fig.1). An investigation of the perceptions of the fishers regarding the functions of the reserve in 1976 demonstrated that many fishers were unclear of the purpose of the reserve. The research was misunderstood initially but by the late 1970s, many fishers were convinced that their yields had increased.

In February 1980, new mayors were elected to the towns of Oslob and

Outstanding coral formations in the Sumilon Island Reserve in 1983, after 10 years of protective management. **Photo by A. White**

Santander. Neither of these new mayors were supportive of the reserve and in early 1980 several serious fishing violations occurred in the reserve. The university made appeals to the national government. This resulted in Sumilon Reserve being declared the first nationally protected fish sanctuary in the Philippines under Bureau of Fisheries and Aquatic Resources (BFAR) Fisheries Administrative Order 128 Series of 1980. Under the order, BFAR, a national body, controlled the reserve and Silliman University administered protection and management and carried out research. The 1980 BFAR Order remains legal to the present day. This BFAR Order led to considerable resentment from many officials on Cebu, including the Governor and the mayors of Oslob and Santander. The resentment stemmed largely from the fact that Sumilon, a part of Cebu, was controlled by a national ordinance administered by a university on another island (Negros).

Fishing violations inside the reserve continued through 1983 until, in May 1984, very serious violations began. The caretaker was removed from the island in November 1984 (for his own safety) and throughout the rest of 1984 and 1985 the reserve was fished heavily, with techniques which included explosives and "muro-ami" drive net fishing. Destructive fishing techniques had ceased in the reserve by late 1985 and fishing probably stopped in the reserve as early as 1987 due to an ad hoc decision on the part of the Santander and Oslob municipal councils in anticipation of the possibility of building a tourist resort on the island.

All forms of fishing were banned from the whole island starting 28 February 1988 under a municipal ordinance of the Oslob city council. This ordinance protecting the whole island was extended until 1 January 1992, at which time the resort had been completed. Fishing was again permitted in the old nonreserve area from 1 January 1992 and the fishers returned, bringing with them more than 100 bamboo fish traps from the mainland. All forms of fishing except hook and line were banned in the old reserve area. There was, however, no effective policing of the fishing regulations in the reserve when the fishers returned to the island. In May 1992, a large fish corral was observed in the reserve. With such a corral, fish are driven into the large catch area of a fixed position trap in a "drive-net" system of fishing. In addition, bamboo fish traps were common throughout the reserve. The fish corral had been dismantled by December 1992 but fish traps have been seen often throughout the reserve area during visits to the island in 1992 and 1993. In addition, there have been frequent rumors of overseas tourists from the resort using SCUBA to spear fish in the reserve area during 1992 and 1993.

The Oslob Municipal Council has been unable to provide copies of the two municipal ordinances (the first closing the whole island to fishing in 1988, the second re-opening the nonreserve area of the island to fishing in 1992) to the first author despite a visit to the Oslob Municipal Offices in December 1993 and two written requests in early 1994. The official position of the Office of the Municipal Secretary of Oslob with respect to the reserve is that BFAR Fisheries Administrative Order (FAO) No. 128 of 1980 covers all municipal ordinances and has no expiry date.

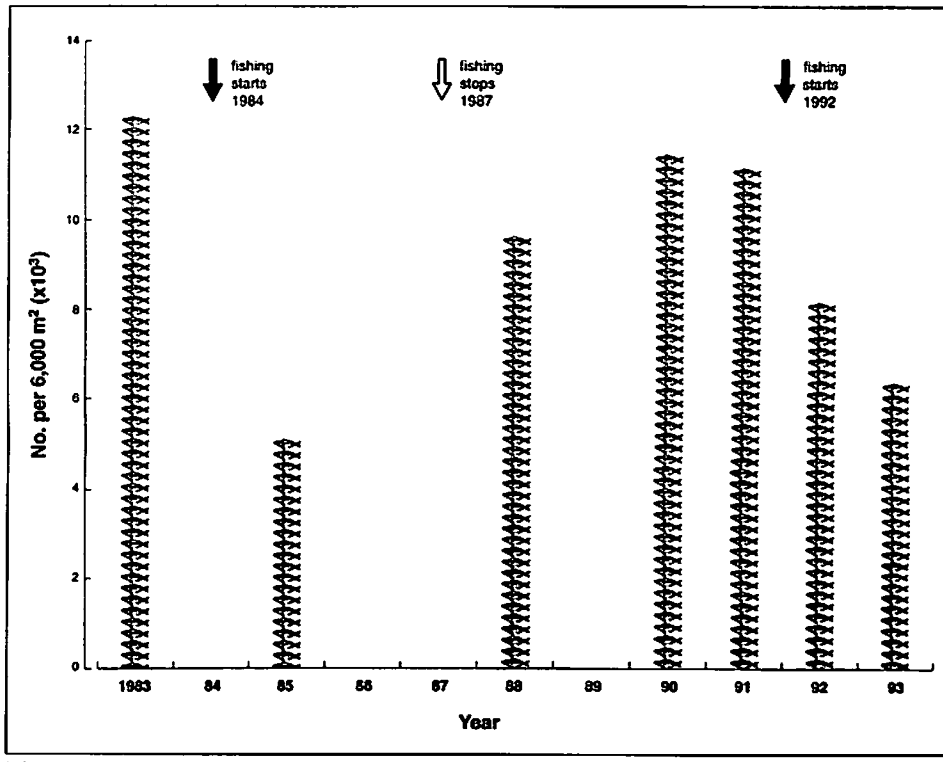


Fig. 2. ***Density of fusiliers (F. Caesionidae) in the Sumilon Marine Reserve, 1983-1993, as measured by a method of visual census. Censuses were made each December in seven separate years. The figure on the Y-axis is the estimated number of fish in six replicate 1,000 m^2 censuses. The censuses sampled almost half of the reserve in the depth range 2-17 m. The reserve had been protected from fishing for almost ten years in 1983. Filled arrows indicate when fishing began (1984, 1992) and the open arrow when fishing stopped (1987).***

Scientific Results, 1976-1993

Quantitative data on yields and catch-per-unit-effort (CPUE) by fishing gear were collected during seven separate years during the period 1976 to 1986. In addition, estimates of abundance of approximately 100 species of reef fishes in over 15 families were made inside and outside the reserve area (using a method of underwater visual census on SCUBA) in seven different years over the period 1983 to 1993. The visual census data demonstrated a *significant* reduction in abundance of the species of fishes which provided the majority of the yield from the reef, i.e., the fusiliers (Family Caesionidae, Fig. 2).

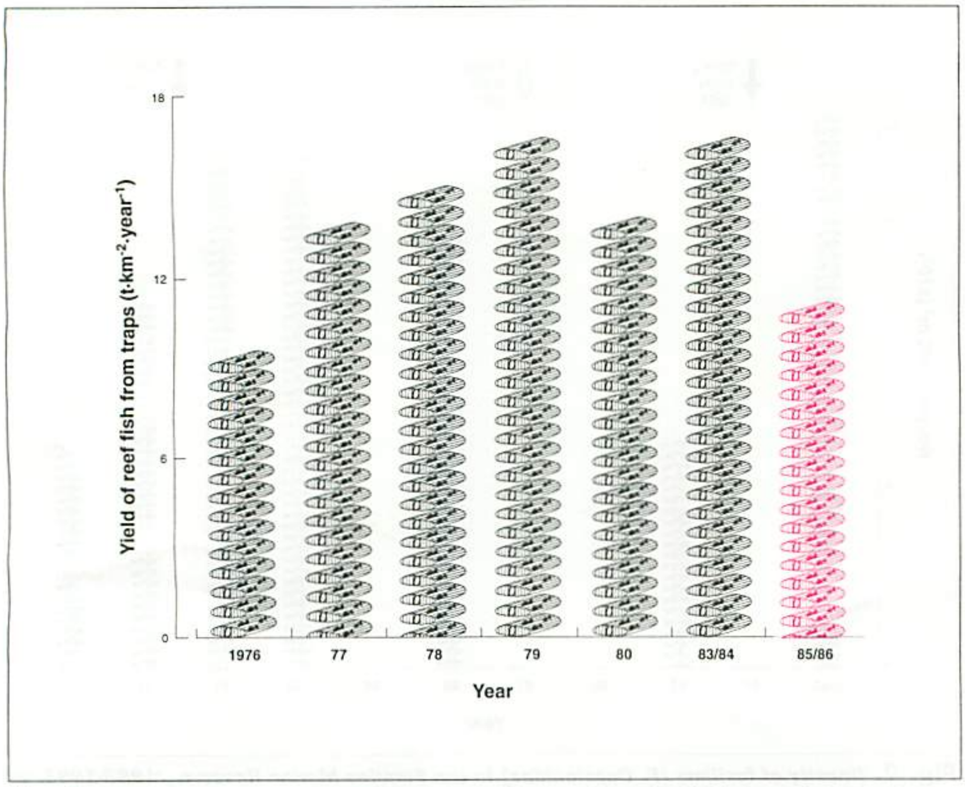


Fig. 3. ***Catch-per-unit effort (t/km^2/year) of fish traps (a major fishing gear) at Sumilon Island from 1976 to 1986.Catch rates showed a tendency to rise from 1976 to 1983 in the presence of the reserve. Yields were significantly lower after the reserve was heavily fished (1985-86) than when the reserve existed, despite the fact that the whole reef was open to fishing in 1985-86. Adapted from Fig. 4 of Alcala and Russ (1990).***

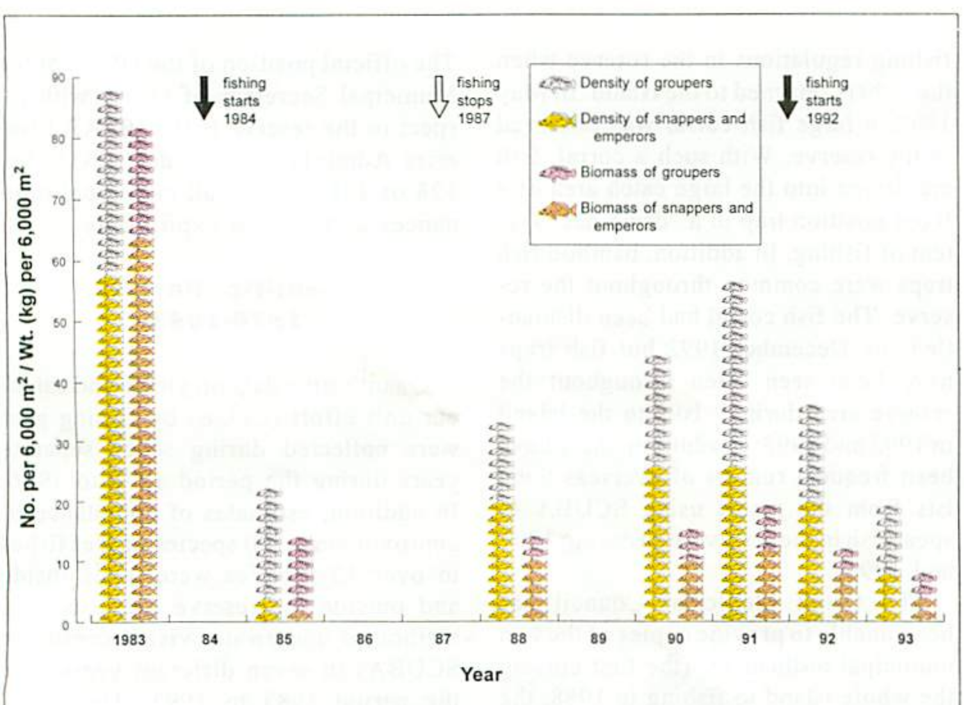
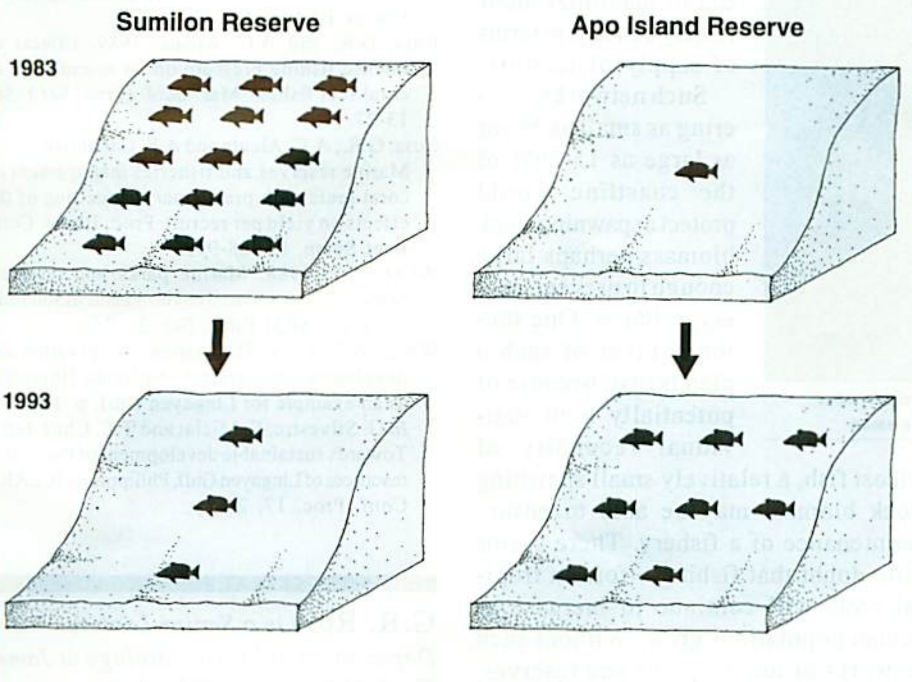


Fig. 4. ***Density and biomass of large predatory fish (Sub-F. Epinephelinae, F. Lutjanidae, F. Lethrinidae - groupers, tropical snappers and emperors, respectively) in the Sumilon Reserve, 1983-1993, as measured by a method of visual census. Biomass estimated from visual estimates of individual total length of each fish and length-weight relationships for a "typical" grouper, snapper and emperor. Remainder of caption as for Fig. 2.***

In addition, CPUE and total yield were significantly less from the entire reef after the reserve had been pulse fished (1985-86) than during the period when the reserve existed (1974-84) (Fig. 3). It was concluded that protective management maintained higher abundances of fishes in the reserve and significantly higher yields to fishers from areas adjacent to the reserve, due to movements of fish out of the reserve area.

The recovery and subsequent decline of reef fish populations were monitored regularly from 1988 to 1993. The fusiliers showed a strong recovery in density in the reserve from 1988 to 1991 (Fig. 2) during the complete ban on fishing. Fusiliers are generally relatively short-lived (2-5 years), fast-growing fishes. The strong recovery in density almost certainly represented an equally strong recovery of fusilier biomass in the reserve. Since fishing began again in 1992, the populations of fusiliers have declined in the reserve (Fig. 2). This has been due to the illegal fishing in the reserve, exacerbated by what appears to be a major failure in recruitment of the second most abundant species of fusilier at the island. Unfortunately, no CPUE or yield estimates could be made at the island in 1992 or 1993 so that there is no way of knowing what effect, if any, the buildup and subsequent decline of fusiliers in the reserve had on local fish yields.

Large predatory fishes (Sub-Family Epinephelinae, and Families Lutjanidae and Lethrinidae: groupers, tropical snappers and emperors, respectively) have never formed a large percentage of yield to small-scale fishers at Sumilon Island but they are very high priced and highly prized target groups. Thus, they are particularly good indicators of fishing pressure. Densities of large predators declined significantly between 1983 and 1985, showed a strong recovery from 1988 to 1991, dropped dramatically again in 1992 and by 1993 were lower than at any other time in the 10 years of monitoring (Fig. 4). The recovery in the period 1988-1991 was due in large part to a strong (somewhat fortuitous?) recruitment of groupers in 1991. However, unlike fusiliers, fishes like groupers, snappers and emperors are relatively long-lived (5 to 20 years) so that, unlike the situation in 1983 after 10 years of protection, the large numbers of



Mean density (number/1,000 m²) of large predatory fishes (groupers, snappers, emperors) in the Sumilon and Apo Marine Reserves in both 1983 and 1993. In 1983, Sumilon Reserve had been protected from fishing for almost 10 years, Apo Reserve for only one year. In 1993, Sumilon Reserve had been fished heavily on two occasions in the previous 10 years, Apo Reserve had been protected from fishing for almost 11 years. Density of large predators declined by a factor of almost 5 at Sumilon Reserve and increased by a factor of almost 8 at Apo Reserve between 1983 and 1993.

predatory fish in the reserve in 1990 and 1991 consisted mostly of small individuals of low individual biomass. Thus 4 to 5 years of protection resulted in what appeared to be a healthy recovery in density of large predatory fishes (Fig. 4). In reality, the recovery in terms of their biomass was not spectacular at all (Fig. 4). Marine reserves are established in many parts of the world with an objective of establishing and protecting spawning stock biomass of these large predatory fishes (because they are the favored targets of both professional and recreational fishers). The rationale is that the larvae of these fish will "seed" and assist fisheries in areas outside the reserves.

Lessons Learned from Sumilon Reserve

1. Education, community organization and community involvement are critical to the development and maintenance of successful marine reserves. If the local communities are not fully convinced of direct benefits of the reserve, they can easily be convinced to reject the concept, something that has happened twice at Sumilon. The history of management of Sumilon Reserve stands in stark contrast to the extremely successful establishment and management of marine reserves at other Philippine islands such as Apo and Pamilacan where the reserves are supported and managed by the local people (see Box). These people protect their reserves not because they are told to do so by an outsider but because they believe that the benefits (in terms of fisheries yields, tourism, etc.) are worth the effort of protecting the area. This point is demonstrated admirably by the Marine Conservation and Development Program (MCDP) of Silliman University, which has as its cornerstones education and community-based management of reserves.

2. The Sumilon Reserve study has shown that protection from fishing can lead to the establishment of very high densities and biomasses of fish of importance to local fisheries. The rates of build-up of fish biomass are species-specific and may be as short as a few years for short-lived fusiliers but as long as 10 years for long-lived groupers.

3. The study at Sumilon Island is the only one to have demonstrated, via a "natural experiment", enhanced fisheries yield to areas adjacent to a reserve. Many more studies, monitoring changes in fish biomass in protected and unprotected areas, and monitoring of CPUE and yields in areas adjacent to (and not adjacent to) marine reserves are required. If local yields can be enhanced, as shown at Sumilon, such benefits will be very important to ensure

A school of fusiliers (F. Caesionidae). Fusiliers constitute 65 to 75% of the total yield of fishes from Sumilon Island each year. PHOTO BY A. WHITE

One of the authors, Garry Russ, carrying out underwater visual census of coral reef fishes. PHOTO BY L. NEWMAN

maintenance of marine reserves for what is, as Jim Bohnsack (p. 4) says, their most important role in fisheries management - maintenance of a critical spawning stock biomass.

4. Most teleost fish are highly fecund and produce abundant larvae that disperse tens to hundreds of kilometers via ocean currents. In marine reserves, not only are there high densities of fish, but also the fish get a chance to live longer, grow bigger and become more fecund. Their larvae spread well outside marine reserves, supplying vital recruits to fished areas. Reserves thus can act as an insurance policy against fishery collapse by protecting a critical level of spawning stock biomass.

What Needs to be Done?

The Philippine situation is by no means atypical. Throughout the tropics, human populations are growing at an alarmingly high rate and stocks of reef fishes are probably reaching critically low levels even now. What is required are networks of marine parks and reserves spread over tropical island nations to act as an insurance policy against fishery collapse. These parks and reserves should range from large (i.e., thousands of square kilometers), nationally protected marine parks to the small (tens to hundreds of hectares) locally protected marine reserves. The larger marine parks should be placed up-current of fished areas to maximize their fishery benefits in terms of supply of recruits.

Such networks, covering as small as 5% or as large as 15-20% of the coastline would protect a spawning stock biomass perhaps large enough to prevent fishery collapse. One factor in favor of such a plan is that, because of potentially high individual fecundity of teleost fish, a relatively small spawning stock biomass may be able to ensure maintenance of a fishery. There seems little doubt that fishing effort on tropical reefs will continue to increase as human populations grow. Without such networks of marine parks and reserves, stocks will continue to decline, until, like many other stocks of fish in the world, they eventually collapse due to overfishing. If such networks can be established and maintained effectively, reef fisheries as we know them in the Philippines and elsewhere throughout the tropics will have a chance to survive. If the reef fisheries are saved by such an approach then the hopes engendered in the Sumilon Reserve story will have triumphed over the frustrations.

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Off The Deep End *Pongase*