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Coral Gardening - Way to Regenerate Marine Ecosystem

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Abstract

Considered the rainforests of the sea, coral reefs have beautiful colours ranging from brown to blue. Reefs can vary in size, shape and colour. Coral reefs have a global value of at least $30 billion because of the resources they provide to people. Now-a-days coral reefs are facing growing challenges from local to global effects of human activities like commercial bottom trawling, deep sea mining, pollution, waste disposal, coral exploitation, over fishing, climate change and hydrocarbon exploration. Hence, we are in the situation to save corals in an effective way. Coral gardening is one of the efficient methods to restore/ regenerate the coral ecosystem. This article mainly focus on the methodology, steps involved and the importance of coral gardening.

Introduction

Coral reefs are the most bio diverse marine ecosystem in the world and cover less than 0.1% of the earth's surface. Coral reefs are generally found in clear, tropical oceans. Coral reef forms in waters from the surface to about 150 feet (45 meters) deep and the suitable temperature for the growth of coral polyps ranges 20 to 28 °C. Coral reefs usually develop in areas that have more wave action because the waves bring in food, nutrients and oxygen for growth. This ecosystem serves as a home to more than 4,000 species of finfish & shellfish, plants and nearly 1 million animals belongs to coral ecosystem for better thriving.

Coral reef ecosystems are very important for many reasons. Coral reefs support a complex and interdependent community of photosynthesising organisms and animals. There is an incredible diversity of life on coral reefs such as algae, sponges, marine worms, echinoderms, molluscs, crustaceans and fish. Primary productivity of coral reefs are very high and it is estimated at 5-10 gc m^{-2} day^{-1} (Sorokin, 1995). Coral reef ecosystem creates habitat for hundreds of thousands of species, many of which support coastal human populations with food, income and other ecological good and services such as coastal protection. These coral reefs are also plays a major role in bio-prospecting and novel pharmaceutical development.

Coral Gardening

Coral gardening is a method of growing coral polyps to help restore reefs around the globe. Coral gardening is the natural process through collecting fragments of broken-off pieces of healthy corals from the seafloor or fragmentation of wild donor coral colonies (Young *et al.*, 2012). These fragments are cut into smaller parts and becomes a new coral clones. The new coral clones or fragments are attached in-situ to artificial substrate in an underwater nursery.

These fragments/ clones have the ability to re-attach to new substratum and grow into new colonies. The fragments in nursery can be cloned multiple times during further growth. Fragments are collected only if they appear alive and healthy, without signs of disease and if they are not yet overgrown by algal turf or sponges. Coral gardening not only provides new habitat for coral growth, with the design of the structures, but also creates new habitat for marine life to allow the artificial reef to develop into a natural reef as quickly as possible.

Figure 1: Coral gardening

Methods Involved in Coral Gardening

Mainly there are two methods followed universally in gardening corals. They are ocean based and land based nursery methods.

1. Ocean-based Nursery Method

In this method, the coral fragments or polyps were taken out from the healthy corals and they were grown up to the particular size. Those grown up coral fragments were placed in the structure made up of any material (steel, iron, cement). The coral fragments may need to grow for 6 to 12 months to reach maturity. After attaining the particular size the coral fragments were transferred to existing damaged reefs, so they can continue to grow further.

2. Land-based Nursery Method

The coral fragments were brought to laboratories or farms to attain particular size & shape. After one year, the grown up fragments were transferred to the structure in the underwater/ ocean region. The land based nurseries are not exposed to the ocean's changing temperature, predators, storms or other problem that interfere the gardening process.

Phases in Coral Gardening

Gardening of corals involves three main phases. They are:

- Nursery phase
- Transplantation phase
- Micro-fragmentation phase

Figure 2: Ocean-based coral gardening

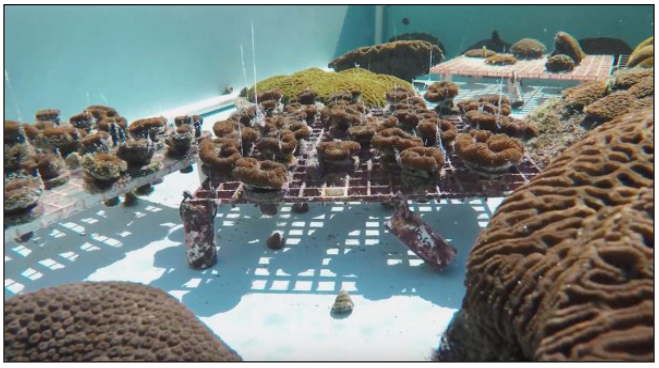

Figure 3: Land-based coral gardening

Steps Involved in Coral Gardening

Coral gardening is otherwise called as "Coral Farming" or "Coral Aquaculture". There are certain steps involved in farming corals. They are listed below.

1. Site Selection: It is one of the important step in which the areas where chosen for gardening.

2. Biodiversity of the coral reef: We should know the diversity of corals in the selected sites by identifying certain coral species in the area.

3. Characteristics of water in the chosen area: The characteristics like; depth, wave energy, turbidity, likelihood of human impacts, etc should be analyzed before gardening corals.

4. Setting up of nursery: It is the main essential step in coral gardening to choose an appropriate nursery site, design & platform structure that will provide adequate attachment and growth space for nursery corals (Ferse *et al*., 2010). Many nursery designs are used, which can be both floating and fixed.

5. Collection of corals: The coral fragments should be collected only from the healthy potential donor coral colonies which is essential to keep the entire nursery setup healthy. For cutting Corals different tools like stainless steel surgical bone cutters, needle nose pliers were used.

6. Nursery operation and monitoring: The main goal during nursery operation is to maintain the coral healthy and maximize growth and survivorship of nursery reared corals. Daily maintenance of coral should be conducted in a regular basis. The activities like removal of algae, fouling organisms, worms and the decayed corals should be done frequently to save the corals.

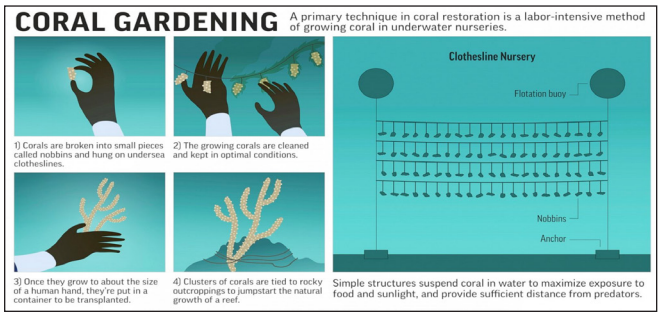

Figure 4: Steps in coral gardening

Importance of Coral Gardening

• The coral gardening process may give lots and loads of benefits not only to the marine ecosystem but also to the people in various ways.

• It creates many opportunities to build strong partnership between scientists, conservation practitioners, researchers and students of various biodiversity fields.

• It also acts as a research platform for various public and private organisations.

• It forms a nursery habitat and protects many species from large predators (Lirman and Schopmeyer, 2016).

• Coral gardening helps the local communities to improve their economic condition.

• Many coral reef species are used to cure various diseases like cancer, HIV and cardio vascular diseases.

• Through gardening the actual coral reef ecosystem will form and that may serve as very good habitat, feeding & breeding ground for various finfish & shellfish.

• Gardening also increases the species & genetic diversity of particular coral reef ecosystem.

• The entire coral reef gives protection against natural hazards such as hurricanes, storms, cyclone *etc*.

Conclusion

Coral reef and its ecosystem are declining at an alarming rate. Hence, restoration process like coral gardening is now considered as an essential component to conserve corals and its ecosystem. We may seek funding support and help from many National and State level organizations. We can also make tie-ups with many Government & Private "Coral Gardeners" to get details about the gardening process of corals, information on donor coral, adopted coral from various resources to start and develop coral gardening.

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