Alaska Department of Fish and Game
Division of Wildlife Conservation
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Brown Bear Line Transect Technique Development

Earl Becker

Research Final Performance Report
1 July 1999–30 June 2003
Federal Aid in Wildlife Restoration
Grant W-27-2 to W-33-1, **Project** 4.3

FEDERAL AID
FINAL RESEARCH REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
Juneau, AK 99802-5526

PROJECT TITLE: Brown bear line transect development

PRINCIPAL INVESTIGATOR: Earl Becker

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FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR.: W-27-2, W-27-3, W-27-4, W-27-5, W-33-1

PROJECT NUMBER.: 4.30

WORK LOCATION: Southcentral Alaska. Specifically northern GMU 9B, GMU 9D, Unimak Island (in GMU 10), GMU 13 A, B, E and northern GMU 16 A and B.

STATE: Alaska

PERIOD: July 1, 1999 – June 30, 2003

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Brown bears are a long-lived species with low recruitment potential, and as a result, prone to inadvertent overharvest. In order to prevent this from occurring, an accurate, precise, and affordable method of accessing population status over sub-GMU sized areas is needed. At the current time, the department is using a mark-resight estimator and has obtained good research results with this technique. However, the cost of implementing the estimator is very expensive, typically exceeding $200,000 when the cost of pre-marking is taken into account. Application of this technique to a management setting suffers from range of inference problems. This problem occurs because the study area for which a bear estimate is obtained is an order of magnitude smaller than the sub-GMU for which an estimate is needed, and as a result, the management decision is based upon heavily extrapolated data.

This study plan would continue development of a comprehensive process to develop, refine, and implement a cost-effective technique to estimate brown bear population size in sub-GMUs. Research will concentrate on the development of a special line-transect model that uses double-count data to estimate the probability of detection at the apex of the detection curve.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

Previous attempts to estimate bear density involved using mark-recapture techniques (Miller et al. 1997). The need to obtain population estimates on a sub-GMU level scale led to a pilot project on the Kiliuda Peninsula of Kodiak Island in the spring of 1996 to collect line-transect data on bears. The general technique, including the collection of double-count data between the pilot and the observer, was implemented at this time. Quang and Becker (1996, 1997, 1999) developed a series of line transect models to analyze this data set, and basically, these models were mathematical stepping-stones to the current model.

The use of double-count data allows for the estimation of the proportion of bears missed at the apex of the detection curve. Without this parameter, line-transect models would have to assume perfect detection at the apex, which is unrealistic and would result in an underestimation of bear density. We choose to incorporate this parameter in a different matter than other researchers (Manly, McDonald, and Garner. 1996, Alpizar-Jara and Pollock 1996).

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: Develop methods to speed up the random selection of transects

Becky Strauch, an ADF&G programmer and a National Park Service programmer wrote an Arcview program to randomly select transects within a study area. If the transects were selected in rugged terrain, they followed the elevational contour. In flat terrain, we used straight transects. In GMU 9D, and GMU 13 A and B, flat terrain was restricted, so we used hinged straight transects (2 straight transects with an angle off the mid-point).

OBJECTIVE 2: Modify the on-board computer programs to increase the flexibility and ease of use.

Becky Strauch wrote an ArcPad application program to collect the line-transect data. The program now keeps track of the length of transect flown and informs the survey crew when the transect endpoint has been reached. The removal of this previously manual process improves crew search efficiency.

OBJECTIVE 3: Refine the selection and measurement of covariates that are considered for use in the line transect model.

The 1996 pilot study revealed the importance of collecting search distance as a covariate. In order to accurately measure this covariate, we use a GPS unit to record this location. Using sheets depicting different bears under different percent cover (0, 10, 20, …. 90%) . We also standardized other covariates, such as bear activity and type.

OBJECTIVE 4: Test the variability of the GPS units, and the pilot/observer team to accurately mark known locations.

We tested commercial GPS units and found no bias in recording target location.

OBJECTIVE 5: Obtain an estimate of brown bear population size in the selected study area.

In the spring of 1999 and 2000 we surveyed northern GMU 9D using aerial line-transects and obtained estimated bear density to be 38.6 brown bears/10000 km^2 and 76.6 black bears/10000 km^2. In the spring of 2002 we obtained an estimated 169.0 estimated the density of 169.0 brown bears/10000 km^2 for GMU 9D and of 102.2 brown bears/10000 km^2 for Unimak Island (the only portion of GMU 10 inhabited by brown bears). We conducted a line-transect survey of brown and black bears in the Talkeetna study area (GMU 13E plus the northern sections of GMU 16 A and B) in the spring of 2000, 2001, and 2003. These data have yet to be analyzed. We conducted a line transect survey of brown and black bears in the Glennallen study area (GMU 13A and B) in the spring of 2003. Future data collection will be needed to obtain a population estimate for this study area.

OBJECTIVE 6: Preparation of reports and publications.

A publication is being revised to report the mathematics of the current line-transect model using the GMU 9D data as an example.

IV. MANAGEMENT IMPLICATIONS

This technique has evolved into a viable tool for estimating bear population size and density. I recommend that the department use this technique to obtain bear density estimates in areas of management concern. The assumption that all bears are available to be seen will restrict use to late spring, just prior to the emergence of bears from their dens. This assumption will preclude the technique from being utilized in Southeast Alaska and the Kenai Peninsula.

V. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN FOR LAST SEGMENT PERIOD ONLY

Job 1.1 Better transect selection process.

Previously accomplished.

Job 1.2 Improved data input program.

Becky Strauch wrote an ArcPad application program to collect the line-transect data, replacing manual processing. The program now keeps track of the length of transect flown and informs the survey crew when the transect endpoint has been reached. The removal of the manual process improves crew search efficiency.

Job 1.3 Refine model covariates.

Previously accomplished.

Job 1.4 Variability of GPS and pilot/observer teams.

Previously accomplished.

Job 1.5 Obtaining the population estimates.

During this period, we refined the estimates of GMU 9D and GMU 10 (Unimak Island) brown bear density. We also collected additional line-transect surveys in the Talkeetna and Glennallen

study area. We have reviewed this data for inconsistencies and errors. Analysis of the Talkeetna data has begun, and we anticipate obtaining a brown and black bear density estimate in the near future.

Job 1.6 Preparation of annual reports and publications

Aside from this report, no other publications were prepared.

VI. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THE LAST SEGMENT PERIOD, IF NOT REPORTED PREVIOUSLY

None.

VII. PUBLICATIONS

None.

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS

Our general approach to this project has worked very well, the addition of the GMU 9D data has proven insightful. Due to high bear densities, we obtained a lot of data from this survey. This will allow us to assess the relationship between sample size and precision. In Interior Alaska, bear densities are low and it takes a lot of flying to obtain enough data to estimate bear density. The use of a probability sampling to select transects may prove beneficial in these situations.

IX. PROJECT COSTS FROM LAST SEGMENT PERIOD ONLY

FEDERAL AID SHARE $59,775 + STATE SHARE $19,925 = TOTAL $79,700

X. APPENDIX

Literature Cited

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