University of Victoria | Graduate Studies

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

of

JUSTIN SURACI

MSc (Simon Fraser University, 2011)
BS (University of Virginia, 2006)

"Fear in Wildlife Food Webs: Large Carnivore Predation Risk Mediates the Impacts of a Mammalian Mesopredator"

Department of Biology

Thursday, April 14, 2016
10:00 A.M.
David Turpin Building
Room A136

Supervisory Committee:
Dr. Michael Clinchy, Department of Biology, University of Victoria (Co-Supervisor)
Dr. Brad Anholt, Department of Biology, University of Victoria (Co-Supervisor)
Dr. Larry Dill, Department of Biology, UVic (Member)
Dr. Chris Darimont, Department of Geography, UVic (Outside Member)

External Examiner:
Dr. Daniel Fortin, Départment de biologie, Université Laval

Chair of Oral Examination:
Dr. Tsung-Cheng Lin, Department of Pacific and Asian Studies, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Mounting evidence suggests that large carnivores regulate the abundance and diversity of species at multiple trophic levels through cascading top-down effects. The fear large carnivores inspire in their prey may be a critical component of these top-down effect, buffering lower trophic levels from overconsumption by suppressing large herbivore and mesopredator foraging. However, the evidence that the fear of large carnivores cascades through food webs has been repeatedly challenged because it remains experimentally untested.

My collaborators and I exploited a natural experiment – the presence or absence of mesopredator raccoons (*Procyon lotor*) on islands in the Gulf Islands of British Columbia, Canada – to examine the breadth of mesopredator impacts in a system from which all native large carnivores have been extirpated. By comparing prey abundance on islands with and without raccoons, we found significant negative effects of raccoon presence on terrestrial (songbirds and corvids), intertidal (crabs and fish) and shallow subtidal (red rock crabs *Cancer productus*) prey, demonstrating that, in the absence of native large carnivores, mesopredator impacts on islands can extend across ecosystem boundaries to affect both terrestrial and marine communities.

To test whether fear itself of large carnivores can mitigate these community-level impacts of mesopredators, we experimental manipulated fear in free-living raccoon populations using month-long playbacks of large carnivore vocalizations and monitored the effects on raccoon behaviour and the intertidal community. Fear of large carnivores reduced raccoon foraging to the benefit of the raccoon's prey, which in turn affected a competitor and prey of the raccoon's prey. By experimentally restoring the fear of large carnivores in our study system, we succeeded in reversing the impacts of raccoons, reinforcing the need to protect large carnivores given the conservation benefits the fear of them provides.

Our experimental work demonstrated that fine-scale behavioural changes in prey in response to predation risk can have community-level effects relevant to biodiversity conservation. However, experimentally testing animal responses to predators and other sources of risk in free-living wildlife presents considerable logistical challenges. To address these challenges, my collaborators and I developed an Automated Behavioural Response system, which integrates playback experiments into camera trap studies, allowing researchers to collect experimental data from wildlife populations without requiring the presence of an observer. Here I describe tests of this system in Uganda, Canada and the USA, and discuss novel research opportunities in ecology and conservation biology made available by this new technology.