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Author
Proctor, Michael

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Michael Proctor (Email: mproctor@netidea.com), University of Calgary, P.O. Box 920, Kaslo B.C. V0G 1MO, Canada

Abstract

Habitat and population fragmentation as a result of human disturbance in the form of human transportation and settlement corridors is affecting the viability of wildlife populations worldwide. I studied dispersal, inter-population movement and population fragmentation of grizzly bears near the southern extent of their North American range in southwestern Canada and northwestern U.S.A. This area represents the interior portion of the southern edge of grizzly bear distribution following 100 years of range contraction. I address whether anthropogenic fragmentation has affected grizzly bear populations in this vulnerable area.

Human attitudes toward grizzly bears, and large carnivores in general, have experienced a paradigm shift from active persecution towards tolerance and respect. However, major forces underpinning range contraction, including human-caused mortality and fragmentation, may be still operating, albeit, more subtly and less intentionally. Checking further range contraction requires specific knowledge of the processes at work. Improvements have been made in managing and monitoring human-caused mortality; however, besides the obviously isolated populations (e.g., Yellowstone National Park), the status of fragmentation in this region was largely unknown.

My goals were to use genetic analyses to explore bear movement and dispersal within and between the relictually inhabited mountain ranges in southwestern Canada and test whether or not the human environment associated with linear transportation and settlement corridors is fragmenting grizzly bear populations. I genetically sampled and generated 15-locus microsatellite genotypes for 835 bears across approximately 100,000 km^2 in immediately adjacent geographic areas separated by various levels of human disturbance associated with highways and associated human development. I used population assignment techniques, parentage analysis, cluster analysis, multiple linear regression and several matrices of population genetics.

I found evidence of natural and human-caused fragmentation, identified fragmenting forces, established population and sub-population boundaries in the region, identified small vulnerable sub-populations, and discussed these in relation to factors that make bears susceptible to fragmentation. Female movement was restricted by human transportation and settlement corridors, and male movement appeared to be reduced in some areas. Fragmentation by north/south-oriented human-settled valleys and by major east/west transportation corridors has resulted in a partially fragmented set of local sub-populations varying in size and intensity of fragmentation. I found one small isolated population ($n < 100$) in the southern Selkirk Mountains, several small sub-populations ($n < 100$), including a “female demographic island,” in the southern Purcell Mountains and several population sub-units that were relatively large ($n > 300$). Through multiple linear regression, I implicated human settlement patterns, human-caused mortality, and highway traffic volume as inhibiting inter-population movement.

Because several fragmented sub-units are small, maintaining regional connectivity may be necessary to ensure long-term persistence. Despite grizzly bear vagility, their conservative dispersal behaviour and difficulty in living close to humans makes maintenance of regional connectivity challenging. This work demonstrates, at a regional scale, the impact that transportation corridors and their associated settlements can have on movements of animals, and highlights the ultimate effect this may have on populations. The historical mechanisms of range contraction (fragmentation and human-caused mortality) appear to still be operating and require mitigating management strategies. My results suggest that these strategies must focus on linkage zone development and highway crossing structures, as well as mortality management beyond the roadway and within adjacent populations.

Biographical Sketch: Michael Proctor earned his bachelor of science degree in ecology from the University of British Columbia in 1995. Michael began working with grizzly bears in 1995 and became interested in using genetic analysis to answer ecological questions that were otherwise difficult using traditional ecological tools. After contributing to the development of a census technique using DNA and mark-recapture, he turned to questions of habitat and population fragmentation in grizzly bears. This eventually became the focus of his recently completed Ph.D. from the University of Calgary.