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Furbearer Management Technique Development

Howard N Golden

ADF&G

stribution and Trend of Marten, Lynx, and Snowshoe Hare Populations
ensities, Trend, and Harvest Potential of Wolverine Populations
istribution, Trend, Habitat Use, and Harvest Potential of Coastal River Otter Populations
oplying the Lynx Tracking Harvest Strategy through Rule-Based Modeling

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RESEARCH PROGRESS REPORT

STATE: ALASKA **Study:** 7.18

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GRANT: W–27–1

STUDY TITLE: FURBEARER MANAGEMENT TECHNIQUE DEVELOPMENT

JOB TITLES:

1. DISTRIBUTION AND TREND OF MARTEN, LYNX, AND SNOWSHOE HARE POPULATIONS
2. DENSITIES, TREND, AND HARVEST POTENTIAL OF WOLVERINE POPULATIONS
3. DISTRIBUTION, TREND, HABITAT USE, AND HARVEST POTENTIAL OF COASTAL RIVER OTTER POPULATIONS
4. APPLYING THE LYNX TRACKING HARVEST STRATEGY THROUGH RULE-BASED MODELING

PERIOD: 1 JULY 1999 – 30 JUNE 2000

SUMMARY

Each of the 4 jobs in this comprehensive study represents a separate research project to address the development of furbearer management techniques in Southcentral Alaska.

Job 1. During this reporting period, we again revised our plan to establish a system of setting up aerial transects to count tracks in snow of lynx, marten, and snowshoe hares. We will test the use of a gps-linked computer program in conjunction with digital video cameras to record tracks along a set of systematically placed 3- to 5-km-long linear transects across a variety of terrain and vegetation types. We will attempt to complete the development and testing of the software during winter 2000–2001.

Job 2. During this performance period, we further revised survival estimates and constructed a model of wolverine sustainable yield in the Talkeetna Mountains. Modified Kaplan-Meier survival rates (± SD) of all radiocollared wolverines in the Talkeetna Mountains averaged 0.89 ± 0.06 annually. Our estimates did not indicate differences in survival between females ($\bar{x}$ = 0.95 ± 0.06) and males ($\bar{x}$ = 0.85 ± 0.08) (χ^2 = 0.063, df = 1, $P > 0.10$) nor between wolverines first captured as adults (>2 years old) ($\bar{x}$ = 0.84 ± 0.07) and those first captured as yearlings (1–2 years old) ($\bar{x}$ = 0.90 ± 0.08) (χ^2 = 1.619, df = 1, $P > 0.10$). The estimated sustainable yield of female wolverines was 4.40 for the expected level and -0.35 and 16.11 for the lower and upper levels, respectively. Lambda was estimated at 1.19 for an 11,500-km^2 area. Assuming an even sex ratio, we estimated annual yield of female and male wolverines

for a population of 54 to be 9. Because this estimate is for a harvested population, it should be considered in addition to the average annual harvest of 4.9 wolverines in GMU 13A for 1984–1998. Therefore, the estimated sustainable harvest for the entire population was approximately 14 wolverines.

Job 3. On 6 June 2000, we used two 3-person crews to sample 32 latrine sites in Esther Passage and Shoestring Cove. Scats determined to be 24–36 hours old were collected and preserved in 95% ethanol (ETOH). These became the set of "marked" scats. All other scats estimated at >36 hours old were sprinkled with colored glitter to identify them from scats that would be freshly deposited over the next 2 days. On 8 June 2000, we resampled the same sites to collect all newly deposited scats, which were also preserved in ETOH. Preserved scats were sent to the DNA Core Lab at the University of Alaska Fairbanks for analysis through the automated sequencer. In Esther Passage we collected 95 "marked" scats for a mean of 2.97 (± 4.12) and 80 "recaptured" for a mean of 2.50 (± 3.40). The DNA analysis of the river otter scats from Esther Passage is underway, and we expect it to be completed by April 2000.

We also conducted a test to determine if counts of newly deposited scats (after fresh scats had been removed as "marked" samples) differed between sites where older scats were identified with colored glitter and left on the ground and sites where all older scats were removed. Test results indicated there was no significant difference between treatments ($Z = -0.6604$; $P = 0.509$). Sites where scats were removed before "recapture" counts had a mean of 0.80 (± 1.16) scats deposited per day, and those where scats were sprinkled with glitter and left in place had a mean of 1.05 (± 1.2) scats deposited per day.

Job 4. No additional work was conducted on this job during the performance period. The paper on the model's structure and mechanics along with a simulation of the model using data from GMU 13 was published as a chapter in the book "Mammal Trapping."

Key words: Density estimation, DNA microsatellite, expert system, food habits, *Gulo gulo*, habitat use, harvest, latrine site, *Lepus americanus*, line-intercept sampling, *Lutra canadensis*, lynx, *Lynx canadensis*, marten, *Martes americana*, movements, network sampling, relative abundance, river otter, rule-based model, sample unit probability estimator, snowshoe hare, survival, sustainable yield, wolverine.

CONTENTS

BACKGROUND

Because this study was extended for 1 year, this is the fifth progress report in a comprehensive program to develop furbearer management techniques by (1) evaluating the scope of species-specific management problems, (2) designing methods to address specific management needs, (3) testing the reliability and usefulness of those methods, (4) refining methods where necessary, and (5) facilitating the implementation of suitable techniques. This research study currently encompasses 4 jobs that represent furbearer management issues of concern in Southcentral Alaska. The goals of these 4 jobs are as follows:

1. Develop ground and aerial techniques for counting tracks in winter to monitor the distribution and trend of marten (*Martes americana*), lynx (*Lynx canadensis*), and snowshoe hare (*Lepus americanus*) populations in Southcentral Alaska.

2. Assess the accuracy of density estimation techniques and develop techniques to monitor the trend and harvest potential of wolverine (*Gulo gulo*) populations in Southcentral Alaska.

3. Develop techniques to index river otter (*Lutra canadensis*) populations, determine the availability and use of their habitat, and assess their harvest potential in coastal environments of Southcentral Alaska.

4. Develop a rule-based lynx management model to use in the lynx-tracking harvest strategy.

JOB 1 — DISTRIBUTION AND TREND OF MARTEN, LYNX, AND SNOWSHOE HARE POPULATIONS

During this reporting period, we again revised our plan to establish a system of setting up aerial transects to count tracks in snow of lynx, marten, and snowshoe hares. We will test the use of a gps-linked computer program in conjunction with digital video cameras to record tracks along a set of systematically placed 3- to 5-km-long linear transects across a variety of terrain and vegetation types. Transect endpoints will be GPS coordinates that will allow aircraft pilots to follow the route more easily than flying between geographic features (Golden 1987, Golden 1988). M Anthony at USGS-BRD in Anchorage (personal communication) has used the camera system on sea ducks and on moose. This system is designed to record animals or tracks on digital videotape from the belly of an aircraft. Images can then be viewed on a computer monitor for identification of the animals, their tracks, and vegetation types. The entire system is linked with the GPS system of the aircraft. We will begin full development and testing of the software and field techniques during winter 2000–2001. This work will be incorporated into the study plan for a new project scheduled to begin on 30 June 2001. Cooperators on this project are Mike Anthony at USGS-BRD, N Guldager at Yukon-Charley National Park, and R Skinner at Innoko National Wildlife Refuge.

JOB 2 — DENSITIES, TREND, AND HARVEST POTENTIAL OF WOLVERINE POPULATIONS

Golden (1993, 1996) and Golden et al. (1993*a*) provided background for this project. Work was planned for Jobs 2.1 and 2.2, but snow and weather conditions were unsuitable for conducting tests of the sample-unit probability estimator (SUPE) (Becker 1991, Golden 1997, Becker et al. 1998) or conducting population density estimates.

OBJECTIVES

2.1 To assess the accuracy and relative precision of wolverine density estimates derived from line-intercept and network sampling techniques.

2.2 To estimate the densities and trends of wolverine populations in different areas of Southcentral Alaska.

2.3 To determine if relationships exist between trends in wolverine density and trends in wolverine harvest, food availability, and abundance of large predators.

2.4 To estimate sustainable harvest levels of wolverine populations in Southcentral Alaska.

STUDY AREAS

The primary area is the eastern Talkeetna Mountains, which lie between the Chugach Mountains and Alaska Range and form the western Nelchina River basin. A description of this area is presented in Golden (1996). Study areas in the Kenai Mountains and Wrangell Mountains are described in Golden et al. (1993*a,b*). The Driftwood study area in the western Brooks Range is described in Magoun (1985).

METHODS

Job 2.1. Tests of Wolverine Density-Estimation Techniques

We did not conduct tests of the density estimation technique this year due to unfavorable snow and weather conditions. Plans for modifying test procedures are described in the Discussion section.

Job 2.2. Wolverine Density and Trend Counts

We did not conduct density and trend counts this year because (1) they were of secondary priority to testing the density estimation technique and (2) snow and weather conditions were unfavorable in the primary count areas adjacent to the Talkeetna Mountains study area.

Job 2.3. Wolverine Harvest and Habitat Relationships

This job was not addressed during this performance period.

Job 2.4. Wolverine Population Model

During this performance period, we further revised survival estimates and constructed a model of wolverine sustainable yield in the Talkeetna Mountains.

Survival Model

We updated wolverine survival estimates for our radiocollared animals originally calculated through the Kaplan-Meier procedure modified for staggered entry of additional animals (Pollock et al. 1989). We used a modification of this procedure that accounts for uncertain relocation of marked animals, i.e., when the probability of relocation is <1 (Bunck et al. 1995). This new procedure divides the study into periods, which in our case were based on 6 months. Only those animals at risk during a particular period were recorded as present. Entries for each marked animal were 1 for present, 0 for absent or not heard, or 9 if found dead. We then developed a matrix indicating presence or absence of each animal across all periods. We estimated survival (S) for each period as

$$\hat{S}_i = 1 - d_i / r_i,$$

where r_i is the number of animals at risk and d_i is the dumber of deaths in the *i*th interval. The cumulative survival function was estimated by the product of the survival estimates for each period,

$$\hat{S}(t) = \prod_{i \le t} \hat{S}_i ,$$

We estimated survival rates using 6-month-long periods beginning in April 1992 and extending for 6 years to March 1998. We also calculated mean annual survival for the entire population and for females, males, adults, and yearlings. A Chi-square test was used to measure differences between sex and age classes (Pollock et al. 1989).

Because we did not radiocollar kits in this study, we estimated survival from birth to age 1 by dividing the proportion of kits to adult females in the harvest for 1962–1968 by the average litter size (determined from embryos in carcasses) (Rausch and Pearson 1972). We used age ratios reported from this period because wolverine harvest was particularly intensive (due to bounties, aerial shooting, digging wolverines out of dens, and professional hunting and trapping) and, therefore, was probably more representative of actual age ratios in the population than more recent estimates that reflect traditional hunting and trapping practices.

Sustainable Yield Model

We estimated the sustainable yield of female wolverines for an area the size of Game Management Unit 13A (11,500 km^2) using a model incorporating variation of the Leslie matrix models described by Eberhardt and Siniff (1977) and modified for wolverines by JW Testa (personal communication). This model used vital statistics of wolverines that were derived from survival estimates in the Talkeetna Mountains and from reproductive data on wolverines in Alaska and Yukon Territory (Rausch and Pearson 1972, Magoun 1985).

Variables used in the model were (1) survival from birth to year 1 (P_0), (2) annual yearling and adult survival (P), (3) average age of first parturition (*a*), (4) mean annual birth rate in female offspring per female (F), and (5) population size (N) based on recent wolverine density estimates (Becker 1991, Becker and Gardner 1992, Golden et al. 1993*a*). The model estimated sustainable yield as equal to

$$n * (\lambda - 1) / \lambda,$$

where n was the estimated population size and λ (lambda) is the finite rate of population growth.

Population (N) and yield were in females only. Lower and upper values of P were 95% CI levels of assigned value, derived from radiocollared wolverines in the Talkeetna Mountains. P_0 values were derived by dividing the proportion of kits/adult female in the harvest by the mean, lower, and upper litter sizes estimated from embryo counts (Rausch and Pearson 1972). Variables *a* and F were derived from the literature. Variable N was derived from density estimates averaging 4.69/1000 km2 (Becker and Gardner 1992) for Unit 13A (11,520km2). Lower and upper levels of N were 95% CI of the assigned value.

RESULTS

Job 2.4. Wolverine Population Model

Survival Model

Modified Kaplan-Meier survival rates (± SD) of all radiocollared wolverines in the Talkeetna Mountains averaged 0.89 ± 0.06 annually (Figure 2.1 and Table 2.1). Our estimates did not indicate differences in survival between females ($\bar{x}$ = 0.95 ± 0.06) and males ($\bar{x}$ = 0.85 ± 0.08) ($\chi^2 = 0.063$, df = 1, $P > 0.10$) nor between wolverines first captured as adults (>2 years old) ($\bar{x}$ = 0.84 ± 0.07) and those first captured as yearlings (1–2 years old) ($\bar{x}$ = 0.90 ± 0.08) ($\chi^2 = 1.619$, df = 1, $P > 0.10$) (Figure 2.2).

Sustainable Yield Model

The estimated sustainable yield of female wolverines was 4.40 for the expected level and -0.35 and 16.11 for the lower and upper levels, respectively (Table 2.2). Lambda was estimated at 1.19 for an 11,500-km^2 area. Assuming an even sex ratio, we estimated annual yield of female and male wolverines for a population of 54 to be 9. Because this estimate is for a harvested population, it should be considered in addition to the average annual harvest of 4.9 wolverines in GMU 13A for 1984–1998. Therefore, the estimated sustainable harvest for the entire population was approximately 14 wolverines (Table 2.2).

DISCUSSION

Job 2.1. Tests of Wolverine Density-Estimation Techniques

The conditions required to test the accuracy of the sample unit probability estimator (SUPE) technique for wolverines (Becker et al. 1998) have not yet been met in the original Talkeetna Mountains study area. Consequently, we will attempt to estimate the density of wolverines in at least 1 of several test areas: 3 areas in the Nelchina Basin, 1 in the western Chugach Range near Anchorage, and 1 in the western Brooks Range. The latter area will be surveyed in cooperation with the National Park Service, which has begun a research project on wolverines. We will conduct the tests within 24 hours following a snowfall sufficient to cover all old tracks. We will survey the same sample units for 3–5 consecutive days to look for tracks of wolverines not detected during the SUPE on day 1. We will assess the technique's accuracy by measuring the proportion of animals detected by the SUPE among the number counted (Golden 1997). SUPE maps were prepared for 3 areas in the Nelchina Basin and 1 area in the western Brooks Range.

Job 2.4. Wolverine Population Model

Survival Model

We believe we met most of the assumptions of the Kaplan-Meier procedure specified by Pollock et al. (1989) and later modified by Bunck et al. (1995). We were able to randomly sample animals of a particular sex and age class by capturing all but 2 animals through helicopter darting. We made no effort to select certain individuals, although we probably caught more males than females because males ranged more widely and may have been more vulnerable to our capture techniques. We met the assumption that survival times were independent for different animals because wolverines are generally solitary and young may be independent before the age of 1 year. Except for the study-related death of a subadult female, we believe it is unlikely that capturing the study animals or their wearing a radiocollar influenced their survival. We considered animals at risk only when they were relocated (even if dead) at some point during a 6-month period and censored them when we lost contact with them during a sample period (Bunck et al. 1995). In defining a time origin, we began our calculation of survival in April when the first study animals were captured, kits had been born, and the trapping season had ended. Because of the small sample size, we were unable to assess quantitatively whether or not we met the assumption that newly tagged animals had the same survival function as previously tagged animals.

Sustainable Yield Model

A stable age distribution with regard to yearlings and adults was assumed, and the maximum age was ignored (i.e., it was assumed that the adult survival rate caused the number of very old animals to be insignificant). If old animals were included in the sample from which adult survival was estimated, an explicit maximum age should not be necessary. Immigration and emigration were assumed roughly equal.

Because survival was calculated for a harvested population, the yield represented the estimated number of female wolverines available to be harvested in addition to the current harvest. The yield multiplied by 2 was the total yield with males, assuming a 1:1 sex ratio. Adding the total yield to the average annual harvest (4.9 wolverines) resulted in an estimate of sustainable harvest for the population.

The average wolverine harvest of 4.9 in the Talkeetna Mountains and the surrounding GMU 13A could be characterized as light to moderate at approximately 1/3 the expected annual yield or 9% of the estimated population. The maximum harvest of wolverines reported for

GMU 13A was 13 in 1984 but the range in subsequent years was 2–7. The estimated density of 4.69 wolverines/1000 km^2 used in the sustainable yield model was slightly lower than other density estimates in Southcentral Alaska that were as high as 5.2 wolverines/1000 km^2 (Golden 1996). Completion of tests to measure the accuracy of the SUPE may result in revised density estimates and estimates of sustainable yield.

RECOMMENDATIONS

This study will end on 30 June 2001. During the last report period, we will focus on completing the evaluation of the accuracy of the SUPE for wolverines and on comparing the efficacy of the TIPS and SUPE through simulation modeling. We will extend movement analyses to measure home range using the adaptive kernel and harmonic mean methods (Kie et al. 1996, Hooge and Eichenlaub 1997), which should more accurately portray wolverine movement. We will measure home range size relative to cumulative location, degree of home-range overlap among concomitant wolverines, and spatial and temporal differences in movement patterns.

PUBLICATIONS

We will prepare papers for publication on results of the SUPE tests and on movements and habitat analyses. We will also prepare papers for publication on (1) a model to estimate wolverine sustainable yield, (2) a comparison of wolverine survival among populations in Alaska, British Columbia, and Idaho through a joint project with other investigators, and (3) on the immobilization of wolverines with Telazol® from a helicopter.

ACKNOWLEDGEMENTS

E Becker provided assistance with planning for tests of the SUPE technique and with the analysis of wolverine survival data. JW Testa provided the software used to estimate sustainable yield and assisted with analysis of some of the model parameters.

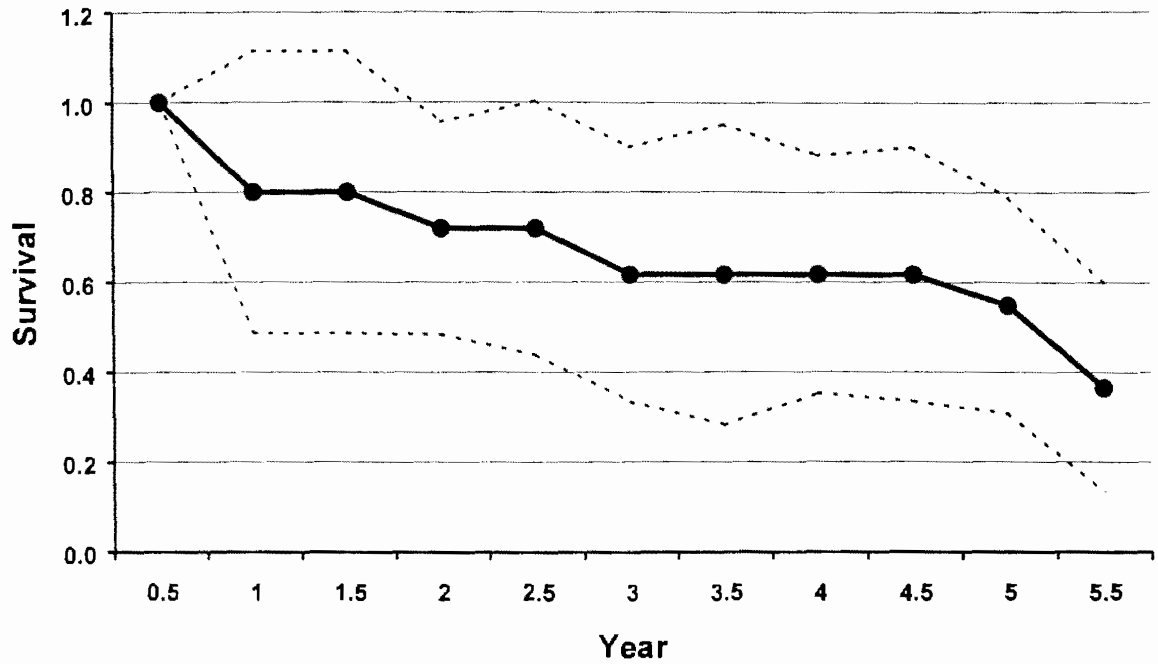

Figure 2.1. Kaplan-Meier survival function (solid line) and 95% (dashed line) confidence intervals for radiocollared wolverines (n = 22) subject to harvest in the Talkeetna Mountains, Alaska, April 1992–March 1998. The survival function was modified for staggered entry of additional animals (Pollock et al. 1989) and to account for uncertain relocation (Bunck et al. 1995).

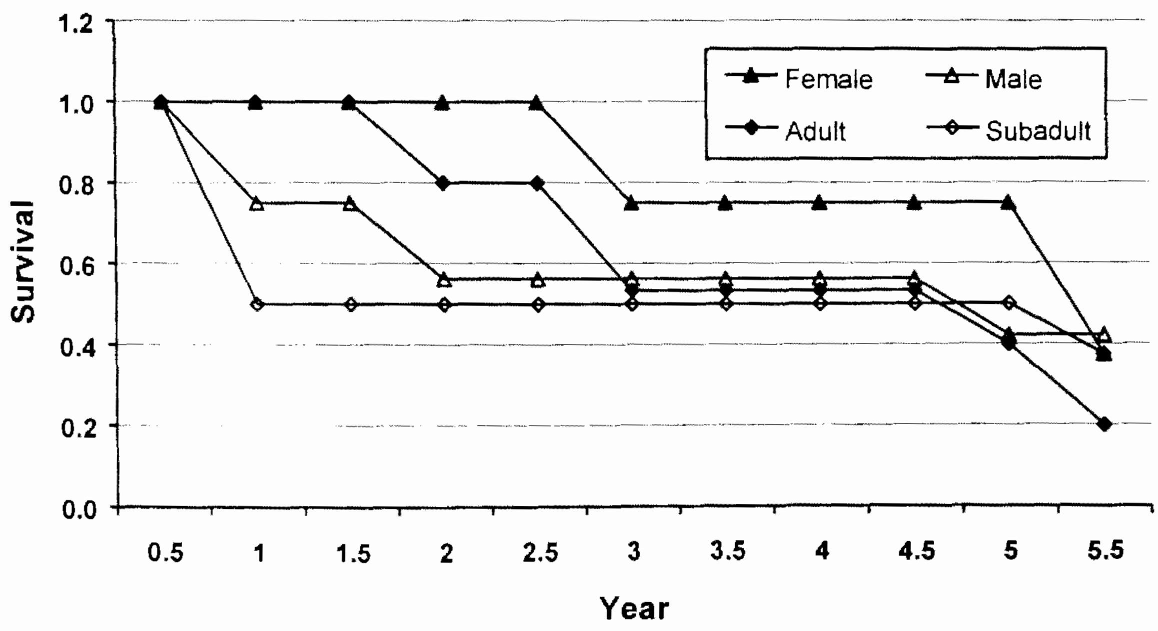

Figure 2.2. Survival functions by sex and age class for radiocollared wolverines in the Talkeetna Mountains, April 1992–March 1998. Survival functions were modified for staggered entry of additional animals (Pollock et al. 1989) and to account for uncertain relocation (Bunck et al. 1995).

Table 2.1. Kaplan-Meier survival functions for radiocollared wolverines in the Talkeetna Mountains ($n = 22$), Alaska, April 1992–March 1998 (Golden 1998). The survival functions were modified for staggered entry of additional animals (Pollock et al. 1989) and to account for uncertain relocation (Bunck et al. 1995).

Year	At Risk r_i	Deaths d_i	Survival $\hat{S}_i$	95% CI
0.5	4	0	1.0000	1.0000–1.0000
1	5	1	0.8000	0.4864–1.1136
1.5	5	0	0.8000	0.4864–1.1136
2	10	1	0.7200	0.4839–0.9561
2.5	7	0	0.7200	0.4378–1.0022
3	7	1	0.6171	0.3343–0.9000
3.5	5	0	0.6171	0.2824–0.9519
4	8	0	0.6171	0.3525–0.8818
4.5	7	0	0.6171	0.3343–0.9000
5	9	1	0.5486	0.3078–0.7894
5.5	6	2	0.3657	0.1327–0.5988

Table 2.2. Estimated sustainable yields of female wolverines for an area the size of Game Management Unit 13A, Alaska, 1992–1998, derived from survival estimates from the Talkeetna Mountains (Table 2) and reproductive data on wolverines in Alaska and Yukon Territory (Rausch and Pearson 1972, Magoun 1985). The model was based on Eberhardt and Siniff (1977) and modified for wolverines by JW Testa (personal communication).

	Talkeetna Mountains		
Variable	**Expected**	**Lower**	**Upper**
Survival from birth to year 1[a]	0.57	0.49	0.68
Annual yearling and adult survival[b]	0.89	0.77	1.00
Age of first parturition[c]	3.5	2.5	4.0
Mean annual birth rate in female offspring per female[cd]	1.12	0.75	1.50
n[e]	27	8	46
λ[f]	1.19	0.96	1.54
Yield[g]	4.4	-0.33	16.11
Total Yield with Males[h]	8.81	-0.69	32.21
Estimated Sustainable Harvest[i]	13.71	4.21	37.11

[a] Estimated by dividing the proportion of kits/adult female in the harvest by the mean, lower, and upper litter sizes derived from embryo counts in carcasses from wolverines harvested during 1962–1968 (Rausch and Pearson 1972).
[b] Lower and upper values represent the 95% confidence intervals of estimated levels (Fig. 2.1).
[c] Estimated from carcass data from Alaska and Yukon Territory presented by (Rausch and Pearson 1972).
[d] Birth interval was accounted for by multiplying the average litter size of 1.75 female kits by 0.75, 0.50, and 1.0 for expected, lower, and upper levels, respectively. Birth intervals were estimated from (Magoun 1985) and (Hash 1987). We assumed a stable age distribution and an even sex ratio at birth.
[e] Population size of female wolverines extrapolated for an area the size of Game Management Unit 13A (11,500 km^2) from a density estimate of 4.69 wolverines/1000 km^2 in the Talkeetna Mountains study area (4000 km^2) (Becker and Gardner 1992).
[f] Lambda: finite rate of population increase.
[g] Estimated sustainable yield = $n * (\lambda - 1) / \lambda$, which represents the estimated number of female wolverines available to be harvested in addition to the current harvest.
[h] Equals the yield *2, assuming a 1:1 sex ratio.
[i] Equals the total yield plus the average annual harvest of 4.9 wolverines.

JOB 3 — DISTRIBUTION, TREND, HABITAT USE, AND HARVEST POTENTIAL OF COASTAL RIVER OTTER POPULATIONS

Golden (1996) provided background for this project. During this report period, we focused on sampling scats in Prince William Sound (1) to develop a density estimation technique through a mark-recapture approach using river otter genetic material in scats and (2) to develop a technique to index the relative abundance of river otters through scat counts at latrine sites and the distribution and relative abundance of those sites.

OBJECTIVES

3.1 To determine if latrine site use and fecal deposition rates are precise indicators of river otter abundance in coastal areas of Southcentral Alaska.

3.2 To determine which habitat features are most important in defining coastal river otter habitat.

3.3 To evaluate food habits of river otters relative to habitat types and geographic area.

3.4 To estimate sustainable harvest levels of river otter populations in coastal environments of Southcentral Alaska.

STUDY AREAS

The Prince William Sound study area includes much of western part of the sound but primarily northern Knight Island and Esther Passage. Bowyer et al. (1995) described habitat features for the sound.

METHODS

Job 3.1. Latrine Site Use and Fecal Deposition Rates by River Otters

Density and Relative Abundance

We are collaborating with P Groves and M Ben-David at the University of Alaska Fairbanks (UAF) to analyze river otter scat for DNA microsatellites (Groves and Ben-David 1997). This procedure extracts DNA from river otter intestinal cells shed within their feces to generate DNA profiles or fingerprints that are specific to individual animals. Microsatellites are hypervariable, noncoding regions of short repeats within DNA that vary in size. They can serve as genetic markers because the regions may be amplified and their sizes compared among individuals with the aid of appropriate markers through polymerase chain reaction products and specific microsatellite primers.

On 6 June 2000, we used two 3-person crews to sample 32 latrine sites in Esther Passage and Shoestring Cove. We searched each latrine site using procedures described by Testa et al. (1994), and we only sampled sites that had at least 5 scats. Scats determined to be 24–36 hours old were collected and preserved in 95% ethanol (ETOH). These became the set of "marked" scats. All other scats estimated at >36 hours old were sprinkled with colored glitter to identify them from scats that would be freshly deposited over the next 2 days. On 8 June 2000, we resampled the same sites to collect all newly deposited scats, which were also preserved in ETOH. Preserved scats were sent to the DNA Core Lab at the University of Alaska Fairbanks for analysis through the automated sequencer.

Test of Scat Collection Protocol

We also conducted a test to determine if counts of newly deposited scats (after fresh scats had been removed as "marked" samples) differed between sites where older scats were identified with colored glitter and left on the ground and sites where all older scats were removed. We conducted this test because we were concerned that scat removal could affect the river otter's use of the sites. While it may be easier to identify all freshly deposited scats if all older scats are removed, the loss of visual and olfactory signs may inhibit otter marking and other behavior. On 31 May and 1 June 2000, we selected 21 latrines sites for scat removal and 21 sites for marking scats with glitter. Treatment sites were alternated along the coastline of northern Knight Island in Herring Bay and Lower Passage. We revisited each site on 4 June to count scat accumulation.

Job 3.2. Habitat Selection and Movements of River Otters

This job was not addressed during this performance period.

Job 3.3. Food Habits of River Otters Among Habitat Types

This job was not addressed during this performance period.

Job 3.4. River Otter Population Model

This job was not addressed during this performance period.

RESULTS AND DISCUSSION

Job 3.1. Latrine Site Use and Fecal Deposition Rates by River Otters

Density and Relative Abundance

In Esther Passage we collected 95 "marked" scats for a mean of 2.97 (± 4.12) and 80 "recaptured" for a mean of 2.50 (± 3.40). The DNA analysis of the river otter scats from Esther Passage is underway, and we expect it to be completed by April 2000. We will use the results to attempt to estimate river otter density and use of latrine sites by individual animals. We will follow the procedure described by Groves and Ben-David (1997) to estimate river otter density using the identification of individuals from DNA microsatellites to conduct a mark-resighting analysis of population density. They used the initial collection of scats at the latrine sites as the marking occasion. A resighting occasion was the subsequent collection of scats from latrine sites several days after the initial collection. They repeated this process several times to produce capture histories that they will use to estimate population density (M Ben-David, University of Alaska Fairbanks, personal communication). Their analysis is in progress and is expected to determine specific criteria (e.g., the need for closure) that may be required for accurate estimates. For the Kachemak Bay study, we will sample scats among

Kachemak Bay latrine sites to estimate density and relative abundance during the next performance reporting period.

Test of Scat Collection Protocol

Test results indicated there was no significant difference between treatments ($Z = -0.6604$; $P = 0.509$). Sites where scats were removed before "recapture" counts had a mean of 0.80 (± 1.16) scats deposited per day and those where scats were sprinkled with glitter and left in place had a mean of 1.05 (± 1.2) scats deposited per day. Although the high variance in the counts make the test somewhat inconclusive, we believe the use of glitter to identify old scats is the preferred technique. This procedure is less invasive and easier and quicker than trying to remove all old scats. The only disadvantage of using the glitter is in trying to adequately mark a scat pile that is very large from long-term use of the site. However, this is still not as difficult as trying to remove very large scat piles from the latrine site.

RECOMMENDATIONS

We recommend continuing the Kachemak Bay phase of this project for another year to estimate river otter density and relative abundance, analyze scat contents, movements, food habits, and habitat data.

ACKNOWLEDGEMENTS

M. Ben-David, J. Fair, N. Fair, K White, B Marston, G Hilderbrand, D Crowley, D Alcorn, and the crew of the vessel "Discovery" helped with latrine site surveys, scat sampling, and logistics in Prince William Sound.

JOB 4 — APPLYING THE LYNX TRACKING HARVEST STRATEGY THROUGH RULE-BASED MODELING

No additional work was conducted on this job during this reporting period. The paper on the model's structure and mechanics along with a simulation of the model using data from GMU 13 was published as a chapter in the book "Mammal Trapping."

JOB 5— PREPARATION OF REPORTS AND PUBLICATIONS

The following technical papers were published or submitted for publication during this performance period:

GOLDEN HN. 1999. An expert-system model for lynx management in Alaska. Pages 205–231 *in* Proulx, G, editor. Mammal trapping, Alpha Wildlife Research and Management, Ltd., Sherwood Park, Alberta, Canada.

WHITE KS, HN GOLDEN, KJ HUNDERTMARK, AND GR LEE. (In Review). Predation by wolves, *Canis lupus*, on wolverines, *Gulo gulo*, and an American marten, *Martes americana*, in Alaska. *Canadian Field-Naturalist* 000:000–000.

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BECKER, EF, AND C GARDNER. 1992. Wolf and wolverine density estimation techniques. Alaska Department of Fish and Game, Federal Aid to Wildlife Restoration Grant W-23-5, Research Progress Report.

BECKER, EF, MA SPINDLER, AND TO OSBORNE. 1998. A population estimator based on network sampling of tracks in the snow. *Journal of Wildlife Management* 62:968–977.

BOWYER, RT, JW TESTA, AND JB FARO. 1995. Habitat selection and home ranges of river otters in a marine environment: effects of the Exxon Valdez oil spill. *Journal of Mammalogy* 76:1–11.

BUNCK, CM, C-L CHEN, AND KH POLLOCK. 1995. Robustness of survival estimates from radio-telemetry studies with uncertain relocation of individuals. *Journal of Wildlife Management* 59:790–794.

EBERHARDT, LL, AND DB SINIFF. 1977. Population dynamics and marine mammal management policies. *Journal of the Fisheries Research Board of Canada* 34:183–190.

GOLDEN, HN. 1987. Survey of furbearer populations on the Yukon Flats National Wildlife Refuge. Alaska Department of Fish and Game, Research Final Report, Cooperative Agreement Project Number 14–16–007–84–7416.

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GROVES, P, AND M BEN-DAVID. 1997. Estimating wildlife population levels with DNA techniques in University of Alaska Fairbanks, Proposal to Alaska Science and Technology Foundation, Fairbanks, Alaska, USA.

HASH, HS. 1987. Wolverine. Pages 574–585 *in* M Novak, JA Baker, ME Obbard, and B Malloch, editors. Wild furbearer management and conservation in North America. Ontario Trappers Assoc., North Bay, Ontario, Canada.

HOOGE, PN, AND B EICHENLAUB. 1997. Animal movement extension to ArcView. Alaska Biological Science Center, U. S. Geological Survey, Anchorage, Alaska.

KIE, JG, JA BALDWIN, AND CJ EVANS. 1996. CALHOME: a program for estimating animal home ranges. *Wildlife Society Bulletin* 24:342–344.

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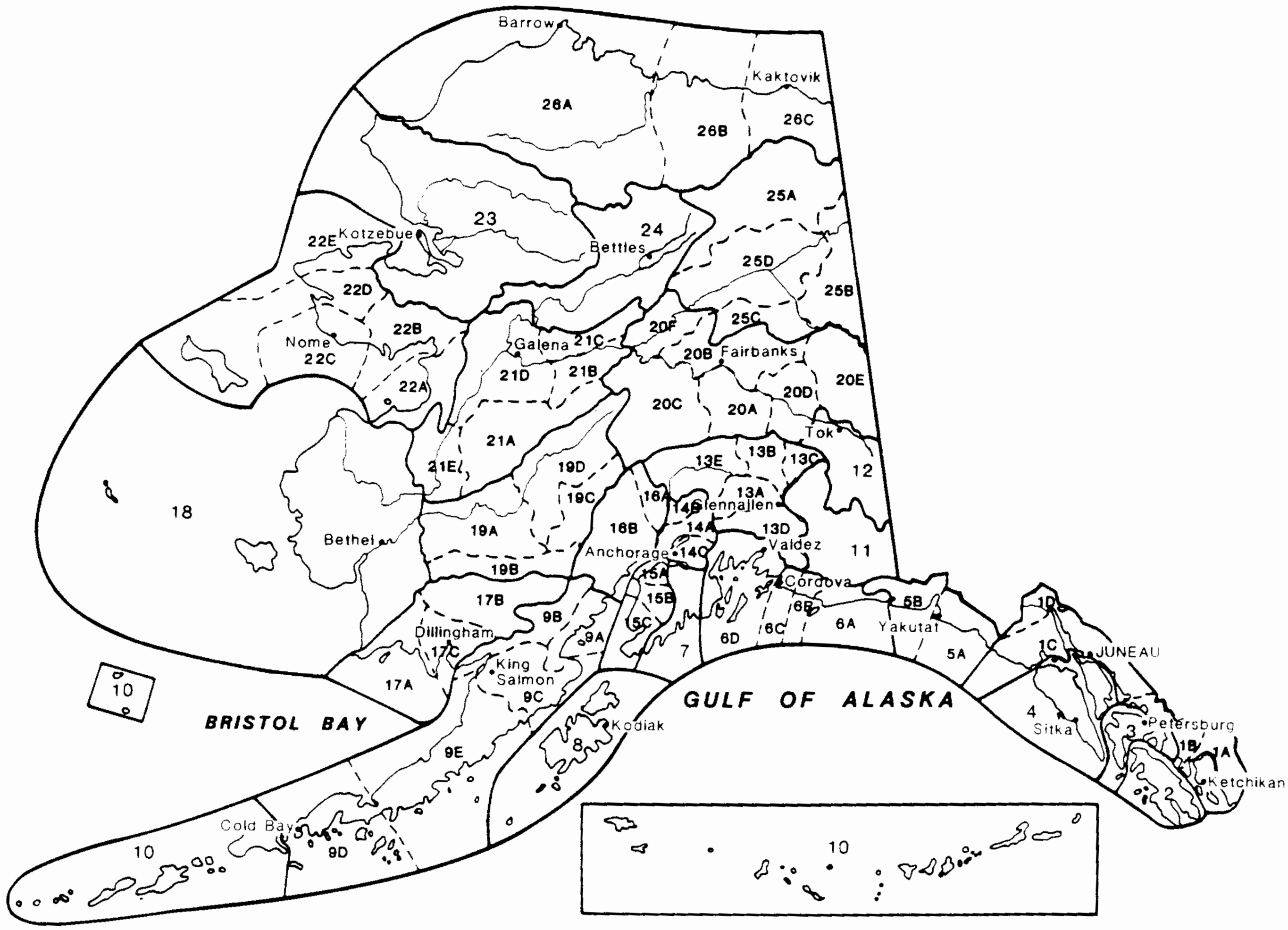
Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.

ADF&G