



**University  
of Victoria**

Graduate Studies

Notice of the Final Oral Examination  
for the Degree of Master of Science

of

**AARON EGER**

BScH (McGill University, 2015)

**“The Role of Predators and Species Diversity in  
Structuring Marine Ecosystems”**

Department of Biology

Monday, December 18, 2017

1:00 P.M.

Clearihue Building

Room B007

Supervisory Committee:

Dr. Julia Baum, Department of Biology, University of Victoria (Supervisor)

Dr. Rana El-Sabaawi, Department of Biology, UVic (Member)

Dr. Clifford Robinson, Department of Geography, UVic (Outside Member)

External Examiner:

Dr. Melisa Wong, Bedford Institute of Oceanography, Fisheries and Oceans Canada

Chair of Oral Examination:

Dr. Frank van Veggel, Department of Chemistry, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

## **Abstract**

Marine ecosystems contain both highly abundant and diverse communities of vertebrates and invertebrates; however anthropogenic activity has drastically altered the species composition and diversity of these ecosystems. Specifically, human activity has targeted high trophic level species and degraded much of the biogenic habitat that faunal communities rely upon. These alterations have resulted in the loss of many marine predators and overall declines of marine biodiversity. To investigate the consequences of marine predator loss and community level species decline, I use a combination of largescale data synthesis and in situ field observations of marine fish communities. I first use a meta-analysis approach to synthesize the consequences of marine predator loss in benthic marine ecosystems worldwide. From this synthesis, I was able to determine some of the biotic and abiotic factors that regulate the response of marine herbivores and primary producers to predator loss. Specifically, I show that marine predators have the strongest effect on populations of marine herbivores when predators and herbivores were similar in size and when larger herbivores were involved. Conversely the factors that best explained the response of the primary producer populations were related to the abiotic environment. The results show that primary producers respond the most positively to the presence of predators in high nutrient environments. While I found no link between the magnitude of change in the herbivore population and the magnitude of change in the producer population, I was able to demonstrate that primary producers are under the strongest topdown controls when nutrient concentrations are high, sea surface temperatures are low, and when the predator is larger in size than the herbivore. Finally, I use the data related to marine reserves to show that reserves are an effective tool to help reverse the trophic consequences of marine predator loss and that they are most effective when they are older in age. The third chapter examines the links between community diversity and community biomass within fish communities in eelgrass ecosystems in Northern British Columbia. After controlling for environmental variation, I found that it was the dominance of certain species within a community that resulted in the highest ecosystem function. This finding was demonstrated by both the taxonomic and functional metrics of diversity used. While previous work on this topic has shown that richness is positively correlated to function, my results are to the contrary, and suggest that further investigation into which aspects of community diversity drive ecosystem function is required. In conclusion, my results provide a new synthesis of the consequences of marine predator loss across the world and show how species diversity is linked to ecosystem function in local eelgrass fish communities.