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Rising SST are the main risk for coral bleaching in the great barrier reef

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Rising Sea Surface Temperatures are Bleaching the Great Barrier Reef

**Introduction**

 Sea Surface Temperatures (SST) are rising and causing the corals in the Great Barrier Reef to bleach, and as a result are unable to recover. As Sea Surface Temperatures increase, the frequency and intensity of bleaching events are expected to increase as well (Ainsworth TD, 2016). If bleaching becomes an annual event, it is hypothesized that in this century more than 90% of coral reefs worldwide may be at risk for long-term degradation (Grottoli AG, 2014). While some corals can recover from single isolated bleaching and can acclimate to recurring bleaching events that are separated by a couple of years, it is still unknown how the coral reefs will survive and recover from annual coral bleaching events (Grottoli AG, 2014). As for the Great Barrier Reef in particular, in the past three decades bleaching events have caused reefs to decline dramatically, this is due to the stress response that causes coral bleaching (Ainsworth TD, 2016). It has also been shown that Global Warming rates are higher today, then those in the geological past (Pandolfi, 2015). In response Rising Sea Surface Temperatures (SST) are the main risk for coral bleaching in The Great Barrier Reef.

**Coral Vulnerability to Climate Change due to Rising SST**

 When Sea Surface Temperatures (SST) rise due to climate change, coral bleaching happens as a stress response (Osman EO, 2017). Due to this response, many corals in the Great Barrier have suffered dramatic declines (Ainsworth TD, 2016. A coral that suffers from this climate- induced response is the tabular coral Acropora Hyacinthus, which is the most vulnerable species in The Great Barrier Reef (Linares C, 2011). This is because it dominates the shallow wave-exposed habitats in The Great Barrier Reef and is therefore greatly impacted by the climate-induced rising Sea Surface Temperatures (SST) (Linares C, 2011).

Another factor that plays a role in coral vulnerability due to climate change and rising Sea Surface Temperatures (SST) is geography. For example, coral reefs in the southern Great Barrier Reef have a lower coral bleaching rate compared to the rest of the Great Barrier Reef, this is because this area doesn’t have annual bleaching events compared to the rest of the reef, and does not have as many vulnerable species that could be effected (Ainsworth TD, 2016). Even though these corals are less vulnerable to the effects of climate change, this doesn’t speak for the rest of the Great Barrier Reef which is very vulnerable to rising Sea Surface Temperatures (SST) due to climate change.

**Rising Sea Surface Temperatures (SST)**

 As Sea Surface Temperatures (SST) increase over the next several decades it is projected that coral bleaching will become a frequent occurrence and will threaten the long-term viability of the coral reef ecosystems across the world (Donner SD, 2011). If the Sea Surface Temperature (SST) increases by +2 degrees Celsius, which could occur by 2100 under the current warming trajectories, then the number of thermal stress events will increase and cause coral bleaching worldwide (Ainsworth TD, 2016). When the Sea Surface Temperature (SST) exceeds a local climatological maximum by 1 degree Celsius for a month or more, onset bleaching usually occurs (Donner SD, 2005). These rising Sea Surface Temperatures (SST) can cause single bleaching or annual bleaching, in which both are pretty hard to recover from.

When looking at Sea Surface Temperatures (SST) around the world, they vary geographically. It has been shown that there has been rising Sea Surface Temperature (SST) induced coral bleaching events in the Caribbean, Florida, Red Sea, and The Great Barrier Reef. These are all places around the world that have been impacted by the rising Sea Surface Temperatures (SST) and have responded in coral bleaching. This shows that rising Sea Surface Temperatures (SST) is a worldwide phenomenon and should be a main concern for the future of coral reefs across the world.

**Coral Bleaching is the Stress Response of Coral Losing its Photosynthetic Pigments**

 Coral Bleaching happens when Sea Surface Temperatures (SST) increase. In response to this increase in temperature, corals whiten due to the loss of symbiotic algae and or their pigments (Mcwilliams JP, 2005). This bleaching mechanism is a thermal stress response, and it can sometimes cause coral reefs to die (Pandolfi, 2015). Coral bleaching can cause partial and whole colony mortality, which is the response to cells dying (Ainsworth TD, 2016). This reaction is the result of single, annual, and repetitive bleaching (Ainsworth TD, 2016). Which happens when corals are negatively affected by the rising Sea Surface Temperatures (SST) and haven’t acquired thermal tolerance which in result causes mortality among vulnerable corals.

As for annual coral bleaching recovery due to rising Sea Surface Temperatures (SST), the solution is still unclear (Grottoli AG, 2014). This is because annual bleaching doesn’t give corals much of a recovery time as single isolated bleaching. It is unknown if corals will be able to survive and possibly acclimatize to annual coral bleaching (Grottoli AG, 2014). This is because recovery from annual coral bleaching all depends on the species and their tolerance level. It is also dependent on the rising Sea Surface Temperatures (SST), which keep rising. Altogether coral bleaching is caused by rising Sea Surface Temperatures (SST), and this stress response is happening throughout The Great Barrier Reef.

**Counterpoints**

Rising Sea Surface Temperatures (SST) is the main cause of coral bleaching worldwide and is continually affecting the Great Barrier Reefs negatively**.** Thisis because The Great Barrier reef is vulnerable to this increase in temperature and is in great decline because it is unable to recover and there is no clear solution to this ongoing issue**.** Although, the loss of coral reefs can be also linked to Ocean Acidification (OA) and Sea-Level Rise (Pandolfi, 2015). These effects are a result of climate change and can affect all coral reefs across the world including The Great Barrier Reef which is vulnerable to climate change. When looking at Ocean Acidification (OA), it causes bleaching, reduced coral calcification, community changes, and it may affect the interplay between carbonate production and bioerosion (Pandolfi, 2015). As for Sea- Level rise, it causes coral bleaching, growth issues, and the corals ability to withstand short-term increases in land runoff (Pandolfi, 2015). Even though these factors play a role in coral bleaching and mortality of coral reefs, they aren’t the main effect that causes coral bleaching. This is because rising Sea Surface Temperatures (SST) has had more incidents of it happening compared to Ocean Acidification and Sea-Level Rise. Which results in Rising Sea Surface Temperatures (SST) playing a larger role in coral bleaching because it is consistent and there is a lot unclear about the future impacts of this effect.

**Conclusion and Implications**

 Rising Sea Surface Temperatures (SST) are the main risk for coral bleaching in The Great Barrier Reef. This is because the temperature continues to rise and as a result coral bleaching happens, as a result the reef continues to decline. Also, the coral diversity of The Great Barrier Reef will continue to decrease as the corals continue to lose their photosynthetic pigment (Grottoli AG, 2014). Also, it is still unknown if the Great Barrier Reef will acclimate and or recover from the effects of rising Sea Surface Temperatures (SST) or continue to decline. Although, in forming coral energy reserves or marine reserves, it might help the reef recover and or acclimate to the rising Sea Surface Temperatures (SST). Altogether The Great Barrier Reef is declining due to rising Sea Surface Temperatures (SST) and bleaching is a result of this climate change effect. It is a hope that one day there will be a solution to the decline of the world’s most diverse coral reef.

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