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INTEGRATIVE GENOMIC INSIGHTS INTO CORAL RESILIENCE: ADAPTIVE AND ACCLIMATORY RESPONSES TO SEASONAL ENVIRONMENTAL SHIFTS

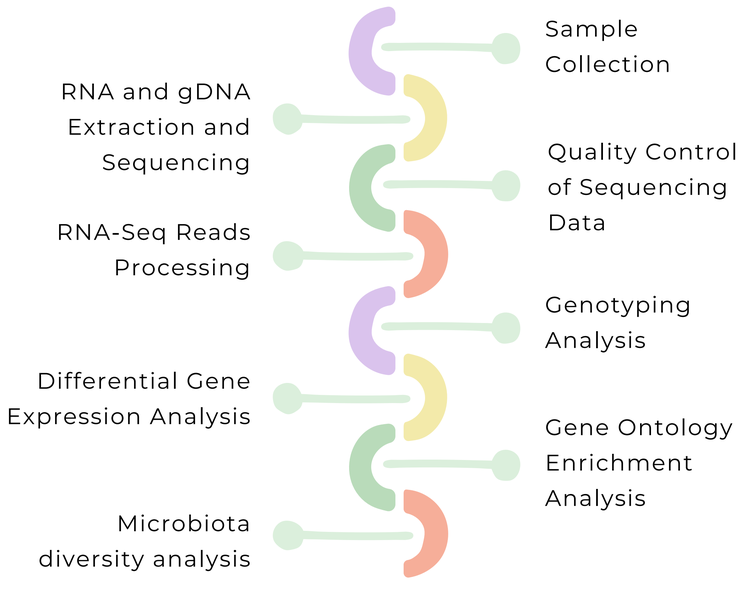
Research question

How do genetic variations and gene expression regulation, as well as the symbiotic relationship with bacterial microbiota, contribute to the adaptation and resilience of the coral species *Platygyra daedalea* to environmental stressors such as ocean warming?

Key studies in the literature

- Studies have shown that some coral species can adapt to warmer temperatures through changes in their genetic makeup, enabling them to better withstand temperature stress (Elder et al., 2022).
- Elder et al. (2022) found **genetic variation** in heat tolerance in ***Platygyra daedalea***, indicating its potential for adaptation to ocean warming.
- The corals in the **Gulf region** have been subjected to **extreme temperature stress**, providing a unique opportunity to study how corals can adapt to these conditions (Kirk et al., 2018).
- Elder et al. (2022) used SNP genotyping to investigate the genetic variation in heat tolerance in *P. daedalea*. The study identified several SNPs and **evidence of genetic variation in heat tolerance**, which suggests that this species has the potential to adapt to ocean warming.

Methedology



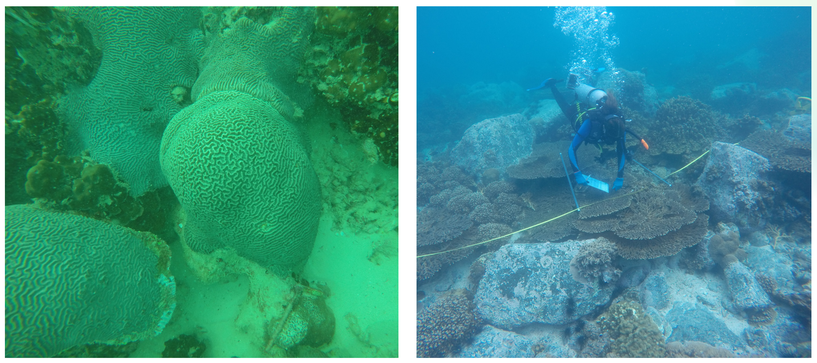


Figure 1. The stony coral *Platygyra daedalea* (left), Emily Howells doing a survey during the sampling (right).

Results

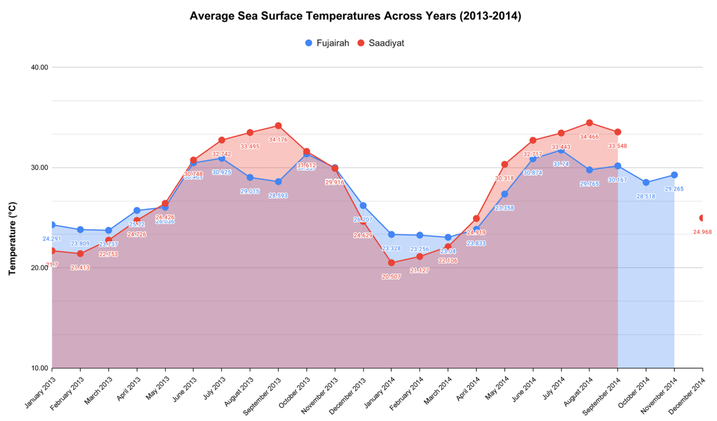


Figure 2. Area Plot Illustrating Monthly Sea Surface Temperature Trends in Fujairah and Saadiyat Over a Two-Year Period (2013-2014).

PAdj	Differential SNPs Count	Percent of Total Count of SNPs
< 0.05	2785131	13.53%
< 0.01	1634933	7.94%
< 0.001	1004492	4.88%
< 0.0001	689402	3.35%
< 0.00001	473671	2.30%
< 0.000001	359914	1.75%

Table 1. Distribution of Significant SNPs Across *P*-Value Thresholds in *P. daedalea*.

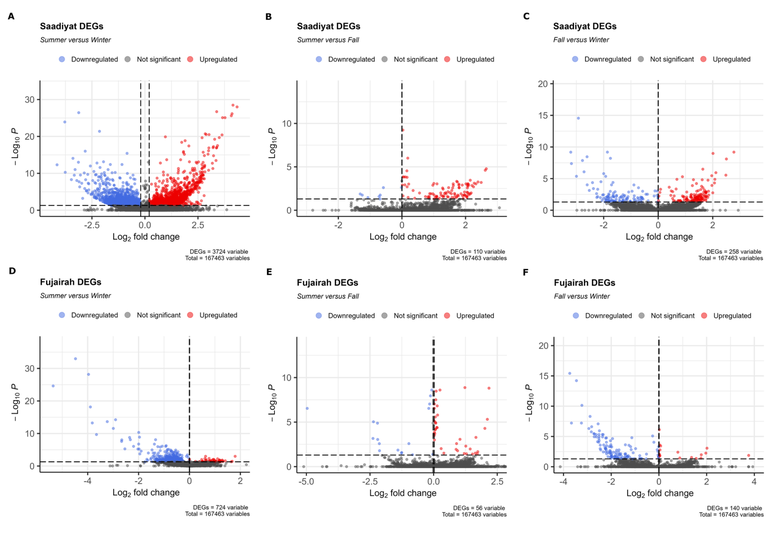


Figure 3. Differential Gene Expression Analysis of *P. Daedalea* in Saadiyat And Fujairah Revealed Unique Gene Expression Patterns.

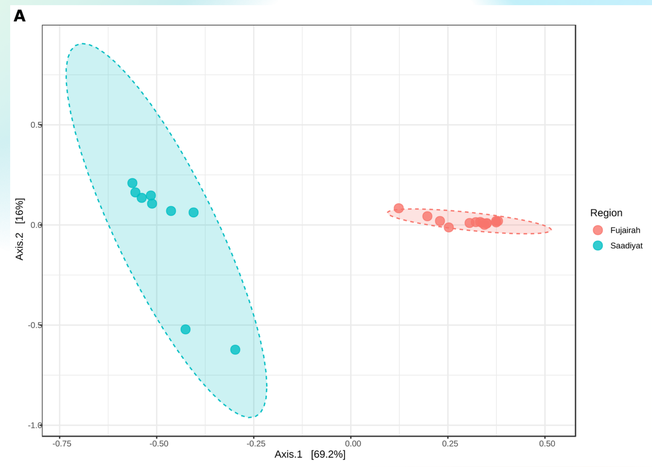


Figure 4. 16S rRNA Gene-Based Bacterial Microbiota Alpha-Diversity..

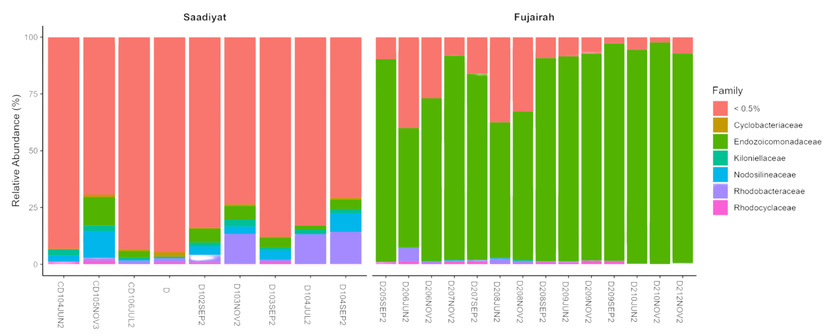


Figure 5. Bacteriome community composition in Saadiyat and Fujairah at the Family level.

Conclusion

The study reveals that *Platygyra daedalea*'s resilience to heat stress is due to its genetic diversity and active gene responses. It reveals that genetic variations and gene expression play key roles in the coral's adaptation to warmer temperatures. This ability is enhanced by its interactions with bacterial partners, forming a regulatory network that boosts its stress resistance. Highlighting the importance of these adaptive traits, the findings emphasize the need for conservation strategies to protect coral reefs against climate change.

Acknowledgements

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References

- Elder, H., Weis, V. M., Montalvo-Proano, J., Mocellin, V. J., Baird, A. H., Meyer, E., & Bay, L. K. (2022). Genetic variation in heat tolerance of the coral platygyra daedalea indicates potential for adaptation to Ocean Warming. Frontiers in Marine Science, 9.
- Kirk, N. L., Howells, E. J., Abrego, D., Burt, J. A., & Meyer, E. (2018). Genomic and transcriptomic signals of thermal tolerance in heat-tolerant corals (Platygyra daedalea) of the Arabian/Persian Gulf. Molecular Ecology, 27(24), 5180–5194.