Wildlife Restoration OPERATING GRANT FINAL PERFORMANCE REPORT	ALASKA DEPARTMENT OF FISH AND GAME DIVISION OF WILDLIFE CONSERVATION PO Box 115526 Juneau, AK 99811-5526

Alaska Department of Fish and Game
Wildlife Restoration Grant

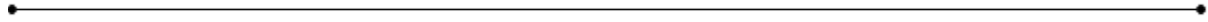**GRANT NUMBER:** AKW-23

PROJECT NUMBER: P4.42

PROJECT TITLE: Southeast Alaska brown bear data analysis and report preparation

PERIOD OF PERFORMANCE: July 1, 2017 to June 30, 2018

REPORT DUE DATE: September 1, 2018

PRINCIPAL INVESTIGATOR: Anthony Crupi

COOPERATORS: Dr. Kim Titus

I. PROGRESS ON PROJECT OBJECTIVES DURING PERIOD OF PERFORMANCE

OBJECTIVE 1: Analyze and prepare for publication historic data on brown bear population and habitat ecology in Southeast Alaska.

ACCOMPLISHMENTS: During this reporting period we continued to make progress towards our objective, by compiling, synthesizing, and analyzing brown bear data from Admiralty and Chichagof islands in Southeast Alaska. Between 1981 and 2015, we conducted brown bear research on these islands, generating a wealth of new information on population ecology and habitat use. These data were successfully integrated into resource management and policy decisions. As the field of wildlife ecology has developed, so have the tools available for analyses. Through this project and specifically this objective, we aim to further our understanding of coastal brown bear populations by applying current analytical methodologies to historic data and have begun drafting publications from this body of research.

The development of a habitat classification scheme was one of the major hurdles overcome during the last segment. We mosaiced several high resolution Landsat satellite images of the study area to develop an object-based supervised habitat classification. These segmented objects were combined with IfSAR elevation data, National Wetland Inventory (NWI) data, timber management polygons, and Normalized Difference Vegetation Index (NDVI) values to define alpine, avalanche/shrub, estuary, forested wetlands, upland forest, muskeg, timber clearcuts, and unvegetated habitats. As timber management was active during many years of the project we assessed habitat changes

over time and analyzed brown bear location data relative to the temporal changes in forest structure.

To measure seasonal habitat selection by brown bears on Admiralty and Chichagof islands, we constructed resource selection function (RSF) models to statistically compare the environmental terrain factors and landscape variables at locations used by study animals to random available locations using logistic regression. We modeled selection of male and female bears in both the early and late summer seasons. On Chichagof Island male bears selected low elevation, low slope habitats in the estuary, alpine, and clearcut habitats and avoided muskegs in late summer. Female bears on Chichagof Island selected more moderate low elevations with higher slopes in the alpine, avalanche/shrub, estuary and clearcut habitats in the late summer season. One interesting pattern observed in several female bears on Chichagof Island was their routine movement from low to high elevation. Several days spent on salmon streams were followed by travel to elevations between 400 and 800m for a day or two, presumably to forage on berries or retreat from competition with other bears, before descending back down to riparian areas. Both sexes selected habitats with moderate terrain complexity, and against areas with high solar radiation. On Admiralty Island males had similar selection patterns in late summer, however clearcut habitat was not selected in the top model, due to the limited spatial extent of timber management within the study area. Female habitat selection on Admiralty Island was also similar to patterns observed on Chichagof Island, though clearcut and estuary habitats were not variables in the top model. Using k–fold cross validation, we found the RSF models were highly predictive. Given that some of our early data were from bears collared with VHF transmitters and later years included GPS collared individuals, this was an interesting data comparison. We built models with the GPS data and evaluated their performance by validating to the VHF data, a considerably smaller dataset though in many cases provided comparable patterns of habitat selection. The relative probability of selection was mapped and contrasted between sexes to evaluate biological hypotheses.

II.   SUMMARY OF WORK COMPLETED ON PROJECT TO DATE

Several VHF and GPS location datasets were collected on Admiralty and Chichagof islands since 1981. We digitized historic VHF telemetry data and integrated those locations with GPS spatial data in a geospatial database for analysis in ArcGIS and R. We collected 7,570 aerial telemetry locations and 104,287 GPS collar locations for use in the analysis of Admiralty and Chichagof islands bear populations.

Our understanding of brown bear habitat ecology was dependent upon numerous landscape and cover-type covariates for the habitat selection models. We acquired a modern IfSAR Digital Elevation Model to define several terrain factors that were important to brown bear habitat selection including, elevation, slope, solar radiation, topographic position, terrain ruggedness, and topographic wetness. We attributed the brown bear spatial data with these fine scale resolution variables, to explain brown bear habitat selection at a level previously not possible. Completing the classification of a high resolution landcover habitat map for the study area significantly improves our

interpretation of habitats biologically meaningful to brown bears, and can be useful to other wildlife analyses. We continue to prepare manuscripts from this research to guide management recommendations for the species.

III.   SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS

None.

IV.   PUBLICATIONS

Crupi, A., K. Titus, R. Flynn, L. Beier and D. Gregovich. *In Prep*. Brown bear seasonal habitat selection of high density insular populations on Admiralty and Chichagof Islands. Alaska Department of Fish and Game, Juneau, AK.

Pendleton, G., K. Titus, A. Crupi, J. Whitman, and L. Beier. *In Prep*. Brown bear population density on Northeast Chichagof Island, Alaska: potential methodological biases. Alaska Department of Fish and Game, Juneau, AK.

V.   RECOMMENDATIONS FOR THIS PROJECT

The primary recommendation for this project is to continue data analysis of home range size and seasonal habitat movement patterns, and finalize the habitat selection publication.

Prepared by: Anthony Crupi

Date: 9/1/2018