# CORAL REEF RESTORATION THROUGH CORAL TRANSPLANTATION: THE CASE OF DUKA BAY, MEDINA, MISAMIS ORIENTAL

by:

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## Introduction:

Damage to the coral reef systems worldwide, particularly in developing and underdeveloped countries, is particularly alarming in recent decades. Blast fishing and other destructive fishing practices have been responsible for annihilating most of nature's coral cover resulting in lower fishery productivity and marine biodiversity. Efforts in the past had been focused on developing artificial coral reefs with little or no appreciable results. In most instances, the artificial coral reefs developed simply became effective aggregating devices for important fish species artificially raising the observed fishery catch yet not really restoring the damaged environment.

We relate our experience on coral bioregeneration in a town in Southern Philippines located in the province of Misamis Oriental (Duka Bay, Medina) over a period of two years from 2000 to 2002. The project on coral transplantation was started not by design but by accident. While the essential concept of using cement blocks as substrates for the transplanted corals had been in the author's mind for a long time, the opportunity to realize the project did not come until the owner of the Duka Bay Resort, Mr. Ernesto Pelaez, himself an environmentalist, aired his concern over the damaged coral reef system of the coast of his resort area. Discussions over what to do with this damaged environment led to a small tryout of the concept, which will not be described in detail.

Coral transplantation in the past suffered from serious difficulties such as: (a.) coral transplants are swept away by tidal currents, (b.) substrates used are not calcium bicarbonate-based which are not conducive to the growth of the transplants, and (c.) even if calcium bicarbonate-substrates are used, they are often too light that the transplants are damaged by tidal currents as well. The basic problem then was to develop a substrate that will hopefully address all these concerns.

The author thought of using cement blocks, 4" x 16" x 22" in dimension, as substrates. The idea was acceptable to Mr. Pelaez and immediately, one hundred (100) such cement blocks were made for the initial tryout of the experiment.

## The Experiment

A preliminary survey of the research locale was made to elicit information on the following: (a.) appropriate donor and transplantation sites, (b.) coral reef status and species composition, (c.) water conditions and other oceanographic parameters. A steel plate molder was constructed measuring 4" x 16" x 22" into which the cement mix was poured in. One hundred (100) such blocks were constructed and serially numbered from 1 to 100. After one week of curing and drying, these blocks were then dispersed underwater with an interval of two meters from each other. There were eight columns and thirteen rows for an estimated total planting area of 500 square meters with depths ranging from 25 feet to 35 feet.

The transplantation site was purposely chosen to be contiguous to the donor site to minimize seedling transport as well as stress on the fragments taken from the donor corals. This strategy also allowed for controls on the water parameters (the sites being contiguous) e.g. similar vectorial currents operating on the two systems, similar salinity, and others. The collected coral fragments were transferred underwater using a plastic basket carried by hired SCUBA divers.

Live coral fragments were individually planted within their respective coral substrates (concrete blocks). Planting of coral fragments were made upright by just inserting them in a center hole provided in the blocks. These planted fragments were cemented right away through underwater cementing procedure. Young corals are particularly fragile and so the divers had to be instructed to be extra careful in handling these materials. The newly cemented coral fragments will take three to four hours underwater before they harden completely.

Monitoring of both the donor corals and the transplanted corals were done periodically, once every quarter for the period 2000 to 2002. Observations included: (a.) coral growth increments (in cm.), (b.) listing of residential, migratory and grazing fishes in the study area, and (c.) number of coral branches. At the same time, related activities such as cleaning of debris attached to the coral clones and preserving the transplantation area (as an off-limits area for the period of the study) were done.

**The Results**

Results on the coral growth increments are very encouraging. Figure 1 shows the comparative graphs of the coral growth increments for the transplanted corals and the donor corals.

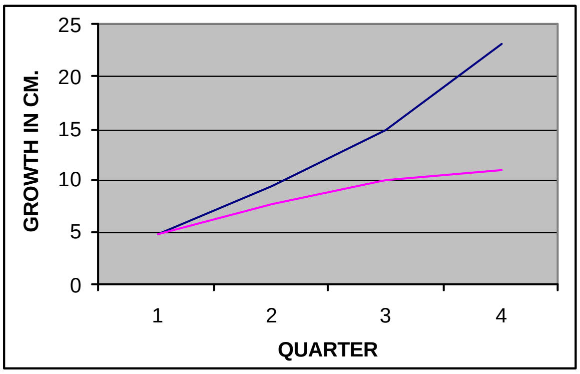


Figure 1
Graphs of the Coral Growth Increments for the Donor and Transplanted Corals

Both coral growth increment graphs are monotonically increasing with time (by quarter). However, what is particularly encouraging is the relatively higher growth increments observed for the transplanted corals. Moreover, with the progression of time, the gap between the coral growth increments of the donor and transplanted corals widen. Two possibilities exist to explain this observed phenomenon: (a.) that the transplanted corals were transferred to sites that were more conducive to their accelerated growth, or (b.) that due to the relative isolation of the transplanted corals, competition on nutrients and other factors that enhance coral growth had been minimized leading to their faster development. A host of possible scientific theories may be evolved even from this very basic observation. For instance, one may surmise that if observations were made for a span of say, one or two decades, and *if coral growth increments were noted as a function of the density of corals then the normal carrying capacity model (e.g. logistic growth model) will hold.*

What about the coral community in the vicinity of the transplanted corals? Were there significant changes that would tend to support the hypothesis that the transplanted corals indeed functioned as desired i.e. as the natural habitat for fish species and other invertebrates? Data obtained so far are inconclusive in so far as these issues are concerned. What little data we observed tend to support the contention. For instance, the first sampling yielded 19 species and 5 families of fish, mostly migratorial in character. However, in the second sampling 24 species of fish belonging to 7 families were observed with both migratorial and residential species already in place. Indeed, it is tempting to conclude that the transplanted corals have become the new habitat for the residential fishes but more evidence is needed to be able to jump to this conclusion.

**Tentative Conclusions**

It is said that the ultimate "test of a pudding is in the eating". Thus, in the end, what may be said about the efforts expended on this new coral transplantation technique? Were the efforts worth the time and money spent for the methodology espoused in this paper? While it is rather premature to draw definitive conclusions about the technique and its success, some promising evidences seem to show that:

- Coral transplantation by the fragmentation method using cement block substrates is an effective method for restoring damaged coral reef environment. The method is particularly useful if branching coral species are considered. The observed coral growth increments in both the donor corals and the transplanted corals tend to support this conclusion.

- Increased biodiversity (in terms of both abundance and species of fish and other invertebrates) is observed which lead us to surmise that such a methodology for coral transplantation will, in the long run, resuscitate a damaged coral reef environment and effectively restore the marine life in specific areas of the country.

**Management Lessons**

What environmental management lessons may be drawn from this experience at Duka Bay? Despite the absence of a clear and well-organized plan for restoring the damaged coral reef environment of the Duka Bay through coral transplantation, the experience has taught us that any attempt at recovering damaged environment can have untold positive effects. In particular:

- The transplanted coral reef area has now become one of the tourist attractions of the Duka Bay Resort. The influx of both local and foreign tourists in the resort brought in revenues that have so far exceeded the expenses originally incurred by the trial experiment conducted. The fisherfolks who, originally were responsible for the massive coral reef destruction, are now beginning to shift away from fishery exploitation to the more lucrative yet less harmful tourism in Medina.

- The local fisherfolks, because of their familiarity with the coral reef area in the vicinity, became the *ipso facto* tourist guides. Income from this activity alone suffices to support the family of the fisherfolks. Investors flock to the area offering glass-bottom observation boats to the tourists and the entire experience practically brought in a new economic dimension to the sleepy town of Medina.

- The local community, who initially were skeptical about the coral reef rehabilitation project, are now convinced that there is income in environmental restoration and conservation. With this experience, environmentalists and other lobby groups would have better chances of disseminating environmental restoration and protection techniques to other communities e.g. the concept of implementing Marine Protected Areas (MPA's) which is often acceptable to coastal townspeople of the country.

- The participation of a few committed, and able private sector individuals in marine conservation and restoration efforts is a largely untapped potential in the country's environmental programme. Persons like Mr. Pelaez and others who are similarly situated are certainly a force to reckon with to successfully implement environmental protection programs of the Department of Environment and Natural Resources.

- Environmental scientists and academicians residing in Philippine colleges and universities must put their expertise to good use by engaging in such productive endeavors as restoring damaged ecological environments, not only in the marine environment but in terrestrial environments as well.

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