Coral Bleaching: A Global Epidemic

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Abstract

Coral bleaching has been an ongoing threat for centuries impeding basic functions of one of the most beautiful and valuable resources on the planet, coral. This unfortunate event occurs when the symbiotic zooxanthellae algae is expelled from the coral itself. when toxic chemicals or increased light pressure the algae out of their tissues leaving the coral baron and bleached. At this point the coral begins to die due to lack of nutrients causing the most biodiverse ecosystem in the world to be slowly suffocated then destroyed. Unfortunately, there are patterns of this phenomena over time as governments such as the United States and Australia have begun to work together to combat this pressing crisis. The global organizations supported by the coalitionary governments are actively researching and discovering new ways for the coral to develop resurgent qualities and continue living. Many countries are realizing the impact reefs can have on their daily lives. Through the depletion of economic growth and tourism, as in some cases reefs are the main source of income for some economies. Luckily, in recent years the resurgence is on the rise, but unfortunately the epidemic is far from over as research continues scientists are learning more and more each day. Calcifiers are acting as algae in some parts of the world solidifying the reef after the algae leaves, keeping it in place and safe from harm while also supplying essential nutrients. The ability to resurge is also not impossible as we have been able to research evolutionary change in coral in the last century requiring minimal to no algae inclusion in nutrient and mineral collection. The ability to return to another peak coral growth is soon but will take continued funding and time to complete.

Key Words: Coral, bleaching, algae, ecosystem, governments, reef, and global.

Word Count: 291

Introduction

Coral bleaching is an epidemic actively killing the most diverse ecosystem on the face of the earth. As one of the main effects of climate change, coral bleaching events are happening all over the world affecting not only the ecosystems, but the governments that prosper off them. These countries have seen a lot of negative impact over the last few decades as tourism begins to taper off and the reef fishing industry has struggled to break even. All these negative attributes are getting worse daily due to the constant rise of ocean waters. The coral allows the symbiotic zooxanthellae algae to live in their tissues as they provide both protection and nutrients to the coral. But, as temperatures rise and detrimental runoff from human settlements meet with the reefs, the corals expel the algae causing it to turn white, hence the name bleached. The coral senses these as a threat, well of course, nothing ever wants to ingest what is not good for them. Yet this is not the corals’ fault, it has survived and adapted for thousands of years doing this very activity, it is the impact of humans that is killing them. The coral bleaching epidemic is not only destroying the reef itself, but the economic values behind them, which is why there are many organizations who continually research and wish to do something to stop these bleaching events from spreading and becoming worse.

Slight Overview of the Essay

Douglas describes coral bleaching habits as, “Bleaching events are increasing in frequency and severity (Wilkinson, 1999), and the ecological collapse of the world’s reefs is predicted by simulation models using current data on the incidence of bleaching and projected climate change (Hoegh-Guldberg, 1999; Risk, 1999).” The issues with increased coral bleaching globally can be explained threefold; (1) the causes of bleaching; (2) the reasons for variation in susceptibility to bleaching; and (3) why, at the evolutionary level, corals bleach. The impact of all of these can be seen in an extreme declination in the last 200 years resulting in gross economic failures and biological tragedies.

Causes

The causes of bleaching can be complex, but it’s generally agreed upon that humans are the main cause as we have been directly causing global warming and pollution for decades. Through the destruction of forests, CO2 emissions, and over harvesting necessary animals global warming does not just man the atmosphere as oceans are one of the most affected areas at this point. The marine pollution caused by runoff from the mainland or offshore dumping can impact the ocean floor and its marine ecosystems by smothering the symbiotic algae and killing them outright. The negative affects this can have on the entire ecosystem is astronomical, as communal fish are cast out, the food sources speedily deplete, and homes are destroyed. These factors could cause huge migrations of species into unfriendly water where they can either be quickly preyed upon or take generations to evolve and adapt into.

Variation

No two bleaching events are the exact same, there is variation, they might seem similar, but both the human and environmental factors affecting the event at any given time can completely alter it. “Monitoring of natural bleaching events has revealed marked interspecific and intraspecific variation in the degree of bleaching at one site. For example, among corals, branching forms, e.g. Acropora and Pocilloporid species, generally bleach more strongly than massive corals (e.g. Jiménez, 2001; McClanahan et al., 2001).” The difference in size of events, speed, and level of destruction are all being researched daily in some of the hot spots of the world such as the Great Barrier Reef in Australia or the Florida Keys in the United States. In this case bleaching events can be seen happening intermittently over the course of decades so the sea life residing in this reef have been able to slowly adapt to the constant change of both food and protection. As good as it may sound that these creatures are evolving, it completely topples thousands of years of advancements to fight a change that has only been increasingly apparent in the last century.

Evolution

In this evolutionary tract the resilience of the symbiotes themselves is determined by the algae looking for a place to stay in the form of a mutualistic relationship. “Symbioses with Symbiodinium species are exceptional in that they commonly live in habitats at 1–2 °C below the temperature which triggers collapse of the symbiosis (i.e. bleaching) with negative consequences for the growth, reproduction and survival of the animal host.” In the review article, *The Evolution of Coral Reef under Changing Climate: A Scientometric Review*, the resilience of coral and the algae is discussed which could lead to a developmental change in the future of coral reefs allowing them to come back after a minor to medium bleaching event. These mechanisms are attributable to genetic diversity within coral populations and their symbiotic association with Symbiodinium algae, which are critical to their health and survival. The authors of the article go on to describe the genetic makeup of the coral and how this is being studied, “Genetic adaptation in corals is mediated through various factors, including the activation of heat-shock proteins, oxidoreductase enzymes, and microsporine-like amino acids. The coral surface micro-layer that absorbs UV radiation has also been identified as a significant mechanism for adaptation.” The spatial and temporal patterns being studied in the anthopence is giving scientists much data about the possibility of resurgence and resilience over time. It appears only when humans can turn around global warming that something can be done about coral bleaching. “The future condition of reefs, and the ecosystem services they provide to people, will depend critically on the trajectory of global emissions and on our diminishing capacity to build resilience to recurrent high-frequency bleaching through management of local stressors (18) before the next bleaching event occurs.” Finally, the recovery capacity of coral is crucial to understand the survivability of the reefs. It is encouraging that two of the species studied here were able to fully recover within a year, and acclimation combined with the capacity to recover between annual bleaching events will likely result in significantly fewer severe bleaching events and coral mortality by 2100. This research is integral to the fight against coral bleaching and gives humanity hope for the lack of any future for this the epidemic.

Conclusion

Unfortunately, the research has yet to be fully completed on the resurgence of coral reefs, but based on these recent studies the future is bright. Coral bleaching is currently destroying the most biodiverse ecosystem in the world and the main cause are the inhabitants it shares the earth with, humans. If humanity were to be able to clean up its pollution and control the drastic increase in global warming, then coral reefs would be able to prosper and return to the point they were at decades ago. Understanding that this estimate is unlikely is deductible in good reasoning, but this ordeal begins at the individual. If everyone can do their part and support coral reefs the great resurgence is right around the corner.

Word Count: 1,735

Resources

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