Journal Home: www.bioticainternational.com

Popular Article

Article: RT660

Biotica Research Today

Vol 3:7 2021

560/562

How to cite this article?

Deepika and Elakkanai, 2021. Coral Transplantation as A Reef Restoration Method. Biotica Research Today 3(7): 560-562.

Coral Transplantation as A Reef Restoration Method

S. Deepika* and P. Elakkanai

Dept. of Aquatic Environment Management, Dr. M.G.R. Fisheries College and Research Institute, Thalainayeru, Nagapattinam, Tamil Nadu (611 002), India

Corresponding Author

S. Deepika

e-mail: deepikanarmi@gmail.com

Keywords

Coral reefs, Coral transplantation, Restoration, Transplantation technique

Article History

Received in 30th June 2021

Received in revised form 03rd July 2021

Accepted in final form 04th July 2021

E-mail: *bioticapublications@gmail.com*

Abstract

Coral reefs are the sensitive and more productive ecosystem of the ocean. Corals respond quickly to the slight changes in the environmental conditions. Current scenario of climate change and marine pollution is causing death of corals along the coastal area. To overcome these circumstances the conservation and restoration process are considered as the need of hour. This article explains in detail about the reef restoration methods for the protection of marine ecosystem

Introduction

Coral reefs are among the most complex and biodiverse ecosystem in the earth serving ecosystem goods and services together with the nearshore ecosystems supporting the human kind. On a global scale, the value of the total economic goods and services provided by coral reefs have been estimated to be US$ 375 billion per year with most of this coming from recreation, sea defence services and food production, this equates to an average value of around US$ 6,075 per hectare of coral reef per year (Edwards and Gomez, 2010). Nowadays, coral reefs are facing serious threat due to marine pollution, over exploitation of resources and anthropogenic and natural disturbances leading them to the mass detoriation. To overcome the declining of reefs, restoration measures such as coral transplantation and artificial reef construction have been carried out in many areas with the aim to restore the degraded areas of reefs. Restoration is defined as an act of returning an ecosystem, as nearly as possible to its original condition. Of the two efficient methods, coral transplantation appears to be more appealing since it involves conversion of bare reef in to the highly covered reef area. However, artificial reef construction is widely used and accepted by public and resource managers but still under scientific consideration.

Need for Restoration

- Reductions in habitat and species diversity, and habitat size and heterogeneity;
- Reductions in the population size, dynamics and range of many species;
- Fragmentation of habitats increasing the vulnerability of remaining isolated pockets to natural or human-induced environmental changes, especially if fragmentation prevents the movement of propagules; and
- Reductions in the ability of naturally functioning ecosystems to provide economically important goods and services such as erosion protection, nutrient reduction, or carbon retention.

Coral Transplantation

Coral transplantation is a widely accepted method worldwide to restore the degraded area efficiently. The prior justification for the transplantation method is if the coral area would fail from the natural recovery due to lack of recruitment. Restoration by means of coral transplantation may bring some clear benefits especially on the promotion of certain species or fish community restoration. Such benefits include: immediate increase in coral cover and diversity, increased recruitment of coral larvae due to the presence of coral transplants, survival of rare and threatened species when their primary habitat is destroyed, reintroduction of corals to the areas where the larval supply is less or where the post settlement mortality is more and instant increase in topographic complexity and hence the accumulation of associated organisms. Potential drawbacks from the coral transplantation includes: loss of colonies from the donor areas, high mortality rate of transplanted corals, reduced growth rate of transplanted corals, failure of attachment of transplants and their subsequent loss due to wave action and reduced fecundity of transplants due to the stress.

Coral Transplantation Technique

Corals must be collected from a habitat similar to that into which they will be transplanted, especially with respect to the degree of water movement, depth and turbidity. Corals from shallow clear turbulent reef fronts will not do well in turbid sheltered bays.

Species Selection

Different types of coral have different environmental preferences. Survivorship of transplanted colonies will be improved by targeting species that are suited to the conditions at the transplant site. For example, species of the genus *Porites* are tolerant to wave action and sedimentation, as are most of the massive (dome-shaped) faviids. *Turbinaria* are very tolerant to sedimentation but not as wave resistant as the massive genera.

Colony Size

Large colonies have several advantages over small colonies for transplantation. Their major advantage is that, other things being equal, larger colonies have a better survival rate. Their reproductive output will also be higher than small colonies, and they will provide more habitat and topographic relief at the transplant site.

Raising of Colonies

Raising coral colonies in nurseries has become the method of choice for active coral restoration because it allows practitioners to generate hundreds of colonies while minimizing the damage and risk to existing coral populations. Many nursery programs have successfully grown their nursery stocks to thousands of corals within a few years from an initial stock of just 100 colonies from the wild population. Numerous techniques have been developed to increase the growth and survivorship of corals in nurseries. Types of nurseries include field-based (*in-situ*) or land-based (*ex-situ*) nurseries. There are advantages and disadvantages to each nursery type that ultimately depend on the resources available and goals of the restoration program. Field-based nurseries, for example, are often lower cost and use low-tech materials and equipment, but are subject to environmental extremes like warm temperatures and storms. Land-based nurseries, by contrast, can be regularly monitored and maintained, but are generally more expensive and require more experienced staff. While field-based nurseries remain the most commonly used nursery type, both nurseries can quickly generate high numbers of coral colonies.

Field Based Nurseries

Field-based, or *in-situ*, nurseries are currently the most common method used to raise corals. These nurseries follow the general process of collecting stock material from wild populations on nearby reefs and growing them to a size suitable for nursery expansion and/or outplanting back to the natural reef. Once established, *in-situ* nurseries can contain a stock supply of corals that can be used for future population enhancement projects.

Field-based coral nurseries have many advantages, particularly their relatively low costs and low technology methods. Although these nurseries can require large investments in time, less skilled or experienced personnel, such as volunteer divers or local citizens, can help offset these costs. Field-based nurseries are more susceptible to environmental extremes like warm temperatures or strong storms that can damage nursery corals and structures. Thus, nursery size, location, depth, design, and structure are important factors to consider when planning and designing the nursery.

Nursery Maintenance

- Removal of fouling organisms, which can cause coral mortality and make floating nursery structures heavier and prone to collapse. Fouling organisms include algae, sponges, fire corals, hydroids, algae, tunicates, mussels, and barnacles.
- Removal of coral predators, such as snails, fireworms, and damselfish.
- Stabilization of coral fragments that have become dislodged or damaged.
- Repair or replacement of damaged nursery structures, such as damaged line materials, weakened anchoring systems, or frayed ropes.
- Check and adjust buoyancy for floating nursery structures.
- Removal and/or isolation of coral fragments with signs of disease.

• Construction or installation of materials for the expansion of nursery structures to increase coral stocks for outplanting.

Nursery Coral Monitoring

• Survivorship and partial mortality (including causes of mortality).

• Coral health, including paling, bleaching, disease, or predation. During warm periods, you can use satellite or buoy data or install small temperature loggers in the nursery.

• Growth of corals in order to determine when subsequent fragmentation should occur or to provide data for benchmark comparisons.

Land Based Nurseries

Coral nurseries that are based on land, also known as *ex-situ* nurseries, is the method most commonly used for sexual propagation from coral larvae. However, they are also being used by more practitioners as an alternative to in-water nurseries for propagating coral fragments from wild colonies. Due in large part to the aquarium trade, many advances have been made in good coral husbandry techniques that have promoted successful coral rearing on land.

A major advantage of land-based nurseries is the ability to manipulate environmental conditions and promote optimal coral survivorship and growth that occurs all year round. With a high quality system, conditions can remain stable through seasonal changes, storms, and bleaching or pollution events. In addition to being protected from environmental extremes, corals in land-based nurseries can be sheltered from biological pests such as predators, damselfish, algal overgrowth, and disease if proper quarantine and maintenance practices are used.

The most common concern for land-based aquaria are high costs, and failures or malfunctions that can result in major losses to coral stocks. Thus, land-based nurseries require more experienced staff that is trained in water chemistry and aquarium husbandry. Practitioners of land-based systems should ensure that no diseases or non-native species are transferred between aquaria and natural reefs. For this reason, any corals which are intended to be out-planted, must be kept in accordance with permitting guidelines. Additionally, a health assessment must be performed by an approved veterinarian before corals may be out-planted.

Pruning

Propagation, or pruning, is the process of continually fragmenting and growing out coral colonies to generate large amounts of clonal fragments within the nursery.

Genotypes of corals in the nursery should continue to be tracked so that genetic diversity can be maintained and genotypes can be fragmented separately. This can be done by placing different genotypes on separate blocks, floating structures, or within separate aquaria, or by maintaining a detailed map of the nursery. Some form of labeling should occur so that nursery personnel do not confuse or mix up genotypes.

Outplanting

The goal of coral propagation efforts is to reseed reefs with coral colonies that can enhance the population recovery and eventually contribute to sexual reproduction, site propagation, and the recruitment of new corals. In addition to aiding in natural coral reproduction, outplanted corals also contribute to reef ecosystem health by increasing habitat space and complexity for other organisms. Thus, the outplanting phase is a crucial step in coral gardening efforts, where corals are transported from nurseries and secured back onto reef habitats.

Outplanting also can be the most expensive and labor intensive part of coral restoration efforts due to long hours and many people needed using SCUBA and boats. Therefore, this phase should be undertaken with thoughtful planning to minimize the loss of nursery-reared corals.

Conclusion

The application of coral transplantation in reef management is more limited than might have been predicted theoretically. In regions where coral larvae disperse widely, coral transplantation is unlikely to play a major role in increasing the recruitment of coral juveniles. In addition, transplantation of many small fragments as a means of seeding large reef areas is unlikely to succeed, despite observations on the significance of fragmentation to the localised dispersal of many coral species.

References

Abelson, A., 2006. Artificial reefs vs coral transplantation as restoration tools for mitigating coral reef deterioration: benefits, concerns, and proposed guidelines. *Bulletin of Marine Science* 78(1), 151-159.

Dizon, R.T., Yap, H.T., 2006. Effects of coral transplantation in sites of varying distances and environmental conditions. *Marine Biology* 148(5), 933-943.

Gomez, E., Dizon, R., Edwards, A., 2010. Methods of coral transplantation. Reef Rehabilitation, p. 99.

Okubo, N., Onuma, A., 2015. An economic and ecological consideration of commercial coral transplantation to restore the marine ecosystem in Okinawa, Japan. *Ecosystem Services* 11, 39-44.

Muko, S., Iwasa, Y., 2011. Long-term effect of coral transplantation: Restoration goals and the choice of species. *Journal of Theoretical Biology* 280(1), 127-138.