

Monitoring changes in the benthic and fish community structure of Tubbataha Reefs Natural Park from 1997 to 2010

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Tubbataha Reefs Natural Park (TRNP) is considered as one of the few reefs in the country with spectacular coral reef formations that harbor great diversity of marine life. It covers an area of 96,828 hectares making it the country's largest marine protected area (MPA). Before its declaration as an MPA in 1988, TRNP was once a major fishing ground of illegal fisher. Had not been for the efforts of conservationists then, the park would probably be at the state of most of the reefs in the country, destroyed and struggling to survive.

Years of safeguarding the park enhanced the reefs' unique and outstanding value that were given international distinctions. The TRNP was declared by the United Nations Education, Scientific and Cultural Organization (UNESCO) as a World Heritage Site in 1993. It was also enlisted in the RAMSAR list of Wetlands of International Importance in 1999. To further enhance the protection, members of the Tubbataha Protected Area Management Board (TPAMB) lobbied for the approval of Tubbataha Bill. Their efforts finally led to the enactment of the TRNP Act of 2009 or Republic Act 10067 on April 6, 2010.

Protection of the park is coupled with scientific studies to determine the status of resources of the area. In 1997, the World Wide Fund for nature Philippines (WWF-Phils) facilitated the annual research and monitoring activity in Tubbataha. Ten permanent monitoring sites were established at 10 meters depth for research and monitoring of benthic and fish communities. Seven of the sites were in Tubbataha and three in Jessie Beazley Reef. In 2002, replicates were added at 5 meters depth for comparison of reef's responses between depths. Different methods were used in assessing the benthic community - the line-intercept transect, video transect and benthos-point intercept transect, the latter being employed in most of the years. These methods provide the percent cover estimates of benthic categories. Along with the annual monitoring of benthic community is the monitoring of reef fishes. The seabirds, seagrass, planktons, large predators including sharks, cetaceans, focal benthic mollusks like topshell (*Trochus niloticus*) and giant clams, were studied and monitored also.

Thirteen years of monitoring have recorded the responses of the benthic community to various disturbances. In 1999, live corals decreased by 17.49% as a result of massive coral bleaching caused by the El Niño phenomenon. The reef gradually recovers, almost reaching its original state within the period of five years. Another decrease was recorded in 2006 and 2008, and it continued up to present. Such was attributed to the storms hitting the country every year. Storms have shattered fragile branching corals into rubbles. The Crown-of-

thorns starfish (COTS) infestation added some damaged too especially in shallow portions of the reef where majority abound.

In this year's survey, Tubbataha's mean live coral cover at 10 and 5 meters depth were found at 48.59% and 49.15%, respectively. Both fall under fair condition based on the quartile scaling of the reef. Jessie Beazley's deep sites with 51.34% live coral cover were classified under good condition while its shallows having 45.23 % mean live coral fall under fair category. The Tubbataha's low coral cover was due to considerable amount of abiotic components in some sites but live corals still account for much of the benthic forms as shown by the condition index. Positive condition index suggests faster recovery and development of the reef. In general, live corals of Tubbataha remained stable over the years despite of the perturbations it has gone through.

With regard to fish, it is safe to assume that the very high biomass estimates, increasing trends in commercial fish biomass and increasing fish sizes in Tubbataha is the function of protection and that indeed protection does play a key role in shaping a reef's fish community structure. The increasing trend in commercial fish biomass and density is substantial evidence that fishing activities are non-existent or minimal in the area. This proves that enforcement ensures the effective protection of Tubbataha Reef National Marine Park.

Other studies have shown a correlation between the biomass of large predatory reef fish and the duration of reserve protection (Rus *et al.* 2005). Such is the case with the grouper biomass and density of Tubbataha which displayed an increasing trend over time. Groupers have been nearly eliminated by overfishing in many reefs in the Pacific, Australia and Southeast Asia (Johannes 1997). The mere presence of top predators and commercially important fishes such as sharks, surgeonfishes, snappers, groupers and large schools of jacks, which are usually first to disappear from heavily fished areas, show evidence of success in protection. Areas that are completely protected possess distinct fish assemblages with higher standing stock and diversity when compared to partially protected areas or areas where fishing is permitted (Friendlander *et al.* 2003). Studies have shown significant reduction in fish abundance in a marine reserves after fishing activities were resumed when protective management was discontinued for a period of time (Alcala & Russ 1990).