JUNE 2017

ALBERTA CONSERVATION ASSOCIATION CHAIR IN FISHERIES AND WILDLIFE

Dr. Mark Boyce, Department of Biological Sciences, Faculty of Science

UNIVERSITY OF ALBERTA

Dr. Mark Boyce

Research Summary

Dr. Mark Boyce began his tenure as the Alberta Conservation Association Chair in Fisheries and Wildlife in July of 1999. His research has focused on the sustainability of fish and wildlife in the face of industrial development in Alberta – integrating ecological theory with wildlife management, while drawing on stochastic population models and spatial ecology. The breadth and depth of Dr. Boyce's scientific contributions are evident in diverse applications that encourage sustainable use of wildlife and other natural resources through fishing, hunting, agriculture and forestry, while protecting the environment and species at risk. Considered an expert in population and landscape ecology, much of Boyce's field research involves studies of large mammals, including bears, cougars, moose, wolves, as well as recent work on wolverines, and has encompassed a broad spectrum of biodiversity such as birds, fish and plants.

The ACA Chair in Fisheries and Wildlife contributes significantly to the activities of the University of Alberta as the whole, the Department of Biological Sciences, and student activities through teaching and research. Through applied ecological research, primarily focused on the conservation of biodiversity in Alberta, "the ultimate objective of Dr. Boyce's work is to ensure that natural resources are managed based on the best available science".

Research Progress

The past year has been highly productive for Boyce and the team with 20 peer-reviewed publications. Additionally, a major report on grizzly bear management, a review of carbon grazed grasslands, papers identifying how western ranchers can coexist with large carnivores, and methods for reducing human conflict with grizzly bears were released.

Several high-profile publications referencing the Chair's work have also appeared, including one validating an app that he developed to monitor moose populations. Moose hunters use the app to report the numbers of moose seen during hunts and the Boyce Lab was able to demonstrate that these counts are highly correlated with moose population. This finding has major implications for reducing the costs of monitoring, which has been done using aerial ungulate surveys, costing approximately $1 million per year in Alberta. The data collected with the app is free citizen science and provides much more data than can be achieved with aerial ungulate surveys. As a bonus, when this paper was published by the Wildlife Society Bulletin, the paper was highlighted through the use of one of the Boyce Lab moose photographs for the cover art.

Habitat selection studies have tended to dominate the publications coming from the Boyce Lab. This has included habitat models for black bears, deer, elk, grizzly bears and wolverines. Two new papers developed statistical methods for the analysis and interpretation of habitat selection. The Boyce Lab has established new methods for integrating movement with habitat selection and a paper this year demonstrated how this marriage of movement ecology and habitat selection facilitates the identification of movement corridors for wildlife.

Extensive data on the genetics of grizzly bears in southwest Alberta and adjacent populations in British Columbia and Montana, allowed the Boyce Lab to use new methods for estimating population size. More remarkably, Boyce has shown that learning is a major driver for conflict behaviours in grizzly bears – the Boyce Lab could find no evidence of a genetic basis for poor behavior. These findings are reminiscent of the classic Nature/Nurture debate by Francis Galton over 120 years ago; claiming, but failing

Additional Achievements

Honours/Awards

Received from 16 organizations and institutions, including:

- The Royal Society of Canada
- Safari Club International
- The Wildlife Society

Publications

- 6 Books
- 280 Articles
- A manuscript on the interactions between grizzly bears and black bears in western Alberta
- A cover photo feature in *The Journal of Wildlife Management* and another in *The Wildlife Society Bulletin*

Memberships

Current memberships include:

- Past President of the Canadian Section of The Wildlife Society
- Organizer of the symposium on Uncertainty in Ecology and Conservation for the Canadian Section of The Wildlife Society and The Canadian Society for Ecology and Evolution

Presentations

- Presented at several national and international conferences and forums
- Presented a workshop for Alberta Conservation Association staff on the analysis of moose app data

to demonstrate, that criminal behavior in humans has a genetic basis.

Nearly all of the Chair's research has focused on wildlife in Alberta, whereas two projects this year have focused on the tropics. Firstly, Boyce has worked with Camille Warbington, Graduate Research Assistant, in studying the population biology of sitatunga (a swamp-dwelling antelope) in central Uganda. Secondly, with Abdi Salari, Boyce has identified a novel application for the zero-altered negative binomial model for studying habitat use patterns in two species of tropical waterfowl in Malaysia.

Two postdoctoral fellows, Andrea Morehouse and Tal Avgar, have completed their fellowships and have moved on to other appointments, with several additional publications through the Boyce Lab in progress. The Boyce Lab also had major turnover in graduate students this year. Three PhD students, and three MSc students completed their degrees, and five new MSc students joined the lab. The lab currently supports six MSc students and one PhD candidate.

New grant funding, totalling $2.7 million, has come through to examine how livestock grazing practices can enhance carbon sequestration and storage, while maintaining or enhancing plant and bird diversity. Other funding has been secured for continuing work on cougars, elk and waterfowl.

Research Plans for 2017-18

The Boyce Lab has undertaken three new projects during the past year. First is an evaluation of alternative grazing practices for both biodiversity and carbon sequestration and storage. Vast amounts of carbon are stored in grassland soils and adaptive multi-paddock grazing has been shown to achieve high rates of sequestration and storage of carbon. However, there are concerns that such intensive grazing could have negative

consequences for native plant and bird diversity – grassland birds are the most imperiled group of birds on the planet. Over the next two years, the Boyce Lab will sample 60 ranches across the grasslands of Alberta, Saskatchewan, and Manitoba to document biodiversity and carbon.

The second project is an attempt to unravel the causes behind declines in Arctic caribou herds. The role of the Arctic Oscillation, global warming, insect harassment, and vegetation phenology will be evaluated to test alternative hypotheses that have been presented to explain caribou declines. Declines in Rangifer tarandus, known as reindeer in the Palearctic, are global in scope – with alarming consequences for Inuit and First Nations people in Canada as well as Sami and other northern aboriginal people in Europe and Asia.The Boyce Lab has identified a strong pattern of population decline associated with the Arctic Oscillation. How the Arctic Oscillation will behave in the future might exacerbate the loss of a major ecosystem component of the north.

The third new direction is studying cougar predation in western Alberta, specifically in areas with sizable bighorn populations. Stable isotopes

and radio telemetry will be used to document the influence of cougars on bighorn sheep. Two students working on this research began their graduate programs in September 2016, already securing support through NSERC, ACA, SCI, Mitacs, and the Wild Sheep Foundation. This research complements a special feature on the management of mountain sheep that Boyce is editing for *The Journal of Wildlife Management*.

Over the next year, the Boyce Lab will wrap up ongoing research on waterfowl nesting as well as a long-term elk population study. Population modelling will continue to be a research focus, using novel modelling approaches to optimize harvest policies for elk and white-tailed deer. Whilst on sabbatical leave, Boyce will explore the role of uncertainty in ecology and conservation, following up on a symposium he organized for The Canadian Society for Ecology and Evolution in Victoria, B.C. in May 2017.

Accomplishments

The Royal Society of Canada honoured Dr. Boyce in November 2016 by awarding him the Mirosław Romanowski Medal for his lifetime contributions to applied environmental research. In addition, Dr. Boyce and his spouse, Dr. Evelyn Merrill, were honoured with a joint Special Recognition Award for their collective contributions to wildlife research and conservation at the annual conference of the Alberta Chapter of The Wildlife Society in March 2017.

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