UNDER WATER CONSTRUCTION UNDER BIOROCK TECHNOLOGY

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ABSTRACT

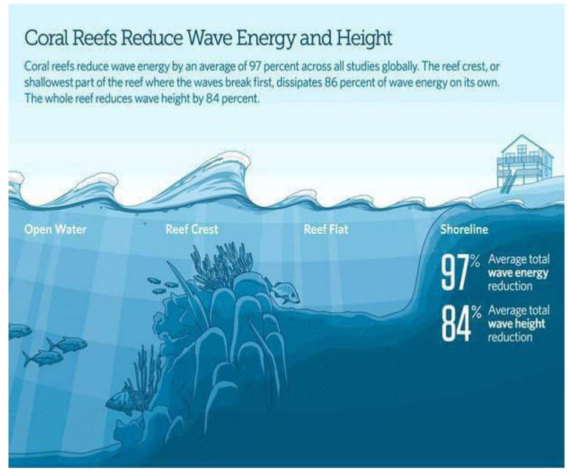
This investigation deals about the importance of Bio-rock Technology in the field of underwater construction and the process involved in constructing it .Bio-rock Technology is an evolving and ingenious technology which utilizes safe, very -low voltage electrical "TRICKLE" charges to grow and repair marine structure at any scale and to rapidly grow or restore vibrant marine ecosystem.The purpose of this study is to give detailed information regarding the role of this technology in protection and development of aquatic life . Alongside increasing the strategical rate in innovative construction for the improvement of economy of a place by tourism in an sustainable manner. In this journal we subjected literature reviews of various authors to describe the process involved in the marine structural development by "Coral Reef Restoration" .Thus the findings may be useful in developing the fish culture by utilizing Bio-rock Technology in marine structural development and construction.

KEY WORDS : Bio-rock technology ,"TRICKLE" charges , Coral Reef Restoration, Sustainable development .

I. INTRODUCTION

Bio-rock , the name by itself means the live mass of rock which is commonly trademarked as a seacrete or seament. which denotes the formation of sedimentation and the electro -accumulation of minerals dissolved in seawater by applying a very low voltage electric trickle charges to a submerged conductive structure . In which the coral reefs are reproduced by accretion to increase the organic bodies by the internal accession of their parts. One of the main component of bio-rock is magnesium hydroxide and another is calcium carbonate which is chiefly the result of the ionic composition of seawater .Over three decades of practical experience with bio-rock have shown that one kilowatt hour of electricity will result in the accretion of about 0.4 to 1.5 kg (0.9 to 3.316)of bio-rock,depending on various parameters such as depth,electric current ,salinity and water temperature.Bio-rock samples range in compression strength of 3720 to 5350 lbf/in^2(26 to 37 mpa) for comparison,the concrete typically used in sidewalls has a strength of about 3500 lbf/in^2(24 mpa),where it is comparatively 4 times stronger than that of concrete.Bio-rock coral reef turns barren dead and dying areas into prinstine reefs swarming with fishes in a few years,even where the natural recovery is impossible. In this paper we shall discuss the importance of this evolving technology in the field of marine structural development as well as in maintaining the aquatic ecosystem in an sustainable manner.

Watson 2000).It is becoming increasingly obvious that coral reefs play a central role in the mitigation and adaptation of changing weather patterns and sea level rise .



II. LITERATURE REVIEW

A. CORAL REEF RESTORATION- (A GUIDE LINE TO EFFECTIVE REHABILITATION) :

AHMAD ALLAHGHOLI (U.N. mandated University for Peace in Costa Rica)

Coral reefs act as buffers to reduce the energy of waves,surges,storms,and in extreme cases tsunamis.As natural barriers, they protect shorelines by preventing erosion,damage of infrastructure,and loss of life. They also protect the highly productive and ecologically important wetlands and mangrove forests along coasts, which play a key role in mitigation against climate change by storing and transforming CO2(Wil-Kinson & Talbot,2001).In a time when the effects of climate change are starting to become visible ,vulnerable nations are beginning to evacuate, like in the example of Kiribati which caused a stir by becoming the first nation on earth to slowly disappear due to rising sea levels and eroding land parts (Rahman 1999,

OCEAN ENERGY REDUCTION THROUGH CORAL REEFS

The term coral reef restoration is not yet widely used ,although it has been practiced for decades. The public is generally unaware of an active approach to give life back to shorelines and their inhabitants looks like.Using an analogy,often it is explained as reef-silviculture (RinKevich,B.2008), which is basically the same as terrestrial forestation.In a controlled environment, a diverse selection of local "reef seedlings" is collected (which are naturally broken off or actively taken small pieces of coral), grown under optimal conditions (current , pH-level,salinity, enough light , no pollution , etc.), and located in relatively easy to reach area, preferably close to the restoration site. This accumulation of seedlings together makes up the term "coral garden" or "coral nursery"and they come in different forms and shapes, depending on local conditions , materials, funding ,seedling types and size of the project.

A. Hard Coral on floating ropes (Seychelles)
B. Coral seedlings tree (FL, USA)
C. Nursery tables in Bora Bora.

The seedlings are either tied up with a small rope or plastic zip-tie to the gardening structure or put onto a bit of epoxy or concrete mixture piece by piece , so they remain in place even in event of a severe weather impact . Floating ropes or nets , as well as seedling trees, usually have a buoy on the surface and are anchored to the sea floor . The location therefore should not be deeper than 5 - 7m .Tidal changes and the structures materials also must be taken into consideration . The length of the ropes holding the structures should be laid out at high tide so the floating device on the surface will always be visible. For seedling trees, PVC tubes are typically used because they are cheap, light, tough and do not erode in salt water (Nedimayer,K.2011).When applying silviculture , establishing a coral garden is one of the first active steps of restoration project, as it takes about 8-12 months for them to grow to a decent size and become strong enough to be transplanted to the area where the restoration takes place .

Once part of the coral garden is ready to be transferred to the restoration site, the coral pieces can be harvested .Pieces that have grown to be 2-3x larger than when initially placed in the coral garden , are either cut off directly from the rope or only partially so the rest of the coral piece becomes a seedling again. The next step is placing the harvested coral pieces onto a 3-D structure .Although these structures can be anything imaginable , some are more effective in terms of optimizing and facilitating growth since the success of (re)populating on a flat area is less than an elevated construction (Fox, H.E.,2000). Many different structures have been tried and tested. Fish and oyster farming for example have a recreational purpose to attract snorkelers and divers, an environmental purpose for providing food and income for the local population , and they can be in the form of art, such as the underwater museum in Cancun ,Mexico .These structures can also secure coastlines from being washed away, or protect coasts by becoming a wave breaker . All these benefits exist naturally with coral reefs , but unfortunately many of them have been destroyed and therefore need to be restored.

B. CHADD SCOTT, (MARINE PROJECT COCORDINATOR, SAVE KOH TAO MARINE BRANCH KOH TAO , THAILAND)

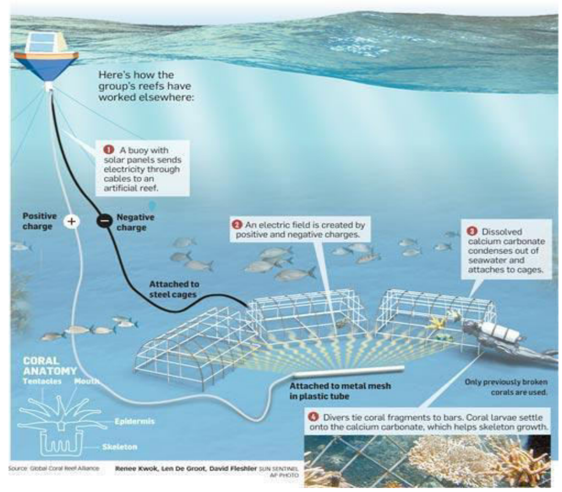
Coral reefs are one of the earth's most valuable ecosystems, contributing about $375 Billion US Dollars to world economies every year (West and Salm 2003). Coral reefs are not only essential for Thailand's fisheries industry , but also contribute greatly to the nation's economy through recreation and tourism. On Koh Tao,it has been estimated that about 60% of the 300,000 visitors per year partake in SCUBA diving on the local reefs, with 46% of all PADI dive certifications from Thailand being issued here in 2009 (PADI International) . But, globally coral reefs are declining at a rate of about 2% per year, and in Thailand about 35% of the reefs have already been classified as being in "Poor / Very Poor" condition (Wilkinson 2008). In addition to locally caused threats due to development and unsustainable business practices, reefs are also faced by increasing global threats.

Coral reef bleaching appears to becoming more frequent and severe in the last 30 years, decreasing reef abundance and diversity when combined with other chronic stresses (Hoegh-Guldberg 1999, Walther et al. 2002). In 2010, reefs throughout the

South China Sea experienced mass **particularly** bleachingand **bad** m**for**tality **Thailand's** 2010 **ree**was fs, with up to 100 % bleaching and 70%-90% mortality in many areas. During this time however, rates of bleaching and subsequent mortality have been found to be much lower on the Hin Fai Bio-rock project (started Oct. 2008) than the surrounding areas. In a survey conducted on the 19th of May 2010, only 10% of the hard corals around the Hin Fai site were considered healthy, while over 56% of the hard corals on the Bio-rock Structure were listed as healthy.

Bio-rock is an artificial reef structure that uses low voltage electrical current to improve the growing conditions for corals and other reef organisms. This process is called mineral accretion, and uses electrolysis of sea water to lower the surrounding water pH level which causes minerals to precipitate out and collect on the structure by. Corals, clams, and other calcium carbonate secreting organisms growing on the structure are able to grow on an average of 3 to 5 times faster, and in a wider range of environmental conditions, such as warmer, more acidic, or more nutrient rich waters (Goreau 2005; Smith 2002).

The structure of the Bio-rock (cathode) can be custom designed and built into almost any shape with a variety of functions to support the local environment and economy. For this proposed project, Salamander Energies has requested to investigate the possibilities of recycling scrap oil platform building materials to serve as the structure cathode. If possible, this will not only decrease the amount of new materials purchased, but also encourage sustainable methods of dealing with business externalities such as construction waste. An example of a Bio-rock site layout and components can be found in Appendix A.



APPENDIX A

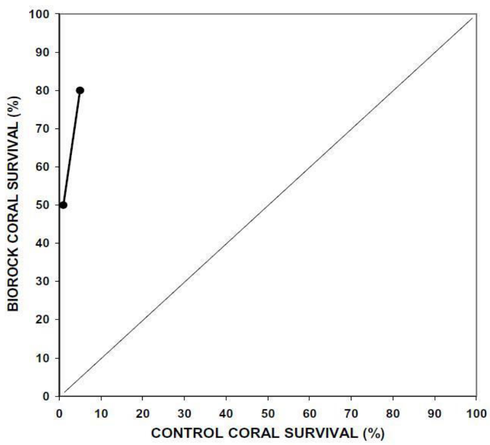
C. THOMAS J.GOREAU GLOBAL CORAL REEF ALLIANCE 37 PLEASANT SR. CAMBRIDGE , MA 02139

WOLF HILBERTZ ,SUN AND SEA , E.V. (MARINE ECOSYSTEM RESTORATION: COSTS AND BENEFITS FOR CORAL REEFS)

Corals grown in the Maldives on Bio-rock structures had 50-80% survival from the severe high temperature bleaching events that killed 95-99% of the corals on surrounding reefs (Goreau, Hilbertz, Hakeem and Hameed, 2000). Survival of Bio-rock corals was from 16 to 50 times greater than surrounding habitats . A large population of corals was being grown in the same habitat using conventional cementing methods and being used as controls to compare growth

BIOROCK CORAL SURVIVAL (%) :

Survival of corals on Bio-rock reefs were 15 to 50 times higher than on adjacent coral reefs after the 1998 Maldives Coral Reef Bleaching Event. Observations are shown by graph connecting data points.



CONTROL CORAL SURVIVAL

The diagonal line shows what would be expected if there were equal survival of corals on Bio-rock compared to the surrounding reef rate. Populations of coral species and fish species were maintained on Bio-rock reefs that had virtually vanished from surrounding reefs. Because Bio-rock structures have up to nearly 100% live coral cover, while no surviving natural reef has more than 5-10%, they are intense tourism attractions. Corals grown on Bio-rock structures in Indonesia show exceptionally rapid growth , and host extremely high, and steadily increasing, density and diveristy of fishes, especially juvenile fishes, quickly building up much higher fish densities than surrounding reefs (Goreau and Hilbertz, 2001). Because of the spectacular increase in fishes, these projects have been awarded the Indonesian KONAS National Coastal Zone Management Award, the Skal Global Ecotourism Award., and been nominated for major awards by the United Nations Environment Program and the World Tourism Organization by the Indonesian Government.

PROFILIC GROWTH OF BIOROCK IN INDONESIA

Bio-rock structures in the Maldives have turned an eroding beach into a growing one as the mass of the corals and Bio-rock material increase, providing more resistance to waves, slowing them down, and causing sediments to be deposited. Up to 15 meters of beach have grown in just a few years, with the effect getting steadily larger as the Bio-rock reef gains mass and as corals grow on it. (Goreau, Hilbertz and Azeez Hakeem, 2004).

III. CONCLUSION

Thus in this journal we have seen various views of literates discussing about the tremendous application and construction of bio-rock in the field of marine structural development by coral reef restoration .Bio-rock coral reef turns barren dead and dying areas into prinstine reefs swarming with fishes in a few years,even where the natural recovery is impossible. Alongside it also plays a major role in different aspects such as increased sea food production, economic development of a place by tourism ,habitat for aquatic animals, as an agent of coastal protection etc. Thereby, it is concluded that it can utilized in the field of under water construction in an inquistive manner.

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