

BOHOL, PHILIPPINES: BUILDING PARTNERS FOR CORAL REEF RESTORATION IN PANGLAO ISLAND

Samuel J. Gulayan*, Jesrelljane J. Aaron*, Dominic Franco C. Belleza**,
Winfield Buscato*, Filipina B. Sotto**

*Bohol Island State University, Candijay, Bohol, Philippines

**University of San Carlos, Talamban, Cebu, Philippines

samgulayan@yahoo.com, jesrelljane@yahoo.com
wbuscato@yahoo.com, arpee55@yahoo.com

ABSTRACT

Panglao Island is one of the tourist destinations in the Philippines due to its white sand beaches, spectacular coral formations, beautiful reef fishes and crystal clear waters. Tourist arrival in 2012 noticeably decreased according to the dive shop operators and hotel and restaurant operators. Coral reefs damaged due to human and natural factors. Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) of the Department of Science and Technology (DOST) implemented the Filipinnovation on Coral Reef Restoration Program in collaboration with the University of San Carlos (USC), Cebu City and Bohol Island State University (BISU), Candijay Campus to manage the Pilot Technology Demonstration on Coral Reef Restoration in Panglao, Bohol. The ultimate goal of the project was to restore the degraded coral reefs through innovative means while maintaining partnerships between the local government units and private sectors which directly benefiting the coral ecosystems. The project team members were able to complete the deployment of 40 coral nursery units (CNUs) underwater in the month of September 2012. About 20,000 coral fragments were planted directly to the substrate using two techniques: 1) underwater epoxy as coral adhesive; and 2) nail and cable tie method. Tagged coral samples, it was found that the survivability of the transplanted coral was at 80% but decreased significantly with the presence of corallivores such as crown-of-thorns seastars, *Acanthaster planci* and the snail that feeds on corals, *Drupella cornus*. Data gathered from the CNUs, it was ascertained that *Acropora nobilis* was a fast growing acroporid species capable of growing at .37 cm in three weeks or at 5.76 cm/ year, with all else assumed being linear. The project invites and encourages dive shop operators, hotel and restaurant owners, local government units and non-government organization's officials in Bohol province to sustain the project.

Keywords: ecosystem, transplant, coral nursery unit, aqua epoxy

1 BACKGROUND

Panglao Island is located southwest of Bohol Island in Central Visayas (Figure 1), with a land area of 80.5 sq. km. The island is divided into two municipalities, Dauis and Panglao, and is populated by approximately 28,603 people (NSO report, 2010). The island is one of the most popular tourist destinations in the Philippines due to its white sand beaches, spectacular coral formations, beautiful reef fishes and crystal clear waters. Scuba diving is the main activity sought by tourists followed closely by dolphin and whale watching. Other activities include swimming, snorkelling, beach combing, boating, and sun bathing.

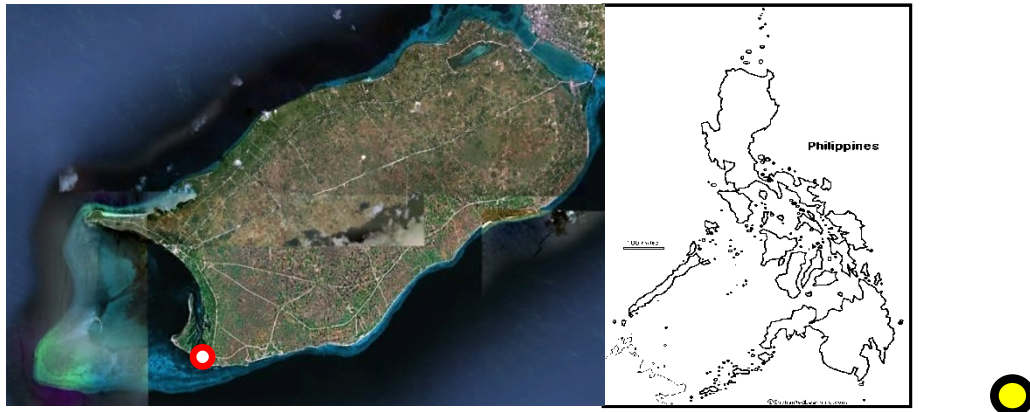


Figure 1: Project site shown as a red circle on the map of Panglao Island

Aside from the tourism activity, the island is known for its rich fishing grounds, mainly on pelagic fish species, reef fishes, and marine invertebrates. Municipal fishers use traditional fishing methods which include: hook and line, nets, spears and fish trap in catching fish. Hand picking or gleaning of sea shells from the shallow intertidal and seagrass areas are also done by some small scale fisher folks. The fishing season begins during the months of April to June with an average fish yield of 4 – 12 kg per trip during peak months while for gleaning a single fisher can glean an average of .5 – 3 kg of sea shells and other invertebrates per gleaning activity. However, due to the recent developments fuelled by the tourism industry, Panglao has suffered an environmental quality and marine resources degradation (i.e., coral reefs and its associated resources, seagrass and seaweeds, and macroinvertebrates). According to the dive shop and hotel and restaurant operators in Panglao, the degradation causes a noticeable decrease of tourist arrival since 2012 and so with the fish catch per fishing operation. This scenario definitely affects the livelihood of the people that depends on tourism activities and fishing.

Hence, the coral reef restoration project in Panglao was designed by Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) with funding from the Department of Science and Technology (DOST). The ultimate goal of the project was to restore the degraded coral reefs, one of the major marine resources, through innovative means while maintaining partnerships between the LGU and the private sector. The collaboration between academic institutions led by the University of San Carlos together with Bohol Island State University (BISU) - Candijay Campus, the LGU of Panglao, and the local resorts and dive shop operators are now facing great challenge of restoring the degraded coral reef in hopes of successful resource management in the future.

2 CHALLENGE

2.1 Tourism industry

The main economic driver of Panglao Island has always been tourism. Tourism contributes to the local economies of Panglao in terms of tourist spending, sales, income, tax revenues and employment. Local and foreign tourists alike share the appreciation for the island's beautiful beaches and its underwater wonders just found close to the shore. Perhaps the centrepiece of Panglao's tourism has been the diving industry that caters countless tourists that are very eager to explore and experience Philippine underwater biodiversity at its finest. At present, there are 17 diving destinations visited by domestic and foreign tourists. To accommodate the great volume of tourists and foreign divers visiting Panglao, local

businesses such as shops, resorts, hotels as well as home-stays have not only mushroomed along Alona Beach, but also constantly upgrade their facilities to keep up with the demand.

Majority of the dive shop operators are established along Alona Beach. The bulk of their investments have been on the procurement of business permits, dive equipment, boats and on maintaining proficient dive personnel. In order to attract and maintain loyal patrons each shop entices customers with affordable dive packages to various dive sites along Alona and in Balicasag Island. Dive shops charge divers from US\$23/dive to US\$56. On the average, a dive shop would cater to 390–1,980 divers per year, totalling estimated gross revenue of US\$10,500 to US\$45,540/year (Samonte-Tan et al., 2007). Because of the sheer number of tourist divers visiting Alona, the aim of each dive shop has been to accommodate them in volume to maximize profits. From this, competition arises and in order to compete, one must have more boats and bigger boats capable of reaching Balicasag Island or dive safaris and this has been at the expense of the underwater environment. Instead of using mooring lines, most boats, including boats-for-hire, are usually anchored on the reef flat close to shore. The anchors destroy large patches of reefs and vast areas of seagrass beds. With this in mind, the aim of the project has been to tap the corporate social responsibility of all business owners and that is to give back to the environment that has sustained their businesses for so long but is now in dire need of help.

2.2 Local government

The local government officials of the Municipality of Panglao are reaping the blessings of an expanding economy due to a blooming tourism industry but despite the evident economic growth, the plan for environmental conservation efforts is somewhat left behind. Perhaps the municipality has failed to foresee the consequences of the detrimental effects of unabated tourism development on the environment which includes pollution and habitat destruction. Hence, the municipality is faced with the challenge of balancing economic growth with intensified conservation efforts. With this in mind, the Bohol Environmental Management Office (BEMO) and the Bohol Marine Triangle – PADAYON (BMT-PADAYON), the groups currently doing conservation efforts in Panglao, should be supported by the Municipality of Panglao for both ends to become more effective in dealing with the environment. Apart from this, the law enforcement arm of the seas (Bantay Dagat) must also be appropriately supported with proper boats and personnel by the municipality. Environmental protection must not only be limited to patrolling the seas but also on the apprehension of violators with penalties as stipulated by the ordinances.

2.3 Coral degradation

According to White and Trinidad (1998), coral reefs in the Philippines can supply up to 35 t/km²/year (the highest reported fish yield from Sumilon Island in 1983) of edible and economically valuable fish and invertebrates assuming that ecologically sound fishing methods are used. Most reef areas in the Philippines have been adversely affected by human activities and less than 5% are considered to be in excellent condition. The rise of human population contributes to the problems of overfishing to the extent that the resource base has been damaged specially the coral ecosystems. A large portion of Philippine coral reefs – up to 95% by some estimates – has been subjected to serious degradation which has reduced their productivity (Yap and Gomez, 1985).

The coral reefs damage in Panglao was partly caused by human and natural factors. Anthropogenic activities such as pollution, anchorage on reef, errant divers with poor buoyancy control, and use of illegal fishing gears contribute to the damages. Natural causes include coral damage due to typhoon and breakage due to monsoonal waves. During the month of December 2012, a tropical storm categorized as super typhoon made landfall in the southern part of the Visayan region which includes Panglao Island. The effect was immediate and was responsible for wiping out of almost 90% of coral reefs along the stretch

of Alona Beach and damaged parts of the Southern part of Balicasag Island, particularly in the Balicasag Black Forest dive site. It was this catastrophic event which prompted action by the dive shop operators to support and dedicate some of their resources and personnel in the coral restoration efforts.

3 OBJECTIVES

Panglao Island was one of the sites for the implementation of Filipinnovation on Coral Reef Restoration Program of the PCARRD-DOST, with the project entitled "Project 6: Pilot Technology Demonstration on Coral Reef Restoration in Panglao, Bohol". The coral restoration was done along the stretch of Alona Beach. The deliverables of the project include:

- a. Introduce the project to the different institutions to obtain support and interest in the project implementation;
- b. Involve the local government units, dive shop operators, non-government organizations, hotel and restaurant owners, government agencies and academe in the project implementation;
- c. Establish and deploy 40 coral nursery units (CNU) inside the marine protected area (MPA) of Danao, Panglao;
- d. Transplant 20,000 coral fragments in the area for coral reef restoration; and
- e. train entities for the turnover of the project activities.

3.1 Strategies and Actions

To implement the project within the given timeline of the coral restoration program the Project 6: Pilot Technology Demonstration on Coral Reef Restoration Project in Panglao, Bohol employed the following strategies and actions: Introduction and site identification, networking and coordination, deployment and formation of coral nursery units, transplantation of coral nubbins, and coral reef rescue project organization.

3.2 Introduction and site identification

Officials from PCARRD-DOST in cooperation with the head of Marine Biology Department of the University of San Carlos, Cebu City formally introduced the project to the officials of the Municipality of Panglao, Bohol, provincial governor of Bohol, congressman of the third district of Bohol, dive shop operators and hotel and restaurant owners in Bohol, to the commander of Philippine Coast Guard-Bohol, the president of Bohol Island State University and barangay officials of Tawala and Danao for their orientation and understanding about the purpose of the project. This first meeting served as the first of a series of Information and Education Campaigns (IEC) of the project. Heads and leaders from the different institutions agreed and signified their unconditional support and commitment for the project implementation.

As the first step in the execution of the project, a site survey was first conducted to determine the area that is most suitable for the nursery site and the restoration site in Alona. Personnel from the Marine Biology Department of the University of San Carlos and Bohol Island State University - Candijay Campus, conducted an underwater survey using standard reef survey methods to determine substrate composition. It was ascertained that the Marine Protected Area located in Barangay Danao was the proper site for nursery due to its wide sandy substrate at 3m depth as well as its protection from human activities as stipulated in the ordinance.

The reef crest of Danao MPA was originally chosen as the restoration site due to patches of bare rock formations. However, due to the severe damage inflicted by the typhoon directly in front of the tourist beach in Alona, restoration was focused in this area

instead.

3.3 Fabrication and deployment of coral nursery units

The coral nursery units were deployed by the project 6 team members and volunteers based on the design prescribed by the DOST, with the supervision of the project development officer. The fabrication and deployment was done simultaneously by deploying the CNU after fabrication in order to meet the deliverables of 20,000 coral fragments in CNU. During this time, corals in the CNU were also sampled and monitored for data on their growth rates and survivorship (Figure 2). The forty CNU were deployed inside the Danao MPA, on the area with sandy bottom.



Figure 2: Fabrication and deployment of coral nursery units

3.4 Transplantation of coral fragments

After the typhoon Bopha struck Panglao, all 40 CNU in the MPA were damaged beyond repair and the corals attached to it were dead and non-viable. To circumvent this problem, the project team members resorted to direct transplantation of corals using the broken coral fragments and rubble resulting from the impact of the strong typhoon waves (Figure 4). To attach the corals to the bare substrate, two methods were employed: underwater epoxy was used while the nail and cable tie method was also used in the later part of the year.



Figure 4: Transplantation of coral fragments

To hasten the transplantation of 20,000 fragments the Project members organized coral transplantation training sessions to train divers for coral conservation. A total of three formal training sessions were conducted and the audience was composed of foreign and local dive masters and dive instructors from the dive shops in Alona. This gave an opportunity to involve tourists into coral conservation because after the seminar, most of the dive shops' personnel integrated the coral conservation activity into their dive briefing and training.

3.5 Networking and coordination

One of the strategies of establishing a good relationship between the stakeholders is proper networking and coordination. Presentation and introduction of the project to the LGU is first recommended so as to garner support through policy recommendations such as resolutions recognizing the projects execution within the barangay's jurisdiction; just to name a few. The basis of identifying partner institutions was to recognize that they have a parallel inclination to the objectives of the project. When they were identified, they were invited to

the preliminary discussions about the details of the project, specifically on the introduction to its field personnel, daily operations, as well as deliverables. An open forum then ensued between the project leaders and stakeholders to respond to queries and concerns regarding the impact of the project on their business operations and daily routines.

After the initial meetings have been done, it is important to make regular feedbacks and progress reports to make them aware of the active presence of the project. This is where the role of the project development officer (PDO) is most important since he/she liaises with the stakeholders on a regular basis. In this case, the PDO makes visits to the Municipality of Panglao every three months to present the progress of the project during their Sangguniang Bayan Sessions, and progress reports to the barangay once every month. This feedback system is important since this is where issues and concerns can be raised and given solutions. For example, in the initial phase of the project, support from the municipality was somewhat suppressed. However, after typhoon Bopha struck Panglao, the PDO reported to the SB the results from dive surveys done at Alona and at Balicasag Island which showed significant declines in coral cover as a result of the typhoon. The response from the municipality thereafter was swift and overwhelming in that they quickly assembled a working team together with BMT-PADAYON and TIEZA to be trained and capacitated by the Project 6 personnel, on the methods of coral restoration so they can restore the reefs there themselves.

With regards to the private sector, their response to the alarming effects of the typhoon was quicker, perhaps because they were faced with complaints by their clients on the lack of underwater scenery after the reefs were destroyed. The result was that the dive shop operators and their staff were more receptive to the three coral restoration trainings done immediately after the typhoon event. Those training sessions can be considered a success due to the high number of attendees. Their follow through was also a sign of success since they were restoring their "house reefs" on their own using the epoxy, along with data sheets which was handed out to them by Project 6. The corals they have directly transplanted to the damaged reef were included in the count to the 10,000 coral fragments which is part of the project's deliverables.

3.6 Sustainability plan

The project was in need of entities or groups that were to take over the project operations after the project ends. This plan ensures that the awareness of conservation is sustained long after the project exits from Panglao. The plan was to let the chosen stakeholders sign a memorandum of agreement for the turnover ceremonies. The signatories of the MOA included the Municipality of Panglao, Barangay Danao and Tawala LGU, Bohol Island State University – Candijay Campus, and a non-government organization called Coral Rescue Project Inc. At present, the incorporators of the organization are on the process of preparing the constitution and by-laws and other necessary documents essential for registration of the organization. Board of Directors are planning to submit the necessary documents for registration before end of the first quarter of 2013. The incorporators of coral rescue project are motivated to continue the transplantation and management of transplanted coral fragments and marine resources in Panglao Island.

4 SUMMARY OF RESULTS AND IMPACTS

The project team members were able to complete the deployment of 40 CNU's underwater in the month of September 2012. Data on their growth rates were also gathered for three months. However, all CNU's were destroyed together with the reefs of Alona during the passing over of typhoon Bopha on December 4, 2012. Due to the setback, 20,000 coral fragments were planted directly to the substrate using two techniques: A.) underwater

epoxy as coral adhesive; and B.) nail and cable tie method. From the tagged coral samples, it was found that the survivability of the transplanted coral was at 80% but decreased significantly with the presence of corallivores such as crown-of-thorns seastars, *Acanthaster planci* and the snail that feeds on corals, *Drupella cornus*. From the data gathered in the CNU's, it was ascertained that *Acropora nobilis* was a fast growing acroporid species capable of growing at .37 cm in three weeks or at 5.76 cm/ year, with all else assumed being linear.

The project team held IEC campaigns to the LGU as well as to the individual dives shops along Alona Beach to inform them of the ongoing activities and the target deliverables for the year. The series of information dissemination activities and public consultations motivated and encouraged officials of local government units and government agencies and private sectors as well as volunteers from local and foreign tourists to join the coral reef restoration training and transplantation of coral fragments. One of the triumphs of the campaign was garnering the cooperation of the municipal LGU through the organization of a team composed of members from BMT-PADAYON, TIEZA, PCG-Auxiliary and BEMO which has been tasked to resurvey the dive sites of Panglao and establish proper mooring for each one. The other monumental milestone was the repair of the Danao Marine Sanctuary which was largely left open to fishers for most of the project duration.

The project has enhanced the ability of faculty researchers and students of the Fisheries and Marine Sciences (FMS) Department of the Bohol Island State University - Candijay Campus on coral reef restoration. This has encouraged the faculty researchers of the University to replicate the technology in Cogtong Bay and have integrated the program with their curriculum. At present, a group of undergraduate fisheries students are doing research on the growth rates of acroporid species to determine the optimum depth at which they can be grown at nursery conditions. These types of researches can pave the way for better scientific potential for newly established universities willing to engage in high impact studies.

5 RECOMMENDATIONS

The Municipality of Panglao should continue the coral reef restoration project with the cooperation from the local people involved in tourism development, and at the same time, enact appropriate local policies that would strengthen the conservation and management of marine resources and ensure the sustainability of tourism activities in Panglao, Bohol. The Bohol Island State University - Candijay Campus and BMT PADAYON Foundation should adapt and replicate the project in other areas of Bohol help sustain the livelihood of the people that directly or indirectly depend on the municipal waters.

REFERENCES

- NSO, 2010, Census of Population and Housing.
- Samonte-Tan G.P. et al., 2007. Economic Valuation of Coastal and Marine Resources: Bohol Marine Triangle, Philippines
- Unpublished report of USC. 2012. Coral reef assessment in the selected diving sites in Panglao, Bohol.
- White, A.T. and Cruz-Trinidad A., 1998. The Values of Philippine Coastal Resources: Why Protection and Management are Critical.
- Yap, H.T., ED. Gomez, 1985. Growth of *Acropora pulchra*. III. Preliminary observation on the effects of transplantation and sediment on the growth and survival of transplants. Mar. Biol. 87: 203-209.