Habitat Characterization of a Mid-Pacific Mountain Across Depth

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Background

- While about 80% of the ocean has yet to be explored (Nuñez, 2020), seamounts have become one of the central foci of ocean exploration since they are largely uncharacterized.
- Seamounts are the result of underwater volcanic eruptions, and their ecosystems are very vital to the biodiversity of marine life within the deep sea.
- Seamounts comprise approximately 28.8 million square kilometers of Earth's surface (Amos, J. National Geographic).
- Seamounts host sensitive ecosystems that can be disrupted through anthropogenic impacts through deep-sea mining operations, fishing industries, and water pollution (Morgan et al., 2015).
- With natural resource extraction and pollution, alongside global warming and rising sea levels, seamount ecosystems are being documented and analyzed to find ways to protect and predict the outcome of these significant impacts.

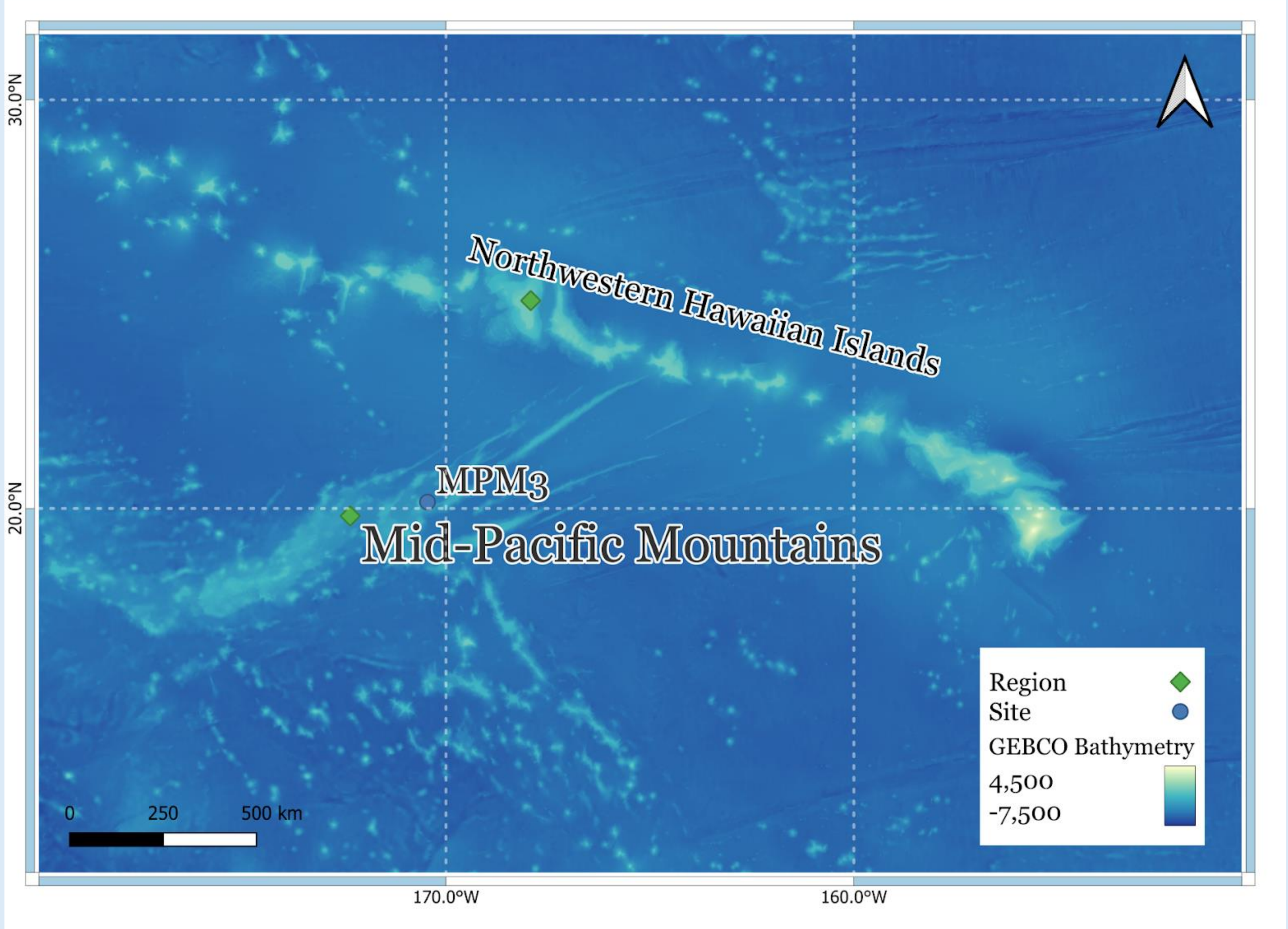

Fig 1. Bathymetric map showing the site location and depths of research within the Mid-Pacific Mountains

Introduction

- Substrate size, substrate type, and rugosity are fundamental to classifying seamount habitats.
- Numerous seamounts can experience various human and environmental factors that lead to relatively biodiverse habitats with similar patterns (Rowden et al., 2010).
- Our research aims to examine numerous factors of substrates and species at different depths of seamount ecosystems.
- Characterizing this habitat will allow researchers to understand the role that damaging factors could have on these vulnerable marine ecosystems.

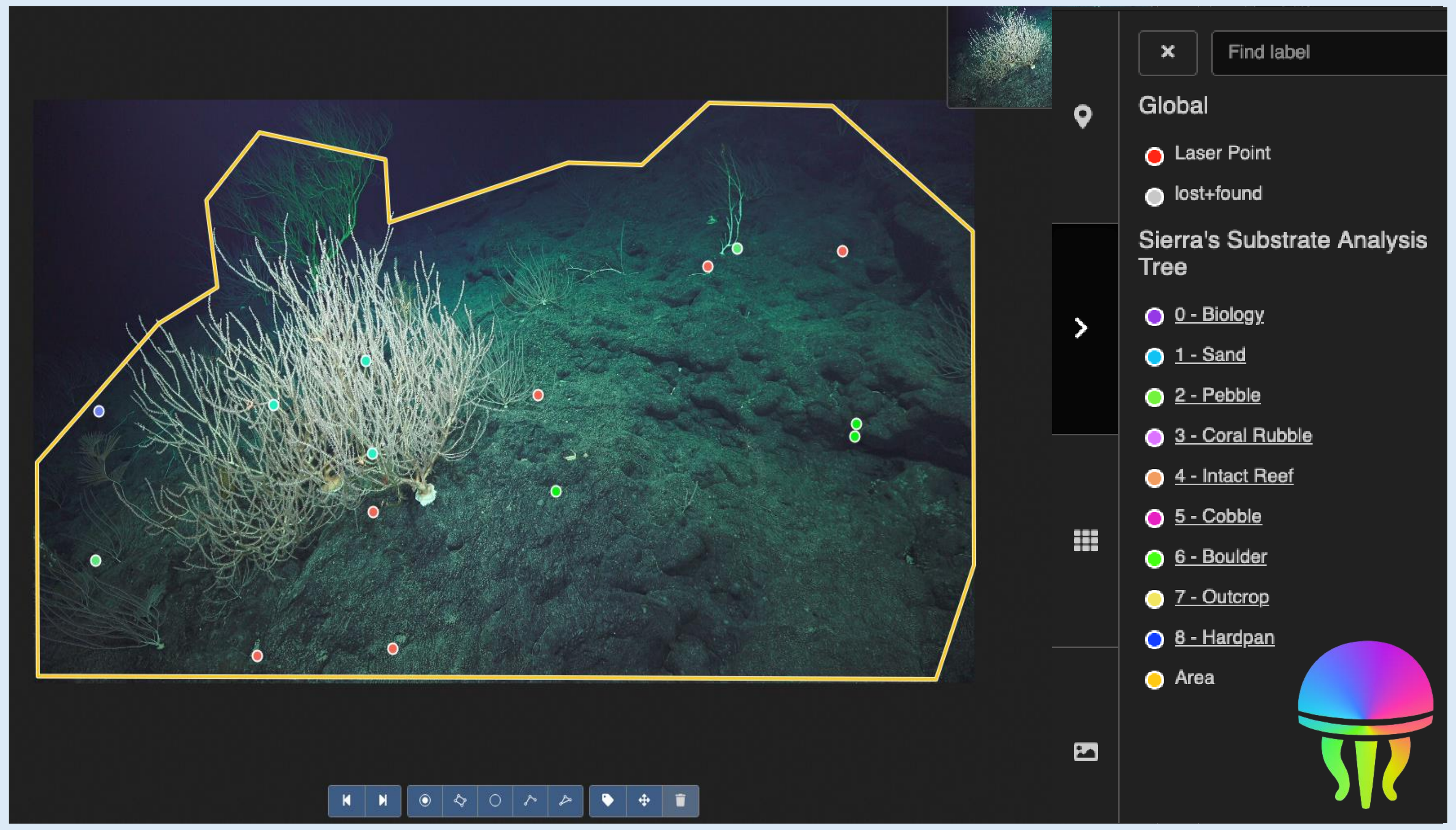

Fig 2. Example of the BIIGLE software interface and labels used for annotation

Methods

- Remotely operated vehicle (ROV) SuBastian from Schmidt Ocean Institute collected video transects from sites in the Mid-Pacific Mountains, including site Mid-Pacific Mountain #3 (MPM3).
- Replicate 500-meter length transects were taken at 500-meter depth intervals ranging from 1,500 to 3,500 meters.
- Video transects were converted to screen grabs collected every 30 seconds along a transect.
- Bio-Image Indexing and Graphical Labelling Environment (BIIGLE) was used to analyze images.
- Rugosity, image area, substrate size, and composition were annotated for 15 randomly selected points in each image.
- Sierra Landreth provided data on the composition of benthic megafauna of the annotated transects collected using the same methods, annotating instead for fauna presence.

Depth	N	S	J'	H'
1500	375	53	0.765	3.038
2000	1337	66	0.614	2.572
2500	30	15	0.851	2.304
2500	234	30	0.475	1.616
3000	25	14	0.944	2.491
3500	31	10	0.855	1.968

Table 1. The total number of individuals (N), number of species (S), Pielou's evenness (J'), and Shannon Diversity Index (H') at each depth

Acknowledgements
This would not have been possible without the help of our research mentors, Sierra Landreth, Dr. Amy Baco-Taylor, Virginia Biede, ship time from the Schmidt Ocean Institute, the R/V Falkor crew, and the ROV SuBastian team.

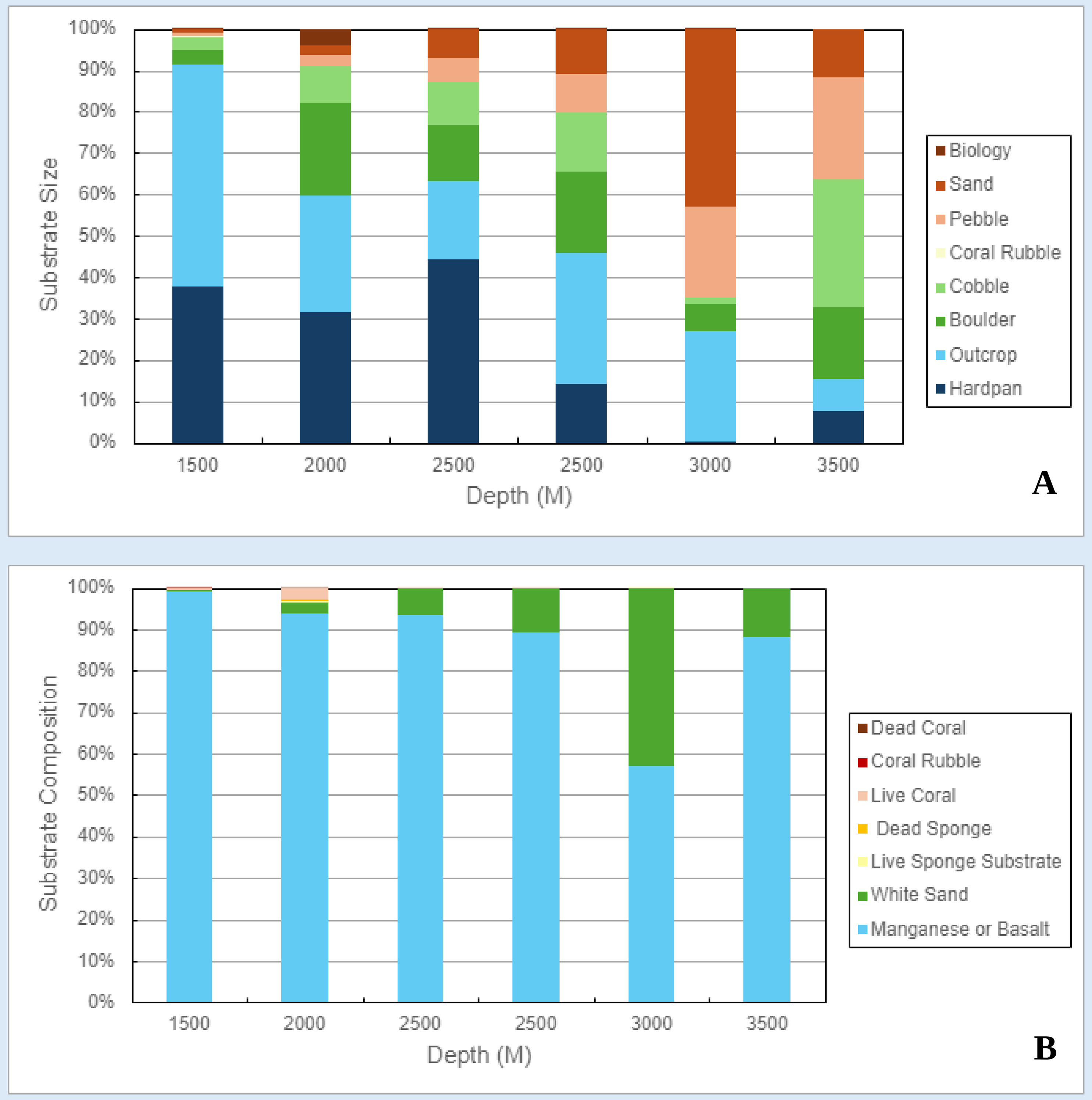

Fig 3. Percent composition of (A) substrate size and (B) substrate composition

Results

- Substrate size varies more as depth increases.
- Substrate composition is relatively similar across depth and is dominated by manganese or basalt.
- Diversity is highest at the shallowest depth, but the evenness of species is higher at deeper depths.
- Depths with a larger composition of manganese or basalt, more specifically with outcrops and hardpans, had higher diversity of taxa.

Conclusion

- It is important to improve the characterization of seamount communities and their connectivity.
- Results collected here are essential for informing conservation and management of vital deep-sea habitats targeted for mining.

Fig 4. ROV SuBastian
Credit: Schmidt Ocean Institute

References