

Coral Farm: the First Step to Restore Reefs

Antonio L. Ortiz-Prosper, Coordinator
Puerto Rico Coral Farmers, *Caborrojeños Pro Salud y Ambiente, Inc.*

Puerto Rico Coral Farmers is a marine scientific group within Caborrojeños Pro Salud y Ambiente, Inc. (CPSA), a non-profit organization registered in the Puerto Rico State Department since 1991. The mission of our organization is to raise awareness on issues regarding the conservation and protection of our environment. CPSA has the support of several local and federal agencies, including the US Department of Commerce, Rural Economic Development, Environmental and Natural Resources Department, among others. At present, we are currently working with the National Fish & Wildlife Foundation to develop effective and low cost methodology to restore coral reefs.

Our goal is to implement methods for manipulating and enhancing depleted coral population through coral farming in the Southwest area of Puerto Rico, specifically in Cabo Rojo, Lajas, and Guánica. We have designed specific procedures to collect, transport and culture of several coral species that will be continually tested on this study. Coral Farming is a proposed plan to overcome part of the problem of reef deterioration in Puerto Rico and the Caribbean. Through the culture of a wide diversity of corals, we will be able to supply corals to deteriorated coral reefs, damaged by natural (storms, and disease) and human induced disturbances (ship grounding, pollution, military activities, among others.)

Our Partners

- Fish & Wildlife Foundation: Main partner that will provide the funding for the proposed project. Is the main sponsor of our current Reef Restoration Methodology Project (ending August 2001), where we developed the coral reef farming methodology, which will be implemented in a larger scale in the proposed project.
- Department of Natural Resources and Environment (DNRE), Guánica State Forest: Will provide storage facilities for the equipment and materials, and to prepare the coral culture device needed for the coral nurseries.
- Other partners: Local organizations such as the Ferré Rangel Foundation, and the Ford Motor Company Foundation have manifested their interest to collaborate in the proposed project, by providing additional funding to cover the costs of a vehicle to be used in the project (to transport heavy equipment, coral culture device, and trailer), and for an educational component, respectively.

Statement of the problem

In an effort to overcome the problem of coral reef deterioration, the active restoration of damaged coral reefs is now at the scope of most conservation efforts. Coral reef restoration is a relative new field of research that will become increasingly important for management purpose. Restoration techniques have the potential to accelerate the re-growth of a reef after disturbance and created new reef where none previously existed. The basic approach is to introduce new colonies of fast growing species into the reef. The establishment, growth, development and maturing of these colonies may increase larvae production and recruitment locally or the increase the number of colonies by the establishment of broken off fragments from transplanted colonies.

Despite the fact that some corals are known to survive after transplantation (Highsmith, 1982), some techniques have been proven not to be feasible options because of the following:

- **Negative effects on collection sites:** The majority of the work done in coral reef restoration projects involve the collection of the coral colonies from one site, transported and transplanted to a second site. Harriot and Fisk (1988) have documented the negative impacts of transplantation on the collection site, such as the reduction of coral population from healthy reefs, among others.
- **Highs cost, and low percent of survival of coral transplanted:** Cost/effectiveness is not measured in most of coral reef restoration project. For example, after the M/V Fortuna Reefer Vessel Grounding at Mona Island (Puerto Rico) the National Oceanic and Atmospheric Administration's Damage

Assessment and Restoration Program initiate an emergency coral reef restoration. After an expedited \$1.25 million settlement funds to restore the reef less than 65 % of *Acropora palmata* fragments survived. Comparable results (68% after one year) were obtained without human intervention when hurricane Georges (September 22, 1998) passed through Puerto Rico, fragmenting many colonies of *A. palmata* in several reefs of La Parguera, southern Puerto Rico (Ortiz and Ruiz, 2000).

Farming corals (or coral nursery) is the best logical step in coral harvesting that will allow us to produce corals to be used on restoration projects. Our experience in coral farming has proved that coral nursery or coral culture is a useful tool in coral reef management. The coral nursery is based on the idea of the metapopulation concept. A metapopulation is a series of small, separate, populations united by some mechanism that allows genetic flow. In this scenario, even if the individual populations go extinct, other population survives and supply dispersing individuals who re-colonizes "extinct" patches (Harrison, 1991). By this concept, the coral culture of different species within the nursery sites may act as a source of corals to replenish extinct populations at different reefs. The proposed coral farm not only will increase the local genetic variability by the addition of new coral strains to the reef, it also will preserve coral strains (on coral nurseries) for future dispersion, including candidate species considered for the Endangered Species Act. For example, we have already successfully farmed *Acropora cervicornis* and *Acropora prolifera*, two of such threatened species.

Expected Results and Benefits

We will establish a total of 6 coral reef nurseries in three southwest towns: Cabo Rojo, Lajas and Guanica (2 nurseries in each town). Each of these nurseries will have at least 50 coral culture devices, for a total amount of 300. Initially, we will collect and culture in these device at least 8,400 coral fragments of different species. By the end of the second year, we expect to have harvested at least 30,000 fragments to be cultured in additional 1,440 new culture devices.

Outcomes

1. Implement effective methodologies for coral propagation and transplantation through human activities.
2. Increase of genetic diversity of local coral population by providing new, genetically different individuals.
3. To have farmed large and diverse amounts of corals, including threatened species of the *Acropora* genus, available to be used in future local reef restoration efforts.
4. Direct involvement of coral reef resource managers; island fishing communities and other non-government partners in coral reef restoration projects.
5. Integration of coral transplantation techniques in the management strategies for improving the fishery resources in Puerto Rico.
6. Increase public knowledge about the importance of coral reefs as essential habitats for marine life, and the joint efforts to preserve and restore damaged coral reefs.
7. Coral farms will also produce direct and indirect benefits to local areas by expanding habitats for marine invertebrates, ornamental and commercial fishes, and underwater attractions for snorkeling or SCUBA diving.

Our ultimate goal is to transfer our findings and experience in restoration and coral farming methodology to other Caribbean nations, as a sustainable method to increase coral populations

We propose the extensive use of experimental and proven methods of coral culture. All coral transplantation or cultured methods will be continually tested to determine the optimum approach. Each methodology will be tested and evaluated using appropriate experimental design. For example, experimental coral culture device will be set up in a complete randomized design. Triplicate coral culture device contained branches or fragments of one strain of each coral species will be randomly allocated within each coral nursery area. The number of coral fragments and its size within the experimental coral culture device will be recorded at the initiation of the project. Coral nursery sites will be visited periodically over the year period and the response variables to be measured are mortality rate of transplant, incremental growth, and colony conditions. All techniques (coral collection, transportation, transplantation, etc.) will be modified depending on previous results.