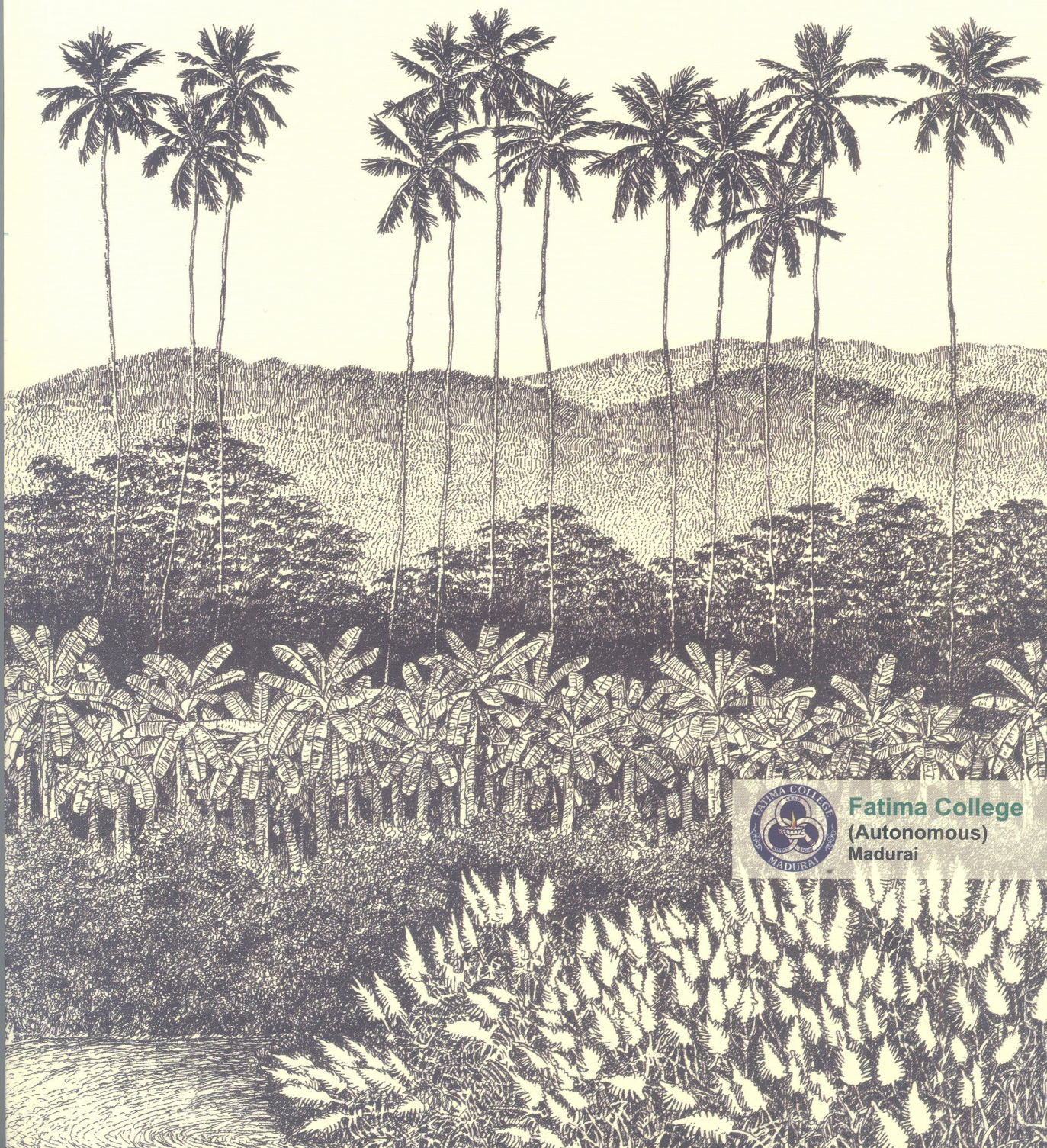
Solutions to Ecological Challenges:
Multidimensional Perspectives



Fatima College
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Solutions to Ecological Challenges:
Multidimensional Perspectives

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Solutions to Ecological Challenges: Multidimensional Perspectives

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Preface

Mother Earth has been squandered and exploited by world's G 20 countries- the so called great economies. The 'third world' countries in their desire for progress have followed the footsteps of the Developed nations and have left our ecosystem irreparably polluted without putting the entire system in place. A classic example of mindless progress in the Indian Silicon Valley , Bangalore with its software industries has been transformed from a Garden city into a Garbage City within a decade.

The proud leaps of mankind into farther most corners of the endless Universe has certainly left several dents in the Ozone layers; with all the secretive nuclear tests under the oceans and several uninhabited spaces we do receive the lashing of the 'tsunami' and pounding of the earthquakes. In the name of advancements the dams have done damage to many communities who have been deprived of their land and livelihood and have been left to fend for themselves. In every G20 summit world leaders discuss the problems of Global Warming, Climate Change, Soil Erosion and related topics. The fact that these are discussed over and over again only confirms that these Challenges are far from over. It is apparent that all are equally clueless about a single workable solution to these highly complicated ecological challenges, intersecting into all aspects of human activity.

In an effort to finding solutions to ecological issues confronting the world Fatima College has taken toddler's steps in this direction. The first is the organization of the UGC sponsored International Conference on "Solutions to Ecological Challenges: Multidimensional Perspectives" held from 11 December 2014 to 13 December 2014. Seven departments namely Tamil, English, Economics, Physics, Chemistry, Zoology and Home Science, along with the expert advice of DHAN Foundation have put this massive programme together. Eminent resource persons were invited. Scholarly articles from all disciplines were received. They were peer-reviewed and the best ones have been incorporated into two books. Being the Organizing Secretaries of the International Conference, we take this opportunity to wholeheartedly thank the UGC, the Management and the staff of Fatima college and DHAN Foundation, for enabling us to put up such a worthwhile, impact-oriented conference.

Organising Secretaries

Dr. S. Renuga, Head, Department of Chemistry
Dr. S. Geetha, Head, Department of English

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The Editorial Board expresses sincere thanks to the contributors of this International Conference Mr.Vasimalai, Mr.Gurunathan and Mr.Krishnamurthi of DHAN Foundation, Madurai for their collaboration and sharing of their expertise.

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The contributions of the invited speakers and the session chairs are also greatly appreciated.

Grazing Fish as a Boon for Survival of Transplanted Corals

N. Marimuthu and Himala Joshi

Abstract

Economic development is dependent largely on the utilisation of coastal environment and establishing infrastructure along the coast. In this context, coastal development becomes inevitable. Along with that, the need for coastal conservation also assumes great importance, in order to make development and management of coasts sustainable. This goal can be achieved by utilising the potential of coral transplantation process- which is one of the important methods of coral restoration process, carried out in areas where the coral population has dwindled or is under threat as a result of unfavourable environment for propagation. In this note, pressures on transplanted coral colonies during restoration process have been discussed, by using various scientific reports. The note highlights the usefulness of grazing fish for increasing the survival rate of transplanted corals.

Keywords: Grazing fish; Coral transplantation; Coral reef; Coral predators

Introduction

Development is inevitable in the present era of globalisation, where economic development is dependent largely on the utilisation of coastal environment and establishing infrastructure along the coast. Coral reefs are an integral part of the marine ecosystem along with being very sensitive components of the coastal environment. There is thus a need to study and establish the link between coral reefs and the development process along the coast. At some sites in the sea, there is a threat to the survival of corals, owing to industrialisation and the resulting effects of pollution on the ecosystem. As a measure to ensure their survival, it is essential to shift the coral to other sites where the environment is pristine and conducive to the growth and perpetuation of corals. This process of shifting the corals from one site to another is known as restoration.

The restoration process can be carried out in two ways, i.e. by two types of restoration of corals, viz., Translocation (in which the entire colony needs to be transferred for survival

purpose) and Transplantation (i.e. enriching the ecosystem through fragment transfer). Of these, coral transplantation through fragmentation method is an economical method and also the easiest way of restoring corals to renovate damaged reefs. The transplanted corals have to struggle for survival and to thrive in the new environment much like refugees as they are under pressure due to physical factors as well as water-quality criteria such as clarity, surface temperature, nutrient parameters etc., which may be different from the site from which they have been transplanted. Once the transplanted coral colony is introduced into the new benthic environment, the algal fouler will try to occupy and grow further from the dead portion (due to splicing or fragmentation) of the colony and also from the bottom of the colony where underwater glue has been used for binding the transplanted colony in the benthic environment (Fig. 1). One of the important and essential steps after the restoration of the corals is to remove or scrap out these micro algae from the transplanted colonies during post monitoring periods[1].

A wide variety of organisms compete for occupying any unoccupied surface in the marine environment. Among them, algae play an important role in colonising most of the substrate[2]. These algal components are tertiary foulers which compete with the coral recruits on the dead coral surface for perpetuation[3,4]. Anthropogenic impact favours the algae in this competition on coral reef ecosystem and also contributes towards inducing the major shift from coral cover to a cover comprising dead coral with algae. Eutrophication (which may either be human-caused or natural) is also one of the other factors which in turn plays against coral recruitment processes. An example of this process is that of the Farassan Islands in the Red Sea. A large amount of water from the Gulf of Aden intrudes into the southern end of the Red Sea through the Bab el Mandab region near Arabian Peninsula[5,6]. This results in the influx of nutrients into the Red Sea which may influence the algal competition on the nearby reefs at Farssan Islands[7]. Algal competition on coral cover in the near Gulf waters has also been recently reported by John[8].

Apart from the constraints to coral growth imposed by algal competition, the coral predators such as parrot fish[9], Crown of Thorn Starfish *Acanthaster sp.* and *Drupella sp.* are the other notorious challenges[7]. Moreover, the impact of natural disturbances such as a bleaching event puts high pressure on restored corals. An instance of the phenomenon was reported by Wilson at Abu Al-Abyad Island, Abu Dhabi, and further colonisation of Turf algal invasion over the corals during the post-monitoring period was also observed. However, some colonies were successfully recovered through post-monitoring efforts by manual removal of algal components.

It is in this context that the relevance of marine organisms grazing on algae must be highlighted. The grazing organisms are known to have a symbiotic relationship with corals, and thus play a vital role in the recolonization[10] of coral recruits, improving their survival rate and additionally, initiating the further growth of the transplanted coral colony. Several reports have depicted that herbivorous fish play an important role in arresting the growth of alga[11,12,13]

which helps to advance the growth rate of coral reef. Grazing fish[14] greatly alter the benthic algal community structure and grazing activity of herbivorous fish increases, depending on accessibility of the substratum. Hence the algal grazing behaviour of herbivorous fish can prove to be a boon for the coral colonies throughout the growth cycle of corals by ensuring survival in the new environment and protecting the new colony from algal threats from during the recruitment and transplanted stages.

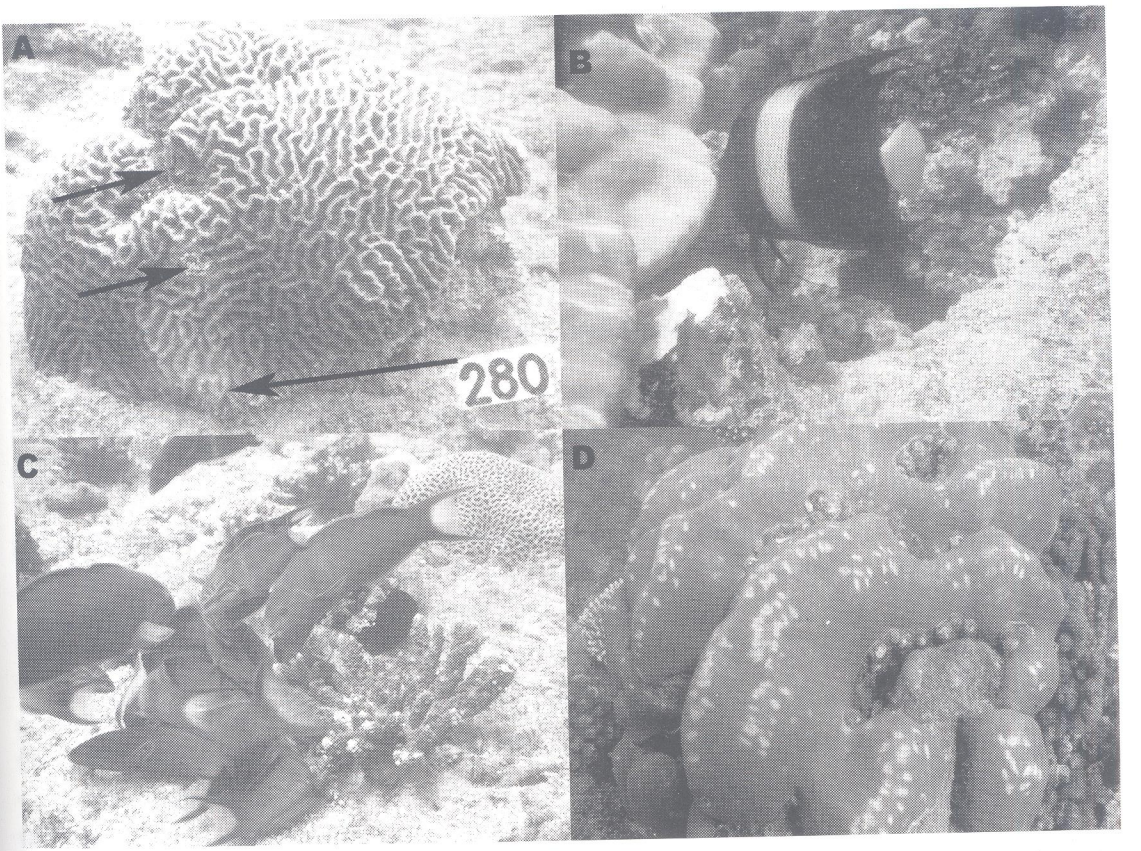

Fig. 1. (A) Algal competition on the dead coral portion of Transplanted coral, *Platygyra sp.;* Algal grazing behaviour of (B) Black Pyramid butterflyfish (C) Wrasses near Transplanted coral, *Acropora sp.* and (D) Grazing scars on the surface of Massive coral, Porites sp. by parrot fish.

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