University of Victoria | Graduate Studies

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

of

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BSc (Hons) (University of Victoria, 2011)

"Spatial and dietary niche variation associated with diverse resource availability, competitive environment, and landscape heterogeneity; ecology and conservation of bear-salmon systems in coastal British Columbia"

Department of Geography

Thursday, April 4, 2019
10:00 A.M.
David Turpin Building
Room B311

Supervisory Committee:
Dr. Christopher Darimont, Department of Geography, University of Victoria (Supervisor)
Dr. Paul Paquet, Department of Geography, UVic (Member)
Dr. Thomas Reimchen, Department of Biology, UVic (Outside Member)

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Dr. Quentin Mackie, Department of Anthropology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

The niche concept provides a tractable measure of the ecological roles and requirements of organisms, which can inform our understanding of the patterns of biodiversity, and subsequently, direct conservation policy. Although niche is most commonly considered for species, variation nested within lower hierarchies of biological organization (i.*e.*, phenotypes, genotypes) also contributes to maintaining biodiversity. Herein I examine spatial and dietary niche variation among and within species in a consumer–resource system where resources and competition are structured by a heterogeneous environment. An underlying theme of this dissertation was developing research through a community-engaged approach that not only contributed to conceptual advancements in niche theory but also to applied conservation priorities.

The marine archipelago of the central coast of British Columbia, Canada structures salmon (*Oncorhynchus* spp.) resources and the inter- and intraspecific competitive context for coastal grizzly (*Ursus arctos*) and black bears (*Ursus americanus*). This assembly of ursids represents nested levels of biological organization (i.e., species, phenotypes (white vs black-coated morphs of black bears) and genotypes (dominant homozygote black-coated black bears, heterozygote black-coated black bears, recessive homozygote white-coated 'Spirit' black bears)), which allows for investigation into niche variation across and within species.

I investigated niche variation using a suite of non-invasive methods. Local and Traditional Ecological Knowledge (LEK/TEK) provided complementary information to genetic and stable isotope (δ^{13}C and δ^{15}N) data from hair samples. First, I investigated changes in the spatial niche of coastal grizzly bears. By combining western scientific approaches with TEK/LEK interviews I found the range of coastal grizzly bears has expanded westward onto several coastal islands. The economic, cultural, and ecological impacts of this shift in spatial niche are not yet understood. Second, I tested hypotheses related to variation in the foraging niche of black bears in response to the competitive environment and salmon resource availability. I found that grizzly bear presence reduced the proportion of salmon in black bear diets by ~40%. I also found that salmon species diversity, and not biomass abundance, was positively correlated to salmon in black bear diets. This highlights the importance of resource diversity to consumers beyond the consideration of abundance. Third, I explored spatial niche patterns of Spirt bears in relation to protected areas. I found that landscape-level Spirit bear allele

frequency and population estimates were lower than previously reported. Approximately ~50% of Spirit bear allele hotspots corresponded to protected areas. This finding suggests Spirit bears are rarer and less protected than previously assumed. Finally, I tested hypotheses related to niche variation between phenotype and genotypes of Spirit bear populations. I found both phenotypes and genotypes diverged in foraging niche, with Spirit bears and black-coated heterozygotes having elevated stable isotope signatures compared to black-coated homozygotes. This result supports the role of 'multi-niche' mechanisms in maintaining this rare polymorphism.

Results from all chapters contributed to land- and marine-use stewardship efforts of collaborating First Nations. Collectively, this dissertation offers novel contributions towards understanding how niche variation at multiple levels of biological organization can contribute to conservation planning.