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Experiences on coral transplantation and rehabilitation

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Introduction

Corals still need to be nature-grown. They cannot be currently produced in the laboratory cost-effectively to sustain coral transplantation or 'planting of corals'. Coral fragments resulting from trampling, improper boat anchoring, net entanglement, gleaning, illegal fishing and other means are raw materials for the planting. When the destruction ceases (which is badly needed) there would be no substantial detached fragments and intuitively no need for transplantation. If (it is true) only 1-3% excellent coral cover (75-100%) remains and the rest of the 27,000 hectares Philippine coral reefs continue to be devastated there would be fragments to initiate transplantation. In hindsight, we lost the opportunity to transplant the 97-99% lost from pristine reefs and those left because they were not replanted. The numbers may not be important anymore but the urgency to rehabilitate corals immediately because any inaction means total loss to leave a coast of sand and dead stones.

Put money where it will grow. Coral transplantation and rehabilitation should have higher priority than their assessment. Its inverse was in part a reason that brought us to the present tragic condition of the coral ecosystem. It means putting money more to the former than the latter. The 1-3% excellent coral cover could be an error to the estimate so nil that there would be none by now. It is thus very imperative that an aggressive action be taken to transplant and rehabilitate corals adopting techniques that can be done by direct stakeholders such as local governments and people's organizations. This contribution illustrates experiences on coral transplantation in Ticao Island, Masbate (Philippines) that engaged local stakeholders in partnership with Bicol University. The activities reported were under the auspices of the Coral Restoration Program of the Department of Science and Technology (DOST) spearheaded by the University of San Carlos, Cebu City.

We want to share experiences. Many methods we used were based and adapted from practices or protocol reported in studies on coral growth, survival and transplantation. Essentially, our desire to perform them has been fueled by sheer interest and intuition. Devastation by typhoon to the coral restoration system has been one of the most difficult factor to predict. So we protected our system by choosing naturally-sheltered nursery and restoration sites and this strategy paid off. Probably, the coral reef space transplanted here (about 10,000 m^2) is the largest achieved for a project in the country. Overall, the system of methods developed and piloted in the coral nursery unit and rehabilitation site is not a cookbook where everything is fixed. Most of them are 'techniques in the making' that will be much improved with the collaboration by many others. With this short contribution together with related aspects covered in this guide, we hope you have considered recommending coral transplantation or doing it yourself.

Selecting the site

Three sites each for a specific purpose were selected namely (i) source of coral fragments or some would call 'corals of opportunity' (COP), (ii) site for setting-up coral nursery units, and (iii) rehabilitation site (Fig. 1). This same sequence has governed the chronology of main activities that

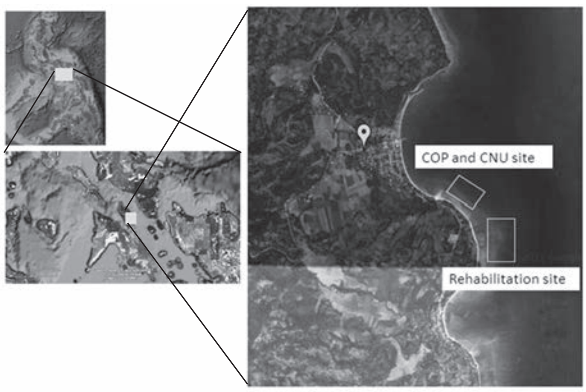

Fig. 1. COP, CNU and rehabilitation sites of the project in San Fernando, Ticao Island, Masbate, Philippines.

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essentially defined the system used. Because the activities for the three sites were complementary, proximity of the sites with each other has been very vital in ensuring efficiency of task performance. Furthermore, the best indicator of suitability is natural presence of corals to be transplanted.

Maps from government agencies and anecdotal accounts by experienced fishers indicated the suitable sites. The COP site was less than a kilometer from the CNU site and the latter was along-coast and in front of a private resort. While deliberating on these sites, the CNU site was thought to be ‘curving along a swing’ of the coast where water velocity would be relatively higher along this bend than in other potential sites. Together with the maps, the dives by the staff showed insights in developing a general picture of corals and coral reef distribution in the sites.

A major criterion was the presence of a resort establishment as private partner to the project. This brings us to a paradigm whereby establishing coral transplantation and rehabilitation sites for restoration should benefit from a private partner to protect them. In this case, the DOST decided this to be a resort or private entrepreneur who was willing to contribute funds for activities of the restoration. The staff could maintain a peace of mind with this set-up and also because the owners of the resort were high government officials.

Collecting the coral fragments

Fragments or coral nubbins discovered in nearby sites were gathered and brought to the CNU site. They were transported in plastic crates hanging underwater beneath wooden boat paddled to the nursery site (Fig. 2). Factors such as stress due to handling, sunlight and air exposure should be reduced because the fragments in the CNUs had at least 60-80% survival rate.

Breaking naturally growing corals as COP is an option that can present a tricky situation conceptually (or maybe philosophically). However, there were situations where it, on a

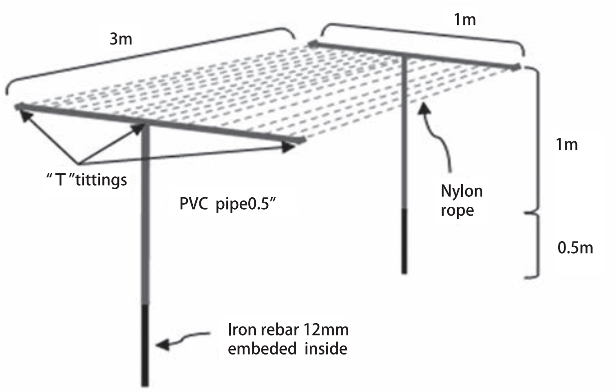

Fig. 2. A CNU framework and its major parts and specification as used in San Fernando.

strictly regulated manner, had been warranted. Isolated coral reefs that were prone to breakage because of fishing activities such as in boat docking areas were source out for coral fragments. Other areas where corals were vulnerable to mechanical breakage such as in gleaning and subsistence fishery sites were harvested. But it is clear to us that naturally growing corals do not have to be broken to be replanted.

Preparing the coral nursery units (CNUs)

The source of fragments was very close to the CNU site so preparing the CNUs were accomplished with optimum efficiency of people and least handling mortality to the fragments. Only the basic description of the CNU (Fig. 3) used was presented here to stimulate creativity of adaptors and suit design with actual conditions (e.g., water current).

Forty-four CNUs were constructed from a design by the technical staff (Fig. 4). A CNU is basically a table flat form where about 500 coral fragments (6-10 cm long) were tied using tie-wire unto polyethylene twine. Each CNU was prepared close enough to shore to enable ease in construction and transfer to a temporary for growing corals. Hung alongside a boat, the CNUs, supported and kept underwater,

Fig. 3. Detached corals used in the CNUs.

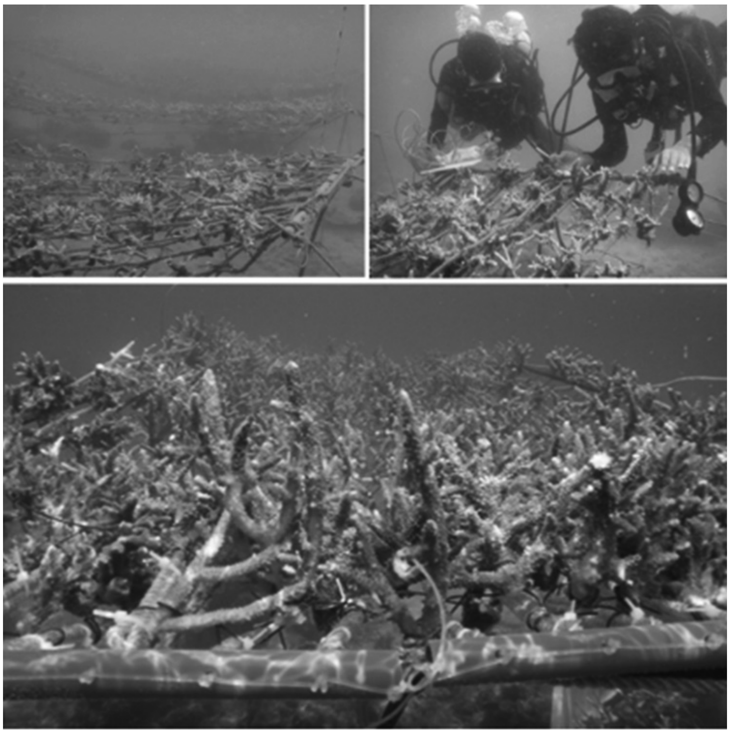

Fig. 4. Growth of corals in the CNUs.

were moved carefully to the growing site. Community members, Barangay and FARMC officials participated in the activities.

Coral species of genera *Acropora* and *Pocillopora* were used because they were abundant, easy to prepare for tying because of their regular elongation and amenable to measuring by caliper (Fig. 4). Monthly measurement of coral growth and survival were performed as well as periodic maintenance of set-up and supporting structures. Two aides were assigned to check on the CNUs, its structural parts and coral fragments under monitoring.

The CNUs were much heavier 3-6 months from installation after the coral fragments added about 1-1.5 cm every month to its length. This required propping up the CNUs with added vertical support to maintain strength and resilience of every structure to strong current. The structure was designed to "swing with the current" whereby its inertial movement also dusted off dirt and debris from it.

Transferring the CNUs to the rehabilitation site

Beginning three months after the fragments were set on the CNUs they were transferred to the rehabilitation site. Motorized banca transported the whole mat of fragments as they were moved underwater. Then, they were fixed in specific areas within the rehabilitation site. In the context of the project, rehabilitation means fixing the grown fragments unto the bottom substrate in the rehabilitation site. It was also achieved by fixing underwater whole mat or mats of coral fragments (i.e., from the top of the CNU). The fixing aimed to populate the site with new coral nubbins that will grow and hopefully restore the pristine corals. This long-term objective is restoration or the process of bringing back the corals into their former condition that is the goal of the project.

Fixing coral nubbins required use of a waterproof marine epoxy bought from commercial sources. A fragment was attached to a hard or rocky bottom by sticking it with epoxy. But first it was necessary to insert the fragment on a crack in the bottom or a hole was drilled to insert the fragment. A 4" or 5" concrete nail should also be pegged close to the nubbin to secure it further for a strong tack with a tie wire (Fig. 5). A scuba diver accomplished this task at a rate of 40-60 nubbins for every hour of underwater scuba work. For attaching whole mat of fragments, the mat was fastened to the bottom using nails tacked along suitable points in the mat. With this method, more fragments were planted in the rehabilitation site.

Enjoining people's support

Transplantation has been practiced here to be more of a development activity than an experiment. Except for the number of CNUs transplanted, biometrics (growth, survival) to monitor them and area of rehabilitation site that were generally fixed deliverables at the start, most of the activities were adaptive. Better procedures were performed as they had been discovered side-by-side with the implementation.

Fig. 5. A coral nubbin that was 'planted' in the rehabilitation site after 3-4 months in the CNU.

The staff has been guided by the formula: research findings + people's support = project success. The findings were on coral growth, survival or recovery and the concomitant environmental factors in the study sites. People's activities were influenced by prevalent meteorological conditions. Local government level of assistance was crucial to implementation because the project site was along its coastal jurisdiction and the site was really countryside where community participation was indispensable to success. A memorandum of agreement was forged among the local government, DOST and BU who collaborated in the project (Fig. 6).

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(a)

(b)

Fig. 6. (a) Signing of Memorandum of Agreement between San Fernando, Masbate LGU, Bicol University, DOST and Municipal FARMC. (b) Ceremonial launching of the coral restoration project in San Fernando, Masbate, Philippines.

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