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Population Ecology and Spatial Dynamics of Wolves Under Intensive Management in the Nelchina Basin, Alaska

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Research Final Report
1 July 2004–30 June 2005
Federal Aid in Wildlife Restoration
Initiated under Grant W-27-4, completed under Grant W-33-3
Project 14.21

FEDERAL AID
FINAL RESEARCH REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
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PROJECT TITLE: Population ecology and spatial dynamics of wolves under intensive management in the Nelchina Basin, Alaska

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COOPERATORS:

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PROJECT NR: 14.21

WORK LOCATION: Nelchina Basin, Game Management Unit 13

STATE: Alaska

PERIOD: 1 July 2004–30 June 2005

PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

During the 1970s and early 1980s, moose and caribou populations in Unit 13 were just beginning to rebound from a widespread and significant decline, and wolf and brown bear populations had been reduced during a predator control effort. Estimates prior to 2000 indicated populations of all 4 of these species were relatively high. Wolf densities were 2.5–3 times higher than they were during the early 1980s. Populations of these species also had a history of receiving significant harvest from humans who have made Unit 13 one of Alaska's most popular hunting areas.

Units 13A, B, and E, which compose a large portion of the 59,200-km^2 Unit 13, are under a legislatively mandated intensive management strategy. This strategy specifies that certain big game prey populations must be managed actively, including through control of predation, to allow for high levels of human harvest. Further, the Board of Game implemented a wolf predation-control implementation plan that became effective during the winter of 2003–2004. This plan, the intensive management strategy, and the large and growing pressure by hunters to harvest big game resources in the area necessitated a thorough understanding of prey and predator population dynamics to meet management objectives.

This wolf research project was designed to help managers meet those objectives by improving our understanding of the population and spatial relationships of wolves to varying densities and distributions of prey, primarily moose and caribou, in Unit 13. We planned to build upon the previous work done on wolves in the area. New techniques and technology available today (e.g., stable isotope analysis and global positioning system [GPS] radio collars) were investigated to produce more explicit estimates of wolf kill rates, prey selection patterns and diet, and the spatial dynamics of packs relative to prey availability.

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

Rausch (1969) summarized the early history of wolf research in the Nelchina Basin. In 1957, the federal government focused on the effectiveness of predator-control techniques. Then, in 1960, the state of Alaska began to look at wolf-prey relationships using the basin as a demonstration area. Much of the effort during this period was devoted to aerial surveys of wolf, moose, and caribou populations to document movements and relative abundance. Closer investigation of wolf-prey relationships was initiated in the early 1970s, when moose and caribou numbers in the basin declined precipitously and scat analysis indicated a high level of those ungulates in the diet of wolves from that area (Stephenson and Johnson 1972; Stephenson and Johnson 1973; Ballard 1991).

In 1975, ADF&G began intensive research on wolf-prey relationships in Unit 13 (Ballard et al. 1987) that was conducted along with studies on moose (Ballard et al. 1991), caribou (Van Ballenberghe 1985), and bears (Ballard and Miller 1990; Ballard et al. 1990). The stated objectives of the wolf research were “to determine food habits and territory size, to examine population dynamics, and to determine the impacts of wolves on moose” (Ballard et al. 1987). This research examined wolf pack distribution, stability, territory size, movements relative to prey, density, productivity and survival, mortality, and prey selection patterns and predation rates.

The purpose of the new wolf study in Unit 13 was to build upon the above and other studies on wolf population dynamics in multiple predator-prey systems. Studies during the past 2 decades have generated new thinking on the functional and numerical responses of wolves to prey availability (Messier and Crete 1985; Dale et al. 1994; Adams et al. 1995; Marshal and Boutin 1999) and on the significance that multiple prey and predator species and human harvest have on wolf population dynamics (Gasaway et al. 1983; Fuller 1989; Boutin 1992; Ballard and Van Ballenberghe 1998).

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

OBJECTIVE 1: Determine the year-round prey selection patterns and kill rates of wolf packs relative to varying densities and distributions of prey, primarily moose and caribou, in and near the core calving areas.

We emphasized monitoring year-round prey selection patterns for 2–4 wolves in each of several packs within the study area. During the year, we regularly located all collared wolves and backtracked the movements of GPS-collared animals to determine their use of different prey items. This approach was useful in estimating seasonal prey use percentages but was inadequate in measuring kill rates because we had an insufficient sample of GPS-collared wolves. Measuring kill rates using traditional methods of continuous monitoring for several days was beyond the scope of funding for this study.

Backtracking flights of GPS-collared wolves during 2000–2003 indicated the following seasonal and year-round prey selection patterns: spring–summer (n = 96) = 48% moose, 33% caribou, and 19% unknown ungulate or other; fall–winter (n = 55) = 49% moose, 13% caribou, and 38% unknown ungulate or other; and year-round (n = 151) = 48% moose, 26% caribou, and 26% unknown ungulate or other.

OBJECTIVE 2: Investigate wolf movements and spatial relationships with prey.

We used VHF and GPS radio collars to monitor the movements of 2–4 wolves in each of several packs. We investigated spatial analysis techniques to measure wolf movements relative to the availability of moose and caribou. We emphasized the development of an integrated database that would allow appropriate spatial and statistical analyses. Our data indicated the possibility of directed movement by wolves toward select prey, for example cow moose with calves and calving caribou. Lack of GPS data for prey precluded more in-depth spatial and temporal analysis, which prompted our effort during the final year of this project to deploy GPS collars on moose. This effort will be part of the new study discussed above.

OBJECTIVE 3: Evaluate diet and body composition of wolves relative to prey availability.

Through 2003, we sampled blood for stable isotope analysis and conducted deuterium water dilution for analysis of body condition. We focused sampling on 3 periods relative to prey (moose and caribou) availability: (1) April — pre-calving and before caribou arrive in the area, (2) July — post-calving for both prey species, and (3) October — autumn/early winter after caribou have left the area. We sampled as many wolves as possible during each capture period.

For stable isotope analysis of diet, we prepared blood and tissue samples for laboratory analysis at Colorado State University. However, results were not available in time to finalize analysis and report findings here. We intend to publish these results as soon as possible.

Our analysis of body condition indicated body mass differed between sexes throughout the year but did not vary within sex. Mean fat mass and mean energy content were highest in both sexes in the spring. Mean lean mass was lowest in both sexes in the spring. Body mass and lean body mass were positively related to animal age in males. There was no relationship between body fat content and animal age in either sex. Thus, growth in males beyond age 2 consists primarily of lean mass. Deuterium should be allowed to circulate in the wolf for at least 120 minutes to ensure complete equilibration regardless of season, sex, age, or reproductive status.

OBJECTIVE 4: Estimate wolf density relative to varying prey densities.

We conducted a density estimate of wolves in and near the study area using a sample-unit probability estimator (SUPE) within 5967 km^2 in February 2001 and within 8329 km^2 in March 2002. Lack of snow, funds, or the initiation of a land-and-shoot wolf control program precluded subsequent SUPE surveys in the area.

For the 2001 survey, we derived estimates of 57.06 ± 4.69 wolves for the area at a density of 9.56 ± 0.78 wolves/1000 km^2. The estimated number of packs was 8.85 ± 1.02 at a density of 1.48 ± 0.17 packs/1000 km^2. The estimated size of wolf packs in the area was 6.44 ± 0.53 wolves. For the 2002 survey, we derived estimates of 61.62 ± 9.19 wolves for the area at a density of 7.40 ± 1.10 wolves/1000 km^2. The estimated number of packs was 12.32 ± 1.79 at a density of 1.48 ± 0.21 packs/1000 km^2. The estimated size of wolf packs in the area was 4.57 ± 0.27 wolves. In comparison, the population estimate for 1996 was 48.83 ± 4.30 wolves at a density of 9.9 wolves/1000 km^2 (80% C.I.: 8.69, 11.10), which indicates there was an actual and substantial downward trend in wolf numbers for western Unit 13A from 1996 to 2001 and 2002.

OBJECTIVE 5: Estimate production, survival, and recruitment of wolves relative to varying prey densities.

During April captures, we used ultrasound techniques to examine pregnancy and the number of fetuses in female wolves. We also monitored den sites to estimate pup production, and we documented loss of wolves from dispersal, natural mortality, and harvest by humans.

Ultrasound conducted during 2000–2003 indicated that only 4 of 13 female wolves examined had fetuses, which was far below the 2–6 pups/pack counted by aerial observation later each spring. Consequently, we discontinued the use of ultrasound to estimate wolf production. Survival of collared wolves was very low, primarily due to heavy ground-based harvest and the aerial-based control effort. Six of 17 collared wolves died during 2000–2001, 7 of 19 in 2001–2002, 12 of 21 in 2002–2003, 8 of 9 in 2003–2004, and 3 of 11 in 2004–2005. We believe 5 wolves dispersed during the study.

IV. MANAGEMENT IMPLICATIONS

During this study, we captured 47 individual wolves, many of which were recaptured for 109 total captures. Because a wolf control program using aerial-based efforts began in the study area in fall 2003 and ground-based trapping continued at a high level, we reduced our effort to capture wolves during the 2003–2004 performance period. Extremely high mortality of the study animals from ground and aerial harvest severely affected our ability to pursue the study objectives as originally planned. Therefore, for the final performance period, we modified our study area to exclude wolf packs within the aerial control area and the most heavily trapped areas by expanding the new study area to the south and east. In addition, we used all available funds to purchase new, state-of-the-art GPS radio collars that we began to deploy during the final performance period. This collaring effort will be continued during a new study in the area: *Population ecology and spatial dynamics of wolves relative to prey availability and human activity in the Nelchina Basin, Alaska*. This study will be done concurrently with a new moose study in the new area, which also involves the deployment of GPS collars on moose.

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

JOB 2: Capture and handling: During this segment period, we captured 11 new wolves (5 females, 6 males) among 4 packs. Two of those animals were recaptured once for 13 total captures. Captures took place on 10–11 November 2004, 17–19 February 2005, 22 March 2005, and 5 April 2005. We deployed GPS collars (Televilt—Simplex and Tellus models) on 10 wolves (2–3/pack) and collared 2 wolves with conventional VHF collars. We did not collar one of the young wolves captured. For each wolf we measured weight (with an electronic load cell) and body size, estimated age (based on tooth wear), applied ear tags and a radio collar, extracted blood for stable isotope analysis as well as for potential DNA and disease analysis, biopsied a fat sampled for fatty acid analysis, and noted general physical condition. There were no capture-related mortalities.

JOB 3: Prey selection patterns and kill rates: Location data collected by the GPS collars was remotely downloaded from the air and used to backtrack the movements and kill-site use by the wolves during the previous week. We were able to backtrack the movements of collared wolves with relatively few gaps in their travel routes. We followed wolf travel routes and recorded their visits to sites of freshly killed or older carcasses of moose or caribou. We also recorded kill sites discovered during telemetry flights of the VHF collars. Remote download of GPS data was done every other week during calving and at 4-week intervals at other times. GPS download and backtracking flights took 1–2 days to complete. Conventional VHF locations were obtained nearly daily for most wolves during calving and up to 2–4-week intervals at other times.

JOB 4: Movements and spatial relationships with prey: The GPS data downloaded remotely or directly from collars and data gathered through conventional VHF collars were compiled for comparative analyses with the movements of radiocollared moose and caribou. Data were collected on the schedule described above.

JOB 5: Diet and body composition: We collected blood, hair, and vibrissae samples from each of the wolves when captured. These samples were prepared in the lab for analysis of the presence of carbon and nitrogen isotopes that have specific signatures for moose, caribou, and other potential prey. Fat tissue samples were taken and stored for future fatty acid analysis. We continued to prepare a manuscript of the results of our research on body composition measured through deuterium water dilution tests on blood sampled from wolves.

JOB 6: Density estimation: Lack of funds and the initiation of a land-and-shoot wolf control program precluded SUPE surveys in the area.

JOB 7: Production, survival, and recruitment: We did not observe pups in any of the packs before the end of June and the close of this segment period, which is typical. Any pups produced during summer 2005 will be reported in the next segment report of the new study. Eight of the 11 wolves monitored during this segment period are still alive. The other 3 wolves died, 2 from ground-based trapping and 1 under land-and-shoot control permits.

JOB 8: Publications and meetings: I coauthored a paper that has recently been published (see below).

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

Becker, E. F., H. N. Golden, and C. L. Gardner. 2004. Using probability sampling of animal tracks in snow to estimate population size. Pages 248–270 *in* W. L. Thompson, editor. Sampling rare or elusive species: concepts and techniques for estimating population parameters. Island Press, Washington, D.C., USA.

We discuss 2 techniques using aerial-based surveys of tracks in snow for estimating low-density mammal populations, focusing on wolves (*Canis lupus*) and wolverines (*Gulo gulo*). One technique employs line transects to intercept animal tracks and the other technique uses quadrant sampling to locate tracks. We present data from numerous surveys, discuss the advantages and disadvantages of each technique, and recommend circumstances when each technique would be most appropriate.

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS

I recommend continuing wolf research in the Nelchina Basin under the new study: *Population ecology and spatial dynamics of wolves relative to prey availability and human activity in the Nelchina Basin, Alaska*.

IX. PROJECT COSTS FROM LAST SEGMENT PERIOD ONLY

Stewardship Investment items purchased:

None

Total Costs
FEDERAL AID SHARE $125,491.26 STATE SHARE $41,830.42 = TOTAL $167,321.68

X. APPENDIX

OTHER STUDY PUBLICATIONS

White, K. S., H. N. Golden, K. J. Hundertmark, and G. R. Lee. 2002. Predation by wolves, *Canis lupus*, on wolverines, *Gulo gulo,* and an American marten, *Martes americana,* in Alaska. Canadian Field-Naturalist 116:132–134.

We report here on 3 instances of wolf predation on mustelids in southern Alaska: 2 involving wolverines and another involving an American marten. Such observations are rare but have usually been documented indirectly in previous studies. This account provides insight into the potential role of wolves in influencing mesocarnivore communities in northern environments.

Golden, H. N., and G. V. Hilderbrand. In preparation. Body composition of free-ranging wolves. Journal of Mammalogy 000:000–000.

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Gasaway, W. C., R. O. Stephenson, J. L. Davis, P. E. K. Shepherd, and O. E. Burris. 1983. Interrelationships of wolves, prey, and man in interior Alaska. Wildlife Monographs 84.

Marshal, J. P., and S. Boutin. 1999. Power analysis of wolf-moose functional responses. Journal of Wildlife Management 63:396–402.

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Stephenson, R. O., and L. Johnson. 1972. Wolf report. Alaska Department of Fish and Game and Federal Aid in Wildlife Conservation, Project Progress Report, Grant W-17-3, Juneau, Alaska, USA.

Stephenson, R. O., and L. J. Johnson. 1973. Wolf report. Alaska Department of Fish and Game and Federal Aid in Wildlife Conservation, Project Progress Report, Grants W-17-3 and W-17-5, Juneau, Alaska, USA.

Van Ballenberghe, V. 1985. Wolf predation on caribou: the Nelchina Herd case history. Journal of Wildlife Management 49:711–720.

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