Feeding and reproductive ecology of three mesophotic octocorals to support restoration in the Northern Gulf of Mexico

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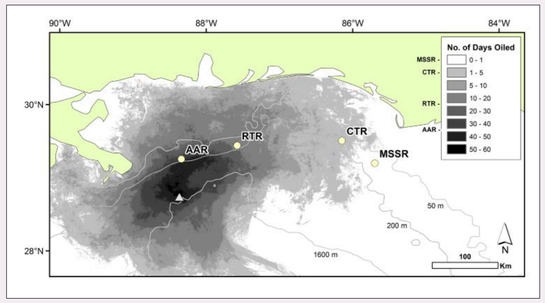
Background

- The Deepwater Horizon oil spill released 4.3 million barrels of oil into the Northern Gulf of Mexico (2).
- Mesophotic octocorals showed greater injury and tissue loss after the spill (2).



Impacted regions in the Northeastern Gulf of Mexico by DWH, and the number of days exposed to oil and dispersants. DWH oil rig is depicted by the triangle.

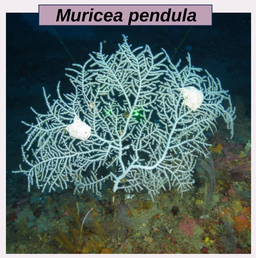
- Coral Propagation Techniques (CPT) project aims to restore biomass in regions impacted by DWH by out planting laboratory grown octocorals.
- It is important to understand the biology of mesophotic octocorals and successful propagation in the lab before out planting. Information regarding nutrition and reproduction of mesophotic octocorals is scarce.

Objectives

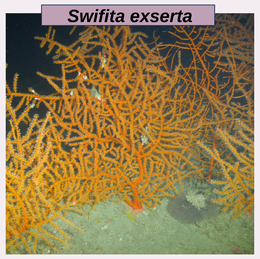
1. Compare the diets of *S. exserta*, *T. nivea*, and *M. pendula in situ*.
2. Determine the optimal diet to promote health of *S. exserta* in aquaria.
3. Determine the optimal diet to promote reproductive success of *S. exserta* in aquaria.

Study Species

Muricea pendula



Swifita exserta



Thesea nivea

- Heterotrophic suspension feeders – especially vulnerable to pollutants (2).
- M. pendula, S. exserta, and T. nivea differ in morphology and distribution – gives reason to suspect differences in diet.

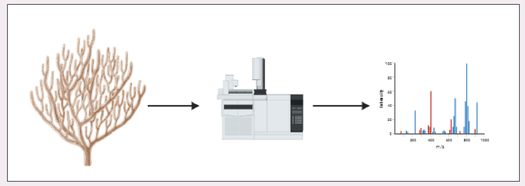
Methods

Sample Collection

- Samples from *M. pendula*, *S. exserta*, and *T. nivea* colonies were collected in the Northern gulf of Mexico in May 2023.
- Samples were collected from depths of 50-65 meters.
- Sample collection was conducted using a remote operated vehicle (ROV) equipped with a multi-function manipulator arm.

Fatty Acid Analysis

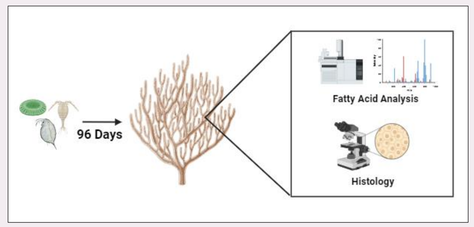
- Fatty acid composition was obtained using gas chromatography – mass spectrometry.
- Fatty acid biomarkers were identified, and fatty acid composition was compared between species.



- Fatty acid biomarkers are a good indication of food source and nutritional strategy.

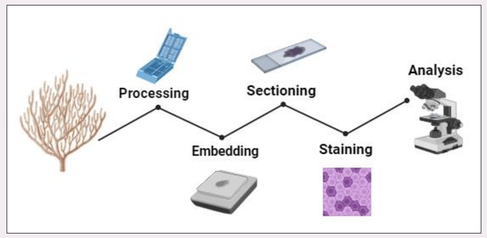
Feeding Experiment

- To determine the optimal diet to support laboratory propagation, *S. exserta* will be exposed to different diets.
- Health, polyp extension, and reproductive characteristics will be analyzed.



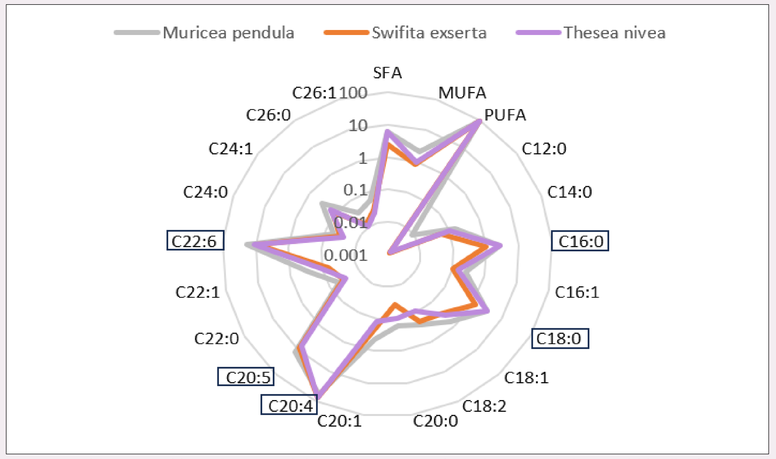
- The experiment will last 96 days. Fatty acid analysis and histological analysis will be conducted before and after.

Histology



- Samples for histology will be taken before and after feeding experiment.
- Oocyte diameter and fecundity will be analyzed.
- Metrics will be compared between diets.

Preliminary Results

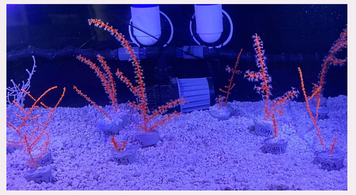


Fatty acid composition of *M. pendula*, *S. exserta*, and *T. nivea*. Each fatty acid is displayed as percent of total fatty acids

- C20:4 and C20:5 are biomarkers for external food sources (3), confirming that *M. pendula*, *S. exserta*, and *T. nivea* are primarily heterotrophic.
  - C20:4 – zooplankton (3)
  - C20:5 – phytoplankton (3)
  - C22:6 – coccolithophores (3)
- C16:0 and C18:0 are known starting materials for PUFA biosynthesis (1).
- The biomarkers for zooxanthellae (C16:2, C18:3, and C18:4) (3) are absent, indicating that symbiodinium do not contribute metabolically to *M. pendula*, *S. exserta*, or *T. nivea*.
- The fatty acid compositions of *M. pendula*, *S. exserta*, and *T. nivea* do not appear to differ drastically, suggesting similar diets.

Future Directions

- Compare fatty acid compositions of *M. pendula*, *S. exserta*, and *T. nivea* in October to detect seasonal differences.
- Expose *S. exserta* to diet treatments to develop a laboratory fed diet that promotes health and sexual reproduction.
- Propagate corals in the lab, for eventual out planting, to restore biomass in the Northern Gulf of Mexico.



References

1. Baptista, M., Lopes, V. M., Pimentel, M. S., Bandarra, N., Narciso, L., Marques, A., & Rosa, R. (2012). Temporal fatty acid dynamics of the octocoral Veretillum cynomorium. Comparative Biochemistry and Physiology - B Biochemistry and Molecular Biology, 161(2), 178–187.
2. Etnoyer, P. J., Wickes, L. N., Silva, M., Dubick, J. D., Balthis, L., Salgado, E., & MacDonald, I. R. (2016). Decline in condition of gorgonian octocorals on mesophotic reefs in the northern Gulf of Mexico: before and after the Deepwater Horizon oil spill. Coral Reefs, 35(1), 77– 90.
3. Figueiredo, C., Baptista, M., Rosa, I. C., Lopes, A. R., Dionísio, G., Rocha, R. J. M., Cruz, I. C. S., Kikuchi, R. K. P., Simões, N., Leal, M. C., Tojeira, I., Bandarra, N., Calado, R., & Rosa, R. (2017). 3D chemoecology and chemotaxonomy of corals using fatty acid biomarkers: Latitude, longitude and depth. Biochemical Systematics and Ecology, 70, 35–42.

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