Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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“Sea Otter effects on soft-sediment flora and fauna, and within ancient Indigenous Maricultural systems”

Department of Geography

Wednesday, June 30, 2021
9:00 A.M.
Remote Defence

Supervisory Committee:
Dr. Chris Darimont, Department of Geography, University of Victoria (Co-Supervisor)
Dr. Tim Tinker, Department of Geography, University of Victoria (Co-Supervisor)
Dr. Jane Watson, Department of Geography, UVic (Member)
Dr. Anne Salomon, Department of Anthropology, UVic (Outside Member)

External Examiner:
Dr. Mary Power, Department of Integrative Biology, University of California, Berkeley

Chair of Oral Examination:
Dr. Ke Xu, Department of Economics, UVic

Dr. Stephen Evans, Acting Dean, Faculty of Graduate Studies
Abstract

Most of what is known about the ways in which strongly interacting species affect ecological communities stems from changes to community structure revealed in contemporary research. However, trophic downgrading has limited the temporal extent to which inferences can be drawn. The aim of my Dissertation was to expand on the strongly interacting species concept by examining species interactions at a historical scale, in a textbook example of a strongly interacting and keystone predator. The sea otter, Enhydra lutris, was driven to near-extinction but is recovering in parts of its range, providing a mosaic of areas with and without sea otters. This mosaic allowed for a series of natural experiments, which I conducted using behavioural observations, genetic tools, and archaeological methods, to examine sea otter effects spanning contemporary (last ~40 yrs.), and late-Holocene (~3500-150 yrs. ago) timeframes, and on an evolutionary scale that inferred middle-Pleistocene interactions. In Chapter 2, my coauthors and I found that sea otter use of clam-based niches increased as occupancy-time increased, and that bachelor groups of male otters primarily inhabited these niches, findings that informed and inspired subsequent questions. In Chapter 3, we found that where sea otters were established for 20-30 years, the disturbance to eelgrass (Zostera marina), caused by sea otters digging for clams and other infaunal prey, was correlated with ~25% greater eelgrass allelic richness than where otters were present <10 yrs, or absent. We posit that sea otter digging has long-influenced the genetic diversity and resilience of eelgrass – perhaps since the middle Pleistocene. In Chapter 4, we asked how strongly interacting species – people and sea otters – co-existed for millennia where they both consumed clams. We used assemblages of live and otter-cracked butter clams (Saxidomus gigantean), to confirm the ecological effects that sea otters exert today. We measured clams from archaeological assemblages in areas densely populated with clam gardens – terraced beaches that enhance clam habitat and productivity – and found that sea otters reduced the sizes of ancient clams, acting as ecologically effective predators in the mid-to-late Holocene. However, clam harvests were stable for thousands of years, with or without otters. We
suggest that clam gardening supported coexistence of people and others in the past, and could function the same way today. Collectively, we found that a few, perhaps long-forgotten, interactions increased the breadth of the strongly interacting species concept. In Chapter 5, I suggest that such rediscoveries could occur in other systems. Many large vertebrates have suffered population declines, but the most insidious losses accompanying these, are the losses of ecological interactions that become unknowable, and thus cannot be intentionally restored. By searching out ancient interactions, long-forgotten relationships have the potential to be recovered, and to inform our understanding of contemporary systems.