University of Victoria | Graduate Studies

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

of

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BSc (University of Victoria, 2011)

## **"Ecological connectivity, adult animal movement, and climate change: Implications for marine protected area design when data are limited"**

School of Environmental Studies

Tuesday, June 18, 2019
12:30 P.M.
Clearihue Building
Room B007

Supervisory Committee:
Dr. Natalie Ban, School of Environmental Studies, University of Victoria (Supervisor)
Dr. Rebecca Martone, BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (Outside Member)
Dr. Emily Rubidge, Institute of Ocean Sciences, Department of Fisheries and Oceans (Outside Member)

External Examiner:
Dr. Rosaline Canessa, Department of Geography, UVic

Chair of Oral Examination:
Dr. Stephen Lindsay, Department of Psychology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

## Abstract

Marine protected areas (MPAs) are important conservation tools that can support the resilience of marine ecosystems. Many countries, including Canada, have committed to protecting at least 10% of their marine areas under the Convention on Biological Diversity's Aichi Target 11, which includes connectivity as a key aspect. Connectivity, the movement of individuals among habitats, can enhance population stability and resilience within and among MPAs. This thesis aimed to understand regional spatial patterns of marine ecological connectivity, specifically through the mechanism of adult movement, and how these patterns may be affected by climate change. I used the Northern Shelf Bioregion in British Columbia, Canada, as a case study for four objectives: (1) evaluate potential connectivity via adult movement for the entire bioregion, using habitat proxies for distinct ecological communities; (2) assess potential connectivity via adult movement among existing and potential MPAs, using the same habitat proxies; (3) model potential connectivity via adult movement among marine protected areas for two focal species (*Metacarcinus magister* and *Sebastolobus alascanus*) and predict how this interconnectedness may shift based on projected ocean temperature changes; and (4) contribute the results of these analyses to the MPA technical team's ongoing planning process so that connectivity may be considered in the implementation of a new MPA network in the bioregion. This thesis developed an approach to assess and design MPA networks that maximize inferred connectivity within habitat types for adult movement when ecological data are limited. It applied least-cost theory and circuit theory to model MPA suitability and interconnectedness, finding that these are projected to decrease for *Sebastolobus alascanus* but increase for *Metacarcinus magister*. I showcased some methods that may be used in MPA design and evaluation, with lessons for other contexts. Importantly, this thesis informed an ongoing MPA planning process, enabling ecological connectivity to be considered in the establishment of a new MPA network in the bioregion. Overall, this work provided examples for incorporating connectivity and climate change into MPA design, highlighting what is possible even when data are limited.