Alaska Department of Fish and Game
Division of Wildlife Conservation
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Preparation of Manuscripts on Brown Bear Ecology and Management in Interior Alaska

Harry V. Reynolds

Final Research Performance Report
1 July 2002–30 June 2003
Federal Aid in Wildlife Restoration
Grant W-33-1, Project 4.31

FEDERAL AID
FINAL RESEARCH REPORT

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

PROJECT TITLE: Preparation of manuscripts on brown bear ecology and management in Interior Alaska

PRINCIPAL INVESTIGATOR: Harry V Reynolds, III

COOPERATORS: Jay M Ver Hoef (ADF&G, Fairbanks, AK), Bruce McLellan (British Columbia Forest Service, CA), Jon Swenson (Agricultural University of Norway, NO), Sven Brunberg (Scandinavian Bear Project, SE), Jon M Arnemo (University of Tromso, NO)

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR.: W-33-1

PROJECT NR.: 4.31

WORK LOCATION: Fairbanks

STATE: Alaska

PERIOD: 1 July 2002–30 June 2003

I PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

An understanding of the impacts of different levels of hunter harvest on brown/grizzly bear population density, structure, and dynamics is necessary for effective management. In addition, rates of recovery and mechanisms of response to high levels of harvest must be included in analyses for management models to reflect real-life situations. Although recent studies have increased the knowledge on some of these aspects of population dynamics, additional crucial information is necessary to clarify the extent and direction of population response to, and recovery from, high harvest levels. Further, as demands on brown bear habitat and populations increase, more intensive management will be required using models based on observed harvest and recovery rates of specific segments of the population.

Parameters of brown bear population dynamics have been measured in the northcentral Alaska Range since 1981. This long-term data set allowed application of a model to assess population growth rates and sustainable harvest rates for females; this was presented in the final report for Project 4.28. In addition, availability of written protocols describing capture and handling wildlife has become more important in management projects. None has been prepared for brown bears. This information should be published in widely available scientific publications to derive maximum benefit in understanding population behavior,

improve brown bear management in Alaska and elsewhere, and encourage the adoption of safe and humane procedures for capture,

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

Research has been conducted on population characteristics of brown bears in the northcentral Alaska Range since 1981. This long-term study was designed as a 3-part effort. Initial efforts determined baseline population measures under a regime of moderate harvest. In the second phase, harvest was increased to 11% and the population was allowed to decline. In the final phase, seasons were restricted to allow population recovery. Following the last phase, a model was selected to describe population dynamics and sustainable yield of females. Although that effort is complete, it has not been prepared for publication in a scientific journal.

Over 1500 captures of brown bears have been completed in this study and others in northern Alaska, and no capture mortalities have occurred in over 500 captures made since 1986. Experience gained during these captures should be made available for future projects.

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

OBJECTIVE 1: Prepare a scientific manuscript on population dynamics of a harvested brown bear population and sustainable mortality rates of females. Included under section V.

OBJECTIVE 2: Prepare a scientific manuscript on protocols and methods designed to ensure safe and humane capture of brown bears. Included under section VII.

IV MANAGEMENT IMPLICATIONS

Results of this project will provide improved documentation and broad distribution of a female-based harvest approach for brown bear management. Availability of a protocol proven to minimize capture mortality of brown bears will improve management capability and increase public acceptance of capture procedures.

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

JOB 1: Prepare a manuscript on calculation of sustainable harvest rates of female brown bears in northcentral Alaska.

Data collected on grizzly bears in the northcentral Alaska Range during 1981–2001 were collated and analyzed to provide input parameters for application of a Lotka–Euler model to determine sustained yield for females. Using this model, estimated sustainable yield in this population was estimated considering natural mortality alone, and total observed mortality which includes both natural and human-caused mortality. Human-related mortality included deaths from hunting in which hunters reported their kills, wounding losses, defense of life

or property kills, illegal kills, presumed deaths of cubs or yearlings following the mother's human-caused death, and capture-related deaths.

Based on staggered-entries of this data (Pollock et al. 1989), Kaplan–Meier calculation of survival to mean age at first parturition, accounting only for natural mortality, was 0.61 (95% CI = 0.50–0.73). In comparison, Kaplan–Meier calculation of survival to mean age at first parturition, when both natural and human-related causes of mortality were considered, was 0.36 (95% CI = 0.23–0.48).

Yield for all females, based on natural mortality rates only, was estimated at 9.4%, with λ (population rate of growth) = 1.1037 (95% CI = 1.0367–1.1613). In comparison, mean annual yield for all females when all sources of mortality were included was 1.4%, with λ = 1.0143 (95% CI = 0.9221–1.0952). In comparison, using the same approach for a grizzly bear population in British Columbia and Montana, Hovey and McLellan (1996) calculated that λ = 1.085 (95% CI = 1.032–1.136). Other models, based on hunter harvest or cautionary input parameters, estimated lower sustained yields of 4.6–7.0% (Miller 1988; Eberhardt et al. 1994; Swenson et al. 1994). Because the model we used appeared relatively unresponsive to substantive changes in model parameters, the yield estimate was high compared to most other studies, and the potential consequences to management of overharvest if the estimate was biased high, an alternative approach was also modeled.

The alternative approach is based on applying survival probabilities for various age classes of females to calculate the rates of female replacement in the population. Survival probabilities of females were calculated for age class and familial and reproductive status (offspring with mother, nonbreeding females of ages 4–7, breeding females, nonbreeding females, females with offspring, females whose litters died, etc.). Based on these inputs, inputs of population parameters previously calculated and assuming a stable age distribution, the model provided a tentative yield of 6.63%, substantially lower than the 9.4% calculated using the Lotka–Euler approach. Based on these differences, Dr. Jay Ver Hoef, ADF&G biometrician, recommends that consultation with a University of Alaska Fairbanks specialist about this technique should occur prior to publishing this work. Initial arrangements for the consultation have been made, but are not yet complete at the time of this report.

JOB 2: Prepare a manuscript describing procedures for maximizing safe and humane capture of brown bears.

This job has been completed. (See Section VII, Publications.) Submitted manuscript entitled "Procedures for maximizing safe and humane capture of brown bears" to the professional journal *Ursus*.

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

PROCEDURES FOR MAXIMIZING SAFE AND HUMANE CAPTURE OF BROWN BEARS

REYNOLDS HV, J SWENSON, B MCLELLAN, S BRUNBERG, AND JM ARNEMO. Submitted. *Ursus* 15:000–000

Abstract: Based on our experience of capturing 2792 brown bears (*Ursus arctos*) using helicopters, traps, or snares during 1973–2003, we provide protocols that have proven effective for capture and successful for minimizing risk of mortality to bears in Alaska, British Columbia, and Sweden. We compare efficacy, advantages, disadvantages and differences in handling characteristics of various immobilizing drugs and dosages. Based on its short induction time, relatively quick recovery time, wide latitude of safe doses for bears, and lack of drug-related mortalities, tiletamine HCl/zolazepam HCl, alone or with medetomidine HCl, was the most effective and safe immobilizing drug we used. In contrast, use of etorphine resulted in the highest rate of drug-related mortalities ($P = 0.00695$, 5 df) and we recommend against its use on brown bears. We discuss methods for effective and safe capture of brown bears, fitting radio collars, maintaining bears' well-being, and minimizing stress and non-drug related mortalities.

Key words: brown bear, capture mortalities, capture protocol, drugs, helicopter, immobilization, snares, traps, *Ursus arctos*

Ursus 15:000–000

VIII RESEARCH EVALUATION AND RECOMMENDATIONS

A manuscript describing various approaches to calculation of sustained yield models for grizzly bears should be completed soon and is crucial to effective management in Alaska. This information will be especially applicable to population management in locations where predation by bears on ungulates is important to predator–prey management.

Monitoring of population parameters and tracking of presence of adult females as an indicator of population recovery have been minimal during this report period. A final assessment of changes in these data and how female harvest has varied should prove valuable in management of bear populations throughout Interior Alaska. Survival data on 2- to 5-year-old females may be biased and driving the model we applied to its apparent high yield estimate. If the study is continued, monitoring of these cohorts should be a priority. Alternately, if further investigation shows that the survival data for these cohorts is accurate, and more appropriate models substantiate sustainable yield we calculated, then many bear populations in Alaska could be subjected to higher mortality rates than are presently allowed with minimal effect.

Most predator–prey studies in Alaska have focused on reduction in ungulate calf and adult numbers as a result of wolf and bear kills. Ongoing studies of ungulate production and survival are presently taking place in and adjacent to study area for this grizzly bear project. Although kill rates by wolves and effects of ungulate availability on pack dynamics have been addressed, similar information is not available for grizzlies. Additional research to address the issues of individual predation rates by bears and how availability of prey affects

bear populations should be initiated to provide a more complete picture for predator–prey interrelationships in Interior Alaska.

IX PROJECT COSTS FROM LAST SEGMENT PERIOD ONLY

FEDERAL AID SHARE $64.0 + STATE SHARE $21.3 = TOTAL $85.3

X APPENDIX

None.

XI PREPARED BY:

Harry V Reynolds, III
Wildlife Biologist III

SUBMITTED BY:

Jay M Ver Hoef
Acting Research Coordinator

Laura A McCarthy
Publications Technician II

APPROVED BY:

Thomas W Paul
Federal Aid Coordinator
Division of Wildlife Conservation

Matthew H Robus, Director
Division of Wildlife Conservation

APPROVAL DATE: _____