Survivorship of *Acropora cervicornis* When Exposed to High Temperature and High CO2

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BACKGROUND

- Global climate change is one of the greatest threats that coral reefs face. Future climate predict that increasing ocean temperatures and ocean acidity are going to greatly impact *A. cervicornis*
- Only 3% of the *A. cervicornis* population remains, and without human intervention the species could be lost by 2035
- It is predicted that by 2100, corals are going to be exposed to over double the present-day concentration of atmospheric CO2
- Ocean warming and ocean acidification, especially when combined, are some of the threats that challenge *A. cervicornis* the most. An increase in ocean temperatures will result in an increase in recurring and severe mass bleaching events, and an increase in in ocean acidification will make it harder for calcareous organisms to build their skeletons between disturbances
- Coral reefs are struggling to keep up with this unparalleled rate of anthropogenic enhanced climate change and are predicted to fail when atmospheric CO2 exceeds 500 ppm

METHODS

- Corals were collected from locations on the Florida Reef Tract (FRT)
- Experiments conducted in 3 flow-through tanks, with an additional tank used for recovery. The procedures were carried out at 3 temperatures, 30C, 31C and 32C and compared to a control group
- To manipulate the acidification conditions, each tank has a bubbler system to inject carbon dioxide (~1000ppm) to maintain the required levels.
- Buoyant weight was measured weekly for each individual until death occurred

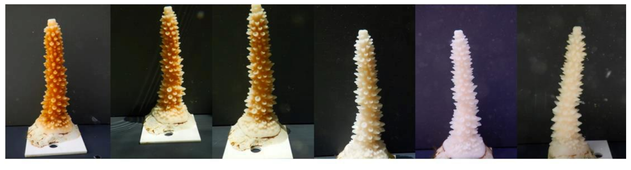

Figure 1: Scale of coral bleaching from 5 (completely healthy) to 0 (completely bleached)

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RESULTS

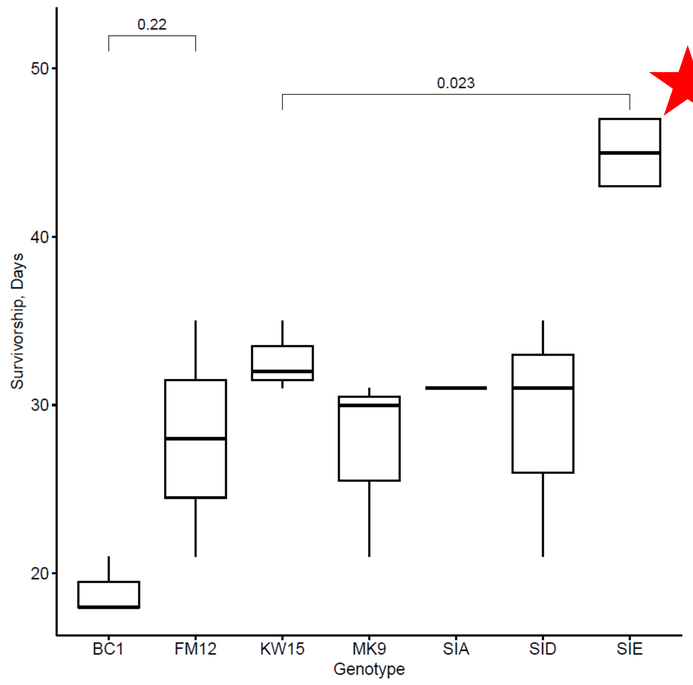

Figure 2: A box and whisker plot showing the survivorship of each genotype of *A. cervicornis*, measured in days. Red star highlights SIE as a super coral

Figure 3: Distribution of *Acropora cervicornis*.. *A. cervicornis* is found throughout the Bahamas, the Caribbean and Florida

Fisheries NOAA (2023) Staghorn coral. Computed generated global map of the approximate distribution of *Acropora cervicornis*
Retrieved from: https://www.fisheries.noaa.gov/species/staghorn-coral

CONCLUSIONS

- There is a lot of variability between the genotypes, with SIE being significantly different (p=0.023) than every other genotype's survivorship
- SIE is a super coral that can survive over twice as long as BC1 when exposed to high temperature and high CO2
- This species is unable to take up a new heat resistant symbiont, but the results show that the animal host itself is able show heat resistant abilities
- Without adequate time to recover, A. cervicornis will be unable to grow between major harmful events, reducing the likelihood of their long-term survivorship
- In order to survive, corals will have to quickly adapt and acclimatize to the changing climate, as there is already some evidence that coral reef ecosystems are presently facing irreversible shifts in their survivorship
- This research highlights the benefits of understanding how *A. cervicornis* may be able to adapt and keep up with increasing ocean temperatures and acidity

Future Research & Benefits

- Future research aimed at determining the source of the host's heat resistance should be investigated
- SIE is a super coral and is super heat resistant making it an excellent candidate for future restoration projects
- BC1 provides a good contrast to SIE, so studying these two genotypes would be beneficial to determining what makes a coral heat resistant
- Human intervention, such as restoration projects, have been key in supporting the recovery and survival of A. cervicornis, especially in combination with marine protected areas (MPAs) which have been a very valuable and successful form of management in protecting reef ecosystems and other marine habitats