# Integrating Multiple Data Sources for Long-Term Black Bear Monitoring, a Hierarchical Modeling Approach

Colby Anton*, Montana Fish, Wildlife and Parks, Missoula
Nathaniel Bowersock, Missouri Department of Conservation,
KristeBrzeski, Michigan Tech University
Tonya Chilton-Radandt, Montana Fish, Wildlife and Parks
Melissa Hogland-Reynolds, Wildlife Research and Education Foundation,
Wayne Kasworm, US Fish and Wildlife Service
Jesse Lewis, Arizona State University
Jerod Merkle, University of Wyoming
Dana Morin, Mississippi State University
Molly Parks, Montana Fish, Wildlife and Parks
Michael Proctor, US Fish and Wildlife Service
Thomas Radandt, US Fish and Wildlife Service
Justin Teisberg, US Fish and Wildlife Service
Brian Wakeling, Montana Fish, Wildlife and Parks, Missoula

*Indicates Presenter

**Indicates Student Presentation

Large carnivores can be challenging to manage. In the mid-1990s, early evaluations of black bear life history established the initial management thresholds (based on harvest data) to evaluate the effect of harvest on black bear populations in Montana. These thresholds were applied to management of black bears in Montana beginning in 1996. After a large-scale population density and demography study in the 2000s, Montana Fish, Wildlife & Parks is developing a black bear monitoring program that uses historical and contemporary data from field studies and harvest statistics to advance monitoring methods. Our approach includes 1) using spatial capture-recapture (SCR) with noninvasive genetic sampling (NGS) to estimate population density and abundance, and 2) extrapolate density estimates from local study areas to surrounding bear management units and the larger ecoregions using SCR population estimates and resource selection function models (RSF). This effort will be replicated across 5 ecoregions in the state and each ecoregion will be revisited every 5 years to produce population indices and evaluate harvest effects. Our first 2 years of NGS was successful with nearly 1,500 samples collected across 2 study areas in western Montana. We used GPS locations from 362 black bears (228M, 134F) radiomarked during 2000-2022 from 8 different study areas in Montana, Idaho, and Wyoming to train and validate RSF models. This approach to hierarchical modelling provides insight on the feasibility of monitoring black bears at large spatial scales on mixed use landscapes where managers seek robust tools for regulated harvest.