FEDERAL AID ANNUAL RESEARCH PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

PROJECT TITLE: Kenai Peninsula brown bear population demographics

PRINCIPAL INVESTIGATOR: Sean Farley

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NO. W-33-11

PROJECT NO. 4.38

STATE: Alaska

PROJECT DURATION: July 1, 2008 – June 30, 2013

PERIOD: July 1, 2012 – June 30, 2013

I. PROGRESS ON PROJECT OBJECTIVES SINCE PROJECT INCEPTION

OBJECTIVE 1: Determine the finite rate of change (lambda) for the Kenai brown bear population.
Job/activity: collect demographic data
Data will be collected by collaring a subset of peninsula bears with vhf radio collars and following them for several years to collect data cub production, litter size, cub survival, adult survival, age of weaning, estimated age of first reproduction (where possible), inter birth interval, and annual natural mortality rate.

OBJECTIVE 2: Complete data analysis on differential reproductive fitness of Kenai brown bears.
Job/activity: data analysis
Collaborate with Dr. Sandy Talbot of the USGS Molecular Ecology laboratory in Anchorage, Alaska to look for individual maternal lineages of Kenai Peninsula brown bears. The data to be used will include recent genotypes determined for Jackson et al. (in press) as well as any additional bears handled. Where possible, perform a genealogical reconstruction of maternal lineages for the past 10 years. Relate that information with reproductive success from past radio-collared work.

OBJECTIVE 3: Develop a model predicting demographic vigor of Kenai Peninsula brown bears.
Job/activity: model development
Explore analysis of data from jobs 1 and 2 to construct predictive model(s) combining biological covariates (genetic relatedness, differential reproductive fitness, demographic data) of Kenai brown bears.

Objective 4: Attend conferences and training, write and present papers.

II. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD

OBJECTIVE 1:

JOB/ACTIVITY __1: There are 38 collars being monitored, of which 10 are potential drops, leaving 28 bears known alive. Figure 1 indicates spring 2013 locations for all bear collars under review.

JOB/ACTIVITY _2_: Animal Captures… Fall 2012 captures were not very successful and only 2 bears were captured (all adult females). During spring of 2013 the capture period experienced extreme weather conditions and only 4 bears (all adult females) were captured. Two spring captures were re-captures from 1995. Figure 1 shows most recent geographic distribution of bears.

JOB/ACTIVITY _3_: Data Analysis….Demographic data is being updated and the 2013 calculations will be updated later in the fall. The information current through June 2012 is listed below.

1) Annual Female survivorship has been calculated for the duration of the project (see Fig. 2)

2) Mean age of reproduction for the duration of the study (through 2010) has been calculated to be 11yr (sd 4) with a range of 3-23 years

3) Annual cub survival and litter size has been calculated for the duration of the project (see Tables 1 & 2).

4) Parameters from Tables 1 and 2 and Figure 2 were applied to a population model based upon Eberhardt and Siniff (1977). The age of first parturition was assigned 5 years with a range of 4 to 7. Mean annual birth rate was calculated from female cubs per female (assuming 50:50 ratio). An interbirth interval of 3.08 (3.05 to 3.17) was calculated from demographic data. Lambda was calculated to be 1.0451 with upper and lower bounds of 0.9693 and 1.1216, respectively.

OBJECTIVE 2:

JOB/ACTIVITY_1: No additional work has been reported on this activity.

OBJECTIVE 3:

JOB/ACTIVITY: A population viability analysis using the program Vortex is being conducted. Inputs were taken from the demographic data collected in this study and from literature when required (citations listed)

VORTEX 9.99 -- simulation of population dynamics

Beginning parameters from Kenai brown bear demographics study and references as indicated.
Modeled for two hypothetical population sizes: 600 and 400 with carrying capacity of 700 individuals.
Simulations run 1,000 times for 100 years each, each year 365 days
Simulations run for projected Human Caused Mortalities (HCM) of 0, 20, 40, 60, 80 & 100 animals per year (50:50 sex ratio calculated from 2010, 2011, 2012 mortality data)
Adult female survivorship calculated from demographics study

Cub litter size and survival by age calculated from demographics study
First age of reproduction set at 6 for females (NOTE: first litter is almost always lost)
First age of reproduction set at 9 for males
Maximum breeding age (senescence): 30 from demographics study and references
Extinction occurs when animals of either sex are gone

Inbreeding depression modeled with 3.14000 lethal equivalents per individual, comprised of 1.57000 recessive lethal alleles, and 1.57000 lethal equivalents not subject to removal by selection. These are the suggested parameters from the program.

Polygynous mating system with 100 % of adult males in the breeding pool
34 % adult females breeding each year. Calculated from demographic data and references.

In an average year 100% of available females produce broods.
Litter sizes calculated from demographic data:
21.00 percent of females produce 1 progeny in an average year
48.00 percent of females produce 2 progeny in an average year
30.00 percent of females produce 3 progeny in an average year
1.00 percent of females produce 4 progeny in an average year
Male and female survivorship estimated from cub survivorship up to age 6, then calculated from adult survivorship data from demographic study.

Initial populations of 600 and 400 with a stable age distribution.

A deterministic projection has been calculated, which assumed no stochastic fluctuations, no inbreeding depression, no limitation of mates, no harvest, and no supplementation. The deterministic population growth rate with 0 HCM was: an exponential rate of increase r = 0.027; the annual rate of change was lambda = 1.028 ; The net replacement per generations was R0 = 1.481, and the generation time for females was 14.29 and 16.59 for males.

REFERENCES

Brook, B. W. , J. J. O'Grady, A. P. Chapman, M. A. Burgman, H. R. Akcakayas, and R. Frankham. 2000. Predictive accuracy of population viability analyses in conservation biology. Nature. 404:385-387.

Leonard, SA, C.L. Risley, S. T. Turvey. 2013. Could brown bears (*Ursus arctos*) have survived in Ireland during the last Glacial Maximum? Biol Lett 9:20130281.

Proctor, M. F., C. Servheen, S. D. Miller, W. F. Kasworm, and W L Wakkinen. 2004. A comparative analysis of management options for grizzly bear conservation in the U.S.-Canada trans-border area. Ursus 15(2):145-160

Schwartz, C.C., K. A. Keating, H. V. Reynolds, III, V. G. Barnes, R. A. Sellers, J. E. Swenson, S. D. Miller, B. N. McLellan, J. Keay, R. McCann, M. Gibeau, W. F. Wakkinen, R. D. Mace, W. Kasworm, R. Smith, and S. Herrero. 2003. Reproductive maturation and senescence in female brown bear. Ursus 14(2):109-119.

Objective 4:

JOB/ACTIVITY: Three manuscripts were completed, submitted, and accepted for publication during this period. An additional work is listed as being *in manuscript* form.

III. PUBLICATIONS

Miller, W., S. C. Schuster, A. J. Welch, A. Ratan, O. C. Bedoya-Reina, F. Zhao, H. L. Kim, R. C. Burhans, D. I. Drautz, N. E. Wittenkindt, L. P. Tomsho, E. Ibarra-Laclette, L. Herrera-Estrella, E. Peacock, S. Farley, G. K. Sage, K. Rode, M. Obbard, R. Montiel, L. Bachmann, Ã". IngÃ³lfsson, J. Aars, T. Mailund, Ã˜. Wiig, S. L. Talbot, and C. Lindqvist. 2012. Polar bear and brown bear genomes reveal ancient admixture and demographic footprints of past climate change. Proceedings of the National Academy of Sciences USA: doi/10.1073/pnas.1210506109.

Sawyer, R. J., S. A. Sonsthagen, S. L. Talbot, G. K. Sage, S. Farley, and D. Causey. (*in manuscript*) Major histocompatibility genotype does not predict levels of blood parasitism in two species of bears in South-central Alaska.

Talbot, S. L., S. A. Sonsthagen, G.K. Sage, S. D. Farley, N. G. Dawson, R. E. Wilson, and J. A. Cook (*accepted 2013*). Are Island Brown Bears Isolated? Insularity and Gene Flow among Coastal Populations in Southeast Alaska. J. Mammalogy**.**

Teisberg, J. E., S. D. Farley, O. L. Nelson, G. V. Hilderbrand, M. J. Madel. P. A. Owen, C. T. Robbins (*accepted 2013*). Immobilization of Grizzly Bears with Dexmedetomidine, Tiletamine, and Zolazepam. J. Wildlife Diseases.

I. APPENDIX.

ALASKA DEPARTMENT OF FISH AND GAME
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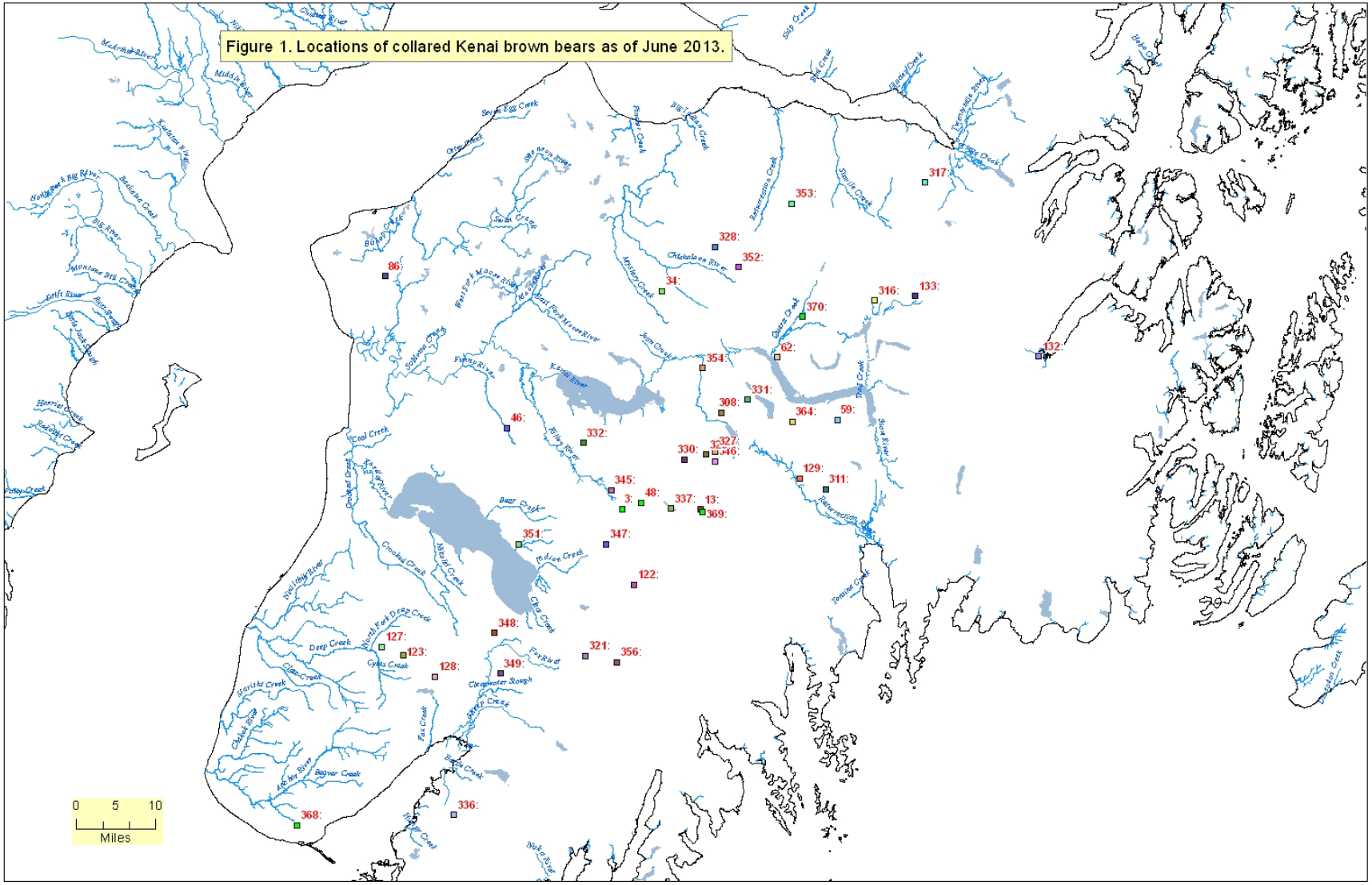

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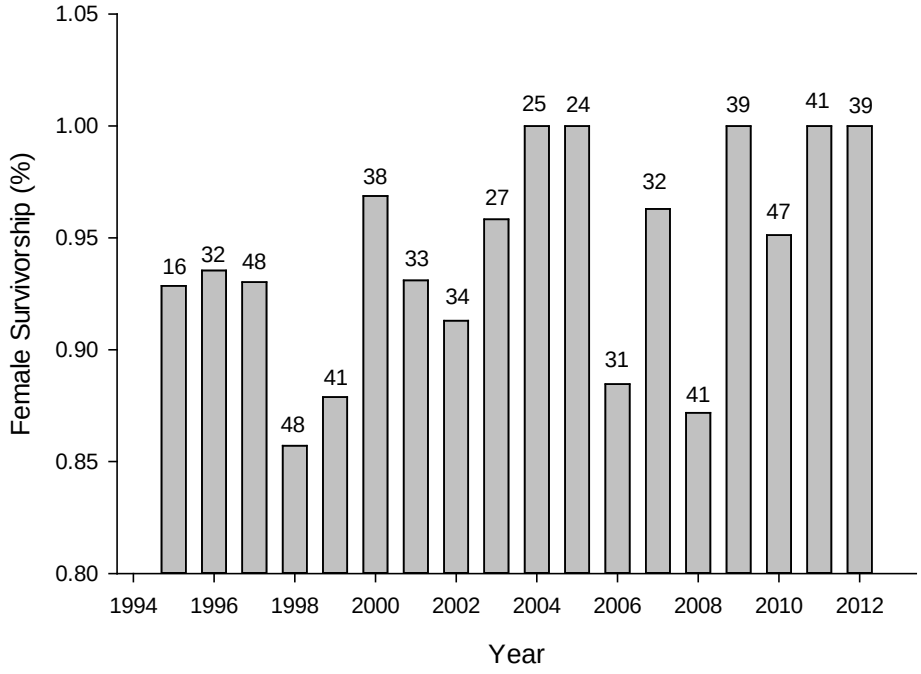
Figure 2

Kenai Brown bear

(Total number of bears collared at beginning of each year is indicated.
This total can fluctuate annually if bears previously censored because
of lost collars are re-identifed through recapture or DNA analyses of samples.)



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Tables 1 & 2: Cub survivorship and litter size for Kenai Peninsula brown bears.

Number of Cubs by Fate and Age to 2012

	Age of Cubs					
	0	1	2	3	Grand Total	
Sum of Survived	211	145	132	16	504	
Sum of Lost	106	71	6	0	183	
Sum of Censor	4	1	3	0	8	
Sum of Unknown	41	20	6	0	67	
Total	362	237	147	16	762	
Maximum Survival	0.67	0.67	0.96	1.00	To Weaning	0.45
Minimum Survival	0.59	0.61	0.92	1.00		0.36

Assumes Lost Cubs Died

Assumes Lost and Unknov Died

Number of litters by Litter Size and Cub Age to 2012

	Age of Cubs				
Litter Size	0	1	2	3	Grand Total
1	31	27	18	2	78
2	77	57	36	4	174
3	55	32	19	2	108
4	3	0	0	0	3
Grand Total	166	116	73	8	363
Mean Litter Size	2.18	2.04	2.01	2.00	