Alaska Department of Fish and Game
Division of Wildlife Conservation
October 2004

Furbearer Management Technique Development

Howard N. Golden

Research Final Report
1 July 2001–30 June 2004
Federal Aid in Wildlife Restoration
Grants W-27-5, W-33-1 and W-33-2, Study 7.19

FEDERAL AID
FINAL RESEARCH REPORT

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

PROJECT TITLE: Furbearer management technique development

PRINCIPAL INVESTIGATOR: Howard N. Golden

COOPERATORS: Mike Anthony, Biological Resource Division of USGS; Nikolina Guldager, Yukon-Charley National Park; Merav Ben-David, University of Wyoming; Mike Goldstein, Chugach National Forest; Aaron Poe, Chugach National Forest; John Morton, Kenai National Wildlife Refuge; Ian Martin, Kenai Fjords National Park.

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR: W-27-5, W-33-1, and W-33-2

PROJECT NUMBER: 7.19

WORK LOCATION: Nelchina Basin, Kenai Peninsula, Prince William Sound, Yukon-Charley Rivers Basin, and western Brooks Range.

STATE: Alaska

PERIOD: 1 July 2001–30 June 2004

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Furbearers are one of the most diverse and widely used groups of wildlife in Alaska. Many species, such as beaver (*Castor canadensis*), lynx (*Lynx canadensis*), and marten (*Martes americana*), provide an important economic benefit to Alaskans. Furbearers may be trapped or hunted under state regulations and several species (i.e., beaver, lynx, river otter [*Lontra canadensis*], wolf [*Canis lupus*], wolverine [*Gulo gulo*], and marten) must be sealed to record their harvest. The subsequent data derived from harvest returns are used as one measure of population trends.

Because of their small body size and secretive, wide-ranging behaviors, furbearers are some of the hardest species to monitor. Developing useful techniques for these species requires a long-term approach because of the difficulties inherent in assessing their population status. Improvements in monitoring techniques have been made but there is still a strong need for reliable techniques that are independent of harvest data.

This project describes a comprehensive process to develop furbearer management techniques by (1) evaluating the scope of individual 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. The goal of this process is to establish tested and reliable tools for managers to monitor the status and trends of furbearers in Southcentral and other areas of Alaska.

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

The scope of work for this research is such that is was most efficient to divide it into separate projects under the umbrella of the Furbearer Management Techniques Development. Background for these projects is discussed below.

Aerial Track Count Techniques

Research conducted under Federal Aid Grants W-24-2–5 and W-27-1–4 by (Golden 1994, 1996, 1997, 1998, 1999b, 2000) indicated counts of furbearer tracks in snow along transects can be used to estimate the distribution and relative abundance of populations. Thus, winter track counts can be used as indices of population trend, which is needed to manage harvest. Most past and recent studies that have used track counts to monitor furbearers have conducted counts from the ground (Golden 1994), (Paragi et al. 1996, O'Donoghue et al. 2001). The main advantage of ground counts is their accuracy in identification and enumeration. The main disadvantage is the limited area that can be surveyed on the ground. Extensive ground coverage requires an abundance of time and personnel.

An alternative to ground counts is aerial counts of tracks. The advantage of aerial track counts is the greatly expanded coverage possible and the speed of gathering data. (Golden 1987, 1988) used aerial transects to survey furbearer tracks across large areas with varied habitat. This technique required the observer to count tracks by looking out the window of a Super Cub and identifying and enumerating tracks as they went by at approximately 100 km/h. One disadvantage of this technique is the difficulty for the observer in making identifications and counts so quickly with virtually no opportunity to recheck a particular track. This required observers who were highly trained in track identification. Another disadvantage of this technique is the need to correct for differential track sightability among the various vegetation types with different canopy cover densities. This is essential for making track count comparisons among habitat types.

Recent advances in digital videography may allow aerial track surveys to be more accurate and efficient (Anthony et al. 1995). A system using a digital video camera that is linked to a GPS unit and laptop computer has been tested in surveying furbearer tracks in Yukon-Charley National Park and Preserve and in Innoko National Wildlife Refuge. A camera or a pair of cameras (with one set at wide-angle and the other at telephoto) can be mounted above a viewing port in the under side of a fixed-wing aircraft. The cameras can record tracks and vegetation along transects and store the data on tape for later viewing on a high-resolution monitor in the office. Preliminary results indicate this technique records clear images of vegetation and furbearer tracks that can easily be identified to species with minimal training of observers. In addition, the GPS link provides accurate locations of tracks and the habitat in which they are found.

Accuracy of Wolverine Density Estimation Techniques

The complete background for this job is discussed by (Golden et al. 1993) and (Golden 1996, 1997, 1998, 1999b, 2000). The density of wolverines is difficult to estimate because of their typically sparse populations, their small size and solitary nature, and their tendency to rest in holes or dens. Two aerial techniques have been used to estimate wolverine density, (1) the transect-intercept probability estimator (TIPS) (Becker 1991) and (2) the sample-unit probability estimator (SUPE) (Becker et al. 1998). There is uncertainty concerning the validity of the assumptions basic to both of these methods for wolverines and, therefore, whether or not they are unbiased estimators.

River Otter Habitat Selection and Population Monitoring

The complete background for this project was discussed in (Golden 1996). There are few methods available for monitoring the status of coastal river otter populations other than harvest data acquired through pelt sealing. In previous studies, density estimates of river otters have relied on home range calculations derived from radio telemetry data (Larsen 1983, Melquist and Dronkert 1987). More recently (Testa et al. 1994) used a mark-recapture technique with scats containing radioisotopes, supplemented with movement data from radiomarked animals, to estimate otter densities in western Prince William Sound, Alaska. The inaccuracy of using radio telemetry data alone and the restrictions of using radioisotopes in wild animals make these techniques unsuitable.

New methodologies in analyzing DNA are being tested to try to develop a better technique for estimating river otter density. The procedures described by (Groves and Ben-David 1997) is designed to estimate river otter density using the identification of individuals from DNA microsatellites to conduct a mark-resighting analysis of population density. 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 (Foran et al. 1997). This density estimation technique is important to establish baseline estimates of river otter abundance, which will allow the use of a relative abundance measure that can be used across larger areas more easily and is less costly. This relative abundance technique will use the distribution and use of latrine sites and the deposition of scats to monitor population levels and trends among different areas of coastline.

The density estimation and relative abundance techniques, along with a habitat model, will also be used to measure river otter habitat availability and use. River otters in coastal environments of Alaska tend to select old-growth forest habitats close to the shore, where their chief food items are marine bottom-dwelling fishes (Larsen 1983, Bowyer et al. 1994). The effects of oil contamination and logging on habitat use, movements, and food habits of river otters indicate these animals are sensitive to disturbance by humans. River otter response to these types of human disturbances and to others, such as harvest, construction of dwellings, and heavy recreational use, are important management considerations that need to be addressed.

Lynx Population Monitoring and Modeling

As part of the tracking harvest strategy used to manage lynx populations in Southcentral and other road-connected areas of Alaska, a rule-based expert-system model was developed to aid managers in their annual decision-making process to modify harvest seasons of lynx in concert with their cyclic populations and varying sustainable yields (Golden 1997, 1999a). This model operates with a program shell that requires regular modification and enhancement to meet the needs of managers. In addition, reproductive and other biological data from lynx carcasses purchased from trappers are necessary to estimate potential yield of local populations.

Miscellaneous Investigations

This job is intended for smaller projects that do not necessarily fit within the other jobs. This job allows pursuit of important technique projects that may be relatively short- or long-term. Two projects are currently being pursued in collaboration with other researchers or institutions.

- *Morphologic and genetic variation in wolverines in southcentral Alaska*. Little is known about the geographic variation in wolverines. Morphological analyses and genetic markers can assess the degree of variation among wolverine populations in Alaska (Cook 2001). There is particular interest in determining if the Kenai population (*G. g. katschemakensis*) is actually a distinct subspecies from wolverine populations (*G. g. luscus*) in other areas of the state. Being able to determine if there is a real distinction is important to wolverine management because it could be a factor in planning and other considerations regarding their level of use or protection.
- *Prey selection and prey switching in lynx as determined by stable isotope analysis*. Lynx populations vary in size on a 9–11-year cycle corresponding to snowshoe hare population changes. Lynx have been reported to consume primarily snowshoe hares, however they also eat a variety of food items, such as birds and rodents (Quinn and Parker 1987). Determining the extent that lynx use these alternate foods, particularly during hare population low phases, would provide insight into their role in sustaining temporarily depressed lynx numbers and the mechanisms of prey switching in lynx (Bergerud 1983).

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

The objective of this study was to develop and test techniques useful for management of furbearer populations in Southcentral and other regions of Alaska. This study encompassed 6 projects indicated below as job objectives. Each job objective has its own set of objectives.

Job 1. Aerial Track Count Techniques

1. Determine the most effective camera settings, aircraft speed, and aircraft type for recording and enumerating furbearer tracks with the digital video system.
2. Determine the most efficient design for transect placement considering topography and aircraft type.
3. Estimate the accuracy of aerial counts versus ground counts.

4. Estimate the level of correction needed to account for sightability differences among vegetation cover classes.

   Both aerial- and ground-based tests were used to conduct comprehensive field tests of the digital video system and track-transect techniques. National Park Service aircraft made all flights. Recent efforts focused on processing the video images and determining the most appropriate method for sampling the track count data. Simulation modeling of various sampling rates of video frames is underway to determine the level of effort required to obtain precise measures of relative abundance of tracks that reflect actual patterns of track counts. Reducing the need to scan all frames of a transect tape is desirable due to the amount of video material accumulated during surveys. A manuscript outline has been prepared and will be completed once all data analysis is finalized.

<u>Job 2. Accuracy of Wolverine Density Estimation Techniques</u>

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

We conducted analyses and published a manuscript describing both sampling techniques and comparing their relative effectiveness in estimating wolverine density. To further our ability to assess the accuracy of the network sampling technique, we developed a plan to estimate wolverine density on the Kenai Peninsula in coordination with managers of the Chugach National Forest, Kenai National Wildlife Refuge, and Kenai Fjords National Park. We completed a survey of approximately half of the study area on the Kenai Peninsula in spring 2004 and plan to survey the remainder of the area in 2005. All funding, other than staff salaries, was provided by federal cooperators.

<u>Job 3. River Otter Habitat Selection and Population Monitoring</u>

1. Determine if latrine site use and fecal deposition rates are precise indicators of river otter abundance in coastal areas of southcentral Alaska.
2. Determine which habitat features are most important in defining coastal river otter habitat.
3. Estimate sustainable harvest levels of river otter populations in coastal environments of southcentral Alaska.

We surveyed river otter latrine sites by boat along the coastline of eastern Prince William Sound to assess their distribution, levels of use, and scat deposition rates. Work in this area of PWS will broaden our understanding of river otter populations throughout the sound. We are completing data analysis and preparing manuscripts on the use of latrine sites and scat counts to monitor coastal river otter populations, on spatial habitat characteristics and use, and on comparative food habits. We are also developing a model to estimate sustainable harvest levels of river otters.

<u>Job 4. Lynx Population Monitoring and Modeling</u>

1. Continue to modify and enhance the lynx management model used in the tracking harvest strategy in southcentral Alaska.
2. Continue to analyze reproductive and other biological data from lynx carcasses.

A new version of the software needed for the lynx management model was purchased and progress was made in updating the model. We purchased lynx carcasses from trappers (as with project 7.18) to measure lynx reproductive parameters for use in the lynx management model. These data were used to recommend changes in lynx trapping regulations.

Job 5. Miscellaneous Investigations

1. Collaborate in a project to determine the morphologic and genetic variation of wolverines in southcentral Alaska.
2. Estimate prey selection patterns and prey switching in lynx during their 9–11-year cycle.

   We purchased wolverine carcasses for DNA sampling and archiving the samples in support of a graduate project that were sent to Idaho State University where DNA analysis is nearly completed. We also collected and archived muscle tissue samples from lynx carcasses purchased from trappers and prepared a subsample for stable isotope analysis.

Job 6. Publications and Meetings

Prepare manuscripts for publication from studies 7.18 and 7.19. Five publications were published from research conducted during study 7.19 and several more manuscripts are in preparation or planned. See section VII for a complete list. The following papers were presented to various meetings.

- Oral paper on "Wolverine spatial use and habitat selection" with Kevin White to *Carnivores 2002* meeting in November 2002, to the *Annual Meeting of the Alaska Chapter of The Wildlife Society* in April 2003, and to the *Northern Furbearer Conference* in Whitehorse in May 2003.
- Poster papers on "Wolverines and Humans on the Kenai Peninsula, Alaska: Evaluating Spatial Use Patterns and Potential Conflicts", with Mike Goldstein and several coauthors to the *International Conference of The Wildlife Society* in New Zealand in December 2003 and to the *Annual Meeting of the Alaska Chapter of The Wildlife Society* in May 2004.

IV. MANAGEMENT IMPLICATIONS

The projects conducted under Study 7.19 should improve our knowledge of furbearers and our ability to monitor their populations in southcentral Alaska. Being able to monitor furbearer distribution and relative abundance through digital videography techniques will provide managers with the ability to accurately identify and enumerate tracks of a variety of furbearer species along aerial transects. In addition, having the track data geosynchronized with habitat will be beneficial in measuring patterns of furbearer distribution and population potential. Our understanding of wolverine density estimation, population vital rates, and spatial relationships should give managers much clearer guidelines for establishing appropriate harvest rates. Management of coastal river otter populations should be improved with the development of techniques to monitor their relative abundance, the availability of suitable habitat, and population density. Finally, our ability to manage lynx harvest by trapping should continue to be more effective with the enhancement of the lynx management model that uses a rule-based, knowledge system to help managers make appropriate decisions.

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

JOB 1. Aerial Track Count Techniques:

We made progress in the development of software to process the video images and conducted statistical tests to determine subsampling capabilities and the minimum sample sizes required to analyze track data from transects. We also prepared a rough draft of a manuscript on the results.

JOB 2. Accuracy of Wolverine Density Estimation Techniques:

We submitted a manuscript on the using probability sampling of animal tracks in snow to estimate population size, which included its use in estimating wolverine density. We also completed a survey of approximately half of the study area on the Kenai Peninsula in spring 2004, using funds from 3 federal cooperating agencies. ADF&G contributed technical expertise and personnel but federal agency funds were used for operations.

JOB 3. River Otter Habitat Selection and Population Monitoring:

I continued analysis of latrine site data and preparation as senior author of a manuscript of river otter latrine site use (see section VII).

JOB 4. Lynx Population Monitoring and Modeling:

I analyzed lynx, snowshoe hare, and harvest trend data as well as area biologist observations for use in the lynx management model, LynxTrak. In consultation with area biologists, I used the model results to recommend season changes for lynx harvest in southcentral Alaska.

Job 5. Miscellaneous Investigations:

We processed tissue samples from lynx carcasses purchased from trappers and prepared them in the lab for stable isotope analysis.

Job 6. Publications and Meetings:

As senior author or coauthor, I completed or made progress on 5 manuscripts related to current and previous work on Jobs 2 and 3 for (Grants W-23-3, W-24-4, W-24-5, W-27-1, W-27-3, and W-27-4). See section IV and Appendix A. I also participated in the National Furbearer Manager's Workshop on Best Management Practices for Trapping in Council Bluffs, Iowa, 29 April–2 May 2002.

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

At the request of the Furbearer Resources Technical Group of the International Association of Fish and Game Agencies, I coauthored a brochure intended as a guide to trappers to help them avoid catching lynx while trapping bobcats and other furbearers (Appendix C). The brochure was prepared, in response to new federal regulations, for the U.S. Fish and Wildlife Service to print and distribute to trappers in the states where restrictions on lynx trapping apply. During this performance period, I worked with reviewers and editors in revising and finalizing the manuscript. This brochure was published in September 2003.

VII. PUBLICATIONS

Golden, H. N., B. S. Shults, and K. E. Kunkel. 2002. Immobilization of wolverines with Telazol® from a helicopter. Wildlife Society Bulletin 30:492–497.

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.

Golden, H., and T. Krause. 2003. How to avoid incidental take of lynx while trapping or hunting bobcats and other furbearers. International Association of Fish and Wildlife Agencies and the U.S. Fish and Wildlife Service, Washington, D.C., USA.

Krebs, J., E. Lofroth, J. Copeland, V. Banci, D. Cooley, H. Golden, A. Magoun, R. Mulders, and B. Shults. 2004. Synthesis of survival rates and causes of mortality in North American wolverine. Journal of Wildlife Management 68:493–502.

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.

<u>Manuscripts in preparation</u>

Golden, H. N. *In preparation*. Estimating sustainable yield of wolverines in Alaska. Wildlife Biology 000:000–000.

Golden, H. N., and M. Ben-David. *In preparation*. River otter latrine sites and scat deposition rates: evaluating their utility to index coastal population trends. Journal of Wildlife Management 000:000–000.

Golden, H. N., N. Guldager, R. M. Anthony, and R. Skinner. *In preparation*. Using aerial videography of tracks in snow to monitor furbearer populations. Wildlife Society Bulletin 000:000–000.

Golden, H. N., D. Henry, E. F. Becker, M. Goldstein, A. Poe, and J. Morton. *In preparation*. Estimation of wolverine population density through stratified network sampling of tracks in snow. Wildlife Biology 000:000–000.

Golden, H. N., and K. S. White. *In preparation*. Wolverine spatial use and habitat selection. Wildlife Biology 000:000–000.

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

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS

Funding for Study 7.19 was reduced by approximately 50% in FY04 and was eliminate for FY05 and beyond due to overall divisional budget cuts. Remaining salary expenses related to data analysis and publications will be completed under regional furbearer management funds. Completing this work is vital to presenting the research findings and the utility of the techniques for managers. I recommend salary funding be provided for the next 12–24 months to allow completion of all manuscripts and final products from this work.

IX. PROJECT COSTS FROM LAST SEGMENT PERIOD ONLY

FEDERAL AID SHARE $49,410 STATE SHARE $16,471 = TOTAL $65,881

X. APPENDIX Literature Cited

Anthony, R. M., W. H. Anderson, J. S. Sedinger, and L. L. McDonald. 1995. Estimating populations of nesting brant using aerial videography. Wildlife Society Bulletin 23:80–87.

Becker, E. F. 1991. A terrestrial furbearer estimator based on probability sampling. Journal of Wildlife Management 55:730–737.

Becker, E. F., M. A. Spindler, and T. O. Osborne. 1998. A population estimator based on network sampling of tracks in the snow. Journal of Wildlife Management 62:968–977.

Bergerud, A. T. 1983. Prey switching in a simple ecosystem. Scientific American 249:130-141.

Bowyer, R. T., J. W. Testa, J. B. Faro, C. C. Schwartz, and J. B. Browning. 1994. Changes in diets of river otters in Prince William Sound, Alaska: effects of the *Exxon Valdez* oil spill. Canadian Journal of Zoology 72:970–976.

Cook, J. A. 2001. Morphologic and genetic variation in wolverines (*Gulo gulo*) with a particular emphasis on Seward and Kenai Peninsula populations. Idaho State University, Study Plan, Pocotello, Idaho, USA.

Foran, D. R., K. R. Crooks, and S. C. Minta. 1997. Species identification from scat: an unambiguous genetic method. Wildlife Society Bulletin 25:835-839.

Golden, H. N. 1987. Survey of furbearer populations on the Yukon Flats National Wildlife Refuge. Alaska Department of Fish and Game, Cooperative Agreement Project Number 14-16-007-84-7416, Final Report, Fairbanks, Alaska, USA.

Golden, H. N. 1988. Distribution and relative abundance, population characteristics, and harvest of furbearers in Gates of the Arctic National Park and Preserve. National Park Service, Final Report, NRFR AR-8808, Fairbanks, Alaska, USA.

Golden, H. N., W. T. Route, and E. F. Becker. 1993. Wolverine demography and ecology in southcentral Alaska. Alaska Department of Fish and Game and National Park Service, Cooperative Research Progress Report, Anchorage, Alaska, USA.

Golden, H. N. 1994. Furbearer track count index testing and development. Alaska Department of Fish and Game, Research Final Report, Federal Aid in Wildlife Restoration Grant W-24-2, Juneau, Alaska, USA.

Golden, H. N. 1996. Furbearer management technique development. Alaska Department of Fish and Game and Federal Aid in Wildlife Restoration, Research Progress Report, Grants W-24-3 and W-24-4, Juneau, Alaska, USA.

Golden, H. N. 1997. Furbearer management technique development. Alaska Department of Fish and Game, Research Progress Report, Federal Aid in Wildlife Restoration Grant W-24-5, Juneau, Alaska, USA.

Golden, H. N. 1998. Furbearer management technique development. Alaska Department of Fish and Game, Research Progress Report, Federal Aid in Wildlife Restoration Grant W-7-1, Juneau, Alaska, USA.

Golden, H. N. 1999a. An expert-system model for lynx management in Alaska. Pages 205–231 *in* G. Proulx, editor. Mammal Trapping. Alpha Wildlife Research & Management, Sherwood Park, Alberta, Canada.

Golden, H. N. 1999b. Furbearer management technique development. Alaska Department of Fish and Game, Research Progress Report, Federal Aid in Wildlife Restoration Grant W-7-2, Juneau, Alaska, USA.

Golden, H. N. 2000. Furbearer management technique development. Alaska Department of Fish and Game, Research Progress Report, Federal Aid in Wildlife Restoration Grant W-27-3, Juneau, Alaska, USA.

Groves, P., and M. Ben-David. 1997. Estimating wildlife population levels with DNA techniques. University of Alaska Fairbanks, Research Proposal, Fairbanks, Alaska, USA.

Larsen, D. N. 1983. Habitats, movements, and foods of river otters in coastal southeastern Alaska. Thesis, University of Alaska Fairbanks, Fairbanks, Alaska, USA.

Melquist, W. E., and A. E. Dronkert. 1987. River otter. Pages 626-641 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, editors. Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Toronto.

O'Donoghue, M., S. Boutin, D. L. Murray, C. J. Krebs, E. J. Hofer, U. Breitenmoser, C. Breitenmoser-Wüersten, G. Zuleta, C. Doyle, and V. O. Nams. 2001. Coyotes and lynx. Pages 275–323 *in* C. J. Krebs, S. Boutin, and R. Boonstra, editors. Ecosystem dynamics of the boreal forest. Oxford University, New York, New York, USA.

Paragi, T. F., W. N. Johnson, D. D. Katnik, and A. J. Magoun. 1996. Marten selection of postfire seres in the Alaskan taiga. Canadian Journal of Zoology 74:2226–2237.

Quinn, N. W. S., and G. Parker. 1987. Lynx. Pages 682-695 *in* M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, editors. Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Toronto.

Testa, J. W., D. F. Holleman, R. T. Bowyer, and J. B. Faro. 1994. Estimating populations of marine river otters in Prince William Sound, Alaska, using radiotracer implants. Journal of Mammalogy 75:1021–1032.

XI. PREPARED BY:

Howard N. Golden
Wildlife Biologist III

SUBMITTED BY:

Earl F. Becker
Research Coordinator

APPROVED BY:

____
Thomas W. Paul
Federal Aid Coordinator
Division of Wildlife Conservation

____
Matthew H. Robus, Director
Division of Wildlife Conservation

APPROVAL DATE: ________________