

Review: Coral Reefs Demolition due to Anthropogenic Activity

Archana Joon¹, Rekha jalandra²

Former M.Sc Student, Department of Zoology, MDU Rohtak, Haryana, India¹

Assistant Professor, Department of Zoology, Hindu Girls College, Sonipat, Haryana, India²

ABSTRACT: Coral reefs are critically important for the ecosystem goods and services they provide to maritime tropical and subtropical nations. Yet reefs are in serious decline; an estimated 30% are already severely damaged, and close to 60% may be lost by 2030. There are no pristine reefs left. Coral Reefs are suffering from natural and anthropogenic activity. Many anthropogenic influences are resulting in the degradation and destruction of coral reefs causing loss of biodiversity, essential food supplies and economic revenue. Each of these threats has a significant impact on the health of coral reefs. Coral reefs grow very slowly and can take hundreds of years to form. If damage to coral reefs continues at the current rate, over half of all reefs in the world could disappear in our lifetimes. Currently, millions of acres of reef have already been severely damaged or destroyed. Through education, awareness, and action, people can help to preserve and protect coral reefs.

KEYWORDS: Coral reef, Anthropogenic activity, Biodiversity, Destruction, Protection.

I. INTRODUCTION

Coral reefs are one of the oldest and the most diverse ecosystems in the planet; because of such matter, scientists coined coral reefs as 'rainforests of the sea. The National Oceanic and Atmospheric Administration (NOAA) (2008) estimated that about 25% of marine life use coral reefs as safe havens from predators, breeding grounds, and feeding grounds despite the fact that coral reefs only cover a small percentage (estimated about 0.1%) of the world's oceans. It serves an umbrella species because it serves both as a habitat and a living, breathing organism for other marine animals to thrive. According to Withgott (2011), coral reefs is a massive oceanic structure composed of skeletons from dead marine animals found in most parts of the world's oceans (p. 439). These animals also serve protection and home for other marine life, such as smaller like clownfish who use sea anemones to keep their young safe after reproduction, to larger marine life like sharks use reefs as feeding grounds. It is not only the fish that should be thankful for coral reefs, humans should also thank reefs because it acts as a natural buffer and reduce the destructive capability of waves when it reaches the shoreline; which is important especially in coastline communities in Florida. Coral reefs also attract tourists, for example, the Great Barrier Reef in Queensland, Australia; explore the wonders of the Earth's ocean and marine life. Due to climate changes, human factors such as pollution, tourism, and overfishing, and the recent rise of the ocean's acidity, coral reefs are considered endangered, and if destroyed the world's oceans would never thrive.

II. STRUCTURE AND DISTRIBUTION

The modern understanding of coral reefs begins in Charles Darwin's book, On the Structure and Distribution of Coral Reefs. In this classic book written in 1842, he distinguished three main types of reef: the fringing reef, the barrier reef, and the atoll. **The fringing reef** occurs near the shoreline and basically follows the profile of the shore. Its stony corals need a firm base on which to establish them, and they must compete with many other sedimentary organisms looking for a firm substrate on which to settle. In off-shore waters, that substrate is usually provided by the limestone secreted by earlier stony corals on rock (often volcanic). Some of the finest fringing reefs in the world are along the edges of the

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

Red Sea where the conditions are premier for the growth of the reef. The water is enclosed by desert. Therefore, there is barely any rainfall to wash either the sand or fresh water into the sea. The second type of reef according to Darwin is **the barrier reef**. It is different than the fringing reef in one main way: the area between the living coral of a fringing reef and the shore is the reef flat, but the area between the barrier reef and the shore is a lagoon. The lagoon is a relatively shallow area of water, only a few meters in depth. However, its width can be enormous as in Australia's Great Barrier Reef, some forty miles wide. The final type of reef distinguished by Darwin was **the Atoll**. It is a more-or-less circular crest of coral with a lagoon located at its centre, only about a few kilometres in diameter. They are usually far from human influence and very deep, making them ideal for diving. There might be areas on an atoll reef where sand is exposed to the air. The reef acts like a trap for sand and with the occasional storm, and persistent currents, banks of exposed sand and small sand islands can be formed.

III. ANTHROPOGENIC ACTIVITY WHICH INFLUENCE CORAL REEFS

Humans have a very large effect on the ecosystems of coral reefs. Sensitivity of coral reefs causes them to be more susceptible to harmful anthropogenic practices. There is serious concern that coral reefs are being rapidly degraded by a wide range of human activities (Wilkinson, 1993)(Ginsburg, 1994)(Birkeland, 1996) (Bryant et al., 1998). Some of these are sedimentation, global warming, recreational activities, poison fishing, blast fishing practices, water pollution, and coral mining. All of these very different practices can effectively end up with the same results; the mortality of coral reefs around the world. Coral reefs are an important ecosystem of the world, and support many different industries and millions of people.

i) **Sedimentation**- Erosion caused by construction (both along coasts and inland), mining, logging, and farming is leading to increased sediment in rivers. This ends up in the ocean, where it can 'smother' corals by depriving them of the light needed to survive. Sometimes dredging and other activities which increase sediments in the water appear to cause only localized or negligible effects on corals (Brown & Howard 1985). Sedimentation can alter the complex interactions between coral reef and their environment (Rogers 1990). Sedimentation is a major controlling factor in the distribution of reef organisms and in overall reef development (Hubbard 1986, Macintyre 1988). For example, sedimentation can lull major reef-building corals, leading to eventual collapse of the reef framework. Modification of terrestrial sediment fluxes can result in increased sedimentation and turbidity in receiving waters, with detrimental impacts on coral reef ecosystems. In the past few decades, multiple threats have contributed to large declines in coral cover worldwide (Bruno et al., 2010).

ii) **Overfishing**- Over exploitation affects the vast majority of the world's reefs. This leads to an average decrease in the size of the fish and a reduction in predatory target fish. Removal of key herbivores and predator species may result in large scale ecosystem change. If grazers are removed from reefs, algae are quick to take over and dominate. This phenomenon has been especially marked in the Caribbean (Gardner et al., 2003), where coral decline on many reefs has been associated with an increase in macroalgal cover (Hughes et al., 1994). The factors driving this shift include direct impacts on corals from hurricanes, disease, bleaching and runoff, as well as the indirect impacts of the release of top-down control of macroalgae, arising from overfishing of herbivorous fish and mass mortality of the grazing sea urchin *Diadema antillarum* (Aronson et. al., 2006) (Sotka et.al.,2009). A high cover of macroalgae reduces the space available for coral recruitment as well as the relative herbivory pressure per unit area, which may result in a positive feedback loop that helps maintain macroalgal dominance (Mumby et al., 2007).

iii) **Blast fishing practice and poison fishing**- Fishing methods in the tropics can be particularly destructive especially those of dynamite 'blast' fishing, cyanide or poison fishing and fish hunting with gum boots. Other adverse fishing practices include disintegration of the reef structure in order to weight traps and remove hiding places and beating coral surfaces to herd fish into nets. Anchor damage and accidental grounding of boats can be a serious threat to reefs. Corals in contact with macroalgae can exhibit lower fecundity (Foster et al., 2008), reduced growth (Burkepile et al., 2010) and increased mortality (Nugues et al., 2006) (Smith et al., 2006).

iv) **Pollution**- Urban and industrial waste, sewage, agrochemicals, and oil pollution are poisoning reefs. These toxins are dumped directly into the ocean or carried by river systems from sources upstream. Land-based activities affect the runoff of pollutants and nutrients into coastal waters (Syvitski et al., 2005) and remove, alter, or destroy natural habitat.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

Some pollutants, such as sewage and runoff from farming, increase the level of nitrogen in seawater, causing an overgrowth of algae, which 'smothers' reefs by cutting off their sunlight. The stability of the macroalgal-rich state has been debated (Mumby et al., 2009), yet it is clear that a higher biomass of herbivores, which exert a stronger control on macroalgae, is beneficial to corals (Mumby et al., 2009), (Hawkins et al., 2004) and (Williams et al., 2001).

v) **Climate change**- Sea level rise caused by melting sea ice and thermal expansion of the oceans could also cause problems for some reefs by making them too deep to receive adequate sunlight, another factor important for survival. Global warming has already led to increased levels of coral bleaching, and this is predicted to increase in frequency and severity in the coming decades. Such bleaching events may be the final nail in the coffin for already stressed coral reefs and reef ecosystems. Higher sea temperatures from global warming have already caused major coral bleaching events. Bleaching occurs when corals respond to the stress of warmer temperatures by expelling the colourful algae that live within them. Some coral are able to recover, but too often the coral dies, and the entire ecosystem for which it forms the base, virtually disappears. Longer-lasting and more extensive bleaching events are already on the rise, with further increases expected in the decades ahead as ocean temperatures continue to rise. Warmer waters are also expected to increase the incidence of other coral diseases such as black band disease, white band disease, white plague, and white pox, all of which can lead to mass mortality of coral, and subsequently the entire ecosystem it supports. In many cases, corals undergo "bleaching," which is a process where corals lose the zooxanthellae (Zooxanthellae is a photosynthetic algae which lives in the polyp and provide energy for themselves and the coral) or chlorophyll pigment, and turn white (Wilkinson et al., 1993). After bleaching corals can survive for several months. It is possible for corals to recover by hosting more zooxanthellae, but it can take between 5 and 50 years for them to recover completely (Wilkinson et al., 1999).

vi) **Ocean acidification**- which occurs when oceans absorb carbon dioxide from the atmosphere is also a threat to coral. As the oceans become more acidic, the corals' ability to form skeletons through calcification is inhibited, causing their growth to slow. A doubling of atmospheric carbon dioxide will reduce calcification in some corals by as much as 50 percent. Ocean-based activities extract resources, add pollution, and change species composition (Pauly et al., 2005).

IV. CONCLUSION

Humans depend on ocean ecosystems for important and valuable goods and services, but human use has also altered the oceans through direct and indirect means (Mayers, Worm 2003; Jackson et al., 2001; Lotze et al., 2006). The careless acts of everyday people are endangering the lives of coral reefs; however, with proper conservation and awareness these reefs can be saved. International integration of management strategies that support reef resilience need to be vigorously implemented, and complemented by strong policy decisions to reduce the rate of anthropogenic activity and global warming.

REFERENCES

1. Aronson RB, Precht. "Conservation, precaution, and Caribbean reefs". *Coral Reefs*. 25(3):441-50, 2006.
2. Brown, B. E., Howard, L. S. "Assessing the effects of 'stress' on reef corals". *Adv. mar. Biol.* 22: 1-63, 1985.
3. Brown, B. E., Howard, L. S., Le Tissier, M. D. "Variation in the dominance and population structure of intertidal corals around KO Phuket, Thailand". *Res. Bull. Phuket mar. Biol. Cent.* 41. p. 1-9, 1986.
4. Bruno JF, Selig ER, Casey KS, Page CA, Willis BL, Harvell CD. "Thermal stress and coral cover as drivers of coral disease outbreaks". *PLoS Biology*, 2007.
5. Bryant, D., Burke, L., McManus, J., Spalding, M. "Reefs at risk—a map-based indicator of threats to the world's coral reefs". Joint publication by World Resources Institute, International Center for Living Aquatic Resources Management, World Conservation Monitoring Centre, United Nations Environment Programme (6):1220-7. 5, 1998.
6. Burkepile DE, Hay ME. "Impact of herbivore identity on algal succession and coral growth on a Caribbean reef". *PLOS ONE*. 5(1):e8963, 2010.
7. C. Wilkinson, Ed., *Status of Coral Reefs of the World* (Australian Institute of Marine Science, Townsville, Australia, 2002).
8. Caroline S. Rogers. Responses of coral reefs and reef organisms to sedimentation. *Mar. Ecol. Prog. Ser.* 62: 185-202, 1990.
9. D. Pauly, R. Watson, J. Alder, "Global trends in world fisheries: impacts on marine ecosystems and food security". *Philos. Trans. R. Soc. London Ser. B* 360, 5, 2005.
10. "Earthjustice: Because the Earth Needs a Good Lawyer." Earthjustice. Earthjustice, Web. 10 Feb. 2014

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

11. Environment: The science behind the stories, 4th edition, Jay H. Withgott, Cornell University
12. F. Moberg, C. Folke, "Ecological goods and service of coral reef ecosystems". Ecol. Econ. 29, 215, 1999.
13. Fieser, Ezra. "Outside Cancun Climate Conference, Caribbean Sea Testifies to Global Warming." InfoTrac Student Edition. Gale Learning, 6 Dec. 2010. Web. 25 Feb. 2014
14. "Fisheries." The Living Earth - Seas and Oceans. Ed. Allyson Fawcett. Madrid: Robert B. Clarke, 1975. 135-136. Print.
15. Foster NL, Box SJ, Mumby PJ. "Competitive effects of macroalgae on the fecundity of the reef-building coral *Montastraea annularis*". Marine Ecology Progress Series.367:143-52, 2008.
16. Gale Learning, 14 Oct. 2011. Web. 25 Feb. 2014. .Birkeland, C., 1996. "Life and Death of Coral Reefs". Chapman & Hall, New York, 536pp
17. Gardner TA, Côté IM, Gill JA, Grant A, Watkinson AR. "Long-term region-wide declines in Caribbean corals". Science. 301(5635):958-60, 2003.
18. Ginsburg, R.N., "In: Proceedings of the Colloquium on Global Aspects of Coral Reefs", University of Miami, Miami, 420pp, 1994.
19. H. K. Lotze, , Lenihan HS, Bourque BJ, Bradbury RH, Cooke RG, Kay MC, Kidwell SM, Kirby MX, Peterson CH, Jackson JB. "Depletion, degradation, and recovery potential of estuaries and coastal seas".Science 312, 1806, 2006.
20. Hawkins JP, Roberts CM. "Effects of artisanal fishing on Caribbean coral reefs". Conservation Biology.18(1):215-26, 2004.
21. Hubbard, D. K. "Sedimentation as a control of reef development: St. Croix". U.S.V.I. Coral Reefs 5: 117-125, 1986.
22. Hughes TP. "Catastrophes, phase-shifts, and large-scale degradation of a Caribbean coral-reef". Science. 265(5178):1547-51,1994.
23. J. P. M. Syvitski, C. J. Vorosmarty, A. J. Kettner, P. Green, "Impact of humans on the flux of terrestrial sediment to the global coastal ocean",Science 308, 376, 2005.
24. Macintyre, I. "Modem coral reefs of western Atlantic: New geological perspective". Bull. Am. Ass. Petrol. Geol. 72: 1360-1369, 1988.
25. Mumby PJ, Harborne AR. "Marine reserves enhance the recovery of corals on Caribbean reefs". PLOS ONE. 5(1):e8657, 2010.
26. Mumby PJ, Steneck RS. "Coral reef management and conservation in light of rapidly evolving ecological paradigms". Trends in Ecology & Evolution. 23(10):555-63,2008.
27. Mumby PJ. "Herbivory versus corallivory: are parrotfish good or bad for Caribbean coral reefs", Coral Reefs. 28(3):683-90, 2009.
28. Mumby PJ. "Phase shifts and the stability of macroalgal communities on Caribbean coral reefs". Coral Reefs. 28(3):761-73, 2009.
29. Nugues MM, Bak RPM. "Differential competitive abilities between Caribbean coral species and a brown alga: a year of experiments and a long-term perspective". Marine Ecology Progress Series. 315:75-86, 2006.
30. R. A. Myers, B. Worm, "Rapid worldwide depletion of predatory fish communities". Nature 423, 280, 2003.
31. Selig ER, Bruno JF. "A Global Analysis of the Effectiveness of Marine Protected Areas in Preventing Coral Loss". PLoS ONE.5(2), 2010.
32. Smith JE, Shaw M, Edwards RA, Obura D, Pantos O, Sala E, et al. "Indirect effects of algae on coral: algae-mediated, microbe-induced coral mortality". Ecology Letters. 9(7):835-45, 2006.
33. Sotka EE, Hay ME. "Effects of herbivores, nutrient enrichment, and their interactions on macroalgal proliferation and coral growth". Coral Reefs. 28(3):555-68, 2009.
34. Wilkinson, C.R., Coral reefs of the world are facing widespread devastation: can we prevent this through sustainable management practices? In: Proceedings of the 7th International Coral Reef Symposium 1, 11-21, 1993.
35. Williams ID, Polunin NVC. "Large-scale associations between macroalgal cover and grazer biomass on mid-depth reefs in the Caribbean". Coral Reefs. 19(4):358-66, 2001.