Research paper on causes of coral bleaching

Business, Management

\n[toc title="Table of Contents"]\n

\n \t

\n[/toc]\n \n

Coral Bleaching: Causes, Effects and Response Action Plan Coral bleaching occurs when there is physiological stress which leads to an imbalance of the symbiotic relationship that the corals have with the algae that live in the coral leaves (Rosenberg, Kushmaro, Kramarsky-Winter, Banin and Yossi 1). The algae will reduce or all will leave. The algae are important to the coral reef since they are a source of nutrition and colour. When this occurs, there is no tissue growth and sexual production in the corals. They end up losing colour and thus the term coral bleaching (Douglas, 386).

The skeletal structure of the coral reefs may be attacked by large populations of parrot fish, worms and sea urchins. The structure becomes weak and in times of storms the reefs will be reduced to rubble. The bleaching which is widespread and prolonged increases the mortality rates of the coral reefs. The 1997-1998 coral bleaching events caused a lot of damage especially in the areas along the Indian Ocean. In these regions, the coral reef mortality rate was as high as 90%.

In the past it was believed that pollution and adverse fishing practices posed the greatest danger to coral reefs. However, with the passage of time and great scientific research, the academic experts have shown that the primary

dangers are climate change and coral bleaching. Scientists have noted a significant relationship between coral bleaching and a rise in sea surface temperatures or global warming (Reaser, Pomerance and Thomas, 1501) Most of the coral reefs will survive when the high sea level temperatures persist for less than a month however if the high temperatures persist for longer periods it has been observed that

a lot of damage is done.

Stress-related bleaching also occurs where there is an increase in the salinity of the waters, sedimentation and intense solar radiation (Sugget and Smith, 1). Other causes are exposure to air when there are low tides and chemical pollutants like copper and oil. These conditions take place in seasons of extreme weather conditions such as hurricanes, typhoons and El Nino which occur when there is a rise in the sea level temperatures.

If climate change trends persist the coral reefs will continue to be in danger. There has not been any significant evidence provided that has shown that the coral reefs have the ability to acclimate or adapt to the changing climatic conditions. In the near future if the conditions are not slowed down, the earth could see extinctions in global and local sea species.

Global warming does not only provide a threat through increased sea level temperatures. There is also the threat of calcification. The emission of greenhouse gases has been steadily increasing. The carbon dioxide in the environment is increasing steadily which makes it more difficult for the coral reefs to grow their carbon carbonate skeletons. Their rate of growth has been reducing.

A third ratio of the carbon dioxide released in the atmosphere is being

observed by the oceans increasing the PH of the waters. The high carbon dioxide in the environment increases the acidity of the water which makes it difficult for the coral reefs to conduct calcification. It has been predicted that the calcification rates will be reduced by 14-30% by the year 2050 due to the increasing carbon dioxide in the air. With lower rates of calcification, it reduces the capacity of the damaged coral reefs to rejuvenate.

There are also other climatic conditions that the scientists are concerned about. There are intense tropical cyclones and storms that end up causing physical destruction of the coral reefs in the local area (Brown, 133). There have been changes in the rainfall patterns that could increase the incidences of droughts. This will reduce the amount of freshwater available to the coral reefs. The rise in the sea levels will limit the penetration of light to the coral reefs and also limit the number of suitable locations for the corals. There will be changes in the regional atmospheric and ocean circulation patterns that will affect the connectivity between the coral reefs.

Effects of Coral Bleaching

The decreased quantity of coral reefs brings various disadvantages. Where there is adverse coral bleaching there will be several changes. The fish and other marine microorganisms have no shelter. There will be decreased yields of the reef fish and the pelagic species that eat the reef fish.

This places the human population at risk in terms of food supply since the stocks of fisheries will reduce. It has been identified that a quarter of the fish harvests come from the coral reefs. There will be a significant change in the catch of the fish which the fishermen will have access to. The trend will be towards the lower value herbivorous types. There will be less income earned

by the fishing communities that usually live near the shore. Due to desperation to catch more fish and earn higher income, the fishermen may resort to damaging fishing methods. They will also change their fishing areas in order to target certain species that they want.

The reefs also provide significant protection to the coastline. They act as a buffer to erosive wave action and storms. There will be higher shoreline erosion and lower tourist business activity which ends up reducing profits for the tourism sector. The coral reefs have long been an area of fascination due to their diverse colours and forms. These are the most biological diverse marine ecosystems in the world (Oppen and Lough, 2). There are a lot of reef-related tourist activities such as scuba diving.

Reef Management Response Action Plans

Coral bleaching has recently been at a high level and there are concerns on the adverse effects it will have on the economies of developing nations. Damaged reefs have been able to regenerate and not die. If the right environmental conditions are prevalent for a considerable amount of time, the mortality rates of the coral reefs can be reduced. Some of the suitable conditions include healthy fish populations, minimal human impact and high coral diversity. There should be sexually mature corals that will provide larvae whether at the shore or close to the waters to provide the larvae. The prevailing winds, currents and upwelling should be suitable to cause the cool waters and the larvae to come to the area. There should also be a solid, submerged surface area on which the coral larvae can settle (Westmaccot, Teleki, Wells and West, 13). The surface should be free from algae. The coral reefs which are shaded and protected from the prolonged sunlight and U-V

radiation are at a better advantage. It has also been noted that the corals which are in the turbid waters survive better than the ones in the clear waters. It has been noted that these coral reefs have the mechanisms to deal with the salinity, turbulence and temperature changes. They are also protected from the sunburns through refraction and absorption of the UV light.

There are human activities that inhibit the recovery processes of the coral reefs. There are destructive fishing practices such as dynamite fishing and trawling in the deep waters which leads to overfishing. Widespread overfishing leads to lower populations of the herbivorous fishes which assist in keeping a check on the harmful algae. The herbivorous fish feed on the harmful algae which tend to overcrowd the coral reefs. The algae overcrowd the corals and eventually kill them.

There are also those people who engage in coral mining reducing the population of coral reefs in the waters. Where there are sewages, the algae blooms block the corals from receiving sunlight in the water columns. This causes stunted growth and there is interference with reproduction. The people may also decide to conduct shoreline construction which disturbs the sediments on the shoreline which smother the coral reefs to death.

Unregulated tourist activities also pose a great threat. There are tourists who engage in trampling the coral reefs and dropping the dive boats’ anchors in the reefs.

There are countries that are now in danger of losing substantial amounts of coral reefs which form a major part of their livelihood. They have been degrading at an alarming rate with the worst related cases in the Philippines

and Indonesia. A country like the Maldives is highly dependent on tourism and fishing which are activities that are directly affected by coral bleaching. In 1995, an international body, the International Coral Reef Initiative was formed which creates awareness of coral reef damage causes, effects and restorative efforts. It has garnered the participation of more than 80 countries. There have been calls for responses to reef management and recovery in order to minimise the socioeconomic effects.

In reef management, the most practical, sustainable and effective approach is to allow for natural rejuvenation or recovery. Artificial or man-made rehabilitation approaches should not be considered at all unless the government at the same time implements successful practices that limit human-induced stresses in the specific area. The costly recovery and rehabilitation practices may be a risk rather than a cure if care is not taken. There are certain questions that the government should ask itself in its implementation plans. The objectives of the restoration project should be clearly stated and understood. What is the scale of the project? A cost budget should be prepared and the available funds compared to the estimate costs. Will the financial resources be sufficient? If not, the country can partner with international environmental interest groups to get the support that they need even in terms of advisory and technical support. What is the benchmark expected or rather what is the acceptable success rate? The parameters should be stated so that the government can measure its findings regularly and decide the corrective steps to take.

It is important for all the stakeholders to be involved in the process? Does the plan take into account this factor? There will be less resistance

experienced by the government from the local community where the fishermen and the public are involved in the initiatives.

Finally, the last crucial question that should be considered is the long-term viability of the project. Is it feasible or practical in the long-term considering all the relevant factors?

The management can assist in reef recovery and rehabilitation by allowing natural recovery by removing or limiting actions that can cause stress to the coral reefs. Artificial substrates can be provided for larval settlement. The corals can be farmed and transplanted to other areas with healthy corals for regeneration. Marine protected areas play an important role in reef management. These are areas that are protected or restricted from negative human impact.

The MPAs however should be structured strategically so as to take into consideration factors such as connectedness, resilience, refugia and the high probability of recovery for the coral reefs. Attention should be paid to the areas that have displayed low vulnerabilities to coral bleaching and the areas that have been found to be sources and sinks of coral larvae. Specific protection measures should be considered by the management for the harmful algal eaters and coral eating fishes which contribute to coral recovery. There should be a wide geographical spread of the different types of MPAs in the region. The management should ensure that the MPAs are effectively managed.

The government should adequately assess the coral reef bleaching by identifying the severe and the mild cases. The remaining live coral reefs should be identified and protected. The government may need to revisit the

zoning and boundaries of the marine protected areas. A moratorium can be issued on those activities that will damage the remaining coral reefs such as diving, anchoring or the collection of the coral reefs by the residents.

The damage or impact on the fishing and tourism activities should be assessed. The recovery results should be monitored so that the government can know the rate of success of the programs. The government should also encourage the promotion of other tourist activities or attractions apart from the coral reefs so that the damaged ones can get time to recover or rejuvenate.

There should be no-fishing zones for certain periods of time. These limitations assist the fish in giving them time and breeding grounds. The government should prohibit and even have laws that prevent destructive fishing methods from being used. The catch composition of the fishermen can be analysed to assess the success of the reef management practices.

In order to supplement the fish income, the government should work with the local communities to have alternate sources of livelihood. Through the introduction of licensing schemes, the government can control and even limit the number of fishermen in a certain region. The local communities can be involved in the reef management practices.

Conclusion

Scientific studies have proven that the rate of coral bleaching can be significantly reduced through human efforts. Global warming can be reduced by countries acting responsibly when it comes to emission of greenhouse gases. The rising sea level temperatures have to be addressed. There has to be awareness and education efforts towards governments, companies and

the local people. This will cause people to stop destructive fishing practices and the government will streamline the industry and put the necessary laws in place. Tourist activities can also be monitored. This will ensure that the people still enjoy the benefits that accrue from the presence of coral reefs and the fishes that reside in them. They will continue getting the fishing and tourism income.

Works Cited

Douglas, Angela. " Coral Bleaching- How and Why?" Marine Pollution Bulletin,

46(2003): 385-392. Print.

Oppen, Madeleine and Janice, Lough. Coral Bleaching: Patterns, Processes, Causes

and Consequences. Berlin: Springer- Verlag Publishers. 2009. Print.

Brown, E. " Coral Bleaching: Causes and Consequences" Coral Reefs, 16(1997): 129-

138. Print.

Reaser, Jamie, Pomerance, Rafe and Peter, Thomas. " Coral Bleaching and Global

Climate Change: Scientific Findings and Policy Recommendations" Conversation Biology, 14. 5(2000): 1500-1511. Print.

Rosenberg, Eugene, Kushmaro Ariel, Esti Kramarsky-Winter, Ehud Banin and Loya

Yossi. " The Role of Micro-organisms in Coral

Bleaching" The International Society for Microbial Ecology, (2008): 1-8. Print.

Sugget, David and David Smith. " Interpreting the sign of coral bleaching as

friend vs.

Foe”. Global Change Biology, (2010): 1-10. Print.

Westmaccot, Susie, Kristian Teleki, Sue Wells and Jordan West. Management of

Bleached and Severely Damaged Coral Reefs. United Kingdom: Information Press. 200. Print.