Temple University
Department of Biology

-Final Doctoral Thesis Defense-

TITLE

"QUANTIFYING THE SPHERE OF INFLUENCE: ECOLOGY AND TROPHIC DYNAMICS OF METHANE SEEP COMMUNITIES ALONG THE PACIFIC COSTA RICAN MARGIN"

April L. M Stabbins

TIME AND PLACE

Thursday, May 2nd, 2024
10:00 AM
In Bio-Life, room 234

Refreshments served at 9:30 AM
Any questions, please contact the Biology Department @ 215-204-8854

Dissertation Committee
Dr. Erik Cordes, Department of Biology
Dr. Robert Sanders, Dissertation Examining Chair, Department of Biology
Dr. Amy Freestone, Department of Biology
Dr. Amanda Demopolous, U.S. Geological Survey, Outside Institutional Affiliation

Abstract: Chemosynthetic ecosystems in the deep sea hold vast amounts of untapped energy that until recent decades have been largely unobtainable. With the growing demand for resources and constant advancements in technology, these ecosystems and the diverse communities that inhabit them now face increasing pressure from anthropogenic exploitation activities. Thus, employing effective management and conservation strategies to avoid devastating these long-lived communities is imperative. However, effective protection hinges on a thorough understanding of these ecosystems. Here, I present a number of studies conducted on methane seeps along the Pacific Costa Rican Margin (CRM), exploring various ecological dynamics and highlighting the unique biodiversity thriving there. These studies aim to address gaps in our knowledge regarding the "sphere of influence" surrounding chemosynthetic methane seeps, providing insights into the flow of energy within these ecosystems, their spatial dynamics and how they interact with background deep-sea habitats.

In Chapter 2, I employ a novel seascape approach using systematic surveys of several actively seeping areas to characterize the seep communities and delineate distinct seep zones, testing for inter- and intraspecific differences in community structure. Our results reveal nuanced patterns in α and β diversity between sites and across different zones, driven largely by depth. Additionally, I identify transitional zones extending the spatial extent of the seeps by up to 300 meters, emphasizing the "sphere of influence" surrounding these ecosystems.

In Chapter 3, I use stable isotope analysis to explore various trophic dynamics within heterotrophic communities associated with mussel beds and tubeworm aggregations at several seeps along the CRM. I also utilize stable isotope mixing models to estimate the contributions of various food sources to each of these communities, identifying differences in trophic strategies that may reflect differences in successional stage. Finally, in Chapter 4, I combine several of the methods used in Chapters 2 and 3 to describe the ecology of a deep-sea seep coral in this region and provide new evidence of facultative associations with chemosynthetic bacteria. Overall, this thesis volume improves our understanding of the spatial and trophic dynamics within vulnerable methane seep ecosystems, highlighting their ecological significance and the need for effective management strategies.