Game Transplants in Alaska

TECHNICAL BULLETIN # 4
Second Edition

THOMAS W. PAUL

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
SEPTEMBER 2009

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by Oliver E. Burris and Donald E. McKnight 1973

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ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
SEPTEMBER 2009

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Doug Larsen, Director

For a hard copy of this report please direct requests to our publications specialist:
Publications Specialist
ADF&G, Wildlife Conservation
P.O. Box 115526
Juneau, AK 99811-5526
(907) 465-4176
dfg.dwc.publications@alaska.gov

Cover photos are (from left) of caribou (see page 87), deer (see page 9), and mountain goat (see page 22) transplant operations. Photos (from left) by Ted Spraker, William Hanlon, and Kent Bovee.

MESSAGE FROM THE DIRECTOR

Game transplants in Alaska have increased hunting opportunity, resulted in more food for Alaskans, affected Alaska's environment, and created some interesting history. In 1973, Bud Burris and Don McKnight wrote the first edition of *Game Transplants in Alaska*, covering efforts that occurred from before statehood until that time. Much has happened since then, which is why I asked Tom Paul to update their report. It is important to document transplant efforts, to understand what makes them work well and how to avoid identified pitfalls in future efforts. Paul's report provides a substantial look at both successful and unsuccessful efforts, and the benefits, challenges, and consequences of moving animals from one place to another. He accomplishes this while relating some good stories of biologists and community helpers exercising their ingenuity.

While introductions of wildlife to previously uninhabited areas can benefit both the species and people, great care must be taken to avoid negative impacts to those introduced animals or existing indigenous species. This new edition details how the attitudes toward and techniques used to accomplish game transplants have changed through the years. Importantly, a new transplant policy, adopted by the Alaska Department of Fish and Game since the first edition of this report, set strict guidelines for wildlife transplants.

I have personal experience with this topic. As an area wildlife biologist living and working in Ketchikan during the 1990s, I had the opportunity to oversee the introduction of mountain goats to Deer Mountain on Revillagigedo Island. Efforts were made beforehand to assess habitats and ecological implications. As with other introductions, time will tell whether our assessment was sufficiently thorough and accurate. In the meanwhile, that introduction, like others, has provided new hunting and viewing opportunities for Alaskans and visitors alike.

While the Revillagigedo introduction met the department's standards, a subsequent proposal to introduce mountain goats to Prince of Wales Island was rejected by the department after an ecological assessment determined there was insufficient wintering and escape habitat to support a viable population of goats on that island. We need to be ready to support wildlife transplants where they are appropriate and reject them where they are not.

As you read this publication, I hope you will reflect both on the positive aspects and inherent risks associated with transplants. It remains my hope that introductions and reintroductions of wildlife in Alaska, undertaken with appropriate care, will provide positive benefits to the species, to Alaskans, and to all who visit our state. I hope too that the information presented in this new edition of *Game Transplants of Alaska* will help biologists and others steer a course to positive results from any future wildlife transplant operations.

—Doug Larsen, Director, Division of Wildlife Conservation
September 2009

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PREFACE TO THE SECOND EDITION

Game Transplants in Alaska by Burris and McKnight (1973) has been one of the most widely used ADF&G publications for 35 years, if not by the general public, then certainly by wildlife professionals. Nearly every wildlife biologist in Alaska has a dog-eared, worn, original or photocopied version on an office shelf that they refer to periodically for reasons related to their job or for just plain interesting reading on a major topic in the history of Alaska wildlife management. Its usefulness and popularity arose because it drew together information from an abundance of sources both common and rare to produce a comprehensive record. Readers needed go no further than *Game Transplants in Alaska* to get the complete account of the rich and varied history of wildlife transplants in Alaska.

In the years since its publication, game transplants have continued in Alaska and an increasing number of current and former ADF&G wildlife professionals have lamented the lack of a similar comprehensive account of the recent transplant activity. Only Franzman (1988) attempted to comprehensively update the transplant record after Burris and McKnight. Although most of the subsequent transplants have been documented to some extent, not all accounts are easily found. Some useful information pertaining to the transplants was not written down or remains unpublished in agency files.

This edition follows the example of the first by pulling together information from a plethora of published agency reports, unpublished memos and data files, personal recollections, popular periodicals, and historical sources in an effort to continue the complete picture of Alaska's transplant history as well as provide an account of how the introduced populations have fared since they were transplanted.

In so doing, I kept most of the original text from the first *Game Transplants in Alaska*. I made minor changes in their text to clarify locations, and to update the status of transplanted populations which in 1973 may have seemed to be failures or successes but which over time have turned around for good or ill. In a very few cases, accounts of early transplants have been changed or expanded based on additional information unearthed or published since. One example is information on fox transplants to Alaska islands, which has been given a great boost by Bailey (1993). I elaborated on some early transplant stories, particularly if some of the circumstances or techniques employed in the operation were unique or unusual, such as the capture techniques used by private citizens supplying animals for deer and goat transplants in territorial days.

As in the original, I have defined transplants as actions whose primary goal is to introduce animals to a new area or augment an existing wildlife population. In the 1980s ADF&G began using more frequently the practice of moving nuisance animals mainly from urban settings to remote areas to reduce human–wildlife conflicts and minimize defense of life and property killings of animals. In addition, some recent predator–prey management projects took a nonlethal approach to predator control by moving bears and wolves to redress the predator–prey balance of an area. Although these could be considered animal transplants, they are not included in this report because the primary goal was something other than populating a

landscape with a particular species. I also have not included information on transplants that were proposed but never conducted because I was uncertain that any list of such proposals would be comprehensive.

For the more recent transplants, this edition provides details on capture, transport, and holding techniques when they could be found. These are provided not only as reference for future operations but to demonstrate the variety and ingenuity practiced by wildlife professionals and private citizens dealing with safely subduing, transporting, and releasing wildlife, and to shed light on the mundane but real problems of logistics, including the high costs of most transplant operations.

A major task in preparing this edition was updating the status of transplant populations. As mentioned earlier, some supposed successes have not endured and some "failures" have found new life. Even the most successful transplants are subject to the same population fluctuations that native populations experience. Some populations have had a more dynamic history than others and seemed to warrant a more detailed accounting. Also, when game is transplanted to areas of marginal or limited habitat, maintaining a thriving population over the long term often raises more complex management issues and requires more effort from wildlife managers than do naturally stocked populations. For that reason, I have included highlights of the management history of some of the transplanted populations.

On the other hand, if a transplanted population presents no difficult management issues and is in place for decades or more, it is not unusual for department management reports to cease special mention of it. In such cases I relied on the local knowledge and expertise of current ADF&G area wildlife biologists for information on the status of those populations.

I hope readers will find this second edition of *Game Transplants in Alaska* as useful and informative as the first edition has been.

—T. W. Paul
2009

References – Preface

Bailey, E. P. 1993. Introduction of foxes to Alaskan islands – History, effects on avifauna, and eradication. United States Department of the Interior, Fish and Wildlife Service. Resource Publication 193. Washington, D.C. 55pp.

Burris, O. E. and D. E. McKnight. 1973. Game Transplants in Alaska. Wildlife Technical Bulletin No. 4. Alaska Department of Fish and Game. Juneau, Alaska. 57pp.

Franzman, A. W. 1988. Review of Alaskan translocations *in* Translocations of wild animals. L. Nielsen and R. D. Brown editors. Humane Society Inc. and Caesar Kleberg Wildlife Research Institute.

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Finally, former ADF&G Director of Wildlife Conservation Matt Robus initiated the project to update *Game Transplants in Alaska*, and current Director Doug Larsen and former Deputy Director, now Wildlife Scientist, Kim Titus continued to support it and offer valuable advice and guidance for its completion.

EXECUTIVE SUMMARY

This report provides documentation of efforts to transplant game animals in Alaska, updating an original report on transplants written by Burris and McKnight (1973). It is intended primarily for wildlife management professionals, though others may find it of interest. It covers only transplant operations attempted, not those merely proposed.

The report groups transplant operations primarily by type of animal, for instance, big game, furbearer, or game bird, and then by species. More than 30 species have been transplanted in Alaska, though not all efforts have resulted in continuing populations.

In each section's description of the transplant history, the report touches on the challenges involved in transplanting animals and some of the lessons learned over the years. Over more than 100 years of transplant history, various techniques have been used to capture animals, to transport them, and to monitor the status of transplanted populations. This report describes some of those techniques. It also presents the results of attempted transplants, including which have been successful and which have failed, and which have had unintended consequences. It illustrates the need for careful consideration of effects on ecology, wildlife health, and other concerns when contemplating transplants.

Photo by Ted Spraker

Caribou from the Nelchina herd are loaded on a helicopter in preparation for transplant to the Kenai Peninsula in 1986.

Wildlife professionals may be able to use the information in this report to better assess whether proposed transplants should occur, to better ensure the health of animals during transplant operations, to anticipate and mitigate possible impacts of transplanting animals, and to better assess the success of transplant projects.

As described throughout the report, individuals working on transplant projects had to exercise ingenuity to figure out how to capture, transport, and release animals from one place to another. Biologists often relied on assistance from local residents and businesses to obtain, care for, and transport animals. Techniques employed have included: lassoing, netting, trapping, snaring, darting with immobilizing drugs, using trained dogs to drive animals to captors, using snow machines and helicopters to approach animals for darting and capture, and rearing animals in captivity prior to release. Biologists have had to design and construct special holding pens, containers, and methods of transport to safely ship animals. Many transplanted animals were

moved hundreds or thousands of miles using boats, trucks, landing crafts, trains, military and commercial aircraft, and more unorthodox methods such as mail trucks and police vehicles. Two illustrations of such transplant ingenuity include the successful transport of sea otters to Southeast Alaska in 1968 and 1969 aboard a Grumman Goose aircraft in individual bathtub-like kennels, and sedated mountain goats transported to the Kenai Peninsula in pickup trucks on beds of crushed ice under burlap.

Biologists have often worked in unique situations with unpredictable results. Subduing wild animals for capture with and without drugs is a dangerous undertaking. Drugs intended to immobilize and calm animals have sometimes killed them. In 1923, during the first effort to capture goats for transplants, in Tracy Arm, more than half of the goats originally sighted and driven toward capture locations died in falls from cliffs or in transport to Baranof Island. Sixty-eight percent of caribou calves initially captured from the Nelchina caribou herd and transported to Adak Island died. After high mortality with Dall sheep in transplant attempts to Kodiak, biologists recommended no further sheep transplants be attempted until adequate capture techniques were perfected. Although all deaths were regretted, biologists learned more each time about how to safely use immobilizing drugs not only in transplant operations but for other wildlife management purposes as well. Mortality in transplant operations has been significantly reduced over time. The most recent transplants of caribou (Nushagak Peninsula, 1988), mountain goat (Revillagigedo Island, 1991), and ruffed grouse (Kenai Peninsula, mid 1990s) suffered mortality rates of only 10%, 12%, and 2.5%, respectively.

The introduction of new wildlife populations affects the existing wildlife and habitat of an area. Alaska bird populations are still recovering from the devastating effects of fox transplants. Wildlife managers must keep a watchful eye on preventing the spread of exotic species like elk to other areas, and on preventing introduced populations without natural checks from destroying local environments and compromising indigenous populations of wildlife.

Wildlife managers have responded to the lessons of earlier transplants by instituting new policies and practices to protect the health of wildlife and the environment. Project managers must now meet new strict standards. Recent transplant operations have seen less mortality and fewer ecological complications than some earlier transplants.

Transplant Policies

Wildlife management policies surrounding transplant of game animals have changed dramatically over the years. Prior to statehood, transplant operations in Alaska were focused on providing animals for local populations to hunt or trap and included few safeguards. Since statehood, new standards have been developed, culminating most recently with adoption in July 1995 of the current transplant policy of the State of Alaska's Department of Fish and Game. The policy recognizes that wildlife transplants may be valuable tools for introducing, supplementing, establishing, or reestablishing wildlife populations, but also details important concerns related to transplants and sets out a protocol for evaluating benefits and risks. The protocol is necessary to prevent the ecological destruction and other negative consequences that resulted from some earlier transplants, including, for instance, the devastation of bird

populations on some Aleutian islands following introductions of foxes. Among other things, the policy prohibits introduction of nonindigenous species to Alaska.

In Alaska the objectives of game transplants have fallen into one or more of the following 10 categories: 1) providing increased recreational hunting opportunities; 2) providing additional food supply; 3) providing economic gain; 4) reestablishing a species; 5) restoring a species to its previous range; 6) speeding the recovery of depleted populations; 7) preserving threatened or endangered species; 8) mitigating development impacts; 9) augmenting populations of previous transplants; and 10) creating better opportunities to view wildlife.

Big Game Transplants

From 1916 through 1991 there were 43 successful and unsuccessful attempts to transplant one or another of 9 different big game animals in Alaska—deer, mountain goat, elk, plains bison, muskoxen, moose, caribou, and Dall sheep. Every major region of Alaska—Southeast, Southcentral, Southwest, Northwest, Interior, North Slope—has had at least one transplant effort. Kodiak and nearby islands have been the site for transplant efforts involving a number of different species, including deer, elk, mountain goats, moose, and Dall sheep. One big game transplant project is currently underway, the reintroduction of extirpated wood bison to Interior Alaska.

Sitka black-tailed deer. Residents of communities in Prince William Sound (PWS) and in the Kodiak Archipelago now harvest thousands of deer each year from populations that grew from transplants of small numbers of Sitka black-tailed deer from Southeast Alaska during 1916–1923 (PWS), and 1924 and 1930 (Kodiak Archipelago). These transplanted populations faced special environmental challenges and population fluctuations but have persisted and expanded. A transplant to islands near Yakutat in 1934 established a small but persistent population that has expanded in the early 2000s. Transplants to Homer Spit (1923) and the Lynn Canal mainland (1951–1956) were total failures. Efforts to transplant deer to Glacier Bay (1920) and Sullivan Island in Lynn Canal (early 1950s), though successful, failed to produce significant populations.

Photo by Kent Bovee

A mountain goat is transported in a sling from Misty Fjords to a staging area on the way to Revillagigedo Island during a 1983 transplant to the Swan Lake area.

Mountain goats. Mountain goat transplants in Alaska began in 1923 when 18 animals were moved to

Baranof Island from Tracy Arm, both areas in Southeast Alaska. The goat population grew and expanded its range and became by 2004 one of sufficient longevity to be considered a population with a history of customary and traditional use by the Federal Subsistence Board.

Persistent efforts that began with studies in 1948 to establish mountain goats on Kodiak Island were successful. By 2004 the islandwide population estimate was 1,560 goats and by 2006 managers began looking at providing increased hunting opportunities to limit the population to a level at which habitat quality can be maintained.

Goat transplants were conducted to reestablish or bolster populations on Mt. Juneau, above Juneau in Southeast Alaska, and on Cecil Rhode Mountain, above the community of Cooper Landing on the Kenai Peninsula. Both areas now have goat populations, though it is unclear if the Mt. Juneau goats resulted from the transplant or from goats moving in from surrounding areas. Transplants to two areas on Revillagigedo Island near Ketchikan have been successful in establishing mountain goat populations in previously unoccupied range. An attempt to establish goats on Chichagof Island failed.

Roosevelt Elk. Roosevelt elk transplanted from Washington state to Afognak Island in 1929 resulted in a huntable population, though several early efforts to transplant elk to Southeast Alaska failed. In one instance, 8 human-conditioned elk calves released on Gravina Island in 1962 became a nuisance and were all shot by a homesteader in 1963.

Photo courtesy of the Sitka Historical Museum

Young elk on Kruzof Island in 1928

In 1985, a new attempt began to introduce elk to Southeast Alaska and they were eventually introduced on Etolin Island. They have since become established on Zarembo and other nearby islands as well. Despite the success of this transplant in providing new big game hunting in the area, agency managers have been uneasy about establishing elk in the region. In 1993, biologists' concerns about the effect of elk on native Sitka black-tailed deer populations through competition for food and disease transmission contributed to failure of legislation that proposed moving elk to other areas of Southeast Alaska. Managers continue to try to prevent the spread of the elk to other parts of the region.

Plains Bison. Alaska's Plains bison populations stem from an initial transplant of 22 animals from the National Bison Range at Moise, Montana to what is now Delta Junction in 1928 and 1930. The Delta herd, from which all other Alaska plains bison herds originated, was obtained from the Range before introgression of cattle genes into that herd. Thus, Alaska plains bison

herds are among the relatively small number of herds of genetically pure plains bison. Other Alaska herds include the Copper River herd, established in 1950, the Chitina herd, established in 1962 from the Copper River herd, and the Farewell herd, which resulted from 2 separate transplants in 1965 and 1968.

Successful management of the habitat and range of the Delta bison transplant has become a complicated and expensive undertaking. But the 1928 transplant ultimately produced a stable population that has been a source for 3 other bison transplants in Alaska, and that has sustained a popular hunt for 40 years.

©ADF&G. Photo by Bob Sutherland

Wood bison were brought to the Alaska Wildlife Conservation Center from Canada. ADF&G plans to reintroduce the species to its historic range in Alaska.

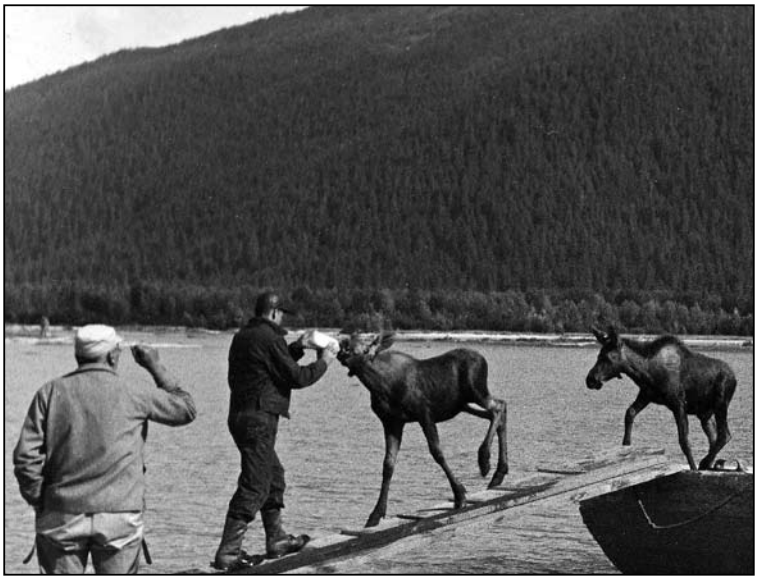
Wood Bison reintroduction. Wood bison once roamed throughout Interior Alaska for thousands of years but were extirpated at least 100 years ago by a combination of hunting and changes in habitat. Over 4,000 wood bison lived in Canada in 2007, where they were listed as a threatened species. By 2008, the Alaska Department of Fish and Game had spent nearly 15 years investigating and eventually championing a proposal to reintroduce wood bison to the state. ADF&G is convinced restoring wood bison to Alaska would increase the worldwide population of the species, contributing to wildlife conservation and ecosystem restoration.

Wood bison have been imported to Alaska from Elk Island National Park in Canada and were being held in 2009 at the Alaska Wildlife Conservation Center near Portage, Alaska, for disease testing and observation before transportation to release sites. Three study areas have been identified as suitable for wood bison and of those the Minto Flats area was being considered in 2009 as the initial site for restoration. Permits must be obtained from the U.S. Fish and Wildlife Service prior to any release.

Muskox. The last of Alaska's original muskoxen (*Ovibos moschatus*) were killed about 1850–1860. Efforts to reestablish them go back as far as 1927. The first muskox to be transplanted to Alaska came from Greenland; 31 were released on Nunivak Island in 1936. Since 1965 the herd has generally ranged between 435 and 700 animals, and has supported a substantial annual harvest for hunters. During 1999 through 2005 the average annual harvest was about 90 muskoxen.

Muskoxen from the Nunivak herd have been used for successful transplants to Nelson Island (1967), Alaska's eastern North Slope (1969–1970), Cape Thompson (1977), and the Seward

Peninsula (1970 and 1981). The Seward Peninsula muskox population grew rapidly; a census in 2005 found 2,387 muskoxen in 173 discrete groups. The muskox population on the North Slope has recently had a rapid decline, and the Cape Thomson herd, although successful in creating a sustainable population, has not thrived.



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Moose calves are coaxed ashore at Berners Bay, 1960.

Hunting has helped reduce local resentment toward muskoxen that arose because residents were not consulted prior to muskoxen being moved to their areas. Some residents in transplant areas have also expressed concern about possible competition for habitat with other game animals and trampling of berry picking areas. Cooperative management structures with local leaders have been developed in some areas to manage the herds. With their meat and the warm wool "qiviut" undercoats, muskoxen are beginning to be seen as a valued subsistence species. On the Seward Peninsula, thanks to a relatively extensive road system for a rural Alaska area, wild muskoxen are easily accessible and muskox viewing activity by local residents, tourists, and others is growing.

Moose. The first moose (*Alces americanus)* transplant in Alaska was conducted near Cordova on the Copper River Delta, and is considered one of the most successful game transplants in Alaska. From 1949 to 1957, 24 moose calves obtained from other areas in Southcentral Alaska were released. The area provided good habitat and the population grew and greatly expanded its range.

In 1958 and 1960, 22 moose calves were released at Berners Bay near Juneau. They established a small but sustained population that has weathered significant downturns in heavy snow years. During 1957–1959 moose calves were released on Kalgin Island, a small island on the west side of Cook Inlet. Managing to keep the population in balance with the limited island habitat has been a continuing challenge.

Other moose transplant efforts, to establish moose populations at Chickamin River northeast of Ketchikan and on Kodiak Island, were unsuccessful.

Caribou. Since 1958 caribou have been transplanted to three general areas of the state. Caribou from the Nelchina herd in eastern Alaska were moved to Adak Island in the Aleutians in 1958–1959 and to various places on the Kenai Peninsula in the 1960s and 1980s. Caribou

from the Northern Alaska Peninsula herd were moved to the Nushagak Peninsula in 1988. Most transplants were successful in establishing herds and have provided at least some hunting opportunity. Hunters have harvested more than 100 caribou from various herds on the Kenai Peninsula in recent years. In other areas success has brought complications, as in the continuing question of what to do to limit the caribou population on remote Adak Island, which has exploded since closure of the Navy base there (the population was estimated at 2,800 in 2005) and which threatens to trample and destroy endemic plant species. The Nushagak herd had spectacular early growth followed by an abrupt contraction. Though it provided hunting opportunity for a number of years, the population of about 550 caribou was too low to support hunting in 2006 and 2007.

Dall Sheep. Sheep transplanted from the Kenai National Moose Range to Kodiak Island in the 1960s failed to establish a continuing population. Due to high mortality of sheep during the capture and release operations, it was recommended at that time that no further sheep transplants be attempted until adequate capture techniques were perfected. There have been no additional attempts to transplant sheep in Alaska.

Furbearers and Small Game Transplants

Furbearer and small game transplants in Alaska have included foxes, beavers, martens, mink, sea otters, raccoons, red and ground squirrels, marmots, wolves, hares and rabbits, and European wild hogs. Most of these transplants occurred on coastal islands along the Aleutian Islands, Kodiak Island, Southcentral, and Southeast Alaska.

Because early Russian settlers recognized the potential of the Aleutian Islands for raising foxes, transplants of these furbearers were the earliest of game transplants in Alaska. The release of foxes on unoccupied islands continued after purchase of Alaska by the United States, and this practice was extended to several other furbearer species. These transplants, motivated by the high economic value of furs, began to decrease as the fur market declined in the late 1940s.

Few of the furbearer transplants made in the 1900s could be considered successful. Many were made to marginal habitats and, even though introductions of the transplanted species were successful, resulting populations were not capable of supporting large harvests or even attracting trapping effort. Even in instances where harvestable populations resulted from introductions, for example martens (*Martes americana*) in Southeast Alaska and beavers on Kodiak Island, declining wild fur markets resulted in only slight utilization of these populations.

Not only were many transplants of furbearers failures, but in several instances these introductions were detrimental to the native fauna. For example, depredations by foxes on ground nesting bird populations in the Aleutian Islands have had a tremendous impact on several avian species.

The motives underlying past transplants of small game species like hares, rabbits, and squirrels are less evident than those for furbearers, but it is clear that many such introductions were made to provide food for carnivorous furbearers and additional hunting opportunities for local residents.

Sea otters. In the 1950s and 1960s many attempts were made to reestablish sea otters (*Enhydra lutra*) on their former ranges in Alaska and elsewhere. Transplants to the Pribilof Islands from the area around Amchitka Island in the Aleutians apparently failed, but transplants to Southeast Alaska and to Canadian and U.S. coastal waters farther south were successful. Surveys in 2002 and 2003 estimated 7,500 sea otters in Southeast Alaska.

Sea otter reintroductions have been controversial with some fishermen because shellfish numbers—crabs, clams, and abalone—have declined following the return of sea otters. On the other hand, sea otters have also reduced sea urchin populations, allowing kelp beds to become reestablished in North Pacific coast waters. Healthy kelp forests typically are evidence of greater biological diversity in the marine coast ecosystem.

Game Bird Transplants

Exotic game birds. None of the numerous attempts to transplant various exotic game bird species into Alaska, such as ring-necked pheasants (*Phasianus colchicus*), and chukar partridges (*Alectoris graeca*), has been successful to date. While occasional sightings occur of individuals that might have resulted from a transplant, there are no significant populations. It is believed they simply couldn't survive Alaska's harsh winters.

Canada Geese. Transplants of Aleutian Canada geese (*Branta canadensis leucopareia*) are examples of successful programs undertaken to restore populations of an endangered species. After stocking of foxes on Aleutian Islands began in the 1750s, breeding populations of the geese were extirpated on many islands. In 1967, the species was listed as endangered. The U.S. Fish and Wildlife Service and others engaged in intensive efforts to help the species recover, including eradicating foxes on some islands and rearing geese for release in captivity because wild populations were too low to provide stock. Transplanted geese helped the population grow to over 40,000 in 2001, the year Aleutian Canada geese were removed from the endangered species list.

An effort began in 1973 to introduce a separate subspecies of Canada geese abundant in Southcentral Alaska to Kodiak Island to provide an opportunity for hunting. The first effort was not successful. However, in July 1986 more than 200 Vancouver Canada geese (*B. c. fulva*) captured in Southeast Alaska were released on Kodiak Island and on northwest Shuyak Island. In 2006, geese numbers were considered large enough to sustain hunting and a season was opened.

Photo courtesy Brad Benter

Stalking Evermann's rock ptarmigan on Attu Island in 2006

Grouse. Transplants of spruce and blue grouse (now called dusky grouse) to Kodiak Island were attempted but failed. However, ruffed grouse, indigenous in Alaska north of the Alaska Range, have been successfully transplanted to areas farther south, including the Matanuska Valley in 1988, 1989, and 1990. No harvest records are kept by the Alaska Department of Fish and Game, but hunter reports indicate ruffed grouse are regularly taken in the area, and that the grouse may have spread to south of Anchorage and across Cook Inlet. Success of a transplant of ruffed grouse to the Kenai Peninsula during 1995–1997 was still debated in 2007, as populations are not abundant, although the goal of establishing a huntable population seems to have been met.

Evermann's rock ptarmigan. In a successful effort to restore a species to former range, about 75 Evermann's rock ptarmigan (*Lagopus muta evermanni*) were transplanted from Attu Island to Agattu Island in the Aleutian Islands during 2003 through 2006. Capture methods included noose poles, carpet snares, decoys, calls, and driving birds into drift nets. The successful transplant was considered an important step in decreasing the risk to the subspecies' survival and restoring island fauna in the Alaska Maritime National Wildlife Refuge.

Conclusion

Because the majority of game transplants attempted have been made to areas previously lacking similar endemic species, a large proportion of these attempts have resulted in viable populations of the introduced species.

Results of many transplants are difficult to assess. In some instances the introduction of only a few animals resulted in tremendous rewards in the form of food and recreational opportunities for the citizens of the state. However, many transplants have generated few benefits for people and some have been detrimental to other species and habitats.

It may be that the majority of transplants in the future will be to restore species, to reestablish locally extirpated populations, or to move an endemic species into previously unoccupied ranges. On the other hand, efforts to undo transplants—eradicating transplanted animals that have caused detrimental effects on endemic species—may play a larger role than transplants in future wildlife management in Alaska.

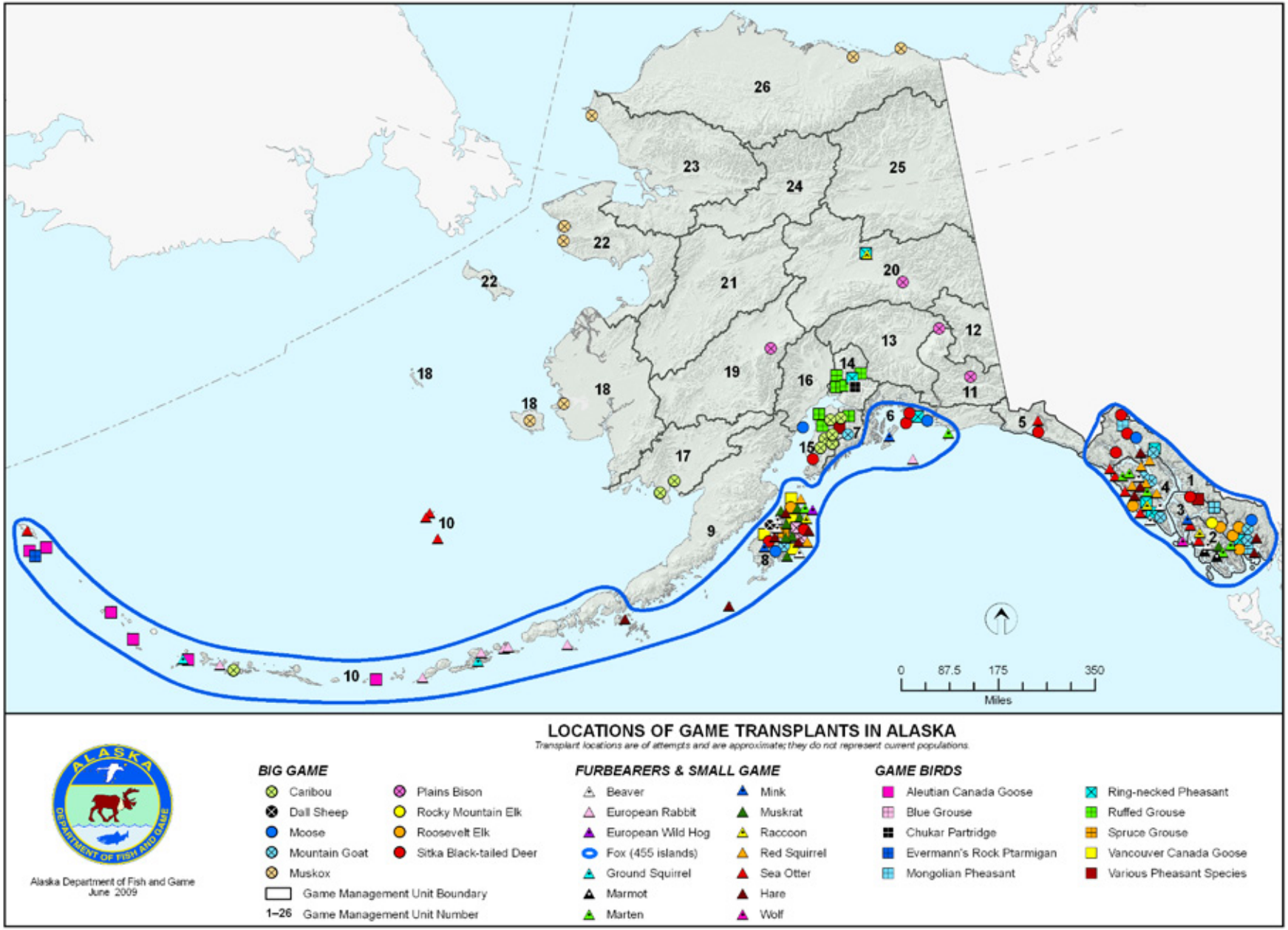

FIGURE 1. Approximate locations of all game transplant efforts in Alaska

INTRODUCTION

Durward Allen, prefacing his discussion of the history of animal transplants in the classic book *Our Wildlife Legacy*, suggested that "It is probably human nature to overlook the blessings close to home and to be forever appraising the seemingly greener grass across the fence." Allen was, of course, referring to man's ostensibly inborn dissatisfaction with the wild animals already available to him locally and to his compelling desire for additional species for his use or enjoyment. This seemingly unquenchable drive to obtain additional animals has resulted in numerous introductions or transplants of animal species into previously unoccupied areas; some have been successful, others have been unsuccessful or even ecologically disastrous.

Many Americans are familiar with the great successes obtained by transplanting ring-necked pheasants (*Phasianus colchicus*) from their oriental homelands to North America many years ago. Regardless of the measure used, whether it be recreational opportunities provided, pounds of meat consumed, or aesthetic considerations enhanced, the importation of this species to the New World must be considered a noteworthy success. Introductions of starlings (*Sturnus vulgaris*) and house sparrows (*Passer domesticus*) into the United States are equally familiar but their results are considered less than beneficial by most. An even more convincing example of an undesirable transplant occurred when the European rabbit (*Oryetolagus cuniculus*) was introduced into Australia. This species spread rapidly across the continent, requiring monumental expenditures of money and effort to control it when through overabundance it became a pest. Still, apparently because of man's inherent optimism, there has been a tendency to remember the few successes and forget the failures and mistakes.

The history of Alaska is replete with a staggering succession of game transplants (Burris 1965). Early in its exploration and settlement the Russians recognized the potential for introducing and harvesting foxes on the many islands comprising the Aleutian Chain (Elkins and Nelson 1954). Fox introductions continued into the 1900s, first by Russians and later by residents of the Territory.

The Territorial Government became involved in transplants in 1917 when the Governor of Alaska directed a black-tailed deer (*Odocoileus hemionus sitkensis*) transplant to Prince William Sound (Elkins and Nelson 1954). This effort was initiated in 1916 by the Cordova Chamber of Commerce.

Transplants in Alaska reached their peak in the 1920s. When the Alaska Game Commission was established in 1925, the Territorial Legislature quickly moved to promote transplants (Elkins and Nelson 1954). That year it initiated a transplant program, devoting an entire chapter of Territorial law to animal introductions. Transplant projects were enumerated, and the Alaska Game Commission was required to conduct at least one project in each judicial division every two years. These statutes are reproduced in Appendix A. With statehood, these antiquated laws were incorporated into state statutes.

Unfortunately, this legislative transplant program was based on very little, if any, biological knowledge and scant consideration was given to its feasibility or desirability. Habitat

requirements of the species were essentially ignored, and several animals were listed that would serve no useful purpose if they were successfully established. To further complicate the matter, the legislature during the 1930s failed to appropriate funds for the specified transplants.

When the Bureau of Biological Survey was absorbed into the Fish and Wildlife Service on 30 June 1940, the latter took over the game transplant activities of the Alaska Game Commission. These activities were later transferred to the newly formed Bureau of Sport Fisheries and Wildlife.

A fairly comprehensive policy on transplants was issued to Fish and Wildlife Service employees in a memorandum to all field stations from Clarence J. Rhode, Regional Director, dated 18 December 1950. The memorandum, in part, stated:

> Since its origin, the Alaska Game Commission has received numerous suggestions, requests, and demands for stocking, restocking, and introducing a long list of game animals, game birds and fur bearing animals in various parts of Alaska. Additional proposals are being made each year and the matter will not rest. That many of these proposals have merit can be shown in the success of the work in Alaska with the black-tail [*sic*] deer, elk, bison and hare but the story is not complete without a review of the failures with hare, muskrat, beaver, deer, pheasant, and many others. So far, Alaska has escaped problems such as those of the rabbit in Australia, the muskrat in Holland and the starling in the United States. The Fish and Wildlife Service should take every precaution to avoid questionable recommendations to the Commission on any proposals for stocking, restocking, or introductions.

This action was significant in that it was an attempt to establish a program based on the merits of a transplant rather than the politics of the time.

In 1959, with the dawn of statehood, Alaska's transplant program was inherited by the Alaska Department of Fish and Game. Ultimately the department established a policy similar to but stronger than that of the Bureau of Sport Fisheries and Wildlife (now the U.S. Fish and Wildlife Service). This policy stated:

> The Department recognizes that transplanting game species for restocking former ranges or stocking vacant habitat may be a useful management tool. Because transplants often have unforeseen detrimental effects, importing and transplanting of game will be generally opposed, but may be approved if substantial public benefit can be shown. Proposed transplants will be reviewed by the Department and must meet the following minimum requirements to be approved: 1) The proposed transplant site must provide sufficient and suitable habitat to support a viable population of the transplanted species, as determined by comprehensive study; 2) Prior study must establish that the introduction of a species will not adversely affect the numbers, health, or utilization of resident species.

In 1970, during the second session of the Sixth Alaska Legislature, the statutes (Sec 16.25.010) dealing with wildlife stocking of public lands were amended to read as follows:

> There is adopted a program of stocking lands in the state with valuable game and fur-bearing animals which do not at present occur on those lands. The department is responsible for establishing priorities on the species of animals to be stocked and the area of the stocking. Priorities shall be based on the habitat requirements of the species, the population of native game animals present, and other factors that will effect the successful establishment of the species.

Transplants conducted by the Alaska Department of Fish and Game (ADF&G) are accomplished primarily under the Federal Aid in Wildlife Restoration Act. Prerequisites of the federal government include the justification of all transplants, preparation of an environmental impact statement, and the formulation of cooperative agreements between the agency which controls the land and ADF&G. The Bureau of Land Management, U. S. Forest Service, and the U. S. Fish and Wildlife Service are the federal land management agencies primarily involved with the land on which transplants may be made by ADF&G.

Early transplant projects in Alaska relied heavily on enlisting private citizens to capture animals, and hold and raise young wildlife until time for release. The government provided some cash incentive for the work but people probably also undertook the work out of enthusiasm for expanding the range and increasing the variety of game animals available for hunting and trapping in the state. They brought an astonishing amount of ingenuity and energy to devising methods of live capture of wild animals. Since statehood, government agencies have had more control over the actual capture and transplant operations but private citizens as volunteers still played major roles in many projects with citizen volunteers contributing manpower, equipment, and money to complete a transplant in a timely and cost-efficient manner.

Alaska's game transplant program has evolved from one based on hope and fancy to one that considers all aspects of the animal species to be transplanted and the potential impact of that species upon native game populations.

Acknowledgment of the detrimental effects of some transplants because of their effects on indigenous and endemic species, particularly on islands; the growing skepticism toward transplants within the scientific community; and the lack of formal transplant criteria making it difficult to resist public and political pressure to undertake questionable transplants, led the department to develop a formal transplant policy in the early 1990s.

In July 1995 ADF&G adopted a Wildlife Transplant Policy with the twofold purpose of 1) identifying concerns that need to be addressed with proposed transplants and 2) establishing a protocol for systematically evaluating those concerns. A copy of the policy is included in Appendix B.

The new policy has substantially increased the hurdles transplant proposals must meet. Twelve transplant criteria were established with the burden of proof on the proposal to meet them.

In addition, 4 steps are required before each transplant can be approved by the department's commissioner. They are: 1) a scoping report, 2) a feasibility assessment, 3) a 30-day public review period and department review by a 4–8 member transplant committee, and 4) a detailed operational plan with budget.

The policy describes 7 categories of transplants arranged in order of risk, indicating the department's predisposition to supporting or opposing them. The policy gives general support to moving indigenous species from one area of the state to another and from other states or countries to Alaska if the species had been extirpated from the area. It promises review and possible support on a case-by-case basis to transplants of indigenous species within the state to new ranges in Alaska, but generally opposes moving animals from other states or countries to fill new range in Alaska because of concerns over disease, parasites, and population genetics. Transplants of any species to islands where they do not naturally occur are generally opposed. Introductions of nonindigenous species to Alaska are prohibited as are transplants of any populations previously exposed to disease or parasites not known to occur in the state.

It should be noted that the current policy would likely have precluded or made more difficult a number of historical transplants, such as plains bison to the Interior; foxes to islands; elk to Afognak Island, Etolin Island and other Southeast Alaska locations; caribou to Adak island; mountain goats to Revillagidgedo Island; marten and squirrels to numerous islands; and, the many introductions of exotic game birds, raccoons, muskrats, and domestic rabbits to the state.

Because each proposed transplant will be preceded by intensive study to preclude predictably unsuccessful or detrimental introductions, it is likely the future transplant program will be more limited than the past. Some of the state's excellent game populations have resulted from past transplants, however, and it is the purpose of this report to consolidate all available information on this aspect of Alaska's relatively brief but interesting wildlife management history.

References – Introduction

ALLEN, D. L. 1954. Our wildlife legacy. Funk and Wagnalls, New York. 422pp.

BURRIS, O. E. 1965. Game transplants in Alaska. Proceedings 45th Conference Western Association of State Fish and Game Commissions pp. 93–104.

ELKINS, W. A. AND U. C. NELSON. 1954. Wildlife introductions and transplants in Alaska. Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

ALASKA TRANSPLANT OBJECTIVES

Game transplants, deliberate efforts by man to remove wild animals from one place and introduce them elsewhere, have been attempted with many goals in mind. These range from merely an aesthetic interest to the desire to obtain a harvestable population. In Alaska the objectives of game transplants have fit into one or more of the following 10 categories: 1) providing increased recreational hunting opportunities; 2) providing additional food supply; 3) providing economic gain; 4) reestablishing a species; 5) restoring a species to its previous range; 6) speeding the recovery of depleted populations; 7) preserving threatened or endangered species; 8) mitigating development impacts; 9) augmenting populations of previous transplants; and 10) creating better opportunities to view wildlife. Examples of Alaska transplants illustrating each category follow.

Increasing Recreational Hunting

Increasing recreational hunting opportunity probably was the primary objective of most big game animal transplants attempted in Alaska. Excellent examples include elk transplants to Afognak Island, Kruzof Island, Etolin, and Revillagigedo Island; deer transplants to Prince William Sound, Kodiak Island and other areas; mountain goats to Baranof, Kodiak, and Revillagigedo islands; and moose transplants to the Copper River Delta, Berners Bay, and Chickamin River.

Providing Additional Food Supply

It is difficult to completely separate this category from that of recreational hunting. Although it is doubtful that any transplant of a wild species in Alaska has been conducted for the sole purpose of providing food for humans, nearly all hunters of edible species are in pursuit of meat to some extent. Indeed, wanton waste of game meat is a criminal offense in Alaska, so by law, the end result of a successful hunt must include food. From this standpoint, the previously mentioned elk, deer and moose introductions could also be classified as transplants of food animals. A more recent example is reintroduction of caribou to the Nushagak Peninsula, which was undertaken to provide a subsistence food source for local communities as one of its objectives.

Providing Economic Gain

This category primarily involves furbearers. Because of the long history of trapping in Alaska, there has been much interest in transplanting furbearers. Furbearers that have been transplanted to various parts of Alaska include foxes, muskrats, beavers, sea otters, and mink.

Reestablishing a Species

The reintroductions of muskoxen to the North Slope and Seward Peninsula are prime examples of transplants conducted for the purpose of reestablishing a game species. Other transplants in

this category are the reintroduction of sea otters to Southeast Alaska waters and the proposed reintroduction of wood bison to Interior Alaska. These transplants, when feasible, are probably more desirable than any other that the Department of Fish and Game might undertake.

Restoring a Species to its Previous Range

A variation of the previous category, this involves restoring populations in local areas where they have become extirpated or reduced. Examples are the reintroduction of caribou to the Kenai and Nushagak peninsulas, and goose and ptarmigan reintroductions in the Aleutian Islands.

Speeding the Recovery of Depleted Populations

A few recent examples are the transplants of mountain goats to Cecil Rhode Mountain and Mt. Juneau, and the transplanting of deer to Kupreanof Island. This category of transplant arises from public impatience with natural population cycles. Although populations in the above cases did recover, it is hard to determine if the transplants had a major role in the recovery or if the population increases resulted from natural population growth and range expansion. Of the 3 examples, it is most unlikely, because of the low numbers moved, that the Kupreanof deer transplant was successful in speeding the recovery of deer on the island.

Preserving Threatened or Endangered Species

The sea otter has at times been placed in this category and its threatened status along the Pacific coast in the 1950s led to a series of transplants to Southeast Alaska and other locations. The importation of plains bison to Alaska in 1928 might also be described as a transplant originally designed to preserve an endangered species. Recent reintroductions of the then endangered Aleutian Canada geese and threatened endemic Evermann's rock ptarmigan on the Aleutian Islands are also examples of this. Reintroducing wood bison to Alaska would contribute to the species' conservation as wood bison are classified as threatened on their range in Canada.

Mitigating Development Impacts

Only one transplant has been undertaken with this as a formally stated partial objective – the moving of mountain goats to Revillagigedo Island from the Quartz Hill mining area on the Southeast mainland in 1983. Transplant as a viable means of project mitigation for goats remains untested, however, as the proposed mining development did not occur. Moving sea otters from Amchitka Island in the Aleutians in advance of proposed nuclear tests there in the late 1960s and early 1970s could also be viewed as a mitigation measure although it was never expressly stated as such. Hundreds of sea otters were removed from harm's way prior to the tests, which killed a significant number of sea otters and other wildlife at Amchitka. Transplanting wildlife for mitigation reasons may again be proposed as development in Alaska continues. However, the current more stringent state transplant policy and its guidelines may make such transplants difficult to implement.

Augmenting Populations of Previous Transplants

The muskox transplants to Cape Thompson in 1977 and the Seward Peninsula in 1981, and the Kenai Peninsula caribou transplants in 1985–1986 were follow-ups to earlier transplants in the same areas and at least partially intended to try to insure the success of the previous transplants. All did succeed in boosting introduced populations and extending their ranges in a shorter time than would likely have occurred without the augmentations.

Creating Opportunities to View Wildlife

Transplanting mountain goats to Mt. Juneau, an area closed to hunting, for the chief purpose of enhancing wildlife viewing is the prime example of this category. Moving mountain goats to Cecil Rhode Mountain on the Kenai Peninsula was also motivated in part to create a viewing opportunity.

In order to determine if a transplant has been successful, the resulting established population must be compared to the original objectives of the transplant. For example, if the objective was to transplant a game animal to provide food for humans, the population must reach a level high enough to sustain a substantial harvest. The same measure of success would apply to those transplants designed to provide economic gain through trapping. In either case, the underlying basic criterion of success is the establishment of a population capable of sustaining itself over a long period of time.

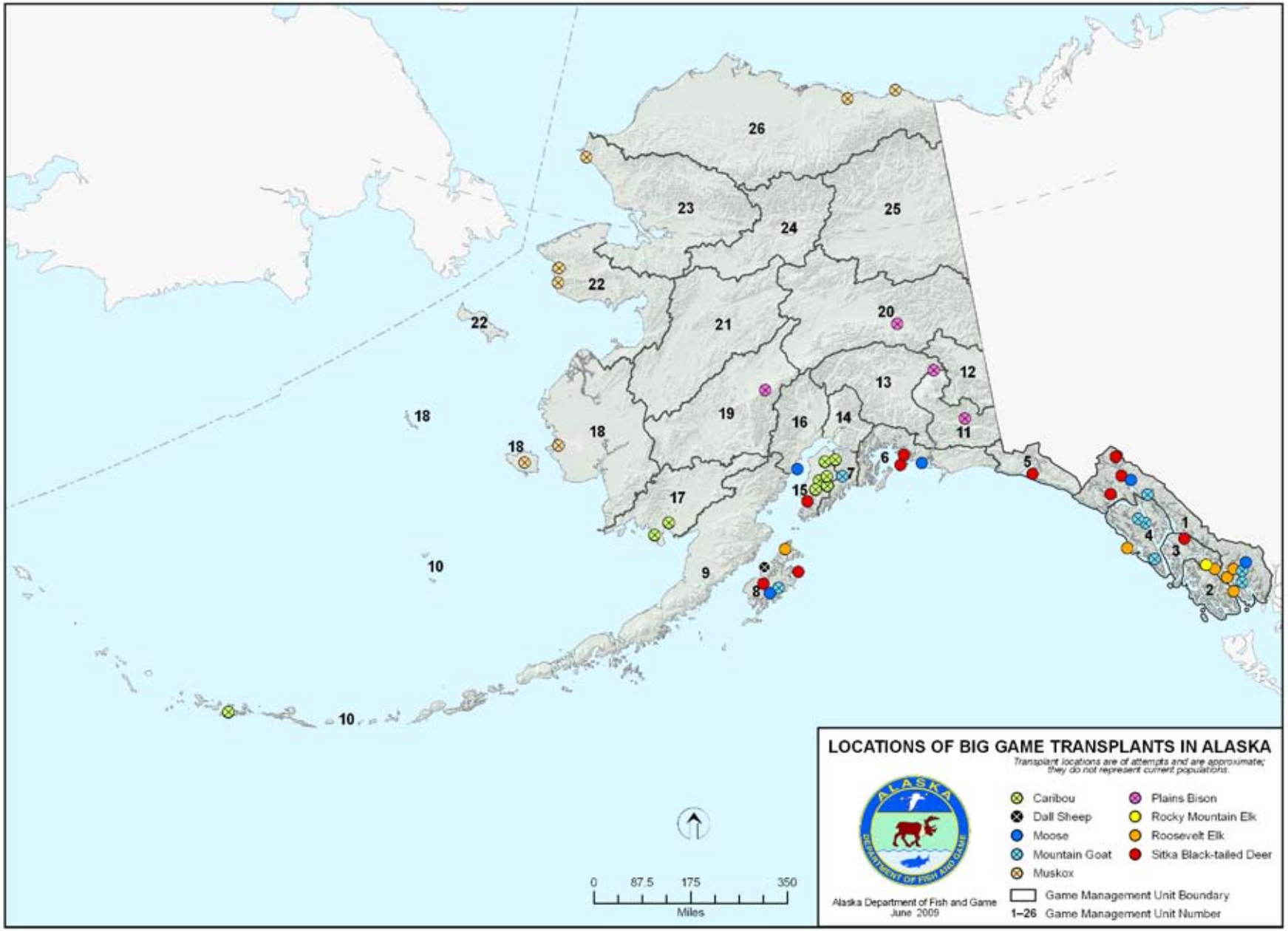

FIGURE 2. Approximate locations of big game transplant efforts in Alaska

BIG GAME TRANSPLANTS

This section documents 43 successful and unsuccessful attempts to transplant big game species in Alaska, as well as information on a pending transplant of wood bison. The section is organized by species in chronological order based on the first transplant attempt for that species. Species included are deer, mountain goat, elk, plains bison, wood bison, muskox, moose, caribou, and Dall sheep. Tables displaying big game transplants in chronological order and by species can be found in Appendix C.

Sitka Black-tailed Deer

Prince William Sound – 1916 to 1923

In 1916, the Cordova Chamber of Commerce arranged to have black-tailed deer (*Odocoileus hemionus sitchensis*) moved from the Sitka area to Hinchinbrook and Hawkins Islands in Prince William Sound (Elkins and Nelson 1954). This was the initial big game transplant in Alaska, and it has proven to be one of the most successful. The effort resulted in the release of 8 deer on these islands.

The Territorial Governor's office, using funds provided by the Territorial Legislature, sponsored a continuation of this project from 1917 through 1923 and an additional 16 deer from the Sitka area were released on the same area during this period. The deer survived and spread throughout the islands of Prince William Sound. A small number migrated to the mainland and established other populations.

Brookman (1984) gives an account of how deer were captured in the Sitka area for this transplant and the Kodiak transplant (see below). Although official records do not elaborate on the Sitka operation, it appears at least some if not all of the deer were captured by William Hanlon and his son Ike, using a simple, creative, but unorthodox method. They trained their dog Tuffy to chase deer into the sea where Ike waited with a small skiff. Ike approached a swimming deer, pulled the rear end of

Photo by William Hanlon; courtesy of Willis Osbakken

Figure 3. The deer catching team of 19-year-old Ike Hanlon and his dog Tuffy with 4 captured deer on the Sitka dock, ca. 1924

the deer into the skiff by its tail, wrapped the rear legs with cloth to protect them, tied the legs with rope, then lifted the rest of the deer into the boat and tied its front legs (Fig. 3).

Upon capture, the deer were shuttled to a larger boat for transport to town and then kept in holding pens in Sitka until transport for all deer was arranged across the Gulf of Alaska to the transplant sites (Brookman 1984). The Hanlons captured at least 30 deer using this method, the same number that were transplanted to Prince William Sound and Kodiak from Sitka during 1923–1924.

Sitka black-tailed deer in Prince William Sound are at the extreme northern limit of their range (Cowan 1969). However, the deer on the islands thrive because the maritime-influenced climate results in milder winter conditions on the islands than experienced on the adjacent mainland (Shishido 1986). Nevertheless, periods of high winter mortality have occurred in the late 1940s, mid 1950s, late 1960s, early 1970s (Reynolds 1979), and late 1990s (Crowley 2001). ADF&G biologists devised a snow index in 1980 to track winter severity that over time has been found to accurately follow deer population trends (Nowlin 1997). As in Southeast Alaska, key to continued deer winter survival is maintaining adequate old growth forest canopy to intercept snow, provide shelter, and keep forage unburied and available to deer (Shishido 1986, Reynolds 1979). Highest deer densities occur on the large islands with lower densities on the small islands and on the mainland close to Prince William Sound. Occasional sightings have occurred in Units 6A and 6B on the mainland east of Prince William Sound, and, after several mild winters, on the Kenai Peninsula and as far north and west as Anchorage (Crowley 2007).

Legal hunting was first permitted in 1935 (Elkins and Nelson 1954). An average of 1,000 to 1,500 deer were harvested annually in the Prince William Sound area before 1978 (Reynolds 1979). Harvests began to increase after 1978 and peaked at 3,000 in 1987. The average estimated harvest in the 1990s was 2,160, ranging from 1,300 to 3,000 deer. Annual reported harvests in the early 2000s averaged 2,500 and ranged from 1,900 to 3,000 deer (Crowley 2007).

Glacier Bay – ca. 1920

An undocumented, unofficial, deer transplant apparently occurred in Glacier Bay sometime around 1920, when a small number of deer were released on Willoughby Island, 12 miles inside the entrance to the bay. Hoonah elder William Johnson, Sr. reportedly claimed responsibility for the transplant many years later, stating it was an effort to aid a struggling deer population through a difficult winter (Greg Streveler, former NPS Glacier Bay National Park Research Biologist, personal communication, 2008). The deer were reportedly moved to the island from the Hoonah area in the hold of Johnson's fishing boat. In 2008 a small number of deer still persisted on Willoughby Island, which has an area of approximately 4 mi^2.

Homer Spit – 1923

In 1923, 7 deer from the Sitka area were released on the Homer Spit on the Kenai Peninsula (Elkins and Nelson 1954). These animals soon disappeared from this area and the transplant was considered a failure.

Kodiak Archipelago – 1924, 1934

In 1924, deer transplant efforts shifted to the Kodiak area when 14 animals were released on Long Island (Elkins and Nelson 1954). Like the animals for the Prince William Sound release, these deer were obtained from the Sitka area. Two additional deer, from Prince of Wales Island, were released on Long Island in 1930.

The results of the Long Island transplant were not immediately apparent. In a March 1931 report to the legislature, the Alaska Game Commission mentioned that only 3 does and 2 bucks had been seen on Kodiak Island.

Because of the apparent failure of deer to move readily from Long Island to Kodiak Island, efforts were renewed in 1934 to establish deer on Kodiak Island (Alaska Game Commission 1935). Using Federal Emergency Relief funds, deer were captured in the Rocky Pass area near Petersburg. On 15 April, 5 does and 4 bucks were released on Kodiak Island.

The techniques used for capturing deer in the Rocky Pass area were similar to those used by the Hanlons in Sitka in 1924. Selected animals were driven from small islands into the water, where they were picked up in small boats and then transferred to the larger patrol vessel *Seal*. The animals were rubbed dry, placed in wooden crates, and held for shipment. The technique was fairly effective; 9 animals were shipped to Kodiak and 12 to Yakutat Bay.

Legal hunting on Kodiak Island was initiated in 1953 and 38 bucks were taken that year (Elkins and Nelson 1954). The harvest in 1967 was 1,500 deer and that decade's average annual kill was about 950 animals. By the late 1960s deer from Kodiak Island had successfully established themselves on adjacent Afognak Island.

After a few years of decline due to severe winters in 1968–1969 and 1970–1971, deer numbers in the Kodiak Archipelago grew steadily to an estimated 100,000 by the mid 1980s (Smith 1989). A series of harsh winters occurred again beginning in 1987–1988 (Smith 1991) and the estimated population dropped 50%, reaching a nadir about 1992. Deer numbers increased for several years to near 80,000 but plunged again to an estimated 40,000 after the 1998–1999 winter, the severest on record (Van Daele 2001). Through 2005–2006, subsequent winters were mild to moderate and the 2006 population estimate was 65,000 deer (Van Daele 2007).

The dramatic population swings are a consequence of an introduced ungulate using an island habitat whose vegetation evolved in the absence of herbivores (Van Daele 2001). Brown bears prey on deer, but predation does not limit the population. Throughout most of the Kodiak Archipelago, winter forage is not protected by a dense forest canopy as it is in the rest of Alaska's Sitka black-tailed deer range. As a consequence, the Kodiak population is more vulnerable to severe winter weather and deer winter kill is usually higher there than other parts of Alaska. In this situation hunting is usually compensatory for annual winter mortality and so over the years hunting regulations have generally been liberal. Bag limits since 1970 have ranged from 3 to 7 deer with usually a 5- or 6-month season. Estimated reported harvest since 1987, when a hunter harvest questionnaire was first sent out, has ranged from a high of 13,800 in 1987 to a low of 2,500 in 2000. The 2005 harvest was about 6,600 deer (Van Daele 2007).

The deer transplant to the Kodiak Archipelago is clearly a success. Although they were put into an area that does not have an ideal climate and lacks adequate winter range, and as a result have suffered large swings in population periodically, the original 25 Sitka black-tailed deer have multiplied into tens of thousands and thrived on the islands, providing a huntable population for over 50 years.

Yakutat Bay – 1934

As mentioned in the Kodiak Archipelago section, some of the animals captured at Rocky Pass in Southeast Alaska in 1934 were shipped to Yakutat Bay. On 27 March 1934, 7 does and 5 bucks were released on several small islands near the east shore of the bay (Alaska Game Commission 1935).

For decades the population persisted in very small numbers on the islands. Heavy snowfall and abundant wolves and black bears limit deer densities, but the population has supported small harvests over the years. Due to deer declines and almost complete cessation of harvest in the 1970s, the deer season in Unit 5 (Yakutat area) was closed in July 1980. By the end of the 1980s, deer had recovered to some degree and the public requested an open season. The Board of Game instituted a limited 1-buck, 1-month season hunt in 1991. Since then, a few deer have been taken most years, including reports of illegal harvest. Estimated harvest from 1991 through 2001 averaged 5 deer a year and was never more than 7.

However, during 2002–2005 the harvest jumped to about 30 deer a year. Local residents report that deer expanded their range to the mainland and as far inland as the Dangerous River, 20 miles to the east. Deer were routinely seen along the road system near the community of Yakutat as well as the areas adjacent to Highway 10 on the Yakutat Forelands. Prior to 2004 deer were seldom seen on the mainland. A series of mild winters in the early 2000s is probably responsible for deer expanding their range (Barten 2007). Even following the severe winter of 2006–2007 with an unusually deep and persistent snow pack, deer tracks were reported at Dry Bay, about 50 miles east of Yakutat (Neil Barten, ADF&G Juneau Wildlife Biologist, personal communication, 2008).

In the past, most deer were taken incidentally by local residents who happened to detect an animal on the beach while they were conducting other activities. But after 2002, the increased abundance of deer and the better chance of success led more hunters to specifically target deer (Barten 2007).

This transplant successfully established deer populations with a long-term, albeit tenuous, presence on the Yakutat area islands. The deer have provided opportunistic hunting for Yakutat residents and augment their main subsistence harvests of moose and mountain goats. It was thought for years that there is little potential for this herd to increase because of the extreme climatic conditions and limited habitat. It remains to be seen whether the recent growth in numbers and expansion of deer to the Yakutat Forelands during mild winters is a temporary or permanent development.

Lynn Canal – 1951 to 1956

Several unsuccessful attempts were made to establish deer in areas around Lynn Canal in Southeast Alaska. This program was conducted by the U. S. Fish and Wildlife Service from 1951 to 1956 with funds provided by the Federal Aid in Wildlife Restoration Act. Records of these transplants are somewhat vague, and the operations were evidently not well organized. At least 3 different introductions were made in Taiya Valley near Skagway, in 1951, 1952, and 1956. The minimum number of animals moved was 5 bucks and 8 does. However, the total is uncertain because 4 fawns were held for release at a later date. Documentation of additional releases could not be located.

These mainland Lynn Canal area transplants were unsuccessful. The deer in the Taiya Valley did not survive to establish a population. Burris and McKnight (1973) state that through the early 1970s reports of deer were fairly common in the vicinity of Haines. However, since then sightings have become very rare and ADF&G has never included Game Management Unit 1D (Lynn Canal mainland north of Eldred Rock) in deer survey and inventory or management reports.

The Sullivan Island transplant was somewhat more successful. Between 1951 and 1954, 8 deer were released on Sullivan Island in Lynn Canal by U. S. Fish and Wildlife Service personnel. Again, because of sketchy reporting, it is difficult to obtain exact dates and numbers. Deer were observed on Sullivan during the winter of 1963–1964 (Burris and McKnight 1973) and later. Although deer have never been abundant on the island, hunting was opened at statehood with a 4-deer bag limit as in the rest of Game Management Unit 1 (Southeast mainland). Through the late 1990s, a small number of hunters periodically reported harvesting a few deer on Sullivan Island, but although hunter effort continued, no harvest was reported from 2000 through 2003 (Paul and Straugh 1996–2003, Straugh, et. al. 2004). Since 2005 the department has received anecdotal reports of deer sightings and of deer taken by hunters on Sullivan Island.

Kupreanof Island – 1979

Severe winters in the late 1960s and early 1970s killed a large percentage of deer in Southeast Alaska. On islands in central Southeast Alaska which have wolves and black bears, predation kept the deer populations depressed throughout the 1970s. In 1979, after deer hunting had been closed for 6 years in Game Management Unit 3 (the islands of central Southeast Alaska), the state legislature, hoping to speed deer population recovery, appropriated $50,000 to “reintroduce” deer to Kupreanof Island and for wolf control in the area. The department had conducted an aggressive wolf trapping program during the winters of 1976–1977 and 1977–1978 on Kupreanof, Mitkof, and Kuiu islands with little apparent affect on deer numbers (LaVern Beier, ADF&G Wildlife Technician—Southeast Alaska, personal communication, 2007). In response to the legislative appropriation, ADF&G transplanted deer to Kupreanof Island from nearby Admiralty Island where, in the absence of predators, deer populations had recovered.

Little documentation of this effort exists. In 2 trips to Admiralty during 10 days in early March 1979, ADF&G staff “free-ranged” 10 deer of mixed sex on the beaches of Pybus and Gambier

bays using tranquilizer dart-guns. In the first trip, a trial to test methods, 2 sedated deer were loaded onto a small landing craft and taken to Kupreanof Island. For the second trip, 8 captured deer were put into a pen on the deck of the ADF&G vessel *Steller* for transport. During that crossing of Frederick Sound the late winter weather turned nasty and rough seas washed overboard all the straw used for bedding in the deer pen. Surprisingly, the deer were not injured (L. Beier, personal communication, 2007).

In all, 10 radiocollared deer were successfully released on the south shore of Portage Bay on Kupreanof Island. Because of the small number of deer involved, it is unlikely the transplant had much impact on the population. Hunting was reopened in most of Unit 3 in fall 1980 with a 1-buck bag limit. As the population recovered slowly over the years the bag limit was increased to 2 bucks in 1988 and was still a 2-buck, 4-month-long season in 2008.

References – Deer

Alaska Game Commission. Annual Reports, 1925 to 1937. Juneau. Mimeo.

Barten, N. L. 2007. Unit 5 deer. Pages 70–75 *in* P. Harper, editor. Deer management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Juneau, Alaska.

Brookman, Sr., A. 1984. "Catching Sitka Deer." Chapter 7. Pages 30–33 *in* Sitka Man. Alaska Northwest Publishing Co. Anchorage. Also as "Catching Sitka Deer for Transplanting." Pages A6–A9. April 1978 issue of Alaska Magazine.

Burris, O. E. and D. E. McKnight. 1973. Game Transplants in Alaska. Wildlife Technical Bulletin No. 4. Alaska Department of Fish and Game. Juneau, Alaska. 57pp.

Cowan, M. I. 1969. What and where are the mule and black-tailed deer? Pages 335–360 *in* W. P. Taylor, editor. The deer of North America. Stackpole Co., Harrisburg, Pennsylvania. 668pp.

Crowley, D. W. 2001. Unit 6 deer management report. Pages 82–92 *in* M. V. Hicks, editor. Deer management report of survey and inventory activities 1 July 1998–30 June 2000. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2005. Unit 6 deer management report. Pages 93–108 *in* C. Brown, editor. Deer management report of survey and inventory activities 1 July 2002–30 June 2004. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2007. Unit 6 deer management report. Pages 76–89 *in* P. Harper, editor. Deer management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Juneau, Alaska.

Elkins, W. A. and U. C. Nelson. 1954. Wildlife introductions and transplants in Alaska Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

NOWLIN, R. 1997. Unit 6. Pages 58–71 *in* M.V. Hicks, editor. Management report of survey-inventory activities. Deer. 1 July 1994–30 June 1996. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Projects W-24-3 and W-24-4. Study 2.0. Juneau, Alaska.

PAUL, T. AND T. STRAUGH. 1996–2003 Annual reports. Deer hunter survey summary statistics. Alaska Department of Fish and Game. Juneau, Alaska.

REYNOLDS, J. R. 1979. History and current status of Sitka black-tailed deer in Prince William Sound. Pages 177–183 in O. C. Wallmo and J. W. Schoen, editors. Sitka black-tailed deer: Proceedings of a conference in Juneau, AK. U.S. Department of Agriculture Forest Service, AK. Region, Juneau, Alaska. Series No. R10-28. 231pp.

SHISHIDO, N. 1986. Seasonal distribution and winter habitat use by Sitka black-tailed deer in the Prince William Sound region, Alaska. M.S. Thesis. University of Alaska Fairbanks. 105pp.

SMITH, R. B. 1989. Unit 8. Pages 78–112 *in* S. O. Morgan, editor. Deer. Annual report of survey and inventory activities 1 July 1989–30 June 1991. Part VI. Volume XIX. Deer. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Project W-23-1. Study 2.0. Juneau, Alaska.

_____. 1991. Game management unit 8. Pages 57–68 *in* S. Abbott, editor. Deer. Survey and inventory management report 1 July 1989–30 June 1991. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Project W-23-4. Study 2.0. Juneau, Alaska.

STRAUGH, T., P. CONVERSE, AND K. WHITE. 2004. 2003 Deer hunter survey summary statistics. Southeast Alaska August 2003–January 2004 hunting season. Alaska Department of Fish and Game. Juneau, Alaska.

VAN DAELE, L.J. 2001. Unit 8 deer. Pages 98–108 *in* M. V. Hicks, editor. Deer management report of survey and inventory activities 1 July 1998–30 June 2000. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2007. Unit 8 deer. Pages 90–106 *in* P. Harper, editor. Deer management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Juneau, Alaska.

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Mountain Goat

Baranof Island – 1923

Mountain goat (*Oreamnos americanus*) transplants in Alaska began in 1923 when 18 animals were moved to Baranof Island (Elkins and Nelson, 1954). The original report of this operation is not available, but apparently the program was under the direction of the office of the territorial governor. Animals for this transplant were captured in the vicinity of Tracy Arm on the Southeast Alaska mainland. Huber (1959) describes the capture party as led by Oscar Oberg, a guide from Douglas. When a herd of approximately three dozen goats were sighted near the beach in Tracy Arm, several men went ashore and worked their way above the goats. Dogs were then landed on the beach to drive the goats up the mountain where the waiting men chased them into deep snow to be roped and tied. They were then dragged down to the water. As many as half the goats originally sighted died in falls from cliffs or in transport to Baranof Island (Huber 1959).

An article in the Sitka Progress newspaper (1926) noted that 2 of the 18 goats were too small to fend for themselves and so were left at Goddard Hot Springs south of Sitka to be cared for until they were older (Fig. 4). A later article in the Sitka Progress (1927) lamented the poaching of one of the newly transplanted goats near Redoubt Lake. In August 1930 a trapper from Sitka reported seeing a lone "billy," but the records do not indicate its exact location (Alaska Game Commission 1931). Success of the transplant was not recognized until 1937 when 41 goats were observed on the island (Alaska Game Commission 1937). By 1950, the Baranof population was estimated to be 165 goats and in 1970 the population had grown to about 250–275 goats. Since 1970, the population has grown rapidly and extended its range to the south. In 1982, 506 goats were counted in aerial surveys on Baranof (Johnson 1984) and the population was estimated to be 1,000 in 1991 and 1,350 in 2002. In 2004 an extensive islandwide aerial survey was conducted leading to a population estimate of 1,500 goats or more (Mooney 2006).

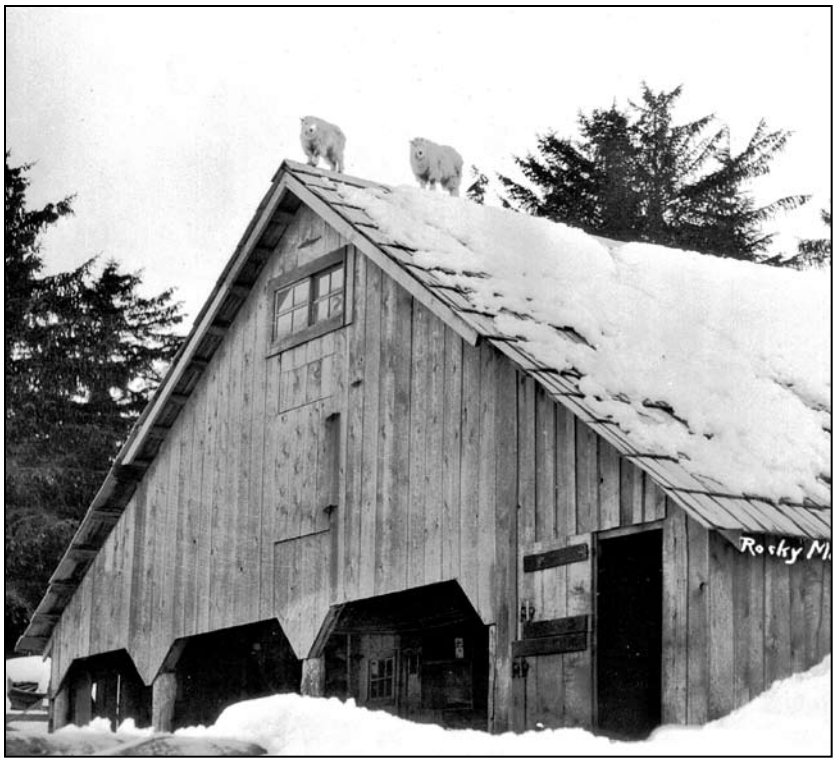

Photo by James Gilpatrick, courtesy of Margaret Dangle

Figure 4. Young mountain goats on the roof of a building at Goddard Hot Springs on Baranof Island in 1928, 5 years after a transplant

The first goat hunting season was proposed in the Executive Officer's report to the Alaska Game Commission in 1946, but hunting was not allowed until 1949 (Nelson 1953). Initially, the open season extended from 1 August through 31 December with a bag limit of 2 goats. A total of 11 were taken the first season (Huber 1959). By the early 1970s annual harvests averaged about 20 to 30 animals. The bag limit was reduced to one goat beginning with the 1975 season and in 1976 a registration permit system was initiated for hunting Baranof Island mountain goats. Harvest ranged from 28 to 75 goats during 1976–2005 with 1,026 goats taken in those 30 years. During the 8 years from 1998 through 2005, annual averages were 53 goats harvested by 155 hunters out of 325 who were issued permits. Females averaged 46% of the total harvest during 2003–2005 and in 2006 the department instituted a harvest point system to better manage for a lower female proportion in the harvest (Mooney 2006).

Mountain goat range expanded on the island to encompass all the available summer range north of Port Herbert and Snipe Bay by 2005. Because contiguous habitat is limited south of Whale and Gut bays, however, the growth in the numbers of goats in this area will likely be slower than throughout the rest of the island (Mooney 2006).

In March 2004, the Federal Subsistence Board issued permits to the Sitka Tribe of Alaska to harvest up to 3 goats each spring for 5 years to obtain goat hair for spinning yarn and weaving ceremonial robes as a cultural and education project. The transplanted goat population had attained sufficient longevity and become such a fixture in the wildlife panoply of Baranof Island that goat hunting was added to the list of customary and traditional subsistence uses.

Kodiak Island – 1952 to 1953

The Kodiak Island mountain goat transplant is a fine example of patience and perserverance. The initial transplant proposal came from a variety of sources including sportsmen's organizations, the Alaska Game Commission and the U. S. Fish and Wildlife Service.

Preliminary studies, funded by the Federal Aid in Wildlife Restoration program, began in 1948 (Nelson 1953). Potential live-trapping locations were investigated throughout goat range in Alaska. Most areas were eliminated from further consideration because of unsuitable terrain. Day Harbor, on the Kenai Peninsula, was finally selected as an adequate trapping site. In September 1949, U. S. Fish and Wildlife Service personnel erected a corral trap on the west side of the river draining Elsworth Glacier. Thus began the first of many attempts to capture goats for the Kodiak Island transplant (Nelson 1953).

Because of the rugged terrain the trap could not be constructed on an established goat trail, and its effectiveness was dependent upon finding a bait that would entice the animals into the trap. Various baits, including salt, were used with no success. The corral trap program was eventually abandoned.

During this same period, padded steel traps were set along established trails and attempts were made to drive the animals down the trails and into the traps. Many difficulties were encountered. The goats did not drive well, they did not readily step in the traps, and when they finally did, the traps would not hold them. These attempts were soon abandoned as well.

In spite of the difficulties with obtaining animals, public interest in transplanting goats to Kodiak Island remained high. In 1950, permits were offered to anyone who wanted to capture goats, with the stipulation that the federal government would pay for all animals obtained (Nelson 1953). No goats were captured.

In 1951, the same offer was made to furnish permits and pay for any goats delivered. Four contracts were issued between the period 1 January and 30 April. Bids varied from $150 per kid to $200 per adult female delivered in good condition. Again, there were no goats taken. Two more permits were issued for May and June 1951 with the same result.

Finally, in 1952, Martin Goresen captured 2 mountain goats near Seward using nylon snares (Nelson 1953). Goresen held the animals briefly at his home until the U. S. Fish and Wildlife Service was able to take them to Kodiak (Fig. 5). These animals were released in February 1952, at Ugak Bay on Kodiak Island. There was only one problem: they were both males.

Not to be discouraged, U. S. Fish and Wildlife Service personnel made a new effort in June 1952 (Nelson 1953). Nylon snares and a salmon net were utilized in further unsuccessful attempts. A nanny was shot and great efforts expended to catch her newborn kid without success. Finally, attempts were made to corner adult goats and lasso them. In very short order these efforts were abandoned because of the hazard to project personnel.

In August 1952, an unusual occurrence provided one more goat for Kodiak Island (Nelson 1953). Three goats were observed swimming in Cooper Lake on the Kenai Peninsula. Fish and Wildlife Service personnel, in a Grumman Widgeon, landed on the lake and captured one of the animals. Their joy was short-lived, however, when it was discovered that this animal was also a male. Because of the difficulty in obtaining animals, it was decided that no opportunity should be ignored, so on 15 August 1952, the lone animal was released on Kodiak Island.

During the spring of 1952, 2 other male goats were obtained from individual trappers around the Seward area (Nelson 1953). In November 1952, another male was captured in the Eagle River drainage near Anchorage followed by a female from the same area in December. As of 1 January 1953, 7 goats (6 males and 1 female) had been released in Hidden Basin, Ugak Bay, on Kodiak Island.

From 19 March 1953 through 11 April 1953, Goreson, Alan Hennessey and other trappers captured 10 more animals (1 male and 9 females) in the Seward area that were later released on Kodiak Island (Nelson 1953, Huber 1959). The increase in the number of females captured in 1953 was undoubtedly due to the difference in fees being offered for males and females. Prior to 1 November 1952, the going price was $350 per animal. After that date the amounts paid were $100 per male and $400 per female. The Goresen-Hennessey capture technique was to stalk a group of goats then charge them yelling. Invariably a few would take a stand to fight at which point the men would capture them with ropes. The bound goats would be towed to sea level on toboggans (Huber 1959).

Survival of the transplanted animals was, at first, doubtful. Willard A. Troyer, refuge supervisor of the Kodiak National Wildlife Refuge, reported that during the severe winters of 1955

and 1956 only one female and a few males were seen in the Hidden Basin area (Nelson 1957). The population slowly increased, however. On 2 October 1964, 26 goats, including 8 kids, were observed during an aerial survey. The counts continued to rise with 54 observed in 1966, 58 in 1967, and 71 in 1968. On 27 July 1972 this population numbered a minimum of 91 goats, including 27 kids, and was extending its range southward and westward.

Photo by Duane Levan, courtesy of Larry Van Daele

FIGURE 5. A captured mountain goat is held in Martin Goresen's basement in Seward prior to transplant on Kodiak Island in 1952.

During the 1968–1969 regulatory year, the first hunting season for goats was established on Kodiak Island. Over the next 5 years 31 goats were taken. Conservative management was in place during the first 3 decades after the transplant. Most areas were closed to hunting to encourage colonization by goats. The drawing permit system, in effect since hunting was opened in 1968, was changed to a registration permit system in 1985. The change lasted only a year, however. A flood of inexperienced hunters resulted in high hunter densities, herd shooting, and wanton waste (Smith 1986). In 1986 the drawing permit system was reinstated. Thereafter, goat harvest on Kodiak increased gradually but steadily, with an average harvest of about 25 goats in the late 1980s, 38 goats in the early 1990s, 60 goats in the late 1990s, and a jump to 70 and 94 goats in the 2001 and 2002 regulatory years (Smith 1994, Van Daele 1998, Van Daele and Crye 2004).

After a study of harvest patterns and use of mountain goats on Kodiak (Williams 2003), drawing permits for the island were doubled from 250 to 500, and registration hunts were allowed after drawing hunts if harvestable surpluses exist. Harvests jumped to 115 and 133 goats the 2 years following that change. As with the Baranof Island mountain goat population, the transplanted Kodiak population was considered entrenched and was designated as a customary and traditional resource of Kodiak Natives in 2003.

In 2004 the islandwide population estimate was 1,560 goats with most of the suitable habitat being used and goats occupying areas not normally considered prime goat range. By 2006, the management focus on Kodiak was changing from encouraging population growth and range expansion to providing increased hunting opportunities, while limiting the population to a level which will maintain habitat quality (Van Daele and Crye 2006).

Chichagof Island – 1954 to 1956

Kodiak Island was not the only location that was being considered by the U. S. Fish and

Wildlife Service for goat transplants in 1952. On 17 September that year, an offer was made to purchase live mountain goats for a planned transplant to Chichagof Island in Southeast Alaska (Nelson 1952a). Delivery would be accepted at Juneau, Sitka, Petersburg, Wrangell, Skagway or Haines at a price of $200 per male and $400 per female. The Fish and Wildlife Service requested that the animals be delivered in lots of three.

Five goats were obtained under this program, but 2 died before they could be released. The remaining 3 were all females.

On 13 August 1953, the offer to purchase goats was reissued as a Federal Aid development project. Glenn Williams of Anchorage captured 2 females and 2 males that were released at Basket Bay on Chichagof, 22 November 1954 (Nelson 1954).

In September 1955, the offer to purchase goats was revised (Nelson 1955b). The announcement named Juneau as the sole delivery point and the price for the animals was increased to $210 per male and $410 per female.

Although the records are not complete as to the locations where the animals were captured, 25 animals were released on Chichagof Island. Three goats were later found dead near the release site. Excluding the mortalities, 11 females and 11 males were released (Nelson 1959). Nine of the goats that were ultimately placed on the island were captured as kids and hand-raised until they were 5 or 6 months old.

The first report of goats on Chichagof Island was made by Ernest Lathram, a geologist with the U. S. Geological Survey, who photographed one of the animals on a peak between Trap Bay and Kook Lake on 4 August 1957 (Nelson 1958). Personnel from the U. S. Forest Service reported observing 5 goats on Chichagof Island in November 1962 (Jones and Merriam 1963). Ken Loken of Channel Flying Service, Juneau, reported seeing a goat between Basket Bay and Tenakee in November 1964 (Ken Loken, personal communication to Burris and McKnight).

The last documented report of a sighting of goats on Chichagof Island was spring 1978, when a brown bear guide reported 15 goats on a mountain above Stag Bay on the west side of the island. Subsequent attempts to confirm the report were unsuccessful (Johnson 1981). As no credible reports of sightings surfaced during the next 30 years, it's likely no mountain goats remain on Chichagof.

Revillagigedo Island – Swan Lake (Mt. Reid) – 1983

Two mountain goat transplants occurred on Revillagigedo (Revilla) Island near Ketchikan in southern Southeast Alaska. The first occurred in 1983 when 17 goats were released at Swan Lake (Mt. Reid). The second transplant released 15 goats at Deer Mountain (Upper Mahoney Lake) in 1991 (see below). Although the primary source population for both transplants inhabited the Quartz Hill area on the mainland east of Ketchikan between the Keta and Blossom rivers, the transplants were undertaken for different reasons.

Transplanting goats to Revilla had been proposed as early as 1962 by staff of the U.S. Forest

Service (USFS). Cleveland Peninsula was suggested as the location for the source population and Forest Service staff had compared forage plant abundance on Revilla with that on the goat range on the Cleveland and had estimated costs and produced a feasibility study. However, without a compelling reason for the transplant, high costs, and a lack of coordination with ADF&G seemed to be prohibitive factors and the plan languished (Smith 1984).

In the late 1970s through the early 1980s, a large open-pit molybdenum mine was proposed on the mainland east of Revilla at Quartz Hill in Misty Fjords National Monument by U.S. Borax, Inc. Extensive tunneling, a plant site, and other developments would be located in the key range of a substantial goat population. As plans for the mine proceeded, department biologists suggested that a possible mitigation measure for the mine's effect on existing goat range would be to transplant goats to Revilla to establish a new population (Smith and Wood 1982, Smith 1984). If it were to be mitigation for the mine, U.S. Borax would pay for the operation, but the process of identifying mitigation was slow and a transplant funded by the company could not likely occur before summer 1984. A feasibility study (Smith 1984) was begun in 1982.

Meanwhile, in spring 1982 the Alaska Sports and Wildlife Club (ASWC) based in Ketchikan (later the Ketchikan Sports and Wildlife Club) proposed a goat transplant to Revilla to increase hunting opportunities on the strength of the 1964 USFS feasibility study and began a fund-raising campaign. Over the next few months the ASWC lobbied ADF&G and legislators to act on its proposal. As public interest in and pressure for the transplant grew and the ASWC advocated for immediate action, ADF&G and the USFS met through the winter and spring of 1983 to develop transplant procedures for the coming summer. A cooperative agreement and memorandum of understanding were crafted and signed by the three parties, and the U. S. Forest Service completed its requisite Environmental Analysis and Finding of No Significant Impact in June 1983.

The feasibility study found that habitat on Revilla Island was similar to populated goat range on the mainland. The release site chosen was a remote ridge complex at Swan Lake and Mt. Reid that connected with other high country on northeast Revilla. Smith (1984) judged the area could ultimately support 500 to 1,000 mountain goats.

In late June 1983, goats were captured using darts filled with the immobilizing drug M-99 fired from a Hughes 500 helicopter. The capture crew checked sex and age of each downed goat, affixed a blindfold and plugged its ears with cotton, then moved the goat in a net slung under the helicopter to a staging area in a nearby snowfield (Fig. 6). At the staging area, goats were weighed, measured, ear-tagged, radiocollared, and had their blood sampled and rubber hose sections put on horns for safety while their internal temperatures were constantly monitored. If temperatures rose too high the goats were doused with snowmelt water until cool (Smith and Nichols 1984).

A second helicopter was used to transport 2 to 4 goats at a time to the release area 20 to 90 km (12–56 miles) away. For faster travel, goats were laid inside the helicopter. At the release site, blindfolds, hoses, and earplugs were removed and goats were injected in quick succession with the drug antagonist M50-50 so that they would disperse in groups. Time under sedation ranged from 1 to 5 hours (Smith and Nichols 1984).

During the first 2 days of the operation, 23 and 24 June, 3 billies and 4 nannies were captured in the Quartz Hill area of the mainland. One of these females died during capture when, not fully sedated, she began struggling, was lassoed by a biologist, and had her neck broken when she fell over a ledge and the noose tightened. During a second transplant session from 15–17 July, 9 nannies and 2 billies were captured in mainland mountains on the Cleveland Peninsula north of Revilla. One other female goat died in this capture operation when it fell from a cliff after being darted (Smith and Nichols 1984).

Each transplant crew was quite small and efficient and consisted of 2 or 3 ADF&G biologists, 1 USFS biologist and 2 helicopter pilots. No spotter plane was used. Smith and Nichols (1984) estimate the cost at $1,100 per goat released. One consequence of conducting the transplant a year earlier than originally planned was that U.S. Borax did not pay any costs because mitigation actions for the mine's development had not yet been agreed upon. The ASWC and USFS paid for the June and part of the July operations. ADF&G funded the transplant of 6 goats in July (McKnight 1983).

Photo by Kent Bovee

FIGURE 6. A helicopter is used to transport a mountain goat in a sling from Misty Fjords to a staging area on the way to Revillagigedo Island during the 1983 transplant.

Altogether, 17 goats were released at Swan Lake. Radiotracking with a fixed-wing plane followed the goats for several months. Within 5 days goats had dispersed over several kilometers. By winter all of the goats had moved into winter range and by March 1984, 15 were known to be still alive. Status of the other 2 was unknown as they were yearlings at the time of capture and not radiocollared. Of the 12 females, 8 were lactating and 1 was pregnant at the time of the transplant. The lactating females dispersed significantly greater distances in the months after the transplant than nonlactating goats. Smith and Nichols (1984) note that although helicopter darting is an efficient capture method, it is "virtually impossible to capture nanny–kid pairs." They suggest that the greater mobility of the lactating females was due to "searching" for the kid left behind.

Once the radio collar batteries expired, the transplanted population was monitored only by periodic visual surveys usually added to the end of surveys of the more established mainland herds. A formal aerial survey route to monitor the Revilla goats was established in fall 1988.

The goats thrived on the Revilla range, increasing 10-fold within 10 years. Larsen (1996) estimated the Swan Lake population at 200–250 goats by 1993. Consequently, a hunting season

was initiated in fall of 1993. Two nannies and 1 billy were harvested during the first season, but none were taken in 1994. By 1998, only 14 goats had been taken from the Swan Lake population in 5 years of hunting. From 2002 to 2006 the harvest averaged 4 goats a year with a range of 2 to 7. Rugged terrain and poor access have likely been the reason for low harvest of this population over the years (Larsen 1998, Porter 2000).

The Swan Lake (Mt. Reid) population had an estimated 250 goats by 2000 and stabilized in subsequent years. The population was still estimated to be around 250 goats in 2007 (Boyd Porter, ADF&G Area Wildlife Biologist—Ketchikan. personal communication, 2007). Goats had expanded their range to occupy ridges overlooking Behm Canal north of the transplant area but had not moved east of Carroll Inlet (LaVern Beier, ADF&G Wildlife Technician—Southeast Alaska, and Doug Larsen, former ADF&G Ketchikan Area Wildlife Biologist, personal communications, 2007). Smith's (1984) estimate that the range could support 500 to 1,000 goats may have been optimistic. Winter conditions are a major limiting factor for the Revilla goat population. Key areas of low elevation old growth winter range have been clearcut in the past 20 years, possibly reducing the habitat's carrying capacity from the 1984 estimate.

Although successful in providing a huntable population and establishing goats in previously unoccupied range, the efficacy of this first Revilla Island goat transplant as a mitigation measure for the molybdenum mine was not tested as the mine was never developed.

Kenai Peninsula – Cecil Rhode Mountain – 1983

The second of the summer 1983 mountain goat transplants took place one week after the Revilla Island transplant, when 12 mountain goats were moved onto Cecil Rhode Mountain above the community of Cooper Landing on the Kenai Peninsula from nearby mountains to the east. The objective of this transplant was to augment a population once numbering at least 22 goats in the 1950s but depleted by hunting to just 4 males by 1983 (Smith and Nichols 1984). Because of its easy access, the mountain was part of an area closed to hunting throughout the 1950s. From fall 1960 through 1964 however, it was open to hunting with a 2-goat bag limit. Goat numbers declined and hunting was closed in 1965 (ADF&G hunting regulations 1960–1965). Although no hunting occurred for the next 17 years, for unknown reasons goats did not repopulate the mountain to prehunting numbers.

It was hoped a transplant would accelerate population growth, lead to a huntable population, and increase wildlife viewing opportunity for the public. The U.S. Forest Service, which participated in the transplant, had established a Dall sheep viewing area at Kenai Lake on the Sterling Highway at the foot of Cecil Rhode Mountain (named for the conservationist and photographer who was a longtime resident of Cooper Landing). The sheep inhabited the mountains on the north side of the highway. If goats again populated Cecil Rhode Mountain on the south side of the road in sufficient numbers, the public could view Dall sheep and mountain goats from the same vantage point (Lew 1984).

As on Revilla, all goats were captured using darts filled with the M99 immobilizing drug fired from a Bell Jet Ranger helicopter. A fixed-wing spotter plane located the goats for darting in the mountains north of Kenai Lake and then tracked the darted goats until they were sedated.

Sedated goats were loaded into a net sling attached to a hovering helicopter and transported to a staging area. At the staging area, goats were blindfolded, hobbled, and their horns covered with sections of rubber hose for safety. Temperatures were monitored while they were weighed, measured, aged by counting horn annuli, and ear-tagged. Radio collars were put on 6 of the goats. After processing the goats were transported by covered pickup truck, with a bed of crushed ice under burlap, 70 km (43 miles) to the release area at the base of Cecil Rhode Mountain (Smith and Nichols 1984).

Four goats, all females with 1 lactating, were captured and moved on 25 July. The next day 10 goats, 8 nannies (1 lactating) and 2 billies were captured and moved. Two nannies died during capture – one of drug-related complications and another of unknown causes in the transport sling – leaving 8 for the second day's total. An additional casualty was an ADF&G biologist seriously injured with a broken leg when he fell from a cliff attempting to reach a sedated goat (Smith and Nichols 1984).

At the release site on each day, goats were placed in a wire holding pen, freed of hobbles, blindfolds, and horn covers and given the M50-50 antagonist to the immobilizing drug. After about 2 minutes when all goats in the pen had recovered from the drug, the pen was opened and the goats dispersed uphill.

On 27 July, the day following the second release, 2 goats were found dead. One was a greater than 10-year-old nanny who left the release site slowly and was found dead a short distance uphill from the holding pen. The other loss was an 8-year-old nanny who descended the mountain and drowned trying to swim across Kenai Lake. That same day, the U.S. Bureau of Land Management, unaware of the transplant, conducted surveying operations on the mountain. Its helicopter activity spooked the transplanted goats, scattering them for several kilometers. The 4 original resident and 10 surviving transplanted goats were still scattered in singles and pairs almost a month later when the first snow fell on the mountain (Smith and Nichols 1984).

The disruption proved to be temporary. Within 5 years, goat numbers nearly doubled to 26 and a hunting season was opened in 1987. Population surveys in subsequent years showed a continued steady increase in the number of goats on the mountain. By 1992, 10 years after the transplant, 53 goats were counted and a drawing permit hunt was instituted. Since then, department biologists have successfully managed an annual harvest, issuing 2 to 6 drawing permits per year. On average 2 goats a year were harvested on Cecil Rhode Mountain from 1992 to 2007. A 2007 survey counted 58 goats on the mountain (ADF&G 2007 unpublished data), an adequate number for both hunters and viewers to enjoy.

In assessing the operation, Smith and Nichols (1984) note that the operation was covered by the press and involved pilots and a large staff (about a dozen people) from the two agencies. The number of people coupled with the need to process goats quickly led to moments of confusion during portions of the 2-day operation. The estimated cost of the operation was approximately $8,500, or $714 per goat released. Although they acknowledge that the ultimate success of the transplant would not be determined for a number of years, the authors note that on both Revillagigedo and the Kenai Peninsula in 1983 the physical relocation of goats was

successful and the goats initially appeared to settle into their new habitat. As a result, they "encourage the reasoned use of transplants after adequate feasibility studies are completed to restock depleted herds or establish new populations to mitigate impacts of development on native goat populations" (Smith and Nichols 1984).

Juneau Mainland (Mt. Juneau) – 1989

Eleven mountain goats were transplanted from the Whiting River–Tracy Arm area to Mt. Juneau on the mainland adjacent to the city of Juneau in August 1989. The operation was carried out largely by ADF&G personnel on a volunteer basis but funded wholly by the Juneau chapter of the National Audubon Society. The primary motivation for the transplant was to reestablish goats near a human population center for viewing.

Circumstances leading to the transplant had their genesis when, in 1981, a hunter legally shot a mountain goat which had spent several weeks on the face of Mt. Juneau and had been watched by many people in the city through the late summer. It was the first time in many years residents had observed goats on Mt. Juneau. Consquently, a large segment of the public expressed its displeasure with the hunt. That, coupled with very low goat numbers, caused the department to propose, and the Board of Game to agree, to close the hunting season on the mountain in 1982 (Zimmerman 1983).

Photo by LaVern Beier, ©1989 ADF&G

Figure 7. Sedated goats were kept cool at this staging area during the Mt. Juneau transplant operation in 1989.

Low goat numbers in the surrounding area, from the Taku Glacier to the south of Juneau to the Eagle Glacier valley north of the city, caused hunting there to be closed by emergency order in 1983 and formally by the Board of Game in spring 1984 (Zimmerman 1985). With a subsequent growth in cruise ship traffic and associated helicopter flightseeing over the Juneau Icefield glaciers and mountains near the city, viewing of goats became the management priority near the city and hunting seasons had still not been reopened by 2007.

In the years immediately following the 1982 hunting closure however, no goats appeared on Mt. Juneau and the public's desire for restoring the local goat population increased. The ADF&G was unable to fund a transplant but staff members were willing to volunteer to coordinate and carry out the project. The local chapter of the Audubon Society raised approximately $12,500

over 2 years to fund the operation. In addition, Temsco Helicopters donated half the flight time of the 3 helicopters used, and the Governor's office contributed $3,000 in contingency funds (Eppenbach 1990).

The transplant was accomplished in one day, 6 August, a Sunday. Of the 11 goats translocated, 8 were females, 3 were males. Six females were subadults and 1 of the 2 adult nannies was lactating. Estimated ages of the billies were 1, 3, and 6 years. Radio collars were attached to 8 of the goats.

Goats were captured after being located by a fixed-wing spotter plane, darted from helicopters, and injected with the immobilizing drug carfentanil. Two Hughes 500 helicopters were used in the capture and an A-Star helicopter was used to transport goats and fuel.

Four goats died during the operation from drug-related causes. One slid off a cliff upon being immobilized. Three others died from a combination of drug dosing and their exertions trying to elude capture. The day was sunny and hot, which may have contributed to the goats' physical stress. At the capture site, goats were outfitted with blindfolds and ear-tags and then taken to a staging area (Fig. 7) where they were doused with water to keep their temperatures below 105°. One billy was placed in a small stream for several minutes when his internal temperature rose to 107.7° F. Goats were loaded into the A-star helicopter in groups of 3 for transport to the release area (McCarthy 1989).

At the release area at the foot of Mt. Juneau next to Gold Creek, a crew of 4 ADF&G staff and a veterinarian, assisted by 8 volunteers, tended to the goats. They collected blood, sex, age, and horn data, checked for diseases and parasites, kept the goats cool with water, and put radio collars on 5 nannies and 4 billies. Goats with wounds were given antibiotics and, after all goats were administered naltrexone and naloxone to bring them out of sedation, their blindfolds were removed.

Activities at the release site, which was accessible to Juneau by road, took place within view of up to 150 spectators. The path up the mountain was away from the crowd but most goats initially headed downhill despite efforts by the release crew to head them off. One goat eluded handlers, pushed through the crowd and climbed into an ADF&G truck before leaping out, crossing a road and stream and escaping into the woods. Later monitoring of her radio collar indicated she joined the rest of the goats on the right mountain, Mt. Juneau. (McCarthy 1989).

For a few days after the operation, 2 goats showed signs of renarcotization. They were observed for several hours on 2 different days moving slowly, stumbling in moderate terrain and standing with heads lowered for several minutes at a time. The difficulties of these 2 goats and the deaths of 4 others from drug-related causes during the transplant caused department biologists to question the use of carfentanil in goat capture operations (McCarthy 1989). Subsequent success with the drug in the Deer Mountain transplant (see below) put those concerns to rest.

Ironically, in the months immediately following the transplant, all the goats dispersed away from Mt. Juneau. Of the 8 radiocollared goats, at least 2 dispersed from the release site; one

traveled 20 miles (32 km), the other 35 miles (56 km). The remaining 6 collared animals wintered within 5 miles (8 km) of the release site (Johnson 1991). Little follow-up monitoring was done, particularly after the batteries of the radio collars expired 2 years later.

Several more years passed before goats returned to Mt. Juneau. By the early 2000s they were a common sight in the summer. Because goats did not use the mountain immediately after the transplant, it is unclear whether it was the transplant that helped to reestablish Mt. Juneau's population or whether goats from neighboring mountains returned there as part of a natural expansion of range.

Revillagigedo Island – Deer Mountain (Upper Mahoney Lake) – 1991

Like the Swan Lake transplant 7 years earlier, the Deer Mountain (Upper Mahoney Lake) transplant originated with a proposal from the Ketchikan Sports and Wildlife Club to the ADF&G and the U.S. Forest Service in June 1990 to establish a goat population in the Deer Mountain area that would be easily accessible from Ketchikan for public viewing and hunting once a harvestable surplus existed (Larsen 1991). The transplant operation provides a model of interagency and public cooperation, planning, and efficiency.

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FIGURE 8. A sedated goat lies in a net awaiting helicopter transport during the Deer Mountain transplant in 1991.

Because of the high public interest, a series of public and team meetings were held in the winter of 1991 to explain and plan the operation. An Environmental Assessment was prepared jointly by ADF&G and USFS. Eight ADF&G and USFS staff and about 22 volunteers were assembled to assist with the transplant, which was completed in one day, 10 August 1991.

The operation involved a spotting crew using a fixed-wing aircraft, 2 capture crews in Hughes 500 helicopters, 2 transporting crews using 2 Bell 206 Jet Ranger helicopters, a staging crew on a tug and barge in Smeaton Bay, a release crew at Mahoney Lake, and a media crew in a separate helicopter. Two ADF&G biologists and a technician were with the capture crews. Because of the use of volunteers and donations of equipment, aircraft, pilots, and fuel by local flying services, merchants,

and companies, the actual monetary cost of the transplant was minimal although Larsen (1991) estimated the expense would have amounted to about $47,500.

Gunners in helicopters shot goats in the Quartz Hill area with darts containing the immobilizing drug carfentanil. When immobile, goats were transported to the barge staging facility where the crew checked for signs of disease, kept goats cool with saltwater, took hair and blood samples, determined sex, measured and covered horns to prevent accidental injury in transport, blindfolded and ear-tagged all goats, and put radio collars on 7 of the 15 captured (2 billies and 5 nannies). After processing, the goats were transported singly or in pairs by helicopter to the release site, a flight of 25 minutes.

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FIGURE 9. A sedated goat is retrieved after darting during the Deer Mountain transplant in 1991.

Ten flights were needed to move all goats. At the Mahoney Lake release site, a crew led by a veterinarian collected blood and fecal samples; treated the goats with an antiparasitic drug and applied ointments to dart wounds; removed blindfolds and horn guards; and administered naloxone and naltrexone as antagonists to the immobilizing drug. Goats recovered mobility within a few minutes and dispersed successfully (Larsen 1991).

Seventeen goats were initially darted during the capture phase of the operation but 2 goats died when they lost footing and fell down cliffs after being darted. No goats died during the following stages of the transplant. Goats were immobile for an average of 90 minutes during the transplant operation.

The first radio collar relocations were made 5 days after the transplant and subsequent tracking flights determined that all but 1 goat (a nanny) survived the first winter. The transplanted population began producing kids within 2 years. By 1994 the population had doubled to about 30 goats (Larsen 1996). Four years later, the transplant was deemed a success, with a minimum of 39 goats in the Deer Mountain area by 1996 (Larsen 1998). By 2002 the population's range had extended to occupy nearly all suitable habitat in the transplant area (Porter 2002). Steady

growth has continued; data and observations from aerial surveys in 2003 led to an estimate of 100–140 goats in the area (Porter 2004).

Because of these goats' proximity to Ketchikan and fixed-wing and helicopter flightseeing routes, ADF&G has an ongoing concern over disturbance-related stress on this introduced goat population. The department attempts to educate the public and air carriers annually about the issue (Porter 2002).

By 2004 the Deer Mountain goat population was estimated at a minimum of 120 goats with high productivity. That fall the Board of Game approved a limited drawing hunt in the area with up to 25 permits issued. The department issued 12 drawing permits for the fall 2006 season extending 16 August–31 December (Porter 2006). Seven of the 12 hunters were successful in that first hunt (Boyd Porter, ADF&G Area Wildlife Biologist—Ketchikan, personal communication, 2007).

Both Revilla mountain goat transplants have been successful in establishing populations in previously unoccupied range. Shortly after the Deer Mountain/Upper Mahoney transplant, during an aerial survey in October 1992, 2 goats from the Swan Lake population were found 12 miles (19 km) south of that transplant area on a ridge near the northwestern head of Carroll Inlet. Only a few hundred yards away was a nanny from the Upper Mahoney Lake group that had dispersed about 30 straight-line miles north of her release site. The proximity of the 2 groups suggested at the time that intermingling of goats from the transplants would become common, eventually creating one large islandwide population (Larsen 1996). Subsequently, it seems the well-traveled Deer Mountain nanny and Swan Lake pair were unusual as no other goats appear to have followed their lead. The 2 Revilla populations had become firmly established but were still in discrete ranges through 2007.

References – Mountain Goats

Alaska Game Commission. Annual Reports, 1925 to 1937. Juneau, Alaska. Mimeo.

Elkins, W. A. and U. C. Nelson. 1954. Wildlife introductions and transplants in Alaska. Proc. 5th Alaska Science Conf. 21pp.

Eppenbach, S. 1990. Capital city goats. Pages 26–28 in Alaska Fish & Game Magazine, Vol. 22, No. 2. March–April 1990. Alaska Department of Fish and Game. Juneau, Alaska.

Huber, L. R. 1959. Mountain goats – alive. Pages 180–185 in The Alaska Book 1959 by Encyclopedia Britannica. Britannica book of the year. Alaska: the forty-ninth state. J. G. Ferguson Publishing Co. Chicago.

Johnson, D.M. 1991. Unit 1C. Pages 2–4 *in* S.O. Morgan, editor. Annual performance report of survey and inventory activities 1 July 1989–30 June 1990. Part VII Mountain Goat. Volume XXI. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Project W-23-3, Study 12.0. Juneau, Alaska.

JOHNSON, L. J. 1981. Mountain Goat Unit 4. Pages 59–62 *in* R. Hinman, editor. Annual report of survey and inventory activities 1 July 1979–30 June 1980. Part III Bison, caribou, mountain goat, muskoxen, and sheep. Volume XI. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Project W-17-12. Job 12.0. Juneau, Alaska.

_____. 1984. Mountain Goat Unit 4. Pages 59–62 *in* J. Barnett, editor. Annual report of survey and inventory activities 1 July 1982–30 June 1983. Part II Mountain goat and sheep. Volume XIV. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Project W-22-2. Job 12.0. Juneau, Alaska.

JONES, F. F. AND H. R. MERRIAM. 1963. Sheep and goat report. Alaska Dept. of Fish and Game, Fed. Aid in Wildl. Rest. Prog. Rept. Project W-6-R4, Juneau, Alaska.

LARSEN, D. 1991. Deer Mountain goat transplant. Alaska Dept. of Fish and Game unpublished memorandum to David A. Anderson, Regional Supervisor. 31 August. 10pp. Ketchikan, Alaska.

_____. 1994. Unit 1A mountain goat management report. Pages 1–9 *in* M. V. Hicks editor. Mountain goat 1 July 1991–30 June 1993. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-1, W-24-2. Study 12.0. Juneau, Alaska.

_____. 1996. Unit 1A mountain goat management report. Pages 1–16 *in* M. V. Hicks editor. Mountain goat 1 July 1993–30 June 1995. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-2, W-24-3. Study 12.0. Juneau, Alaska.

_____. 1998. Unit 1A mountain goat management report. Pages 1–12 *in* M. V. Hicks editor. Mountain goat 1 July 1995–30 June 1997. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-4, W-24-5. Study 12.0. Juneau, Alaska.

LEW, K. 1984. Getting your goats. Pages 13–17 in Alaska Fish & Game Magazine, Vol. XVI, No. 2. March–April 1984. Alaska Department of Fish and Game. Juneau, Alaska.

MCCARTHY, T. 1989. Mountain goat capture and reintroduction, Mt. Juneau. Alaska Dept. of Fish and Game, Division of Wildlife Conservation unpublished memorandum to David A. Anderson, Regional Supervisor. 11 August. 4pp. Juneau, Alaska.

MCKNIGHT, D. 1983. Goat transplant to Revilla Island. Alaska Department of Fish and Game, Game Division unpublished memorandum to Lewis Pamplin, Jr., Director. 12 July. 2 pp. Juneau, Alaska.

MOONEY, P. 2006. Unit 4 mountain goat management report. Pages 59–68 *in* P. Harper, editor. Mountain goat management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 12.0. Juneau, Alaska.

NELSON, U. C. 1952a. Quarterly progress report-development. Federal Aid in Wildlife Restoration Project W-4-D-3, Alaska. Vol. III, No. 1.

_____. 1953. Stocking Mt. Goat, Kodiak Island, Alaska. Federal Aid in Wildlife Restoration Projects 3-R and 4D, Alaska. Completion Report.

_____. 1954. Quarterly progress report-development. Federal Aid in Wildlife Restoration Project W-4-D-5, Alaska. Vol. V, No. 1 & 2.

_____. 1955b. Quarterly progress report-development. Federal Aid in Wildlife Restoration Project W-4-D-6, Alaska. Vol. VI, No. 1 & 2.

_____. 1957. Quarterly progress report-development. Federal Aid in Wildlife Restoration Project W-4-D-7. Vol. VII, No. 1-4.

_____. 1958. Progress report-development. Federal Aid in Wildlife Restoration Project W-4-D-8. Vol. VIII, No. 1-4.

_____. 1959. Completion report-development. Federal Aid in Wildlife Restoration Project W-4-D-9. Vol. IX, No. 1-4.

PORTER, B. 2000. Unit 1A mountain goat management report. Pages 1–14 *in* M. V. Hicks editor. Mountain goat 1 July 1997–30 June 1999. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-27-1, W-27-2. Study 12.0. Juneau, Alaska.

_____. 2002. Unit 1a mountain goat management report. Pages 1-19 *in* C. Healy editor. Mountain goat management report of survey and inventory activities 1 July 1999 – 30 June 2001. Alaska Department of Fish and Game. Project 12.0. Juneau, Alaska.

_____. 2004. Unit 1a mountain goat management report. Pages 1–21 *in* C. Brown editor. Mountain goat management report of survey and inventory activities 1 July 2001–30 June 2003. Alaska Department of Fish and Game. Project 12.0. Juneau, Alaska.

_____. 2006. Unit 1A mountain goat management report. Pages 1–16 *in* P. Harper, editor. Mountain goat management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 12.0. Juneau, Alaska.

ROBUS, M. 1994. Unit 1C mountain goat management report. Pages 17–24 *in* M. V. Hicks editor. Mountain goat 1 July 1993–30 June 1995. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-2, W-24-3. Study 12.0. Juneau, Alaska.

SITKA PROGRESS. 1926. The Game Commission is active. 30 April 1926.

_____. 1927. Goat is slaughtered by lawbreaker. 27 May 1927.

SMITH, C. A. 1984. Potential of Revillagigedo Island for a goat transplant. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Final Report. Project W-22-1, Job 12.6R. 41pp.

SMITH, C.A. AND L. NICHOLS, JR. 1984. Mountain goat transplants in Alaska: Restocking depleted herds and mitigating mining impacts. Pages 467–480 *in* M. Hoefs, editor. Proceedings of the Fourth Biennial Symposium of Northern Wild Sheep and Goat Council. 30 April–3 May 1984. Whitehorse, Canada.

SMITH, C.A. AND R. WOOD. 1982. Revilla goat transplant decision. Alaska Department of Fish and Game unpublished memorandum to Donald McKnight, Regional Supervisor. 13 January. 2pp.

SMITH, R. 1986. Unit 8. Pages 34–35 *in* B. Townsend editor. Annual report of survey and inventory activities 1 July 1985–30 June 1986. Part VII Mountain Goat. Volume XVII. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grant W-22-5. Job 12.0. Juneau, Alaska.

_____. 1994. Unit 8 mountain goat management report. Pages 107–118 *in* M. V. Hicks editor. Mountain goat 1 July 1993–30 June 1995. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-2, W-24-3. Study 12.0. Juneau, Alaska.

VAN DAELE, L. J. 1998. Unit 8 mountain goat management report. Pages 111–122 *in* M. V. Hicks editor. Mountain goat 1 July 1995–30 June 1997. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-4, W-24-5. Study 12.0. Juneau, Alaska.

VAN DAELE, L. J. AND J. R. CRYE 2004. Unit 8 mountain goat management report. Pages 122–137 *in* C. Brown, editor. Mountain goat management report of survey and inventory activities 1 July 2001–30 June 2003. Alaska Department of Fish and Game. Project 12.0. Juneau, Alaska.

_____. 2006. Unit 8 mountain goat management report. Pages 106–22 *in* P. Harper, editor. Mountain goat management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 12.0. Juneau, Alaska.

WILLIAMS, L. 2003. Patterns of harvest and use of mountain goats on Kodiak Island, GMU 8. Alaska Department of Fish and Game. Division of Subsistence. Technical paper 276.

ZIMMERMAN, D.W. 1983. Subunit 1C. Pages 12–15 *in* J. A. Barnett, editor. Volume XIII Annual report of survey and inventory activities 1 July 1981–30 June 1982. Part IV Mountain Goat & Sheep. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grant W-22-1. Job 12.0. Juneau, Alaska.

_____. 1985. Subunit 1C. Pages 11–14 *in* A. Seward, editor. Annual report of survey and inventory activities 1 July 1983–30 June 1984. Part IV Mountain Goat & Sheep. Volume XV. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grant W-22-3. Job 12.0. Juneau, Alaska.

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Elk

Kruzof Island – 1926, 1927–1928

The first record of attempts to transplant elk (*Cervus canadensis*) in Alaska comes from the 1926 session of the Territorial Legislature. During this session, $2,000 was allocated to place Roosevelt elk (*Cervus canadensis roosevelti*) on Kruzof Island near Sitka in Southeast Alaska. Available documents indicate that arrangements were made with the Washington State Game Department to obtain elk in trade for mountain goats. Details of the trade were not recorded.

In September 1926, 2 yearling elk, a male and female from Washington state were released on Kruzof Island (Alaska Game Commission 1929). A calf was observed there during the early summer of 1927 and this prompted the Alaska Game Commission to renew negotiations with the State of Washington to secure additional elk.

Photo courtesy of the Sitka Historical Museum

Figure 10. Young elk on Kruzof Island in 1928

Arrangements were made for an exchange at the ratio of 1 mountain goat for 2 elk (Alaska Game Commission 1929). As a result of this agreement, 6 calves were shipped from Port Angeles, Washington, to Sitka, Alaska, and subsequently released on Kruzof Island on 24 September 1927. One calf died within 3 months, and the remaining 5 were returned to Sitka in January 1928. An extended cold snap with heavy snows necessitated retaining the animals at the U. S. Agricultural Experiment Station at Sitka. In April, the animals were returned to Kruzof Island. Documentation of the results of this transplant was, at best, sporadic. A report by the Alaska Game Commission to the Territorial Legislature, dated 1 March 1931, stated that the elk had shown a slight increase. The report also mentioned the tendency of the elk to wander to adjacent islands and stated that 1 female elk had been mistaken for a deer and shot. Another Game Commission report to the legislature in 1933 stated: "from the very first these animals have shown a tendency to wander, and to break up into small groups until it is impossible to secure an accurate check on them."

A later report (Alaska Game Commission 1935) indicated that the elk had left Kruzof Island and crossed over to Chichagof and Baranof Islands. Sporadic reports of elk on these islands were subsequently received for a short while, but by 1937 the Kruzof Island elk transplant was labeled a failure (Alaska Game Commission 1937).

Afognak Island – 1929

On June 29, 1925, the Territorial Governor approved a program to transplant Roosevelt elk (*Cervus canadensis roosevelti*) to the Kodiak-Afognak island archipelago. Under the same goat–elk exchange program with the State of Washington that was utilized to obtain animals for Kruzof Island, 8 elk calves (3 males and 5 females) were shipped from Port Angeles, Washington, in late August 1928 (Batchelor 1965). They were held over the first winter at the U. S. Agricultural Station at Kalsin Bay, Kodiak Island.

The elk did very well in captivity and in March 1929 they were released on Afognak Island. From the beginning, the herd thrived and 5 calves were reported in the spring of 1930. The Alaska Game Commission's report to the legislature in 1933 stated there were 30 or more elk on Afognak. An estimate made in September 1934 placed the population at 50 to 60 animals, and by 1 January 1937, it was estimated that 100 animals were present on the island (Alaska Game Commission 1937). On 3 December 1948, 162 elk were observed during an aerial survey and the population was estimated to be not less than 212 animals (Batchelor 1965).

As a result of the 1948 survey, a limited harvest of 50 bull elk was recommended for Afognak Island. A permit hunt was initiated in 1950 and 27 bulls were harvested (Elkins and Nelson 1954). The season was closed in 1951, but other permit hunts were held in 1952 and 1953. After a season closure in 1954, a 15-day bull elk season was set for Afognak Island in 1955. Season length was increased to 20 days in 1957 and 31 days in 1958. In 1959, the first either-sex hunt was held. The population continued to increase and was estimated at 1,100 animals in 1961 (Batchelor 1965). As the number of elk increased, the hunting seasons became more liberal. In 1963, a season of 153 days was established with a bag limit of 2 elk in the Tonki Cape area.

In spite of liberalized hunting seasons and bag limits, the Afognak Island elk herd has followed the course often associated with transplanted animals. Population numbers reached a peak of approximately 1,200 to 1,500 animals by 1965, with 9 separate herds on Afognak and 1 on nearby Raspberry Island, and subsequently underwent a sharp decline (Griffin and Alexander 1969). A series of winters with heavy snow accumulation resulted in extensive natural mortality and reduced calf production and survival (Alexander 1973). The population probably numbered about 450 animals in 1972.

Another population peak estimated at 1,400 animals was reached by the 1980s and maintained to the mid 1990s. Two consecutive severe winters in 1998 and 1999 reduced elk numbers to as few as 740 in the early 2000s. By 2005 the population had rebounded to about 950 elk with at least 7 herds on Afognak and 1 on Raspberry. Elk were reported on Kodiak Island (2 water miles [3 km] from Raspberry Island) in 2004 and 2 bulls were harvested on Kodiak that year (Van Daele 2006).

When road construction associated with commercial logging began on Afognak in 1977, elk became increasingly vulnerable to hunting in some areas of the island. Drawing hunts and shorter seasons were established. In 2003, the Afognak hunt was split into 3 separate drawing hunt areas to address issues of overcrowding in areas with good access. In 2007, drawing hunts

on Afognak were 1 month long, late September–October, followed by a 5-week registration hunt through November if harvest targets were not met with the drawing hunt. The highest harvest was in 1989 when 206 elk were killed by hunters. During the period 2001–2005 harvest ranged from 62 to 95.

Van Daele (2000) reports that elk herds on Afognak were relatively stable with discrete ranges prior to 1998. After that, herds began interacting more and changed some of their use areas. The changes may be due to severe winter and early spring weather at that time combined with two decades of logging that had decreased and altered the amount and quality of winter range habitat on some areas of the island.

In the mid 1990s the Federal Subsistence Board designated Afognak elk as a customary and traditional resource for Kodiak Archipelago residents, and established a subsistence hunt for them. Only one elk had been killed under a federal subsistence permit by 2007, but as with some other transplanted populations, the customary and traditional use designation confers an additional stamp of success on the transplant. Despite the longevity of the Afognak population, continued logging of winter range and vulnerability of some island herds to easy hunter access are concerns enough to have resulted in a cautious management approach over the years.

Revillagigedo Island – 1937, 1963, 1964

In the Executive Officer's report to the Alaska Game Commission in 1937, it was stated that 4 elk from a park in Seattle had been released at Ward Creek on Revillagigedo (Revilla) Island in May 1937. The transplant was a cooperative effort between the sportsmen of Ketchikan and the Alaska Game Commission. A favorable report of the transplant was made in December 1937 and on 27 June 1938, W. R. Selfridge of Ketchikan reported in the Executive Officer's report to the Alaska Game Commission that "The elk in Ward Valley are doing fine." Two years later, however, the Executive Officer's report listed the transplant as a failure. No explanation or further details of the transplant and its subsequent failure were provided.

In 1963 ADF&G made another attempt to transplant elk to Southeast Alaska by asking the U. S. Forest Service for permission to transplant elk to Kruzof Island. The Forest Service refused, however, and the 2 agencies subsequently agreed on Revilla Island as a suitable site (Burris 1964). A feasibility report specifying the release site as Fire Cove in Neets Bay was submitted to the U. S. Bureau of Sport Fisheries and Wildlife for subsequent approval so the project could be conducted with Federal Aid in Wildlife Restoration funds. Holding pens were constructed at Fire Cove and the entire operation was similar to the 1962 elk transplant to Gravina Island (Burris 1964). In August 1963, 9 calves were transferred from Afognak Island to Annette Island where they were held in pens for a short period and subsequently released at Neets Bay. The elk were observed in the vicinity of the release site for a few weeks, but they soon dispersed to the area around Neets Creek.

Somewhat encouraged by the results from the 1963 transplant to Neets Bay, ADF&G made a second transplant to the same area in 1964 (Burris personal files). The operation was conducted as before except that a larger pen was constructed near Neets Creek. Drainage, exposure and forage were much improved at the new holding pen. Fourteen elk calves, 6 males and 8 females,

arrived at Neets Bay on 13 July, where they were held until September 1964. All 14 animals were in good physical condition when they were released.

Although anecdotal accounts of elk sightings, tracks, and droppings were reported to the ADF&G in the years immediately following the release (Burris and McKnight 1973), none of the reports was ever substantiated. As elk have not been confirmed on Revilla for at least 40 years, the transplant can confidently be considered a failure.

Gravina Island – 1962

After the failure of the 1937 elk transplant to Revillagigedo Island, no further efforts were made in Southeast Alaska until 1962 when the Alaska Department of Fish and Game and the U. S. Forest Service cooperated in an elk release on Gravina Island.

In June 1962, 11 calves were captured on Afognak and Raspberry Islands in the Kodiak Island group (Batchelor and Merriam 1963). This operation involved a cooperative effort by the Alaska Department of Fish and Game, the U. S. Coast Guard Air Detachment of Kodiak and the 80th Transportation Company, United States Army, Fort Richardson. The Coast Guard supplied a Bell HUL 3-place helicopter and a 2-man crew, while the Army provided an H-21 helicopter.

The capture operation, while simple to describe, was difficult to accomplish. First a herd containing calves was located by use of the helicopter. A crew was then landed several hundred yards ahead and uphill from the herd. The pilot then hazed the animals in the direction of the crew, hoping that one of the calves would lag behind and become separated from the herd. When this occurred, the calf would seek shelter in the tall grass or alders and the helicopter would hover over the location while the capture crew approached on the ground. The crew, receiving verbal instructions from the helicopter pilot, cautiously approached the hidden calf and pounced with the hope of landing on the animal. All calves were held at the Afognak Lake Naval Recreation Camp for approximately 2 weeks prior to their shipment to Gravina Island.

The care and feeding of elk calves is a relatively simple process. A standard livestock starter pail equipped with a rubber nipple was used initially to feed vitamin-supplemented evaporated milk to calves. Within 3 days nearly all the calves would take milk directly from the pail without the aid of the nipple, and Karo® (corn) syrup and Pablum (a baby cereal) were added to the undiluted evaporated milk. The calves were fed 3 times daily for the first 4 days, after which the schedule was reduced to twice daily. Scouring was successfully treated with a commercial antiscouring medicine. Under this care, weight gains often exceeded a pound per day.

The calves were taken to the Kodiak Naval Station in a chartered Grumman Goose aircraft and then transported to Annette Island in Southeast Alaska via a Coast Guard C-123 aircraft (Batchelor and Merriam 1963). At Annette Island, the calves were transferred to a Coast Guard truck, hauled to the village of Metlakatla, placed aboard the *M/V Kittiwake*, taken to Gravina Island and transferred to a holding pen at the David Perry residence. They were held at the Perry residence until large enough to release.

One female died en route to Annette Island, and 2 more calves died prior to release. On 31 August 1962, 5 male and 3 female calves were placed aboard a Coast Guard LCVP landing craft and released at Vallenar Bay, Gravina Island.

The 3 months in captivity did a great deal for the calves' physical condition, but during that period the animals lost their fear of people. Because of this, the young elk became nuisances around one of the homesteads on Gravina Island. Finally, on 30 January 1963, the Gravina Island elk transplant ended when the homesteader shot all 8 calves.

Etolin Island – 1987

The failure of 6 previous elk transplant attempts in Southeast Alaska did not deter the Alaska Legislature when in 1985 it passed a bill directing that ADF&G transplant between 30 and 150 Roosevelt elk to a "suitable location" in the region within 3 years, and passed a companion bill providing $50,000 to fund the transplant. The chief purpose of the transplant was to provide more hunting opportunity and another big game species for the region's hunters.

An interagency task force was assembled and 4 islands – Zarembo, Etolin, Prince of Wales, and Kuiu – were investigated as potential sites in an ADF&G feasibility study (ADF&G 1985 and 1986) and a U.S. Forest Service Environmental Assessment (EA, USDA Forest Service 1986). The ADF&G study ranked Zarembo as the best location whereas the Forest Service EA concluded that Etolin Island was preferred. Among the points favoring Etolin listed in the EA's Decision Notice were: 1) a low potential for poaching (due to lack of roads and difficult access), 2) a moderate prey-to-wolf ratio, 3) low snow accumulation on key portions of the island, and 4) low probability of elk becoming established in a designated wilderness area. In addition, as a larger island with more habitat, Etolin could ultimately support a larger population of elk than Zarembo. With the Forest Service as the land manager of all the sites, its choice prevailed.

Photo by LaVern Beier, ©1987 ADF&G

FIGURE 11. A mountain goat in a crate is prepared for transport to Oregon as part of an exchange of goats for Roosevelt elk in 1987.

Ironically, less than 4 years after elk were transplanted to Etolin, the Tongass Timber Reform Act, passed by Congress in 1990, created the 82,619 acre South Etolin Island designated wilderness area in the heart of the new elk herd's habitat. Had the wilderness area been designated prior to 1987, it is certain, given USFS policy at the time, that a transplant to Etolin would not have been permitted.

Perhaps as a result of the earlier failed transplants, the Etolin Island transplant was thoroughly investigated beforehand and extensively documented with periodic follow-up studies that continue 20 years after the elk were moved. The Etolin elk transplant was the first to use radiotelemetry and numbered visual collars on elk released in Alaska (Young et al. 1988).

Securing the elk for the transplant led to subsidiary capture and transplant sagas. Alaska elk from Afognak Island were specifically excluded as a source population for the transplant in the legislature's bill, so the department contacted other states for elk. The Oregon Department of Fish and Wildlife (ODFW) offered to trade 30 Roosevelt elk from the Jewel Meadows Wildlife Area for 15 Alaska mountain goats. ODFW later also agreed to provide up to 20 Rocky Mountain elk (*Cervus canadensis nelsoni*) from the Elkhorn Wildlife Refuge in eastern Oregon (Young et al. 1988, Land and James 1989) if Alaska would send 20–24 river otters to Nebraska as repayment for wild turkeys that Nebraska had sent to Oregon some years earlier. The deal eventually became even more complex when ADF&G determined trapping otters and shipping them from Alaska was more expensive for the department and riskier for the animals than purchasing river otters from an otter farm in Louisiana and paying for shipment to Nebraska from there. The otter-for-elk transaction wasn't completed until 1991 (Anderson 1991).

The mountain goats used in the exchange were captured from the Misty Fjords National Monument near Ketchikan over 2 days in August 1985. Sixteen goats were darted from a helicopter using the drug M-99 and transported while immobilized to a processing area. One goat died of suffocation while being transported in a cargo net slung under the helicopter. After they were tested for disease, injected with antibiotics and ivermectin, ear-tagged, and 5 fitted with radio collars, the goats were placed in crates and transported to Ketchikan on the ADF&G boat *Sundance* – a mostly uneventful, routine operation to that point (Fig. 11).

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FIGURE 12. A truck carrying elk is unloaded from a landing craft on Etolin Island in 1987.

However, while department bioloigsts waited for arrival of a special Alaska Airlines freight flight to take the goats south, they decided to hose down the crates to clean them. With his crate door propped slightly up for the hosing, one billy, no doubt sensing a chance for freedom, stuck his horns into the gap, lifted his head and the door, and dashed out onto the deck. He then ran into the *Sundance*'s galley and leaped onto the nearest

escape terrain, a counter. An effort by a biologist, originally from Texas, to bulldog the billy into submission was unsuccessful as the bulldogger found himself at a stalemate with a firm grip on the goat's horns but pinned to the galley floor with the billy's forehead pressed against his chest. The goat calmed down when a dishtowel was placed over its face and its bid for freedom ended seconds later as another biologist sedated it with M-99 (La Vern Beier, ADF&G Wildlife Technician—Southeast Alaska, personal communication, 2007). Following their flight to Oregon, the goats were released both in the Elkhorn refuge and in Wallowa–Whitman National Forest (Young et al. 1988).

Roosevelt elk were captured in corral type traps at Jewel Meadows in Oregon on 2 different occasions in January 1987. The first group of 22 elk were shipped by truck to Seattle. All had ear-tags and collars for easy visual identification. Fifteen also had radio collars. During the 8-hour trip one cow became overly stressed and had to be killed. The trucks were loaded onto an Alaska Marine Highway ferry and reached Ketchikan 40 hours later. Water and hay were available to the elk at all times. They hyperventilated and overheated each time strangers approached the vehicles. At those times, spraying them with water calmed them. Burlap hung on the truck sides to screen them from people also helped calm them (Young et al. 1988).

In Ketchikan the trucks were loaded onto a landing craft and the next day, 19 January, they were taken to Dewey Anchorage on southwest Etolin Island (Fig. 12). Reluctant to leave the trucks which had been their home for 3 days, the elk had to be encouraged with electric cattle prods. No elk were injured during the unloading and all appeared to be in good condition; however, several took to the water and began to swim away from the island. Staff in skiffs herded them ashore (Young et al. 1988).

An additional 13 cows were captured at Jewel Meadows in late January using darts with the drug carfentanil because corral trapping was not successful. The elk were ear-tagged and collared before the antagonists Nalaxone or Narcan were administered. One elk had to be euthanized when the effects of carfentanil could not be reversed by the antidotes. The remaining 12 elk were shipped as before by truck, ferry, and landing craft to Dewey Anchorage. They were released without incident on 3 February. Altogether, 33 Roosevelt elk from Jewel Meadows were released on Etolin, satisfying the conditions of the 1985 legislative act.

In early March 1987, 19 Rocky Mountain elk were trapped on the Elkhorn Wildlife Refuge. Most were subadults which were more easily trapped. Fourteen of the elk received radio collars. One female calf broke a leg while being loaded into a truck and had to be euthanized. The truck, ferry, and landing craft journey culminated in a release at Johnson Cove on northwest Etolin Island on 15 March 1987. Another calf broke a leg during unloading and had to be killed (Young et al. 1988).

In all, 50 elk (33 Roosevelt and 17 Rocky Mountain) were transplanted on Etolin in 1987. As with other transplants, significant volunteer help made the operation possible. Most notable of the volunteers were members of the Ketchikan Sports and Wildlife Club and staff from USFS and Oregon Department of Fish and Wildlife. Landing craft and crews were donated by Panhandle Rigging, Inc. and the Alaska National Guard (Young et al. 1988).

The transplanted populations faired poorly at first. Over 50 aerial fixed-wing surveys were flown in the first 18 months after the transplants and a comprehensive ground survey was done in June 1988. They revealed that two-thirds of the transplanted elk had died. An estimated 20 elk (6 Rocky Mountain and 14 Roosevelt), including 3 young that were born on the island, were alive in June 1988. Of the 18 elk carcasses found before June 1988, 8 were certain or probable wolf kills, 3 deaths were attributed to accidents, 2 to malnutrition, 1 to a twisted gut, 1 to a bear kill, and 3 to unknown causes. Once more in Southeast Alaska, the outlook appeared grim for the transplant's success (Land and James 1989).

However, no further mortalities of radiocollared elk were documented between May 1988 and June 1991. A small group of Rocky Mountain elk had dispersed to Zarembo Island (2 miles [3 km] away at its closest point) by summer of 1991. Recruitment improved in both subspecies and the total population was estimated to have rebounded back to 50, the number originally transplanted (Land 1992).

By 1993 the estimated population was 100–150 animals. With the success of the transplant now evident, the state legislature debated a bill to move elk to other areas of Southeast Alaska. Biologists' concerns about the effect of elk on the native Sitka black-tailed deer populations through competition for food and disease transmission (ADF&G 1993) and opposition from the Board of Game and people who lived near some of the proposed transplant areas contributed to the bill's failure.

In 1996 the Board of Game approved a hunting season and the Alaska Legislature passed a bill allowing the department to donate 4 elk harvest permits per year to nonprofit hunting and fishing organizations for auctions or raffles. Elk were first hunted on Etolin during fall 1997 under drawing permits issued for a 1-month, 1-bull season in October.

Despite the success of the transplant, agency managers have had a somewhat uneasy relationship with elk in the region. The propensity for Rocky Mountain elk to disperse readily to other islands rang alarm bells that the elk were perhaps initiating additional transplants on their own to places not altogether desirable or suitable. Over the years, unsubstantiated sightings of elk have been reported on Farm Island at the mouth of the Stikine River, Deer Island, Cleveland Peninsula, Wrangell Island, and Prince of Wales Island. A radiocollared cow elk was documented to have traveled from south Etolin Island to Farm Island at the mouth of the Stikine River in 1993 (Doug Larsen, former Area Wildlife Biologist—Ketchikan, personal communication, 2008). Confirmed elk populations have been established on Shrubby and Brushy islands between Zarembo and Prince of Wales. A department study in the late 1990s found evidence that elk and Sitka black-tailed deer depend on many of the same foods in Southeast Alaska (Kirchhoff and Larsen 1998). Concerns about competition between the introduced elk and native deer led the Board of Game to issue unanimous resolutions on elk management in Region I (Southeast Alaska) in 1993 and 1998 that found deer to be the most important ungulate for human consumption in Southeast Alaska, opposed additional elk transplants, and charged the department to restrict elk to islands with established populations until the effects of elk in the region have been fully evaluated (Alaska Board of Game 1993, 1998). The board asked the department to survey the public and produce a management plan for elk.

A draft management plan was distributed in May 1999 which called for managing for hunting opportunity on Etolin and Zarembo islands but keeping the population below carrying capacity to limit dispersal to other islands and the mainland and minimizing elk numbers in the remainder of Southeast Alaska (ADF&G 1999). Although the plan was not formally finalized, the ADF&G management through 2007 closely followed its recommendations.

For 1997, the first year of elk hunting in Southeast Alaska, the ADF&G issued 27 drawing permits and 2 raffle permits for a 1-bull-only bag limit and a 1-month season 1–31 October in an area encompassing Etolin and Zarembo islands and neighboring small islands. Two years later, a separate archery-only season was established during the last half of September. As the elk population and concerns over elk dispersal to other islands grew and the number of elk harvested did not meet expectations, the Board of Game increased the number of permits allowed to be issued. Beginning in 2001, a 4-month-long either-sex season was established in the areas surrounding the Etolin–Zarembo permit area to try to forestall elk herds becoming established elsewhere. By 2007 on Etolin and Zarembo there were 2 separate 2-week-long drawing hunts for firearms and 1-month-long drawing hunt for archery. In addition, a late season registration hunt was held the last 2 weeks of November (Lowell 2006).

Through 2004, 103 elk had been harvested in the 8 years of the hunt, with 6 of those taken during the special archery seasons. Hunters' success rates have been low with the overall harvest rate well below what is sustainable. Over 300 permits were issued in 2003 and 2004 with only 20 elk taken in that period. The hunt is considered extremely difficult with challenging logistics. The population was estimated to be 350–450 elk in 2006; 75–100 on Zarembo Island and the rest on Etolin (Lowell 2006).

The Etolin transplant was a notable success in terms of establishing a new big game species in the region. The inaccessibility of the elk to hunters and the ongoing concerns about elk competition with deer may ultimately temper the magnitude of that success.

References – Elk

Alaska Board of Game. 1993. Resolution on elk in Southeast. Resolution 93-67-BOG. Juneau, Alaska. 1pp.

_____. 1998. Findings on elk management in Region 1. Resolution 98-128-BOG. Juneau, Alaska. 2pp.

Alaska Game Commission. Annual Reports, 1925 to 1937. Juneau, Alaska. Mimeo.

Alaska Department of Fish and Game. 1985. Biological feasibility of transplanting elk in Southeast Alaska. Juneau, Alaska. 19pp.

_____. 1986. Social aspects of a proposed elk transplant program in Southeast Alaska. Division of Subsistence. Douglas, Alaska. 8pp.

_____. 1993. The introduction of elk to Southeast Alaska: an assessment and annotated elk bibliography. Division of Wildlife Conservation. Region I. Douglas, Alaska. 23pp.

_____. 1999. Draft Southeast Elk Management Plan. Division of Wildlife Conservation. Juneau, Alaska. 8pp.

ALEXANDER, J. E. 1973. Seasonal movements of elk. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Final Report. 37pp.

ANDERSON, D. 1991. Purchase of otters. Alaska Department of Fish and Game. Division of Wildlife Conservation unpublished memorandum to D. Kelleyhouse, Director. 3 July. 1 p.

BATCHELOR, R. F. 1965. The Roosevelt elk in Alaska—its ecology and management. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration. Final Report. 37pp.

_____ AND H. R. MERRIAM. 1963. Game introductions. Alaska Dept. of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-6-R-4, Juneau, Alaska.

BURRIS, O. E. 1964. Alaska wildlife stocking. Alaska Dept. of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Project W-11-D-1, Juneau, Alaska.

BURRIS, O. E. AND D. E. MCKNIGHT. 1973. Game Transplants in Alaska. Wildlife Technical Bulletin No. 4. Alaska Department of Fish and Game. Juneau, Alaska. 57pp.

ELKINS, W. A. AND U. C. NELSON. 1954. Wildlife introductions and transplants in Alaska. Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

GRIFFIN, W. H. AND J. E. ALEXANDER. 1969. Bison and elk studies. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Projects W-13-R-3 and W-17-1, Juneau, Alaska.

KIRCHHOFF, M. D. AND D. N. LARSEN. 1998. Dietary overlap between native Sitka black-tailed deer and introduced elk in Southeast Alaska. Journal of Wildlife Management 62(1):236–242.

LAND, C. R. AND D. JAMES. 1989. Unit 3 elk survey-inventory progress report 1 July 1987–30 June 1988. Pages 1–10 *in* S. Morgan, editor. Annual report of survey and inventory activities. Volume XIX, Part III. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Proj. W-23-1, Study 13.0. Juneau, Alaska. 22pp.

LAND, C. R. 1992. Unit 3 elk management report Pages 1–5 *in* S. Abbott, editor. Elk survey-inventory management report 1 July 1989–30 June 1991. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Projects W-23-3 and W-23-4. Study 13.0. Juneau, Alaska.

LOWELL, R. 2006. Unit 3 elk management report. Pages 1–10 *in* P. Harper, editor. Elk management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 13.0. Juneau, Alaska.

USDA FOREST SERVICE. 1986. Environmental Assessment, Decision Notice and Finding of No Significant Impact: Proposed elk transplant to Southeast Alaska. Stikine and Ketchikan Areas, Tongass National Forest. Ketchikan, Alaska. 16pp.

VAN DAELE, L. J. 2000. Unit 8 elk management report. Pages 6–8 *in* M. Hicks, editor. Elk management report of survey and inventory activities 1 July 1997–30 June 1999. Alaska Department o f Fish and Game. Project 13.0. Juneau, Alaska.

_____. 2006. Unit 8 elk management report. Pages 11–24 *in* P. Harper, editor. Elk management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 13.0. Juneau, Alaska.

YOUNG, E. L. 1986. Elk transplant release site selection, anticipated habitat suitability, and anticipated use by elk on Etolin Island in Southeast Alaska. Elk report No. 1 to the U.S.D.A. Forest Service. Alaska Department of Fish and Game. Juneau, Alaska. 23pp.

YOUNG, E. L., C. R. LAND, AND R. E. WOOD. 1988. Documentation of the 1987 elk release on Etolin Island in Southeast Alaska. Elk report No. 2 to the U.S.D.A. Forest Service. Alaska Department of Fish and Game, Game Division, Region I. Juneau, Alaska. 12pp. with Appendices.

BISON

Plains Bison

Delta – 1928

Alaska's Plains bison (*Bison bison bison*) population stems from an initial transplant in June 1928. The project to transplant bison to Interior Alaska was an alternate proposal to appease Alaska citizens who had voiced an interest in having deer and elk transplanted to the Interior (Alaska Game Commission 1929). The U. S. Bureau of Biological Survey, as administrators of the National Bison Range at Moiese, Montana, agreed to ship bison to Alaska, charging only for crating and handling (Alaska Game Commission 1929). Twenty-three bison (6 males and 17 females) were shipped about the middle of June and arrived 27 June 1928 at College, Alaska (Elkins and Nelson 1954). Nineteen of the animals were released near McCarty (now Delta Junction) in June 1928 and 3 were held at the University of Alaska and released in June 1930 (Elkins and Nelson 1954). Two bison died after being released at McCarty and another died at the University (Palmer 1935).

Photo courtesy U.S. Army

FIGURE 13. Plains bison arrive in Alaska from Montana in 1928.

The Delta herd, from which all other Alaska plains bison herds originated, was obtained from the National Bison Range in Montana before introgression of cattle genes into that herd. Thus, Alaska plains bison, particularly the isolated Farewell herd (see below), are among the relatively small number of herds of genetically pure plains bison (ADF&G 2007 pp. 5–6).

The population grew rapidly and limited harvests were permitted in 1951, 1952, and 1953 by the U. S. Fish and Wildlife Service (Elkins and Nelson 1954). Drawing permit hunts were begun in 1961 after statehood and have been held annually since 1968. Delta bison hunts have been extremely popular. In the 1960s, 2,000 applications were received for the 20 permits available. Since 1987, the number of available permits ranged from 40 to 135, depending on herd size and hunter success rate. The number of applicants has been as high as 17,895 (1996) and averaged over 15,000 a year in the decade since 1997. Hunter harvest since 1987 has ranged from 38 bison to more than 100 in some years (Dubois 2006).

Hunting is used to manage the size of the herd (Dubois 1994, 2006). Since the late 1980s the population objective has been to maintain the herd at approximately 360 bison before calving (Dubois 1990). The prehunt population in that time has averaged between 400 and 500 bison. A formal Delta Bison Management Plan, developed in the early 1990s with public involvement and periodically updated, guides management and sets population and other objectives (Dubois 1994).

Photo courtesy U.S. Army

FIGURE 14. A cow that had collapsed and then been revived upon arrival in Alaska in 1928 chases one man (R. A Perkins) up a tree while another (E. B. Collins) backs off.

Shortly after their arrival in 1928, the bison established a pattern of range use and movements. The herd spent summers in the Delta River riparian areas and moved into open forests in the fall. Later in the winter they slowly moved back toward the river (ADF&G 1980). Beginning in the 1950s and in the decade following statehood, small farms and then larger agriculture developments were established on tall grass and sedge meadows of the bison's winter range and the herd began grazing on field crops in the fall and winter (ADF&G 1980). In 1976 a state policy made agricultural development the chief priority of the area and large land disposals for private farming known as the Delta Agricultural Project (DAP) began in the heart of the herd's range in 1978. This greatly complicated management of the herd.

Photo by Stephen DuBois, ©2008 ADF&G

FIGURE 15. A bull of the Delta plains bison herd in September 2008

Inevitably, bison came into conflict with farmers as they started feeding on the vast new croplands before fall harvest. In an effort to reduce the conflict and still keep a free-ranging bison herd, the Alaska Legislature in 1979 established the Delta Junction Bison Range (DJBR) south of the Alaska Highway and next to the DAP. The goal was to divert bison from the DAP fields to new winter range on the 90,000 acres of the DJBR. To make the new range more attractive to bison the Alaska Legislature appropriated funds beginning in 1984 to develop and maintain bison forage crops and grassland. The effort was a success and crop damage to farms was significantly reduced (although not totally eliminated) as soon as the bison range fields began producing forage in 1985. By 2006, 2,800 acres were cleared and producing forage annually on the DJBR (Dubois 2006).

Further complicating bison management, some of the forage intended to attract bison on the DJBR also attracts moose from the surrounding area. An influx of moose hunters disrupted forage management on the bison range, and so in 2002 the Bison Range Youth Hunt Management Area was established to regulate moose hunting on almost 7,000 acres of the DJBR (Dubois 2006). The Delta Bison Working Group, with membership made up of both private citizens and staff from agencies, meets regularly to advise the department on the many management issues associated with the herd (Dubois 1994, 2006).

Successful management of the habitat and range of the Delta bison transplant has become a complicated and expensive undertaking. But the 1928 transplant ultimately produced a stable population that has been a source for 3 other bison transplants in Alaska and that has sustained a popular hunt for 40 years.

Copper River – 1950

In 1950 the U. S. Fish and Wildlife Service conducted the first transplant of bison from the Delta area (Nelson 1950). Procedures used to capture the bison were similar to those employed in other parts of North America. A sturdy corral was constructed and the animals were herded into the enclosure. The bison were then crated, loaded on trucks, and transported to the release site at Slana in the Copper River Valley. In this transplant effort, 17 bison (5 males and 12 females) were released in several separate groups.

Moving south of their release point, eventually the Copper River bison settled on range bounded by the Dadina River on the north, the Copper River on the west, the Kotsina River on the south, and the Wrangell Mountains on the east. A few bison began to cross to the west side of the Copper River in the 1990s to graze in hay and crop fields in the community of Kenny Lake.

The herd slowly increased to a high of about 119 animals in 1970. The population was relatively stable through the 1970s and 1980s until 1988 when it began to decline (Tobey 1992). A low of 64 bison was reached in 1995. Between 1996 and 2006 however, the herd grew steadily to an estimated 125 animals, a record high. As early as 1976, ADF&G biologists recognized that the optimum overwintering population for the range available to the Copper River herd was 60 bison (McIlroy 1976), and that remains the objective. However, achieving a hunter harvest high enough to reach the objective is difficult (Tobey 2006a).

Hunting of Copper River bison began in 1964 and continued through 1988 except for 6 years (2 each decade) when season closures occurred. During that period, hunting was managed under a registration permit, but hunting conditions were poor with a short season and hunters crowded into a small accessible hunt area. Harvest quotas were reached in 1 to 3 days and emergency closures to the season were common.

A severe winter with 7 months of persistent deep snow in 1989 caused starvation and poor calf survival. Hunting was closed and recovery of the herd was slow. When hunting was resumed in 1999 after a 10-year hiatus it was with a drawing permit hunt allowing a long season (1 September–31 March) and a more relaxed hunting atmosphere for the permit holders. As a consequence, hunter interest grew to the point that 1,283 people applied for the 24 permits available in 2004. Twelve permits were issued during 1999–2001, 20 permits during 2002–2003, and 24 permits during 2004–2006. Harvests averaged 7 bison a year from 1999 through 2006 (Tobey 2006a). The population is large enough to warrant issuing more permits annually, but numbers have been kept low to avoid trespass problems on private lands closed to hunting (Tobey 2006a).

Given the small amount of range available, the Copper River bison herd seemed in 2006 to be faring well, supporting a small but consistent harvest for most of the previous decade. Managers were concerned however, that unless hunter take increased and the herd size was reduced significantly, a large die-off during the next long winter with deep snow was inevitable (Tobey 2006a).

Chitina – 1962

In 1962 the Alaska Department of Fish and Game attempted to extend the range of the Copper River bison herd by planting animals in the Chitina River drainage (Burris, personal files). Bison were captured at Fort Greely and transported by air to May Creek, an airstrip near the Chitina River. Thirty-nine were shipped; 4 died en route, and several succumbed during the first winter, which was unusually severe. The population dropped to as low as 16 during the first decade and managers did not expect a huntable population would ever materialize. But the herd grew to an estimated 56 bison in 1985 before declining again to a low of 30 in 1989. During 1989–1995 the number of bison remained in the low 30s. It grew gradually during 1999–2004 to a high of 50. The management objective from the late 1980s to 2006 was to maintain a minimum of 50 overwintering adult bison (Tobey 1990, 2006b).

The Chitina bison herd chiefly uses the riparian areas along a 40-mile (64-km) stretch of the upper Chitina River valley, typically between the Tana River and Barnard Glacier. Deep-snow winters resulting in starvation are the primary cause of periodic high natural mortality and poor recruitment in the herd. A 1984 habitat study by the National Park Service found that a population of 50 bison did not appear to damage the available forage on the range. However,

Photo courtesy U.S. Army

Figure 16. A Delta bison is run through a chute for transport loading and introduction elsewhere in Alaska, perhaps as part of the Chitina area transplant in 1962.

since the early 1990s, flooding and river channel changes have reduced the amount of high quality habitat available to the herd, probably making the population objective hard to attain until new forage colonizes the riparian areas (Tobey 2006b).

A drawing permit hunt for Chitina bison was held beginning in 1976 through 1988. An average of 4 bison a year was taken during that period. As with the Copper River herd, hunting was suspended during 1989–1998 because of low numbers. Hunting resumed in 1999 with a bulls-only season. One to 2 were taken a year until hunting was closed by emergency order in 2004 after starvation from a deep snow winter reduced the population from 50 to 25 bison. The 2005 aerial census found 35 bison, suggesting the herd was on the rebound (Tobey 2006b).

Farewell – 1965, 1968

The Farewell Lake bison herd is the result of 2 separate transplants. During the first, on 10 and 11 August 1965, 18 bison (5 males and 13 females) were trapped on the Fort Greely Army Reservation, crated, and flown by C-123 aircraft furnished by the Air National Guard to the Farewell airstrip. The second transplant to the Farewell area was conducted 14 and 15 August 1968 (Griffin and Alexander 1969). This introduction consisted of 12 cows and 8 bulls. Procedures followed were the same as those employed in the 1965 operation.

Bison flourished on the new range from the beginning. Initially the herd used mainly the riparian areas of the South Fork of the Kuskokwim River. Although the original carrying capacity of the Farewell bison range was estimated to be 80–90 animals, the Bear Creek (also called Farewell) forest fire occurred in 1977, adding new high-quality grass and sedge forage to the range within the burn area. The herd soon exceeded the initial estimated range capacity. In summer, groups of bison travel upstream on the Kuskokwim to the headwaters of the South Fork Kuskokwim, Hartman, Stony, and Happy rivers (Boudreau 2000).

From the original 38 transplanted bison the herd grew rapidly to nearly 80 animals when the first hunt was held in 1972. The first year's harvest was 11 animals (10 bulls and 1 cow). No hunt was held in 1973, but hunting has occurred each year since under a drawing hunt, except 1979 (registration hunt) and 1984 (Tier II hunt). The number of permits issued each year has ranged from 20 to 80, depending on the population size.

Like the Delta bison hunt, the Farewell hunt is popular. The number of applications for the 40 drawing permits issued in 2004 was 615 for the 20 fall permits and 1,102 for the 20 spring permits (Roger Seavoy, ADF&G Area Wildlife Biologist—McGrath, personal communication, 2008). In March 1990 the first spring bison hunt was held, and fall and spring seasons were still in place in 2006. Beginning in 1998, one bowhunting permit, called the "Governor's Permit," has been issued each year to the Alaska Bowhunters Association for auction. Proceeds are split 10% to 90% between the organization and the department, respectively. Winning bids have ranged from $8,100 to $3,500.

The herd reached an estimated high of 350 bison in 1999 and remained at or near that level through 2003. A spring 2006 survey revealed only 94 animals, however, and the population was estimated to be only about 100 at that time (Parker McNeill 2006). It was not known

whether the lower estimate was due to a population decrease or to survey error. Actual decrease could be a result of habitat senescence, particularly in the Bear Creek/Farewell burn, or to wolf predation. Both are occurring, but the extent to which each affects the herd is not known. On the other hand, some Farewell bison may be expanding their range into unsurveyed areas and thus may not be counted in population assessments. A more reliable population estimate will require more radio collars and other survey resources not available at the time (R. Seavoy, personal communication, 2008).

Certainty about the population size would alleviate concerns about maintaining genetic diversity. The isolated Farewell herd may be the most genetically pure plains bison population in the state, with no domestic cattle incursions in the genome (see section on Delta herd above). Minimum population requirements for preserving a healthy genetic variability range from 300 to 500 animals (R. Seavoy, personal communication, 2008).

In 2006 herd objectives were to maintain a minimum population of 300 bison and an annual hunting harvest of up to 40. Habitat assessments in the 1990s suggested unused range still existed. Federal and state land management agencies have also developed burn plans for prescribed fires in the area designed to increase forage for bison and other ungulates. However, favorable weather conditions for implementing the burns had not occurred by 2008 (Parker McNeill 2006).

Photo by Bob Sutherland, © ADF&G

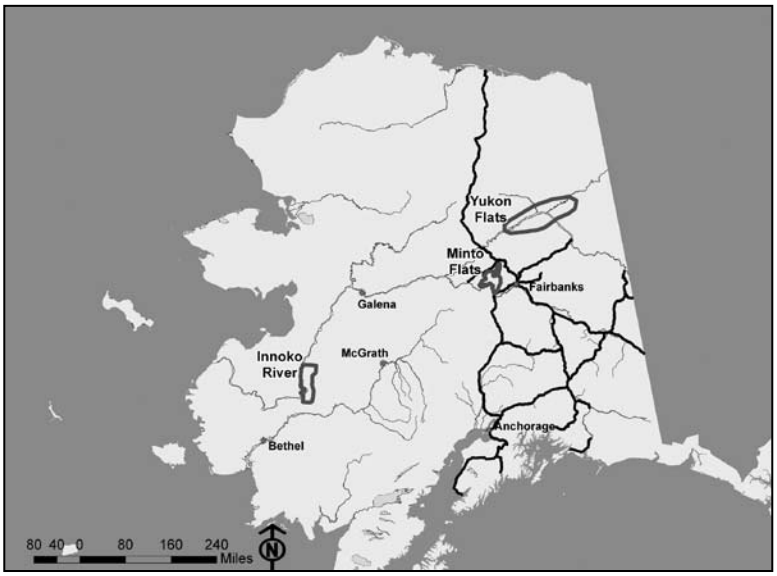
FIGURE 17. Three wood bison cows and a calf at the Alaska Wildlife Conservation Center near Portage, Alaska. These animals are among approximately 80 wood bison that have been relocated to Alaska from Canada and are in quarantine awaiting release to the wild.

Wood Bison

Although a transplant had yet to occur, by 2009 ADF&G had spent 15 years investigating and eventually championing a proposal to reintroduce wood bison (*Bison bison athabascae*) to the state. Wood bison had ranged throughout Interior Alaska for thousands of years before being extirpated in Alaska sometime in the last few hundred years. Archaeological evidence and Athabascan oral history confirm the former presence of wood bison and their importance as a food source for Interior Alaska Native people (Stephenson et al. 2001, ADF&G 2007). Another species which had been extirpated in Alaska, muskox, was successfully reintroduced to Alaska 70 years ago (see page 55).

Over 4,000 healthy free-ranging wood bison lived in Canada in 2007, where they were listed as a threatened species under Canadian law. ADF&G is convinced restoring wood bison to Alaska would increase the worldwide population of the species, contributing to wildlife conservation and ecosystem restoration. The department's stated goal with the transplant is to "Restore wood bison populations to their former habitat in Alaska so they are again an integral part of Alaska's wildlife, providing Alaskans and others the opportunity to enjoy, and benefit from, this ecologically important northern animal" (ADF&G 2007). Eventually, once populations reach sufficient size, hunting of wood bison will be permitted.

Extensive habitat assessment projects (Berger et al. 1995, Gardner 2007) identified 3 areas with suitable habitat for populations of at least 400 bison. The 1995 study found the Yukon Flats area could support at least 2,000 bison and it became the preferred location of the department for a transplant. However, in 1997 the U.S. Fish and Wildlife Service (USFWS) became uncertain about whether a transplant would be compatible with the purposes of the Yukon Flats National Wildlife Refuge (Yukon Flats NWR). This set back progress on the project several years and prompted ADF&G to seek other possible transplant sites. Gardner (2007) subsequently found that two study areas (Fig. 18), Minto Flats and the lower Innoko/Yukon River, were suitable and could support at least 500 and 400 bison, respectively. By 2007 the USFWS still preferred that ADF&G use lands outside of Yukon Flats NWR for the reintroduction but did not object to a proposal to reintroduce bison to private lands on the Yukon Flats (ADF&G 2007). In 2009 the USFWS agreed to work cooperatively with ADF&G to develop special regulations under the Endangered Species Act



ADF&G

FIGURE 18. Yukon Flats, Minto Flats, and lower Innoko/Yukon River study areas have been found suitable for wood bison transplant.

(ESA) to designate wood bison in Alaska as a "non-essential-experimental population." This designation would reduce potential restrictions on other land uses due to the ESA, provide greater flexibility in state mangement of wood bison, and allow harvest in the future once populations have grown and are prospering.

A public advisory group was established in 2005 to review issues and advise the department in a public forum. The Wood Bison Restoration Advisory Group recommended the department continue to consider all three sites under review for wood bison restoration. In April 2007 the department released the report *Wood Bison Restoration in Alaska: A Review of Environmental and Regulatory Issues and Proposed Decisions for Project Implementation* (ADF&G 2007). The department conducted a review of wood bison restoration as required by the Wildlife Transplant Policy (WTP) of ADF&G's Division of Wildlife Conservation (DWC) (See Appendix B). That review concluded that wood bison restoration is not likely to cause a significant reduction in the range, distribution, habitat, or preexisting human use of other wildlife species.

Photo by Bob Sutherland, ©2008 ADF&G

FIGURE 19. ADF&G veterinarian Dr. Kimberlee Beckmen draws a blood sample for disease testing from a wood bison at the Alaska Wildlife Conservation Center in March 2008.

The findings of the WTP review committee and the Environmental Review (ER) were available for public review and comment through September 2007. The Director of DWC issued a Notice of Decision of the ER and findings of the WTP review committee in December 2007 and concluded strong public support existed for wood bison restoration in Alaska. He directed staff to proceed with efforts to import wood bison from Canada, initiate cooperative planning for wood bison restoration on Minto Flats and proceed with consideration of wood bison restoration on Yukon Flats and the lower Innoko/Yukon River area as expeditiously as possible.

Already, in preparation for a transplant, 33 wood bison were being held in the state at the Alaska Wildlife Conservation Center (AWCC) near Portage under a cooperative agreement between ADF&G and AWCC (Fig. 17). In June 2008, 53 additional wood bison were imported to Alaska and brought to the AWCC from Elk Island National Park in Canada. Wood bison were to be held at AWCC for 1 to 2 years for disease testing and observation before transporting them to the release sites (Fig. 19). During this time ADF&G planned to work on developing cooperative implementation and management plans for specific release sites and work with USFWS to develop the special regulations designating wood bison in Alaska as "non-essential-experimental populations."

The preferred approach for the transplant is to release 40–50 wood bison on private lands near a local community with the expectation that the animals would soon expand onto other suitable range in the area. The earliest possible date for the initial release is spring 2010. Detailed descriptions of the expected effects, logistics, and holding areas for the transplant are included in the environmental review (ADF&G 2007).

References – Bison

ALASKA DEPARTMENT OF FISH AND GAME. 1980. The American bison in Alaska. Game Division report. Juneau, Alaska. 13pp.

_____. 2007. Wood bison restoration in Alaska: A review of environmental and regulatory issues and proposed decisions for project implementation. Division of Wildlife Conservation. Fairbanks, Alaska. 191pp.

ALASKA GAME COMMISSION. Annual Reports, 1925 to 1937. Juneau, Alaska. Mimeo.

BERGER, M., R. O. STEPHENSON, P. KARCZMARCZYK, AND C. C. GATES. 1995. Habitat inventory of the Yukon Flats as potential wood bison range. Alaska Department of Fish and Game, Fairbanks, Alaska.

BOUDREAU, T.A. 2000. Unit 19 bison management report. Pages 15–25 *in* M. Hicks, editor. Bison management report of survey and inventory activities 1 July 1997–30 June 2000. Alaska Department of Fish and Game. Juneau, Alaska, USA.

DUBOIS, S. D. 1990. Unit 20D. Pages 23–34 *in* S.O. Morgan, editor. Bison annual report of survey-inventory activities. Part I. Volume XX. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Project W-23-2. Study 9.0. Juneau, Alaska.

_____. 1994. Unit 20D bison management report. Pages 26–51 *in* M. V. Hicks, editor. Bison survey-inventory management report 1 July 1991–30 June 1993. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-23-5 and W-24-1. Study 9.0. Juneau. Alaska.

_____. 2006. Unit 20D bison management report. Pages 30–68 *in* P. Harper, editor. Bison management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 9.0. Juneau, Alaska, USA.

ELKINS, W. A. AND U. C. NELSON. 1954. Wildlife introductions and transplants in Alaska. Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

GARDNER, C. L. 2007. Habitat assessment of potential wood bison restoration sites in Alaska. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration annual research performance report. Grant W-33-2. Project 9.10. Juneau, Alaska.

GRIFFIN, W. H. AND J. E. ALEXANDER. 1969. Bison and elk studies. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration progress report. Projects W-13-R-3 and W-17-1, Juneau, Alaska.

MCILROY, C. 1976. Bison Game Management Unit 11 Copper River herd. Pages 84–94 *in* D.E. McKnight, editor. Annual report of survey-inventory activities. Part I. Deer, sheep, bison, mountain goat, elk, and muskoxen. Volume VI. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Project W-17-7, Jobs No. 2, 6, 9, 12, 13, 16 and 22. Juneau, Alaska.

NELSON, U. C. 1950. Quarterly progress report-surveys and investigations. Federal Aid in Wildlife Restoration. Project 3-R-5, Alaska. Vol. 5, No. 1.

PALMER, L. J. 1935. Letter to chief, Biological Survey. Washington, D. C.

PARKER MCNEILL, D.I. 2006. Unit 19 bison management report. Pages 17–29 *in* P. Harper, editor. Bison management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 9.0. Juneau, Alaska, USA.

STEPHENSON, R. O, S. C. GERLACH, R. D. GUTHRIE, C. R. HARINGTON, R. O. MILLS AND G. HARE. 2001.Wood bison in late Holocene Alaska and adjacent Canada: paleontological, archaeological and historical records. Wildlife and People in Northern North America. Essays in Honor of R. Dale Guthrie. S. C. Gerlach and M. S. Murray, editors. British Archaeological Reports, International Series 944.

TOBEY, R. W. 1990. Game management unit 11. Chitina River. Pages 1–6 *in* S. Morgan, editor. Bison. Annual report of survey-inventory activities 1 July 1988–30 June 1989. Vol. XX, Part I. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Project W-23-2. Study 9.0. Juneau, Alaska.

_____. 1992. Unit 11 Copper River management report. Pages 1–6 *in* S. M. Abbott, editor. Bison survey and inventory management report 1 July 1989–30 June 1991. Alaska Department of Fish and Game. Projects W-23-3 and W-23-4. Study 9.0. Juneau, Alaska.

_____. 2006a. Unit 11 Copper River herd bison management report. Pages 1–8 *in* P. Harper, editor. Bison management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 9.0. Juneau, Alaska, USA.

_____. 2006b. Unit 11 Chitina River herd bison management report. Pages 9–16 *in* P. Harper, editor. Bison management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 9.0. Juneau, Alaska, USA.

Muskox

Nunivak Island – 1935 to 1936

The last of Alaska's original muskoxen (*Ovibos moschatus*) were killed about 1850–1860 (Spencer and Lensink 1970). Their reestablishment was initiated in April 1927 when the Territorial Legislature of Alaska urged Congress to appropriate money to obtain muskoxen for domestication or husbandry experiments at various locations in Alaska. In May 1930 Congress appropriated $40,000 for the procurement, shipment, and extended care of muskoxen for the Alaska project.

On 15 September 1930, 15 bull and 19 cow muskoxen from Greenland arrived in New York City (Spencer and Lensink 1970). These animals were held in quarantine from 16 September through 18 October then shipped to Seattle by rail. They went to Seward, Alaska by steamer and thence to Fairbanks by rail, arriving 5 November 1930.

All of these muskoxen were retained at the University of Alaska and, even though at least 19 calves were born, various losses reduced the herd to 31 animals prior to release (Elkins and Nelson 1954). These animals were ultimately transported to Nunivak Island and released, 4 in the summer of 1935 and 27 on 17 July 1936. This initial herd on Nunivak consisted of 18 males (12 adults, 4 two-year-olds, and 2 yearlings) and 13 females (12 adults and 1 two-year-old) (Palmer and Rouse 1963).

The herd grew slowly until about 1958, but by 1965 there were more than 500. Since then, the population has ranged between 435 and 700 animals, except for 1994, when numbers fell to about 360. That rapid decline is thought to be a result of up to 70 muskoxen drowning when they wandered onto pack ice and were carried out to sea with the spring thaw. By spring 1996, however, the precalving population had recovered to almost 500 muskoxen (Patten 1997). Because Nunivak Island is part of the National Wildlife Refuge system, a cooperative management plan was established between the Alaska Department of Fish and Game and the U. S. Fish and Wildlife Service. The plan calls for maintaining a population of between 500 and 550 muskoxen on Nunivak. Aerial surveys have found muskoxen evenly distributed on the 4,200 km^2 island (Hughes and Perry 2007).

The Nunivak Island muskox transplant is one of the most successful wildlife transplants undertaken in the state. Over the years the Nunivak muskox population has been productive and stable. Besides being the source population for additional muskoxen transplants in the state, the Nunivak population has also supported a substantial annual harvest for hunters.

The first hunting season was in 1975. Drawing permit hunts have been used to regulate the bull harvest each year since and are distributed through a statewide drawing. In 1980 a registration hunt for cows was started. A limited number of cow permits are issued in Bethel and Mekoryuk each year. A maximum of 45 bull permits and 45 cow permits were issued annually between 1999 and 2006. In 2005, the Board of Game gave the department authority to issue up to 60

bull and 60 cow permits a year, effective for the 2006–2007 season. During 1999 through 2005 the annual harvest was near 90 muskoxen. Almost all hunters have been Alaska residents.

Nelson Island – 1967 to 1968

In 1967, a pilot program was initiated to develop procedures for transplanting muskoxen from Nunivak Island to other locations (Alexander et al. 1968). The objective of this program was to make an experimental release of up to 30 animals on Nelson Island, which is located across Etolin Strait from Nunivak. Personnel on the project included employees from the Alaska Department of Fish and Game, U. S. Bureau of Land Management, and U. S. Fish and Wildlife Service, plus several local residents from the village of Mekoryuk on Nunivak Island.

A Cessna 180 and a Piper PA-18 were used for reconnaissance and logistics flights and a Cessna T-50 Bushmaster was contracted to transport the muskoxen from Nunivak to Nelson Island. Because of the lack of experience in handling muskoxen, it was decided to work with yearling animals (about 10 months old) until capture procedures were perfected to the point that they could be applied to adult animals.

Snow vehicles were used to herd animals from the dune areas to flat terrain, where yearlings were separated from adult animals. A drug (succinylcholine chloride) administered with a CapChur gun was used to immobilize the young muskoxen. They were then hobbled, loaded onto a sled (Fig. 20) and towed by snowmachine to the airstrip. After being crated, they were loaded aboard the Cessna T-50 for delivery to Nelson Island. Because of inclement weather, it was necessary to hold some of the animals for a prolonged period. The muskoxen were kept hobbled in readiness for transport and as a result many became exhausted and exhibited signs of stress. When this occurred, they were released and replaced by freshly captured animals. Some muskoxen were captured by Native snowmachine drivers on their own initiative. However, most of these animals were males and were released immediately because emphasis was being placed on the capture of females.

Thirty animals were captured on Nunivak Island between 20 March and 30 March 1967 (Alexander et al. 1968). On 23–24 March, 8 muskoxen (6 males and 2 females), all yearlings, were released on Nelson Island. Of the 30 animals captured, 2 died from an overdose of drugs and 1 died from exhaustion.

During March 1968, the second step of the muskox transplant program was undertaken (Jennings 1969). For this operation, a helicopter replaced snowmachines for herding and capturing animals. The muskoxen were hazed from the dune areas by a Hiller 12E helicopter, which was also utilized to position the gunner so that suitable animals could be immobilized using drug-loaded syringes. As was the case in 1967, succinylcholine chloride was the drug used. In some instances the animal tranquilizer Tranvet® (propiopromazine hydrochloride) was used to keep the animals tractable. The drugged animals were transported by sling to a temporary runway located on the ice at Duchikthluk Bay at the south end of Nunivak Island. When 4 to 6 animals had accumulated, they were placed in plywood crates and flown by Northern Consolidated Airlines' Skyvan to Nelson Island. Between 17–20 March 1968, 15 muskoxen were transplanted: 5 yearling males, 9 yearling females, and 1 male about 2 years

old. Four fatalities occurred during the transplant, 2 from drug overdoses, and 2 when syringe needles struck vital organs.

Benefiting from a lack of large predators on Nelson Island, the herd thrived. Four calves were born to this herd during 1969 and 5 calves were observed in September 1970 when the herd numbered 20 to 30 animals (Jennings and Burris 1971). Forty-four muskoxen, 6 of which were yearlings, were observed during an aerial survey of the herd on 4 May 1973. From 1968 through 1981 the herd grew at an average rate of 22% a year to about 200 animals (Smith 1984).

Photo by L. B. Jennings

FIGURE 20. An immobilized muskox is lashed to a sled in preparation for the trip to an airstrip on Nunivak Island.

Muskoxen hunting was introduced in 1980, as the optimum precalving population was estimated to be 200–250. An average of 25 muskoxen were killed by hunters annually on Nelson during the first 3 years of the hunt. The hunt has always been managed by registration permit issued on a first-come, first-served basis from local villages. Almost all those receiving permits have successfully harvested muskoxen. From 1984 through 1994, 30 permits were issued annually. When the 1994 population was estimated at 149 animals hunting was suspended for 2 years.

The Nelson Island Muskox Herd Cooperative Management Plan was drafted and implemented in 1995. It calls for maintaining a minimum population of 250 muskoxen. Hunting was resumed in 1997 but suspended for one year in 2001 when a population survey revealed numbers below the 250 animal threshold, probably due to emigration of muskoxen off Nelson Island (only shallow waters separate it from mainland Southwest Alaska) and some illegal harvest. The maximum number of permits issued was increased from 30 to 42 at the beginning of the 2002 season. Annual harvest for the next 3 years ranged 35–40 muskoxen. The 2004 population was estimated to be 318 (Hughes and Perry 2007).

The transplanted Nelson Island muskox herd has been thriving for over 40 years. For all but 3 years between 1981 and 2004 the Nelson Island population has exceeded 200 animals. Despite regular emigration of animals from the island to the mainland, biologists' hopes that a viable mainland population would be established from Nelson Island migrants were unrealized as of 2007. Approximately 100 muskoxen were estimated to be on the mainland scattered in small groups in 2007. Muskox habitat in the Yukon-Kuskokwim Delta adjacent to Nelson Island is extensive, but poaching by residents of the area and muskoxen that wander back to Nelson

Island appeared to be major factors preventing a mainland population from becoming firmly established (Hughes and Perry 2007).

Mainland transplants

Muskox transplants to the Alaska mainland presented certain problems not encountered in the initial plant on Nunivak Island. Although Nunivak is relatively large (approximately 40 miles [64 km] wide and 70 miles [113 km] long), the dispersal of the transplanted animals was limited. Group cohesion and social interactions, including breeding, were therefore insured. This is not the case in the vast reaches of the Arctic. Calves transplanted without adults to such large, unconfined areas would tend to disperse widely and few groups would survive the 2 to 5 years until the animals were old enough to reproduce. The only logical approach was the transfer of adult animals, particularly cows, along with the calves.

Eastern North Slope – Barter Island/Kavik River – 1969 to 1970

Because of encouraging results from the experimental transplants to Nelson Island conducted in 1967 and 1968, a major transplant was planned for 1969 (Jennings 1970). Its objective was the reintroduction of muskoxen to historic ranges on the Arctic coast. The Camden Bay area near Barter Island was selected as the release site on the basis of previous favorable range evaluations. This transplant was a cooperative endeavor between the U. S. Fish and Wildlife Service and the Alaska Department of Fish and Game.

Photo by J. L. Hout, U.S. Fish and Wildlife Service

FIGURE 21. For the 1969 muskox transplant, yearlings were rounded up using snowmachines and lariats.

Yearlings were captured with the use of snowmachines and lariats (Fig. 21), and adult animals were drugged from a helicopter. After capture, the yearlings were placed unrestrained in a 16- by 32-foot storehouse. Adults were placed in crates and held for transport. All animals were maintained on hay and melted snow.

During the project, 71 animals were handled. Of these, 10 succumbed to drugs (succinylcholine chloride and sernylan) and 6 were released after they showed signs of distress. The high drug loss was primarily due to experimentation with different drugs and dosages and the erratic results obtained with mature bulls.

Between 25 March and 6 April 1969, 53 muskoxen were transported to the Barter Island area using Alaska National Guard C-123 aircraft. The release consisted of 27 males and 25 females. One cow died en route from Nunivak.

Shortly after the transplant, Ave Thayer, of the U. S. Fish and Wildlife Service, reported 6 additional deaths along the coastline near Barter Island. Five of these animals were autopsied. Three appeared to have died from a respiratory disorder, 1 from a broken pelvis and 1 from unknown causes. In 1971, an additional muskox carcass was recovered at Flaxman Island. Apparently the animal had died of natural causes.

The Barter Island muskoxen wandered widely and were observed from the Sadlerochit River in the western part of the Arctic Wildlife Range to Arctic Village (one was shot there by a local resident in 1969) on the south slope of the Brooks Range. At least 6 of the 52 animals released on Barter Island in 1969 moved eastward into Canada; 2 animals were observed at Shingle Point on the northern coast of Yukon Territory and 4 animals were seen a few miles from the Northwest Territories border.

According to Burris and McKnight (1973), a 1969 report from Canada tells of a local resident who shot a muskox believing it was a moose. The animal went down, but soon regained its feet and ran off through the willows. The man, never having seen a muskox, stood in awe as this great, shaggy beast crashed through the brush. Returning to his village, he related, in profound terms, how he shot the head “clean off” a moose, and the animal jumped to its feet and escaped. Following initial reports of local villagers killing muskoxen, Canadian authorities established a closed season and widely advertised the presence of straying muskoxen.

In 1970, an additional 12 animals were captured in March and held in a corral on Nunivak until June in a test to compare winter and summer transplant operations. Two animals died in the corral, but this loss was partially offset when one of the mature cows gave birth during this period. These 11 muskoxen were released at the Kavik River on the western edge of the Arctic National Wildlife Range.

The area of the transplants was within ADF&G Game Management Unit 26C (Canning River to the Canadian border). From the initial 54 animals the population grew steadily during the 1970s and 1980s. During the late 1980s and early 1990s, the population continued to grow and muskoxen dispersed eastward into Yukon, Canada, and westward into neighboring Unit 26B (Canning River to Colville River) and eastern Unit 26A. The population was considered stable

during the mid 1990s at around 500–600 muskoxen in Units 26B and 26C, with perhaps an additional 100 animals in Yukon, Canada (Lenart 2003). The population seemed well-established and widely distributed and the transplant appeared to be a success.

Hunting of muskoxen on the eastern North Slope began in 1983. For each of the first 6 years, 5 permits were issued. In 1990 North Slope muskox hunting became a Tier II hunt. In 1992 a federal subsistence hunt was initiated in Unit 26C and the state season was closed to prevent overharvesting (Lenart 1999). But hunting on state Tier II, drawing, and registration permits continued in Unit 26B. Total North Slope harvest averaged about 14 animals a year from 1990 to 2001, with a low of 5 to a high of 20 in the 2000–2001 season.

For some years, North Slope residents had expressed concerns about the growing muskox numbers having detrimental effects on caribou and caribou hunting. To address those concerns and other issues of muskox management such as hunting, ADF&G convened a management planning process in 1996 that included the North Slope Borough and affected federal agencies. The North Slope Muskox Harvest Plan was adopted and signed by all parties in February 1999. Objectives included maintaining a stable eastern North Slope population of 500–650 muskoxen; sharing population, harvest, and other information about muskoxen among users and managers; setting a maximum annual hunting harvest rate of 10% in Unit 26B; and minimizing detrimental effects of muskoxen on caribou and caribou hunting (Lenart 2001). In the years since, no detrimental effects of muskoxen on caribou or caribou hunting have been observed or reported (Lenart 2001, 2003, 2005, 2007).

Beginning in 1999, however, shortly after the plan was signed, muskox calf production, yearling recruitment, and number of adults declined rapidly in Unit 26C. The major factors influencing the decline probably were annual variation in weather affecting female body condition and winter foraging, and brown bears becoming more efficient predators. Emigration and disease may also have been factors (Lenart 2003). Muskox numbers in Unit 26B also declined beginning in 2004, although calf recruitment appeared stable. Increased predation, flooding that was known to have killed several muskoxen, and change in distribution have been suggested as reasons for the apparent decline in 26B (Lenart 2007).

The federal subsistence hunting season in 26C was closed in 2003. State registration and drawing hunts in 26B were closed in 2006 and the Tier II hunt ended in 2007. Hunting however, which had taken less than 5% of the population every year, was ruled out as a cause for the declines.

Whatever the causes, muskoxen numbers declined precipitously, from an estimated 331 in Unit 26C in 1998 to 1 animal counted in a 2006 census. The Unit 26B population dropped from 302 in 2003 to 216 in 2006 (Lenart 2007).

After 30 years of viable and growing muskox populations, success of the eastern North Slope muskox transplants seemed indisputable. But after the rapid decline in the first years of the new century, a 2005 prognosis for the introduced population suggested the "possibility that muskoxen could become scarce on the eastern North Slope in the future if present trends continue" (Lenart 2005). Research was begun in 2006 to collect detailed information on distribution, group sizes, movements, and habitat uses; investigate the role of weather; and

document frequency and causes of mortality in the hope of understanding the decline and changing management practices if necessary.

Cape Thompson – 1970

The third and final muskoxen transplant operation of 1970 occurred on 3 and 4 April, when 36 animals from Nunivak (17 males and 19 females) were flown to a frozen lagoon north of Cape Thompson on the northwest Arctic coast. Within 8 months the Cape Thompson muskoxen dispersed widely and occupied about 75% of the area that would become the core range of the population for the next 35 years (Dau 2005). By the fall after the transplant, one group of 11 animals was seen periodically near Point Hope. In addition to sightings of scattered animals throughout 1971, a herd of 13 animals was located along the Kukpuk River in September. Apparently this same group of animals, but by then numbering only 11, was observed repeatedly in 1972 in the vicinity of Iviangik Mountain and the Kukpuk River. In July 1973 these 11 animals, plus 2 calves, were observed regularly in the vicinity of Point Hope.

Cape Thompson – 1977

Another group of 34 Nunivak muskoxen (19 males, 15 females) was moved to Cape Thompson on 3 and 4 April 1977. There is little documentation of this operation and it is unknown whether the newly transplanted animals joined the Kukpuk herd. However, 46 muskoxen in 6 groups were observed 26 April 1977 near Cape Thompson, and 5 additional animals were observed in 3 groups between the community of Kivalina and the Tahinichok Mountains in September and October of that year. A 1980 census found 67 muskoxen in the Kukpuk herd and 5 more in the Mulgrave Hills. Although the number found was less than the 86 transplanted since 1970, there were 15 calves, leading biologists to conclude the transplant was successful (Quimby 1982). By 1983, at least 100 muskoxen were known to be in the Cape Thompson area – 80 in the Kukpuk herd, 9 at the cape, and 9 northeast of Cape Krusenstern (Grauvogel 1984). Grauvogel estimated that the Kukpuk herd grew at a rate of 16–21% annually from 1970 to 1982.

Throughout the late 1980s and 1990s herd growth was slow compared to growth on the nearby Seward Peninsula and a cause for concern (Ayres 1993). Dau (2005) reports that from 1970 to 1998 the Cape Thompson population grew approximately 8% annually, but from 1998 through 2004 the average growth was only 1–2%. He suggests that because the core range of the population is not expanding it may be experiencing density-dependent growth limitations. Muskox census results have ranged from 123 in 1988 to 424 in 2000. The census in February 2005 found 369 animals, only a few more than the previous year. Of the 5 areas in Alaska where muskoxen have been transplanted, the Cape Thompson transplant populations have grown the least.

It appears most muskoxen in this area have a strong preference for coastal areas, probably because high winds on the coast minimize snow depth on exposed ridges during winter. Although snow in these areas is minimal, the quantity and quality of forage appears to be limited. Muskox may also be attracted to coastal areas during summer by cooler conditions than occur inland (Dau 2001, 2003).

Slow growth delayed the onset of muskox hunting in the northwest Arctic. Hunting began under state Tier II permit during the 2000–2001 season. Six permits were issued annually through the 2006–2007 season to residents of Point Hope, Kivalina, Noatak, and Kotzebue. Over the 7 years, 13 muskoxen were harvested. In 2005 the season was closed by emergency order when 7 muskoxen (6 in one location) were found shot and abandoned (Dau 2007). Illegal harvest has long been an issue in the Cape Thompson area with many documented instances (Ayers 1993; Dau 1997, 2001, 2003, and 2005). The Federal Subsistence Board initiated a subsistence muskox hunt on Cape Krusenstern National Monument for residents of the monument during the 2005–2006 regulatory year. In 2005–2006, 1 bull was taken under this hunt, and in 2006–2007 the quota of 2 bulls was taken (Dau 2007).

As with muskoxen transplants elsewhere on the Alaska mainland, many local residents harbor resentment that muskoxen were reintroduced to the Cape Thompson area without consulting them. They also have concerns about muskoxen competing with and displacing caribou and many have felt threatened by muskoxen when they were picking berries during late summer (Ayres 1993; Dau 1997, 2007).

The Cape Thompson transplants are a biological success as of 2007, as muskoxen appear to be established throughout their available range and the population, though slow to grow, has supported several years of hunter harvests. Even so, in terms of social acceptance by residents of Kivalina and Point Hope, the success of this transplant is equivocal at best. Most residents of these communities consider muskoxen to be a nuisance or a threat. Few Inupiaq hunters participate in the Tier II hunt to harvest them–either out of disdain for their meat or an unwillingness to negotiate the paper-based drawing permit system–and carcasses of animals are found shot but unsalvaged disturbingly often.

Seward Peninsula – 1970

Following the Kavik River operation, a second major mainland transplant was conducted in March 1970, again as a cooperative effort between the U. S. Fish and Wildlife Service and the Alaska Department of Fish and Game (Jennings and Burris 1971). The drug sernylan, lariats, and heavy nets were used to capture the muskoxen. Utilizing a chartered C-119 aircraft, 36 animals (19 males and 17 females) were moved from Nunivak Island to Feather River on the Seward Peninsula (Fig. 22). Only 4 deaths occurred during this operation.

At the end of 1970 at least 28 animals from the Feather River transplant (including 2 calves born in 1970) were alive. On 3 March 1971 a herd of 21 animals, apparently part of the Feather River transplant, was seen near Brevig Mission. Later that year this herd, consisting of 4 adults, 16 two-year-olds, and 1 yearling, moved to the vicinity of the lower Nuluk River, a distance of approximately 200 km (124 mi) from the release site.

By March 1972, 2 years after the transplant, most Seward Peninsula muskoxen had formed into 2 herds totaling 22 animals; one herd in the Nuluk River drainage and one at Black Mountain near Brevig Mission (Grauvogel 1984). As most of the transplanted muskoxen were yearlings, the herds grew little in the first years. Once cows reached breeding age, however, growth was slow but steady. A survey in 1980 estimated 43 muskoxen in the Black Mountain herd

and 61 in the Nuluk River herd (Nelson 1982).

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FIGURE 22. Muskoxen are released from crates at Feather River, Seward Peninsula. Crates are arranged in a crescent to encourage muskoxen to form a herd on release.

About 14 animals at the time of the transplant did not remain with the 2 known herds but dispersed widely throughout the peninsula singly or in groups of 4 or fewer. For some years they disappeared into the landscape, their fates unknown. However, Smith (1987) found that they survived and that life in remote locations apart from a herd did not seem to be more hazardous than life within an established herd's range. Some animals left their herds, traveled considerable distances and returned, suggesting muskoxen were better navigators than previously supposed. Smith (1987) also found that herds were not as exclusive as thought and that muskoxen commonly associated with individuals outside their herd's range.

Seward Peninsula – 1981

The breeding success of the Black Mountain and Nuluk River herds from the 1970 Seward Peninsula transplant led managers to believe augmenting those populations with a supplemental transplant would be successful; so, on 24 March 1981 an additional 37 muskoxen (10 males and 27 females) were flown from Mekoryuk on Nunivak Island to an airstrip at Port Clarence (Fig. 23). Upon release from their crates, the animals were driven 13 miles [21 km] north to the vicinity of Black Mountain using snowmachines (Nelson 1982). By driving the animals, biologists hoped to keep them together and avoid them dispersing widely as singles or pairs (Grauvogel 1984). Two female muskoxen made a stand and refused to be driven (Fig. 24). Nelson (1982) also reports that upon release several muskoxen appeared to suffer from "capture myopathy" (a buildup of lactic acid in the muscle tissue) which slowed the progress of the drive and kept them from reaching the Black Mountain herd by dark. Overnight the muskoxen separated into several groups and climbed a steep, snow-covered mountain. undermining efforts to drive them farther the next day (Grauvogel 1984).

Two animals are known to have died during the capture and transplant operation. One yearling female was so incapacitated from capture myopathy that she was flown back to Nome for observation and treatment. She did not recover. Another adult female, one of those left behind who refused to be driven, apparently broke through an area of thin ice in Port Clarence during the first night after release. Her carcass was discovered frozen in the ice (Nelson 1982).

Experiences during the 1981 transplant led to recommendations about future muskox transplant operations: 1) If feasible, animals should be transported to the release site in crates rather than

attempting to herd them over long distances; 2) If that is not feasible, then they should be held in confinement for a couple of days to allow them to calm down, rest, and reabsorb excess lactic acid buildup (this might also result in the animals being more inclined to remain together as a unit during herding); and, 3) The number of herders and snowmachines should be kept to a minimum. The large number used in 1981 (although unspecified), apparently confused the muskoxen more than anything (Nelson 1982).

In 1988, the Seward Peninsula muskox census counted 527 animals. Ten years later the numbers had increased to 1,432. The 2005 census found 2,387 muskoxen in 173 discrete groups on the Seward Peninsula, an average 5.5% annual increase between 2002 and 2005. From introduction in 1970 until 2000, the population grew an average of 14% annually, and between 2000 and 2002 annual growth averaged 7% (Gorn and Persons 2007). Muskoxen have also spread east of the Seward Peninsula to colonize areas in the Nulato Hills and Selawik, Kobuk, and Yukon River drainages. Although recent censuses showed a slowing in the total population growth rate, it was not clear whether that is due to habitat limitations or other factors, like emigration off the peninsula and increased predation by bears and wolves. No habitat assessments on the Seward Peninsula had been done through 2007. Smith (1987) notes that past efforts to predict habitat carrying capacity for muskoxen underestimated the number that can be supported, the adaptability of the species to range characteristics, and their productivity in subarctic areas.

FIGURE 23. Crates containing muskoxen are unloaded from a cargo plane at Port Clarence in 1981.

With muskoxen spreading widely on the peninsula and occupying lands managed by different agencies, it became clear by the 1990s that a cooperative management structure was needed. The Seward Peninsula Muskox Cooperators Group was formed during 1992–1994 and produced a management plan (Nelson 1994). The group comprises staff from ADF&G, National Park Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, Bering Straits Native Corporation, Kawerak Inc., Reindeer Herders Association, Northwest Alaska Native Association, residents of Seward Peninsula communities, and representatives from other interested groups or organizations.

Hunting was begun in the winter of 1995–1996 under federal subsistence regulations when 14 muskoxen were taken (Machida 1997). The Alaska Board of Game designated muskoxen on the Seward Peninsula a customary and traditional use population in 1997, paving the way for a state-managed hunt. A state Tier II subsistence hunt was inaugurated in 1998 with 26 animals taken under state permit and 11 under the federal permit. Since then, harvest on the Seward

Peninsula has increased annually to 92 taken under all permits in the 2005–2006 season, and hunting regulations have been gradually liberalized (Machida 1997; Persons 1999, 2001, 2003, and 2005). A drawing hunt was instituted for the first time in 2002, allowing Alaska residents who don't qualify for subsistence to take muskoxen for meat and trophies. For the 2006–2007 season a registration hunt was approved, further liberalizing hunting opportunity on the northern peninsula. The cooperators group recommended harvest rates of up to 8% in some areas of the peninsula, but even at that, actual harvest rates in all subunits in both state and federal hunts have consistently been lower than the harvest quotas (Gorn and Persons 2007).

By most measures, the transplant and reintroduction of muskoxen to the Seward Peninsula has been quite successful. However, local residents have not always welcomed the animals. Initial and long-lingering resentment arose because local residents were not consulted before the reintroduction of muskoxen to the area. Some local residents continue to be upset by muskoxen occurring near villages and camps, where they can be frightening, and by competition between muskoxen and subsistence users for greens and berries at traditional gathering sites. Their practice of standing their ground when threatened makes muskoxen often impossible to drive away from areas they are not wanted (Persons 2005).

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FIGURE 24. A recalcitrant muskox at Port Clarence in 1981

For many years after muskoxen were introduced to the Seward Peninsula, reindeer herders complained that muskoxen compete with and displace reindeer. Eastern North Slope residents voiced similar concerns about muskoxen competing with caribou. However, habitat and diet selection studies have found that although reindeer and muskoxen often occupy the same feeding areas, they select different forage species (Ihl and Klein 2001). Muskoxen and reindeer have not been documented competing for habitat or avoiding each other, and it is not uncommon to observe reindeer and muskoxen in relaxed close proximity (Persons 2005; Gorn and Persons 2007).

Hunting has helped reduce local resentment toward muskoxen which, with their meat and the warm wool "qiviut" undercoats, are beginning to be seen as a valued subsistence species (Persons 2005). Muskox viewing on the Seward Peninsula has also grown with the population. Thanks to a relatively extensive road system for a rural Alaska area, it is one of the few places where wild muskoxen are easily accessible to local residents, tourists, photographers, and wildlife enthusiasts from around the world.

References – Muskox

ALEXANDER, J. E., W. H. GRIFFIN, AND H. WOOD. 1968. Elk and Goat, Bison and Muskox. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-15-R-2, Juneau, Alaska.

AYRES, L. A. 1993. Unit 23 management report. Pages 21–33 in S. Abbott, editor. Muskox. Survey-inventory management report. 1 July 1990–30 June 1992. Federal Aid in Wildlife Restoration Projects W-33-4 and W-33-5, Study 16.0. Alaska Department of Fish and Game. Juneau, Alaska.

BURRIS, O. E. AND D. E. MCKNIGHT. 1973. Game Transplants in Alaska. Wildlife Technical Bulletin No. 4. Alaska Department of Fish and Game. Juneau, Alaska. 57pp.

DAU, J. 1997. Unit 23 management report. Pages 21–33 *in* M. Hicks, editor. Management report of survey and inventory activities. Muskox. 1 July 1994–30 June 1996. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2001. Unit 23 muskox management report. Pages 31–38 *in* M.V. Hicks, editor. Muskox management report of survey and inventory activities 1 July 1998–30 June 2000. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2003. Unit 23 muskox management report. Pages 43–53 *in* C. Healy, editor. Muskox management report of survey and inventory activities 1 July 2000–30 June 2002. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2005. Unit 23 muskox management report. Pages 38–48 *in* C. Brown, editor. Muskox management report of survey and inventory activities 1 July 2002–30 June 2004. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2007. Unit 23 muskox management report. Pages 35–48 *in* P. Harper, editor. Muskox management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Project 16.0. Juneau, Alaska.

ELKINS, W. A. AND U. C. NELSON. 1954. Wildlife introductions and transplants in Alaska. Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

GORN, T. AND K. PERSONS. 2007. Unit 22 and southwest portion of Unit 23 muskox management report. Pages 12–34 *in* P. Harper, editor. Muskox management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Project 16.0. Juneau, Alaska.

GRAUVOGEL, C. A. 1984. Muskoxen of northwestern Alaska: transplant success, dispersal, and current status *in* D.R. Klein, R.G. White, and S. Keller, editors, Proceedings of the first international muskox symposium. Biol. Pap. Univ. Alaska Spec. Rep. No. 4:57–62. Fairbanks, Alaska.

HUGHES, L. AND P. PERRY. 2007. Unit 18 muskox management report. Pages 1–11 *in* P. Harper, editor. Muskox management report of survey and inventory activities 1 July 2004 – 30 June 2006. Alaska Department of Fish and Game. Project 16.0. Juneau, Alaska.

IHL, C. AND R. KLEIN. 2001. Habitat and diet selection by muskoxen and reindeer in western Alaska. Journal of Wildlife Management 65(4):964–972.

JENNINGS, L. B. 1969. Muskox report. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-15-R-3. Juneau, Alaska.

_____. 1970. Muskox transplant. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-17-1. Juneau, Alaska.

_____ and 0. E. BURRIS. 1971. Muskox report. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-17-2. Juneau, Alaska.

LENART, E. A. 1999. Subunits 26B and C. Pages 30–43 *in* M. Hicks, editor. Muskox management report of survey and inventory activities 1 July 1996–30 June 1998. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2001. Subunits 26B and C muskox management report. Pages 39–54 *in* M. Hicks, editor. Muskox management report of survey and inventory activities 1 July 1998–30 June 2000. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2003. Subunits 26B and C muskox management report. Pages 54–71 *in* C. Healy, editor. Muskox management report of survey and inventory activities 1 July 2000–30 June 2002. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2005. Subunits 26B and C muskox management report. Pages 49–68 *in* C. Brown, editor. Muskox management report of survey and inventory activities 1 July 2002–30 June 2004. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2007. Units 26B and 26C muskox. Pages 46–69 *in* P. Harper, editor. Muskox management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Project 16.0. Juneau, Alaska.

MACHIDA, S. 1997. Muskox survey-inventory management report. Pages 16–20 *in* M. Hicks, editor. Annual report of survey and inventory activities. Muskox. 1 July 1994–30 June 1996. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report Grants W-24-3, W-24-4. Study 16.0. Juneau, Alaska.

NELSON, R. 1982. Muskoxen survey-inventory progress report game management unit 22. Pages 45–48 *in* R. Hinman, editor. Annual report of survey-inventory activities 1 July 1980–30 June 1981. Part III Bison, deer, elk, muskoxen, and sheep. Volume XII. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Project W-19-1 and W-19-2, Job 16.0. Juneau, Alaska.

_____. 1994. Seward Peninsula Cooperative Muskox Management Plan. Unpublished document. Alaska Department of Fish and Game, Nome, Alaska USA.

PALMER, L.J. AND C. H. ROUSE. 1963. Progress of muskoxen investigations in Alaska 1930–1935. Bureau of Sport Fisheries and Wildlife. Juneau, Alaska. 25pp. (mimeo)

PATTEN, S. 1997. Unit 18 management report. Pages 1-15 *in* M. Hicks, editor. Management report of survey and inventory activities. Muskox. 1 July 1994–30 June 1996. Alaska Department of Fish and Game. Juneau, Alaska.

PERSONS, K. 1999. Unit 22 and southwest portion Unit 23 management report. Pages 14–23 *in* M. Hicks, editor. Management report of survey and inventory activities. Muskox. 1 July 1996–30 June 1998. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2001. Unit 22 muskox management report. Pages 13–30 *in* M. Hicks, editor. Muskox management report of survey and inventory activities 1 July 1998–30 June 2000. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2003. Unit 22 muskox management report. Pages 13–42 *in* C. Healy, editor. Muskox management report of survey and inventory activities 1 July 2000–30 June 2002. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2005. Unit 22 muskox management report. Pages 13–37 *in* C. Brown, editor. Muskox management report of survey and inventory activities 1 July 2002–30 June 2004. Alaska Department of Fish and Game. Juneau, Alaska.

QUIMBY, R. 1982. Muskoxen survey-inventory progress report game management unit 23. Page 49 *in* R. Hinman, editor. Annual report of survey-inventory activities 1 July 1980–30 June 1981. Part III Bison, deer, elk, muskoxen, and sheep. Volume XII. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Project W-19-1 and W-19-2, Job 16.0. Juneau, Alaska.

SMITH, T. E. 1984. Status of muskoxen in Alaska. *in* D. R. Klein, R. G. White, and S. Keller, editors, Proceedings of the first international muskox symposium. Biological Paper University of Alaska Special Report No. 4:15–18. Fairbanks, Alaska.

_____. 1987. Status and dispersal of an introduced muskox population on the Seward Peninsula. Final research report. Big game investigations. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Projects W-22-3, W-22-4 and W-22-5. Job 16.10R. Juneau, Alaska.

SPENCER, D. L. AND C. J. LENSINK. 1970. The muskox of Nunivak Island, Alaska. Journal of Wildlife Management 34(1):1–15.

Copper River Delta – 1949 to 1958

The first moose (*Alces americanus*) transplant in Alaska was conducted near Cordova on the Copper River Delta in Game Management Unit 6C. This program was financed by the U. S. Fish and Wildlife Service, but much of the labor was furnished by sportsmen in the Cordova area (Elkins and Nelson 1954).

From 1949 through 1957, calves were obtained from the Kenai Peninsula, Susitna River drainage, Matanuska Valley, and the general Anchorage area. These calves were all picked up by well-meaning citizens who felt that the animals had been abandoned by their mothers. In 1958, calves were captured from the wild for the express purpose of introduction to the Copper River Delta (Robert Rausch, ADF&G wildlife biologist, personal communication, Burris and McKnight 1973).

Because records are incomplete, it is difficult to determine the number of calves handled, but it appears that a minimum of 50 were obtained and 24 released. The largest single release was that of 5 moose in 1951 (Nelson 1951b). Several calves released but found dead a few days later and subsequently identified by ear-tag number are not included in the total number transplanted. Considering the generally poor condition of the calves and the lack at that time of information on rearing moose calves, it is small wonder that calf mortality was high.

Hollis Henrichs, president of the Cordova Chapter of the Isaak Walton League of America, took chief responsibility for raising the calves and received a great deal of help from others in the community (Figs. 25 and 26). Henrichs was active in developing successful calf-rearing procedures and in several of his letters outlined his program in detail. He reported that, "information on feeding has been invited from various sources and that from P. C. Winslow, Pacific Region manager of the Ralston-Purina Company, proved most helpful. Upon his advice we obtained 25 lbs. of Purina Nursing Chow, which is a milk supplement, and 450 lbs. of Purina Calf Startena, which is a grain and protein with molasses included." Henrichs contended with major health problems among the calves, including injured and debilitated calves, and calves with diarrhea and scouring. Fortunately, moose

Photo courtesy Cordova Historical Society

FIGURE 25. Hollis Henrichs feeds moose calves that are being raised for the Copper River Delta transplant.

were not difficult to observe on the Copper River Delta and a fair record could be maintained on the status of the transplant. As early as 15 October 1950, U. S. Fish and Wildlife Service Game Management Agent Fred Robards reported observing all 3 moose released to that date (Robards 1953). Numerous subsequent observations indicated that survival and reproduction were good.

The suitability of the Copper River Delta as moose habitat is reflected by the observation of a cow with calf in the fall of 1952 (Robards 1953). The cow bred as a yearling and bore the calf as a 2-year-old, a situation that normally occurs only on better moose ranges. By 1954 considerable evidence had been obtained of the successful wintering and breeding of the moose on the Copper River Delta (Elkins and Nelson 1954).

Photo courtesy Cordova Historical Society

FIGURE 26. Moose calves are held in a truck in Cordova, ca. early 1950s.

A limited harvest of this newly established herd was initiated in the fall of 1960. Twenty-five bulls were harvested by permit hunters that year. The herd continued to increase and expanded its range across the Copper River to the east to game management subunit 6B and by the late 1960s had reached the outwash plain of the Bering Glacier in subunit 6A. Eventually moose migrated even further east along the coast to the shores of Icy Bay, almost 200 miles (322 km) from the Copper River. At the same time, another small group of moose negotiated the few miles of channels and tide flats to Hinchinbrook Island southwest of the delta in subunit 6D (Griese 1989). Unlike the rest of the Unit 6 populations, the 6D population has remained small with limited hunter harvest.

Rapid and consistent growth of the population led to hunting seasons being established throughout Unit 6. In 1968, the first antlerless season was held west of the Copper River, and the next year antlerless moose could be taken east of the Copper River.

After the severe winter of 1971–1972, population objectives were set at conservative levels because of concern about mortality during severe winters. Population objectives were revised in 1994 after a new method of determining habitat capacity was used (Nowlin 1998). The estimated population for all of Unit 6 peaked at about 1,600 moose in 1988–1989. The population then declined somewhat and has ranged from an estimated 1,200 to 1,450 moose through 2004 (Nowlin 1995, 1998; Crowley 2000, 2006). With vegetative characteristics constantly changing on the dynamic Copper River Delta, ADF&G and the U.S. Forest Service conducted a joint research project from 2000 through 2004 that measured back fat thickness of female moose as a corollary for determining habitat quality and condition there.

Management objectives have focused on keeping the separate subunit populations within habitat carrying capacities, providing for optimum harvest and high hunter participation, and in subunit 6A east of Cape Suckling, harvesting large bulls. Since hunting began, Unit 6 hunting seasons have been relatively liberal with both bull and cow seasons in place in most areas. Hunters harvested more than 4,300 moose during 1965–2004 in Subunits 6A, 6B, and 6C (Crowley 2006).

With a stable moose population extending almost 200 miles [322 km] to the east of the initial transplant site and over 40 years of reliable hunter harvests to its credit, the Copper River moose transplant can be considered one of the more successful game transplants in Alaska.

Berners Bay – 1958, 1960

The second moose transplant in Alaska was conducted in a more organized and deliberate manner than was the Copper River operation. In 1958 the Alaska Department of Fish and Game, U. S. Fish and Wildlife Service, and Territorial Sportsmen cooperated with the military to capture and transport calves to Juneau (Nelson 1959) for release at Berners Bay, north of the city. An Air Force helicopter was used to capture calves in the Susitna and Matanuska valleys in May 1958.

Seventeen calves were transported to Juneau in an Air National Guard DC-3 to be reared for 2½ months at the Minfield Childrens' Home at Lena Point (Fig. 27). Their diet in captivity was milk and calf feed (The Daily Alaska Empire 1958a). One calf died shortly after arriving at its destination (Nelson 1959). The rearing process was successful, however, and 16 calves (5 males and 11 females) were released at Berners Bay on 15 August 1958. The calves were transported to Berners Bay in a landing craft which grounded at high tide 100 yards from shore. Forced to swim ashore, some of the calves became disoriented in the water and swam in circles. Although all eventually made the beach, 1 calf died of exhaustion overnight (The Daily Alaska Empire 1958b).

No moose transplants were conducted in 1959, but in 1960, 11 additional moose calves were captured and shipped by the Alaska Department of Fish and Game to Juneau for subsequent release at Berners Bay (Merriam 1960). The rearing process was not as successful as in 1958 and only 6 calves survived to be released 24 August (Fig. 28).

Moose thrived in the newly (in geological terms) deglaciated and unexploited habitat in Berners Bay. Four rivers flow into the head of the bay and moose are limited to the habitat of their valleys and floodplains. The rivers are short, originating in the Coast Range Mountains, and most are fed by meltwater from glaciers of the Juneau Icefield. The mountains and icefield effectively isolate Berners Bay moose from other habitat and other moose populations, resulting in a closed population with limited habitat. Consequently, management of the herd is challenging.

The ADF&G began browse surveys in the 1980s and developed a habitat capability model to guide biologists' efforts to keep the population size within the habitat carrying capacity. For many years the management strategy has aimed to limit the posthunt population to no more than 90 moose observed during aerial surveys while maintaining a balanced sex ratio. To

accomplish this objective both bulls-only and bull-cow seasons have been employed. Harvest limits have varied based on total population, calf recruitment, and bull-to-cow ratio.

Three cows with calves observed in June 1960 demonstrated the early reproductive success achieved by the animals transplanted in 1958 to Berners Bay (Merriam 1960). In order to produce calves, these moose bred at approximately 16 months of age and produced offspring when 2 years old.

Because of the excellent initial reproduction, a limited open season on bull moose was established in 1963 just 5 years after the transplant. The first 2 years, 10 bulls were harvested and for the next decade yearly harvests ranged from 5 to 23 animals. Either-sex hunts were initiated in 1971 to help maintain a balanced sex ratio in the herd. In 1971, 50 permit holders harvested 23 moose at Berners Bay (20 females and 3 males) and in 1972 the same number of permittees harvested 22 moose, including 5 bulls.

Severe winters in the early 1970s, combined with continued high harvest of cows, reduced the population, requiring several subsequent years of closed seasons. Hunting was resumed by drawing permit in 1978. Twelve bulls were taken that year and in aerial surveys a record 120 moose were counted. After that, the number of permits issued annually ranged from as many as 20 in the late 1970s and early 1980s to as few as 5 bulls per year during 1987–1990 after low population counts (Johnson 1980, Dinneford 1989). Both bull and cow permits were issued during 1991–2002, averaging 15 a year during that time and peaking at 20 permits (10

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FIGURE 27. Moose calves are reared in 1958 at Lena Point for transplant to Berners Bay.

bulls, 10 cows) for the 2000 and 2001 seasons (Barten 2006). Hunter success rates are typically near 100% in Berners Bay. Because of its high success rates and close proximity to Juneau, the hunt draws a large number of applicants. For the 8 permits available in 2003 there were 773 applications.

In 2003 and 2004, low numbers of calves counted in aerial surveys led biologists to issue just 8 bulls-only permits, and cow hunts were limited to just 2 permits during the 2003–2006 seasons (Barten 2006). During the winter of 2006–2007, Berners Bay experienced an extremely severe deep-snow winter and high winter kill. As a result, the moose hunting season was closed to allow the population to recover (Neil Barten, ADF&G Area Wildlife Biologist—Juneau, personal communication, 2008).

Despite this setback, extensive habitat evaluation studies done in 2006–2007 associated with planned road construction through the area have convinced biologists that the moose population in Berners Bay could be substantially higher than what has long been considered the optimal number of moose (N. Barten, personal communication, 2008).

The Berners Bay transplant was quite successful. It established a moose population in an area that, because of its geographic isolation, may not have been colonized by moose naturally for many years, if ever. That population, aided by attentive and active management, has supported an extremely popular hunt for over 40 years near Southeast Alaska's largest city.

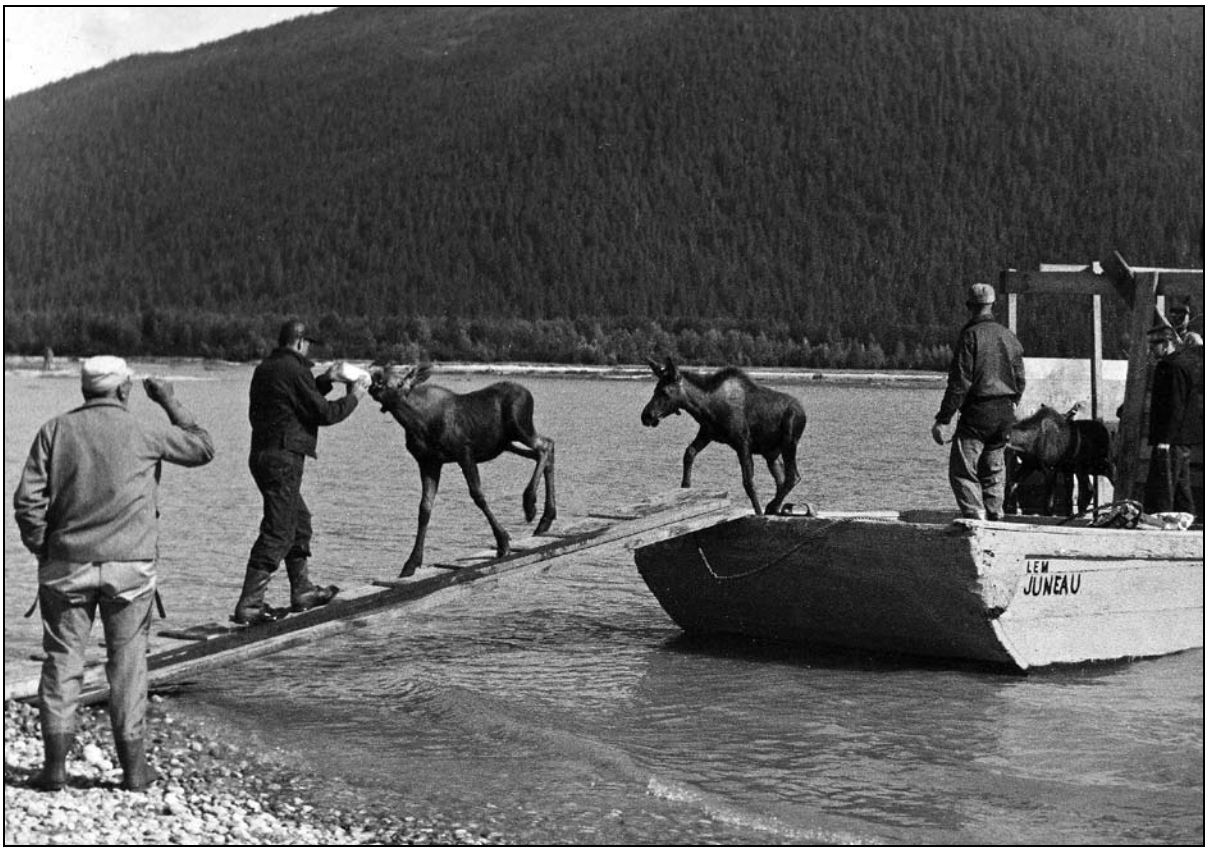

FIGURE 28. Moose calves are coaxed ashore at Berners Bay in1960.

Kalgin Island – 1957 to 1959

In 1957, 1958, and 1959, moose calves were released on Kalgin Island. Kalgin Island, with an area of approximately 23 square miles (60 square kilometers), is located on the west side of Cook Inlet west of the city of Kenai. The techniques differed somewhat from those used at Cordova or Berners Bay. Calves were supplied by the Alaska Department of Fish and Game and reared by Charles and Edith Parsons, who were summer residents of the island (Rausch 1958). The moose were not confined to a pen, but instead were allowed to roam at will. This procedure permitted the animals to select unlimited quantities of natural feed.

The animals remained in the vicinity and were fed twice daily until the Parsons departed the island in August of each year. Under these conditions, the moose acclimated themselves well to the new environment. Freedom to select natural foods probably offsets many nutritional problems that often affect penned animals. It also probably reduced the possibility of disease. During this operation, a male and a female calf were released in 1957 (Rausch 1958), 2 females and 1 male in 1958 (Rausch 1958), and 1 male in June 1959 (Albert Erickson ADF&G, personal communication, Burris and McKnight 1973).

On 15 June 1958, a commercial fisherman reported observing 2 moose on the island (Rausch 1958), and a calf was killed by an unidentified fisherman in the summer of 1959 (Robert Rausch ADF&G, personal communication).

Kalgin Island is relatively small and lacks predators to naturally regulate the population. Although summer forage is abundant, there is a lack of taller browse species like willow and birch that would be available to moose in moderate and deep snow winters. Thus, hunter harvest is necessary to keep the population within the habitat carrying capacity. Underharvesting rather than overharvesting has been the primary management concern for Kalgin Island (Faro 1989). With access limited to boats and airplanes, achieving adequate hunter harvest has been difficult during periods when moose numbers are very high.

Moose hunting began in 1969 and continued through the 1978 season, when public concerns about low moose numbers and lack of information on the population led to a season closure. However, after a survey in winter 1980 found 70 animals, a drawing permit hunt was approved for fall 1981 and 10 moose were killed. Later that winter another survey counted 141 moose or 7 moose/mi^2. As biologists had determined Kalgin Island habitat could support only 30–40 moose, an emergency registration hunt was called for that winter to reduce the population so existing habitat would not be destroyed by overuse. Seventy moose were taken in the hunt, of which 26 were cows (Taylor 1983). Liberal regulations were put in place to reduce the population further and during 1981–1983 hunters took an estimated 200 moose (Faro 1985). With continued liberal regulations the herd declined and annual harvest dropped through 1987. To maintain habitat quality, biologists set a population objective of 20–25 moose or 1 moose/mi^2 (Faro 1989). The population reached that level in 1986 and low hunter harvests indicated the population remained low through the early 1990s. Bulls-only seasons were in place during 1991–1994 and single-digit annual harvests were common, but as the population began a slow increase “any moose” registration hunts were reauthorized beginning in 1995 (Griese 1996).

A habitat assessment done in 1997 confirmed that the optimum population of the island is 20–40 moose. Griese (1998) suggested a controlled burn on the island would improve the carrying capacity.

In 1999, 80 moose were taken by hunters on the island. Despite harvests averaging almost 50 moose a year from 2000 through 2004, the Kalgin Island population grew to an estimated 179 moose in a 2003 survey, about 6 times the population objective (Peltier 2006). Harvests were somewhat lower during 2005–2007 and the number of moose observed in surveys was lower during those years (Tony Kavalok, ADF&G Area Wildlife Biologist—Palmer, personal communication, 2008). The 2007 regulations maintained an any-moose registration hunt.

The history of Kalgin Island moose management for the first 50 years since the transplant and likely for the foreseeable future has been focused on keeping the population in check to avoid dramatic population declines in hard winters from depleted habitat. In terms of providing a huntable moose population, the transplant was very successful. Management of the island's moose has been a continuing challenge.

Chickamin River – 1963 to 1964

In response to public interest in a moose transplant in the Chickamin River area northeast of Ketchikan, field investigations were initiated in 1962 (Burris personal files). Extensive glacier systems at the headwaters of the La Duc and Chickamin Rivers were believed by many to have hindered the movement of moose into this valley. A few moose had occasionally been observed on the Chickamin River, but apparently they were infrequent visitors.

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FIGURE 29. A calf moose is coaxed to the LCM landing craft during the Chickamin River transplant operation in 1963.

In field investigations in 1962 and 1963, the U.S. Forest Service prepared a vegetative type map of the valley (Burris 1964). This study suggested that sufficient forage was present to support moose. Snow boards were installed to determine if winter conditions were suitable for moose. Very little has been documented about the effects of snow on wintering moose in Southeastern Alaska, and a period of 5 to 10 years would be necessary to evaluate seasonal fluctuations of snow conditions and their potential effects on moose. Considering the time and money necessary to conduct investigations to accurately predict the outcome of a moose transplant, the ADF&G considered it more practical to conduct an experimental transplant and closely observe the results.

An agreement to transplant moose to the Chickamin River was established under the Cooperative Agreement that existed between the U. S. Forest Service and the Alaska Department of Fish and Game. Under this arrangement, ADF&G undertook the transplant.

Seventeen moose calves (11 females and 6 males) were captured in June 1963 on the Chickaloon Flats near Anchorage and transported to Gravina Island to be reared by David Perry, a local resident (Burris 1964). An Air Force H-21 helicopter was used to capture the calves and transport them to Anchorage. The calves were held overnight in Anchorage and then shipped to Annette Island on an Alaska Air National Guard C-123 aircraft. A truck transported them from the Annette airfield to docking facilities at Metlakatla where they were placed aboard the ADF&G vessel *Kittiwake.* Docking facilities suitable for the *Kittiwake* did not exist at the Perry residence on Gravina and it was necessary to transfer the calves ashore in a skiff. Initial mortality was high and 5 calves had been lost by 19 June. This initial loss was attributed primarily to excessive handling.

In August, 10 moose were transported in an LCM landing craft (Fig. 29) from Gravina Island to the mouth of the Chickamin River (Burris 1964). Because the calves became a nuisance to James Wolf, the only resident on the Chickamin River, on 10 August the animals were moved to a new location 1.5 miles (2.4 km) up the river. Only 9 of the 10 calves were subsequently relocated to the new site. Of these, 6 were females and 3 males.

Additional animals were transplanted to the Chickamin River area in 1964 (Burris personal files). The operation was similar to that of 1963 except the location of the rearing site was changed and the direct transfer of the moose from Annette airfield to the holding pen was conducted via an amphibious aircraft.

Wet weather and possibly insufficient natural food in the holding pens reduced the number of moose to 6 (4 females and 2 males). One female calf sustained a broken leg while being loaded into the LCM and had to be killed, reducing the total released to only 5 of the original 15 animals. A camp was established on the Chickamin River and the moose were fed for a few days until they had become adjusted to the release site.

The moose released in 1963 were last observed as a group about 7 October 1963 (Burris 1964). Tracks were seen by U. S. Forest Service and Alaska Department of Fish and Game personnel on several trips to the Chickamin River from November 1963 through March 1964. One moose was sighted on 27 March 1964 by Forest Service personnel and numerous tracks were observed on 5 May. Moose sign was observed throughout the summer of 1964, prior to the second release.

However, no population became established and the Chickamin River moose transplant is considered a failure. During moose population counts in 1970, biologists were unable to locate any sign of moose in the Chickamin River drainage. Again in 2000, an aerial survey under ideal conditions confirmed that no moose are in the drainage (Porter 2002).

Kodiak Island – 1966 to 1967

The last attempt to transplant moose in Alaska occurred during 1966 and 1967, when mainland moose were transported to Kodiak Island (Sterling Eide ADF&G wildlife biologist, personal communication, Burris and McKnight 1973). In 1966, 27 moose calves were moved to Kodiak to be hand-reared until large enough for a transplant attempt. Only 1 of these animals, a male, survived and was later released. Efforts were renewed in 1967, with the animals being reared at Palmer. Nine animals were eventually flown to Kodiak; 3 of these died and 6 were released on the island. Although moose persisted for several years on Kodiak Island, all of the transplanted animals eventually were killed or died of natural causes.

Moose Transplant Results

In summary, 3 of the 5 moose transplants attempted in Alaska have been successful; those at Kalgin Island, Berners Bay, and the Copper River Delta. Copper River moose were introduced to a large area of habitat only recently made available by glacial recession. Kalgin Island and Berners Bay populations are isolated from other moose populations. Management of these populations in recent years has been focused on keeping moose numbers within the limitations of the available habitat.

References – Moose

BARTEN, N. L. 2006. Unit 1C moose management report. Pages 24–46 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project. 1.0. Juneau, Alaska.

BURRIS, 0. E. 1964. Alaska wildlife stocking. Alaska Dept. of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-11-D-1, Juneau, Alaska.

BURRIS, O. E. AND D. E. MCKNIGHT. 1973. Game Transplants in Alaska. Wildlife Technical Bulletin No. 4. Alaska Department of Fish and Game. Juneau, Alaska. 57 pp.

CROWLEY, D. W. 2000. Unit 6. Pages 65–81 *in* M.V. Hicks, editor. Management report of survey and inventory activities 1 July 1997–30 June 1999. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Grants W-27-1 and W-27-2. Study 1.0. Juneau, Alaska.

_____. 2006. Unit 6 moose management report. Pages 85–100 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

DINNEFORD, B. 1989. Unit 1C. Pages 14–24 *in* S.O. Morgan, editor. Moose annual report of survey and inventory activities 1 July 1987–30 June 1988. Volume XIX, Part VII. Federal Aid in Wildlife Restoration. Project W-23-1, Study 1.0. Alaska Department of Fish and Game. Juneau, Alaska.

ELKINS, W. A. AND U. C. NELSON. 1954. Wildlife introductions and transplants in Alaska. Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

FARO, J. B. 1985. Moose survey and inventory progress report Unit 16B Kalgin Island. 1 July 1983–30 June 1984. Pages 67–71 *in* A. Seward, editor. Annual report of survey and inventory activities. Volume XV, Part VIII. Federal Aid in Wildlife Restoration. Project W-22-3. Job 1.0. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 1989. Unit 16 B Kalgin Island. Pages 167–172 *in* S.O. Morgan, editor. Moose annual report of survey and inventory activities 1 July 1987–30 June 1988. Volume XIX, Part VIII. Federal Aid in Wildlife Restoration. Project W-23-1, Study 1.0. Alaska Department of Fish and Game. Juneau, Alaska.

GRIESE, H. J. 1989. Unit 6 Prince William Sound and North Gulf Coast. Pages 49–63 *in* S.O. Morgan, editor. Moose annual report of survey and inventory activities 1 July 1987–30 June 1988. Volume XIX, Part VIII. Federal Aid in Wildlife Restoration. Project W-23-1, Study 1.0. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 1996. Unit 16B. Pages 208–221 *in* M.V. Hicks, editor. Management report of survey and inventory activities 1 July 1993–30 June 1995. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Grants W-24-2 and W-24-3. Study 1.0. Juneau, Alaska.

_____. 1998. Unit 16B. Pages 208–221 *in* M.V. Hicks, editor. Management report of survey and inventory activities 1 July 1995–30 June 1997. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Grants W-24-4 and W-24-5. Study 1.0. Juneau, Alaska.

JOHNSON, N. P. 1980. Moose survey and inventory progress report 1978–1979, Unit 1C. Pages 66-70 *in* R. A. Hinman, editor. Annual report of survey and inventory activities. Volume X, Part II. Bison, Caribou, Moose, and Muskoxen. Federal Aid in Wildlife Restoration. Project W-17-11, Jobs 9.0, 3.0, 1.0, 16.0 and 22.0. Alaska Department of Fish and Game. Juneau, Alaska.

MERRIAM, H. R. 1960. Moose investigations, Southeast Alaska. Alaska Dept. of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-6-R-1, Juneau, Alaska.

NELSON, U. C. 1951 b. Quarterly progress report-development. Federal Aid in Wildlife Restoration. Project W-4-D-2, Alaska. Vol. II, No. 1.

_____. 1959. Completion report-development. Federal Aid in Wildlife Restoration. Project W-4-D-9. Vol. IX, No. 1-4.

NOWLIN, R. A. 1995. Unit 6. Pages 45–65 *in* M. V. Hicks, editor. Survey-inventory management report 1 July 1991–30 June 1993. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-23-5, W-24-1. Study 1.0. Juneau, Alaska.

_____. 1998. Unit 6. Pages 53–73 *in* M.V. Hicks, editor. Management report of survey and inventory activities 1 July 1995–30 June 1997. Moose. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Grants W-24-4 and W-24-5. Study 1.0. Juneau, Alaska.

PELTIER, T. C. 2006 Unit 16B moose management report. Pages 225–238 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

PORTER, B. 2002. Unit 1A moose management report. Pages 1–6 *in* C. Healy, editor. Moose management report of survey and inventory activities 1 July 1999–30 June 2001. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

RAUSCH, R. A. 1958. Memo to chief, Division of Fish and Game Restoration. Bureau of Sport Fisheries and Wildlife, Juneau, Alaska.

ROBARDS, F. 1953. Annual game report. Typewritten.

TAYLOR, W. P. 1983. Moose survey and inventory progress report Unit 16B Kalgin Island. 1 July 1981–30 June 1982. Pages 70–72 *in* J. A. Barnett, editor. Annual report of survey and inventory activities. Volume XIII, Part III. Federal Aid in Wildlife Restoration. Project W-22-1. Job 1.0. Alaska Department of Fish and Game. Juneau, Alaska.

THE DAILY ALASKA EMPIRE. 1958a. "Moose herd finds enclosure life good, gaining weight." 18 June 1958. Juneau, Alaska.

_____. 1958b. "16 moose calves released on Berners Bay as forerunner of future herds." 20 August 1958. Juneau, Alaska.

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Caribou

Adak Island – 1958 to 1959

In response to a request from the U. S. military in 1958, the U. S. Fish and Wildlife Service and the military cooperated in a project to transplant caribou (*Rangifer tarandus*) to Adak Island (Jones 1966), where several thousand military personnel served at the U.S. Naval Air Station beginning in World War II. The U. S. Fish and Wildlife Service supplied personnel to capture the caribou and to supervise the project while the military provided transportation.

Adak, one of the Aleutian Islands, is approximately 75,000 hectares (185,000 acres) in size. The land is now owned by the Alaska Maritime National Wildlife Refuge and The Aleut Corporation.

Because of the expense and difficulty involved in transplanting adult animals, it was decided to capture newborn calves and hand raise them until they were self-sufficient (Jones 1966). The calves were captured from the Nelchina herd using Air Force helicopters and transported in Navy cargo aircraft to Adak, a distance of nearly 1,400 miles (2,253 km). The calves were reared on Adak Island by military personnel from the Marine Barracks and the Special Services Department of the Navy Base.

Initial mortality of calves was very high with most loss occurring within the first 2 weeks (Jones 1966). Mortality was 68% in 1958 and 69% in 1959. Two-thirds of the losses occurred within the first 48 hours. In 1958, 31 calves were captured and 10 were released (7 females and 3 males). Forty-five were captured in 1959 and 14 released (5 males and 9 females). By 1967, the population was estimated at 189 animals (Hemming 1971), and by 1972 the herd had expanded to 347 animals.

No natural predators of caribou exist on Adak Island and managers recognized that if the hunting pressure was not sufficient to control caribou numbers, a rapid increase and subsequent crash would likely occur.

In an attempt to hold the population below the critical level on Adak, the Board of Fish and Game authorized the first hunting season for the period 15–25 August 1964. Under the stipulations of this hunt, 10 permits were issued for the taking of bull caribou only. In 1965, the season was lengthened to 17 days and the bag limit changed to one bull with no permit requirement. Another change in 1966 set a limit of 30 caribou, but allowed the taking of either sex. In 1967, the allotment was raised to 50 animals of either sex and a bag limit of 2 caribou was established. The objective of the management plan for the Adak caribou herd was to hold the population at between 200 and 250 animals by harvesting approximately 50 animals annually. In late 1972 it became apparent that this harvest was inadequate to maintain the population at the desired level. In an effort to attain a larger kill, the 50-caribou limit per season was dropped.

By the 1980s the bag limit was 2 caribou per person and the hunting season was 7 to 8 months long. Hunter harvest grew to about 33% of the herd a year but the population continued to

increase slowly. Harvest peaked at about 200 caribou a year during 1989–1993 with the highest reported harvest in 1993 when nearly 250 were killed by hunters. During those high harvest years the population remained relatively stable at 300 to 500 caribou (Williams and Tutiakoff, Jr. 2005). Then in 1994, the military base closed and hunting declined sharply.

Hunting regulations were liberalized in 1993 to no bag limit and no closed season in anticipation of the base closing. Nevertheless, managers' long-time fears of rapid, uncontrolled growth began to be realized as the caribou population exploded. A 2005 census found that the Adak herd had more than tripled in size in just 7 years to nearly 2,800 caribou (Williams and Tutiakoff, Jr. 2005). Because of the remoteness of the island, logistical difficulties, and limited year-round human population, it is difficult to increase hunting effort. One attraction for hunters is that with plenty of food and little to bother them, Adak caribou can get big.

In 2007, to encourage taking of cows and diminish herd productivity, regulations limited harvest of bulls to 2 a year with a 4½ month bull season open 10 August–31 December while leaving no bag limit and no closed season for cows. Harvests during the early 2000s are estimated to have averaged between 100–150 caribou annually (Williams and Tutiakoff, Jr. 2005) although, because no harvest reports were required from 1996 to 2003, the numbers may be higher. In any case, the harvest was insufficient to control growth of the herd.

With hunting access difficult, and no predators, disease, or known parasites, options for arresting the herd's growth before the island is overgrazed are limited. In 1994 the Alaska Maritime National Wildlife Refuge wrote and received comments on an Environmental Assessment to eradicate caribou on Adak Island in 1994. Because of opposition from the state congressional delegation and the Aleut Corporation, and a general public misconception that the proposal was somehow related to predator control, the EA was never signed and the eradication never carried out (Steve Ebbert, USFWS wildlife biologist, personal communication, 2007). Other proposals rejected by the EA included introducing sterilized wolves as predators to eliminate the herd, and transplanting Adak caribou to the Kenai Peninsula or other locations. (USFWS/ ADF&G 1994).

In the current situation, a likely scenario is for the Adak herd to continue to grow to a population of about 5,000, then, because its habitat is overgrazed, experience a rapid massive die-off to about 300 animals (Lem Butler, ADF&G Area Wildlife Biologist—King Salmon, personal communication, 2007). An additional concern with that scenario is what it may mean for the viability of the Aleutian Fern (found only on Adak) should caribou overpopulate the island. Evidence of caribou was found on nearby Kagalaska Island by U.S. Fish and Wildlife Service biologists, but by 2008 caribou had not yet established a breeding population on that island (L. Butler, personal communication, 2007).

The purpose of the Adak caribou transplant, to provide food and hunting opportunities for military personnel, was achieved and, as long as the military base and a ready hunting population remained on the island, herd growth could be managed. Military officials and land and game managers did not anticipate an end to that beneficial situation. Now uncontrolled, the Adak herd must rely on a habitat almost certainly insufficient to support them long term. Their efforts to survive may in turn threaten the existence of endemic plant species on the island.

The management challenges posed by Adak caribou seem likely to continue many years into the future.

Kenai Peninsula Caribou Transplants

Historical records show that caribou were once abundant on the Kenai Peninsula and occurred there until about 1913 (Spencer and Hakala 1964). Although the reasons for their extirpation from the peninsula are not clear, it has been suggested by Leopold and Darling (1953) that widespread fires in the late 1800s destroyed much of the lichen forage used by caribou and, due to long regeneration times for this important winter forage, may have been a dominant influence in caribou decline. Spraker (1992) citing Palmer (1938) and McDonough (2007) citing Allen (1901) indicate that market hunting to feed mining camp employees and to send antlers "at good prices…to San Francisco" was also a primary factor in the extirpation.

The Kenai Peninsula transplants initially established 5 small caribou herds. Two – the Kenai Mountains and Kenai Lowlands herds – were mostly a result of a project in 1965–1966. For a few years following that transplant, caribou were observed over a wide area of the Kenai Peninsula from Anchor Point to near Hope. By 1969, however, the animals had become established into the 2 discrete groups. The other 3 herds – Killey River, Twin Lakes, and Fox River – are located farther south on the Kenai and resulted from a project in 1985–1986.

Kenai Peninsula – 1965 to 1966

In 1952 a U. S. Fish and Wildlife Service survey resulted in the conclusion that range conditions on the Kenai Peninsula would again support caribou (Alaska Game Commission 1952). The concept of a caribou transplant to the Kenai Peninsula was dormant for the next several years, however, until 1964, when a reevaluation of the potential release sites was made by the Alaska Department of Fish and Game, the U. S. Bureau of Sport Fisheries and Wildlife and the U. S. Forest Service (Lentfer 1965). In accordance with Federal Aid in Wildlife Restoration requirements and because it was anticipated that the caribou would wander over considerable areas of the peninsula, cooperative agreements covering the introduction and management of the caribou were signed between the three agencies. The actual transplants were conducted by personnel of ADF&G with funds provided by the Federal Aid in Wildlife Restoration Act.

Caribou in Newfoundland had been successfully immobilized using the drug succinylcholine chloride and, on this basis, an attempt to capture caribou was made on 15 April 1965 (Glenn 1967). The attempt proved that the technique was practical and the transplant was planned for late April that year.

Kenai Mountains herd

This operation, initiated on 27 April 1965, initially captured 32 animals from the Nelchina herd (Burris and McKnight 1973) near Chistochina, east of the Copper River. They were located and darted using a Hiller 12-E helicopter, with succinylcholine chloride. Problems occurred finding the proper drug dose for each animal. Individual caribou of similar size, age, and sex were found to respond differently to similar dosages and males were found more susceptible

to the drug than females (Glenn 1967). As a result, 7 caribou died from the effect of the drug (Burris and McKnight 1973). Several were saved by artificial respiration (Glenn 1967).

Tranvet® (propiopromazine hydrochloride) was used for tranquilizing caribou after capture during handling and shipment. Caribou injected with Tranvet® too soon after succinylcholine chloride also experienced problems. Successful use of Tranvet® occurred when it was injected 15 to 20 minutes after caribou had recovered from the capture drug. While caribou were sedated, biologists fitted them with ear tags, removed their antlers, tested for brucellosis, and recorded data on age, sex, and condition (Glenn 1967).

A harness was devised for slinging the captured animals by helicopter to holding pens at Chistochina Lodge. After some experimentation, 4 ft by 8 ft pens holding 1 or 2 caribou were found to be better than larger enclosures because they restricted movement and reduced self-inflicted injuries. In large pens, caribou were able to run and jump over a 7½ foot fence (Glenn 1967). Three caribou escaped from the temporary holding facilities (Burris and McKnight 1973). The animals were flown from Gulkana to the Pipeline Airstrip next to the Chickaloon River in a C-130 cargo plane provided by the Alaska Air National Guard. This phase of the project also experienced problems. Seven caribou died in handling or en route to the release site (Burris and McKnight 1973).

Of the initial 32 captured, 15 caribou (12 cows and 3 bulls), ranging in age from 11-month-old calves to large adults, were released in the area between the Chickaloon River and Mystery Creek north of the Sterling Highway on 2 May 1965 (Glenn 1967). Many of the adult females were pregnant and calves were born only a few weeks after the release. The herd settled in to an area in the northern Kenai Peninsula Game Management Unit 7. The estimated home range covers more than 1,400 km^2 (540 mi^2) in the drainages of Chickaloon River, Big Indian Creek, and Resurrection Creek (McDonough 2007).

This group, originally called the American Pass band, but now termed the Kenai Mountain herd, grew rapidly to 119 animals in November 1970, 162 animals in November 1971, and at least 214 animals in December 1972. In 1972 the first harvest of Kenai caribou was allowed and 20 permit-bearing hunters took 6 bulls.

The herd continued to grow to over 300 by 1975 (Selinger 2005). From 1972 to 1976 the department issued an unlimited number of registration permits, and the season was closed by emergency order when the harvest reduced the population to less than 200. In 1977, a limited drawing permit system was implemented and remains in place 3 decades later (McDonough 2007).

Despite the close control over hunting harvest, the population of the Kenai Mountains herd has swelled and contracted over the years. By 1985, 8 years after the drawing permit hunt was implemented, the herd had grown to about 430 animals, then went into a sharp decline to about 305 caribou in 1988. A new peak population of 500 was reached by 1996 but it declined gradually to an estimated 350–400 animals by 2004. The 2007 estimate was 300 caribou (Selinger 2005, McDonough 2007).

Habitat limitations are likely responsible for the fluctuations. Although the herd's original study in 1952 by the U. S. Fish and Wildlife Service estimated the range carrying capacity at about 200 animals, the initial high productivity of the transplanted animals suggested a far higher range capacity. When calf:cow ratios began to drop in the mid 1980s, after the herd had reached a peak of over 400 caribou, the ADF&G initially began questioning the ability of the habitat to support the herd (Selinger 2003). Selinger (2003) observes that hunting mortalities probably became additive around 1985. But although hunting may have accelerated the decline, by reducing the herd it provided some habitat protection. He notes that the Kenai Mountains herd appeared more productive when stabilized at around 350–400 caribou. Based on the past fluctuations in population size, the carrying capacity for this herd is now considered to be 300–400 caribou, due to limited winter range (McDonough 2007).

The department issued 250 drawing permits annually from 1996 through the 2007 season and annual harvest during that period averaged 22 caribou. Typically, only about 50 percent of those who draw permits actually hunt because of difficult access. The herd is typically several miles from road access. Off highway vehicles are not allowed so hunters must walk in from the road.

Kenai Lowlands herd

In April 1966, 29 more caribou (26 cows and 3 bulls) from the Nelchina herd were released at Watson Lake near Sterling to augment the 1965 transplant (Glenn 1967). At least 10 of the females successfully released in the 1966 operation were pregnant. Caribou capture techniques were similar to those used in 1965. Capture teams used a Hiller 12-E helicopter and succinylcholine chloride and Tranvet® for sedation. Captured caribou were held in pens at Chistochina prior to transport. More experience with drug dosages and handling techniques yielded better results and of 34 caribou captured, only 5 died – 3 at Gulkana before transport and 2 at the release site. In general, the caribou were in much better condition when released in 1966 than in 1965 (Glenn 1967). A C-46 cargo plane was chartered to transport caribou in 2 trips from Gulkana to Soldotna. Sixteen animals were moved and released on 26 April and 18 were moved on 28 April. The move was not without problems, as late arrival of the plane in Gulkana added to the stress of the animals being held and several could not be calmed without an additional drug dose (Glenn 1967).

Glenn (1967) estimates the cost of the 1966 operation was $6,800, not including salaries of 8 members of the capture and holding area crews or the personnel and equipment costs at the release site. Aircraft charters and equipment costs and rentals were included. The average cost per caribou released in 1966 was $234. Glenn does not estimate a cost for the 1965 operation but because the 1966 transplant was more efficient using experience gained from the prior year, he says the second year's expense was likely lower.

The range of the Kenai Lowlands caribou herd encompasses about 1,200 km^2 (463 mi^2) in and around the communities of Soldotna, Kenai, and Sterling between the Moose and Swanson rivers in Game Management Units 15A and 15B. The herd summers in Subunit 15A north of the Kenai airport to the Swanson River and in the extreme western portion of subunit 15B. The population winters on the lower Moose River to the outlet of Skilak Lake and in the area around Browns Lake (McDonough 2007).

This herd has had the slowest growth of all Kenai caribou herds. It took 20 years for the population to grow from 29 in 1966 to more than 100 in 1986; and, after 20 more years, the Kenai Lowlands herd had grown only 20–35% more to an estimated 120–135 animals in 2007 (McDonough 2007).

High body weights and high calf counts directly after parturition indicate the Kenai Lowlands caribou are not yet limited by habitat quality or quantity. Growth in this population has been limited by predation rather than by habitat. Free-ranging domestic dogs and coyotes kill calves in summer and wolves prey on all age classes during winter. In addition to natural mortality, highway vehicles typically kill several caribou annually (McDonough 2007).

Hunts were held in 1981 and 1988–1992 with 3 permits issued per year and an average harvest of 2 caribou. No permits have been issued since.

Kenai Peninsula – 1985 to 1986

Despite the success of the earlier Kenai caribou reintroductions, the only 2 areas where early 1900 antlers had been found—the 2 principal historic caribou ranges on the Kenai, the Caribou Hills and Skilak-Tustumena Benchlands—remained unoccupied. Seeking to reestablish caribou on these historic central and southern peninsula ranges and, secondarily, to provide additional opportunities to hunt caribou on the Kenai Peninsula, ADF&G and USFWS cooperated on a project to introduce more caribou to the peninsula in 1985 and 1986.

Thirty to 80 caribou were to be transplanted, initially to the Skilak–Tustumena Benchlands, and then, if adequate numbers of caribou were captured, to the Caribou Hills. ADF&G had responsibility for the operational aspects (capture and release) of the transplant. The U.S. Fish and Wildlife Service provided funding for the project and was responsible for evaluating its success. The Nelchina herd served as the source for the transplanted populations (Spraker 1992). During the 2-year project, 121 caribou were captured with 80 successfully transplanted to the Kenai. Different capture, transport, and immobilizing techniques were tried each year, resulting in different incidental mortality rates and operational costs.

During the first year, helicopter-darting was used to capture caribou. The second year caribou were captured by drop-net. Total mortality during the 1985 project was 19 caribou (40%) compared to 7 caribou (9%) in 1986. Mortality related to the capture operations was similar for both years, 3 and 5 caribou, respectively, but more caribou died in transit in 1985. Capture time for each animal with helicopter-darting, including chase and time between darting and immobilization, averaged 23 minutes. For the drop-net method, capture time was less than half that. Consequently, animal stress and overheating were significantly less with the drop-net method (Spraker 1992). The approximate cost per caribou captured using the helicopter-darting method was $553. The approximate cost per caribou captured using the drop-net method was $191. However, the 1986 costs would have been greater if drop-nets had been purchased rather than borrowed and if salary and per diem costs had not been offset by using 8 volunteers in 1986 (Spraker 1992).

In April 1985, 47 caribou were darted from the air over a 2-day period using 2 Bell 206 Jet Ranger helicopters. A mixture of etorphine (M-99, 1 mg/ml) and acetylpromazine (Prom Ace®, 10 mg/ml) was used as the immobilizing drug. Captured caribou were hobbled, fitted with cloth hoods and padded collars for protection, and put into a canvas transport bag. The bags were attached to the helicopter with a wire cable and carried by air to a staging area. Three (6%) mortalities occurred during the capture operation (Spraker 1992).

At the staging area, teams fitted the caribou with visual or radio collars, removed antlers, recorded sex, age, and body measurements, took hair, fecal, and blood samples, tested for brucellosis, inoculated against parasites, and administered the antagonist to the immobilizing drug. The animals were then moved to a nearby holding pen constructed of rodeo fencing, whose walls were padded and screened by netting and burlap (Spraker 1992).

On the third day, the 44 caribou were loaded into a 40-foot cattle truck and transported 325 road miles to Soldotna on the Kenai Peninsula. Sixteen (36%) caribou died in transit because of stress and trampling. Spraker (1992) observes that only 3 of the animals held for over 24 hours in the holding pen died during transport, compared to 13 mortalities for animals transported less than 24 hours after initial capture. He suggests the higher survival rate of caribou captured on the first day was due to the additional time they had to recover from drugging.

At Soldotna, the remaining 28 caribou (6 males, 22 females) were tranquilized again using a mixture of xylazine (Rompun®, 100 mg/ml) and ketamine hydrochloride (Vetalar®, 100 mg/ml), transported by Bell 205 helicopter to Glacier Creek and released on 14 April 1985. Of those, 20 (4 males, 16 females) were fitted with radio collars (Spraker 1992). Three of the radiocollared females died before 1 November 1985: one died near the release site on approximately 24 April 1985, probably because of transport stress; the second died on 21 May 1985 when struck by a highway vehicle; the third was shot and killed by a hunter on 24 October 1985 after it joined the Kenai Mountains caribou herd, where caribou hunting is allowed. At least 8 calves were observed shortly after the calving period at or near the release site on Tustumena Flats (Spraker 1992).

Two small distinct groups of caribou were identified in subsequent surveys during the months after the transplant: one group (12 adults and 4 calves) was regularly observed at the headwaters of Funny River; the second group (3 adults and 2 calves) occupied a small home range near the headwaters of Crystal Creek, south of Tustamena Glacier. Of the 10 remaining adults released, at least 2 joined the Kenai Mountains herd and 1 joined the Lowlands herd. Six caribou without radio collars were not immediately accounted for (Spraker 1992).

In April 1986, 74 Nelchina caribou were captured with two 21.3 m by 21.3 m (70 ft by 70 ft) drop-nets at 8 different sites. Caribou were baited to the net sites prior to capture using a combination of alfalfa and salt. The optimum baiting period before capture was 2 weeks. The sites were located on frozen lakes or wetland areas near lakes both to provide a flat area for net deployment and to have a good view of the site from a distance to avoid spooking caribou. A team of 2 to 3 people would drop the net and be stationed about 300 m (984 feet) away. A second team of 6 to 12, for holding and transporting animals, would be 500–800 m (1,640–2,625 ft) away. At net drop, both teams would hurry to the site on snowmachines. The first team's task

was to attend to any animals in danger of injury under the net. When the second team arrived, caribou were sedated, blindfolded, hobbled, secured in a canvas transport bag, and transported by snowmachine and sled 1 to 5 km (3 mi) to the processing site (Spraker 1992). Captured animals were tranquilized using a mixture of xylazine and ketamine at different dosage levels depending on age class.

As with the previous year's transplant, the processing teams removed antlers, recorded sex, age, and body measurements, took hair, fecal, and blood samples, tested for brucellosis, inoculated against parasites, and administered the antagonist to the immobilizing drug. This time, animals were also injected with an antibiotic to bolster immune response to disease and infection (Spraker 1992). After processing, the caribou were loaded into individual crates for transport.

Five caribou died during the capture operation: 1 caribou died of a broken neck in the capture net, and 4 caribou died when 7 animals were accidentally captured during the night because of an electrical net release malfunction in the cold temperature. The 7 caribou were entangled in the net for up to 8 hours before they were discovered; the surviving 3 caribou were released at the capture site. In addition, 1 male calf died in the holding pen 20 hours after capture from trampling by adults (Spraker 1992).

Ten of the captured caribou were radiocollared, tagged and released immediately as part of an ongoing Nelchina herd study. Two animals escaped from the holding pen during loading and

Photo by Ted Spraker

FIGURE 30. Kenai Air helicopter pilots Monty Haugh and Larry Rogers secure crates holding blindfolded caribou prior to transport in 1986. Crates were configured 4 per side and 1 in the center facing forward.

one was released due to insufficient space on the transport vehicle. The remaining 52 caribou (5 males and 47 females) were placed in individual crates and loaded on a 2-ton truck and 20-foot trailer. Caribou were captured and processed during the day, then transported on the 9-hour truck ride to the Kenai Peninsula during the night. It took 3 trips to move all the caribou. No mortalities occurred using this transport method (Spraker 1992).

In Soldotna, adult caribou were fitted with visual or radio collars. Then, still in individual crates, they were transported 9 at a time by Bell 205 helicopter to 2 release sites on the east side of Tustumena Lake: 1) 18 caribou to Lake Emma on 15 April; 2) 18 to Green Lake on 20 April (Fig. 30). Caribou were blindfolded but only those that were extremely excited were tranquilized again, using a mixture of xylazine and ketamine for the 20–25 minute helicopter trip to the remote release site. Sixteen more caribou were transported by truck to Caribou Lake at the base of the Caribou Hills and about 10 miles (16 km) north of the Fox River on 17 April. At all release sites, crated caribou were released as a group facing one direction. One aged adult female died shortly after being released because of injuries and stress from transporting (Spraker 1992).

Animals of both the 1985 and 1986 transplants suffered a 25% mortality rate from predation, unknown causes, and dispersal to other areas during the first months on their new range. However, recruitment was strong and total population grew by an estimated 25% per year to 1990 (Spraker 1992).

As a result of this second series of Kenai transplants, 3 discrete caribou herds emerged – the Killey River, Twin Lakes, and Fox River herds. However, in 2002 the Twin Lakes herd was absorbed by the Killey River herd as the latter expanded its range.

Killey River/Twin Lakes herd

Caribou from the 1985 transplant and probably 2 of the 3 release sites in 1986 moved north and over time formed 2 distinct herds. The largest, known as the Killey River caribou herd, ranges over 600 km^2 (232 mi^2) in the upper drainages of the Funny and Killey rivers in Game Management Unit 15B. From the original 52, the herd grew steadily to more than 700 animals until 2001, but was down to an estimated 300 individuals in 2005 (McDonough 2007). A major reason for the decline was the minimum of 191 caribou that died in avalanches between 2001–2002 and 2003–2004. Most of the mortalities were cows and calves (Selinger 2005). Due to the steep terrain within the herd's range, avalanches may be a significant limiting factor for the Killey River caribou population and caribou may compete with an abundant population of Dall sheep for winter range (McDonough 2007).

A smaller group, the Twin Lakes caribou herd, occupied the Benjamin Creek drainage a bit farther north in Game Management Unit 15B. It was first censused separately from the Killey River herd in 1990 with 18 animals counted (Spraker 1995). The population grew slowly and peaked at an estimated 75 animals in 1996 before declining for several years. The herd was absorbed by the Killey River herd in 2002 when the latter expanded its range (Selinger 2003). Because of low numbers, the Twin Lakes herd was never hunted.

Management guidelines for the herds following the transplants called for 3 conditions before hunting seasons could be opened. It was required that population(s) 1) reach a sufficient size which enables them to maintain themselves or increase, coincident with predation, other natural mortality, and hunting; 2) investigate or seasonally use the majority of suitable caribou habitat in these subunits; and 3) maintain a minimum postseason bull:cow ratio of 35:100 (Spraker 1992).

Hunting of the Killey River herd began in 1994 with a drawing permit hunt and a 1 bull bag limit when the herd size reached an estimated 300 caribou. Access to the herd is difficult (horses and boats are the primary means used) and many who draw a permit do not hunt for that reason (Selinger 2005, McDonough 2007). Those that do hunt typically have a high success rate.

For the first 5 years of the hunt the average number of bulls taken increased from 10 a year to 25 a year. For the next 5 years, with the population estimated at 600–750 caribou and concerns growing about numbers exceeding habitat capacity, registration hunts for cows were approved and fewer bull permits were issued. About 140 cows were taken in hunts during the 1999–2003 seasons, while 64 bulls were taken. In 2004, after the population decline from avalanche deaths, the registration cow hunts were discontinued and the drawing hunt was reduced to 25 permits and again restricted to a 1 bull bag limit. Harvest averaged 4 bulls annually during the 2005–2007 seasons (Thomas McDonough, ADF&G wildlife biologist—Homer, personal communication, 2007).

Fox River herd

Survivors and descendants of the Caribou Lake release in 1986 formed the Fox River herd. It has the smallest range of all Kenai herds—about 120 km^2 (46 mi^2) south of the Tustumena Glacier between upper Fox River and Truuli Creek in Subunit 15C. The first survey of the herd in 1988 estimated its size at 32 animals (Spraker 1993). It grew steadily to a 1998 peak of nearly 100 caribou but dropped to an estimated 50 animals during 2004 (Selinger 2005). Two reasons for the decline have been suggested. Selinger (2005) suggests it is due to increased predation by wolves and bears or dispersal north into the Killey River herd. McDonough (2007) suggests that collaring Fox River caribou could reveal if they are dispersing to other nearby areas or if their growth is limited by other factors. Whatever the cause of the decline, the low number of Fox River caribou in 2007 raises concerns about the herd's continued viability (McDonough 2007). Very limited hunting occurred on the Fox River herd during 1995–2003; an average of 2 caribou a year were taken. Hunting was closed in 2004 (McDonough 2007).

ADF&G and Kenai National Wildlife Refuge biologists conducted preliminary habitat assessments for the areas occupied by the Killey and Fox River herds before the 1985–1986 transplant. These results, published in the Kenai Peninsula Caribou Management Plan and revised in 2001, indicated the Killey River herd's range should sustain a population of 400 to 500 caribou whereas the Fox River herd's range limit is approximately 80 caribou. Calf recruitment has been moderately low and insufficient habitat may now be limiting the growth of the Killey River, Fox River, and Kenai Mountain herds (Selinger 2005, McDonough 2007).

Caribou reintroductions to the Kenai Peninsula have been, on the whole, successful. Of the 4 discrete herds occupying areas of the peninsula in 2007, 2 have grown to, and at times exceeded, the estimated limits of their range and supported sustained hunting seasons – Kenai Mountains and Killey River. The ability of the other 2 herds to support hunting is in doubt as of 2008 but, although the Kenai Lowlands herd has not been productive enough to support hunting seasons for more than 6 of the 40 years since introduction, the herd appears well-established and has not yet reached the estimated limits of its habitat capability. After a promising initial 20 years, the Fox River herd, confined to the smallest range area on the peninsula, appeared to be struggling to maintain viability in 2007. However, in another sign of success for the reintroduction of caribou to the Kenai Peninsula, caribou have been reported well to the east of established herds across the Harding Ice Field and near Seward. Although caribou inhabited the Seward area more than 100 years ago (Porter 1893), it is unknown if the small number of dispersing caribou reported in that area so far is enough to establish a durable population (McDonough 2007).

Nushagak Peninsula – 1988

The largest big game transplant in Alaska in terms of the number of animals moved at one time occurred in Southwest Alaska in 1988. Caribou had been absent from the Nushagak Peninsula on the west side of Bristol Bay for a century when a reintroduction was proposed in the ADF&G Southwest Alaska wildlife management plan of 1978 (ADF&G 1978). Although once abundant on the coast between Bristol Bay and Norton Sound, caribou had nearly disappeared by 1880. Overhunting and predation are thought to be the chief causes of the decline, but changes in migration patterns and competition with reindeer may also have been factors (Hinkes and Van Daele 1993, 1996). Reindeer were introduced to the area in the early 1900s to provide Native communities with a reliable source of meat and an economic base. But reindeer herding entered a decline in the 1930s and ended completely in the early 1940s (Hinkes and Van Daele 1993, 1996).

After the creation of the Togiak National Wildlife Refuge in 1980, with its goal to restore wildlife populations to historic levels, the impetus for a reintroduction of caribou to the Nushagak Peninsula grew. The objective of the transplant was to reestablish a caribou population large enough to support a sustainable subsistence hunt for local Native villages. ADF&G staff worked for 5 years prior to the transplant to build local support for it (Ken Taylor, former ADF&G Area Wildlife Biologist—Dillingham, personal communication, 2008). In January 1988 the U.S. Fish and Wildlife Service, ADF&G, and 2 villages in the area–Manokotak and Togiak–signed an agreement to cooperate in the caribou reintroduction. Villagers would help with the capture, release, and herd monitoring, and no hunting would occur for at least 5 years after the transplant (USFWS 1988).

The transplant occurred during 2 weeks in February–March 1988. It was paid for by the U.S. Fish and Wildlife Service while planning and capture operations were done largely by ADF&G staff. Crews of 8 to 10 were used in the operation including Togiak residents who helped with the capture and handling of animals.

Using a net gun mounted on the landing skid of a Hughes 500 helicopter, the crews captured 167 caribou from the Northern Alaska Peninsula herd near Becharof Lake on the Alaska

Peninsula. It was the first time a skid-mounted net gun had been used to capture wildlife in North America (K. Taylor, personal communication, 2008). As many as 27 caribou were captured in a day. Once netted, caribou were mildly tranquilized, hobbled, blindfolded, and flown suspended in a canvas sling to a staging area (Fig. 31). There, antlers were removed, each animal was fitted with an ear tag, and 20 caribou were radiocollared. Biologists also collected blood samples and recorded the physical condition of each animal (Hinkes and Van Daele 1993, 1996).

Photo by Ken Taylor, ©1988 ADF&G

FIGURE 31. A captured caribou is transported in a sling to a staging area on the Alaska Peninsula in 1988.

Sedated caribou were loaded into cargo nets in a single-engine Otter and flown 8 or 9 at a time to Kikertalik Lake on the Nushagak Peninsula for release (Fig. 32). One load of 8 was released at Kanakanak near Dillingham when bad weather prevented transport to Kikertalik. The capture operation focused on adult, pregnant cows (K. Taylor, personal communication, 2008). Of the 167 caribou captured, 3 were released and 1 escaped at the capture site, 6 were killed during capture, 3 died at the staging area, 6 died at the release site, 2 more caribou died soon after release, and 146 (12 calves, 118 cows, 16 bulls) were successfully released on the Nushagak Peninsula (Hinkes and Van Daele 1993, 1996). The 10% mortality rate was low for caribou transplant operations.

For several years after the transplant, Manokotak residents monitored the herd by snowmachine and kept animals from leaving the peninsula and returning to their former range (K. Taylor, personal communication, 2008). Before long however, the herd showed strong fidelity to its new range and few animals have left the peninsula to join other herds or expand their range even during the period of peak population (Hinkes and Van Daele 1993, 1996; Hinkes et. al. 2005).

By 1992 the Nushagak Peninsula caribou population had grown to over 700 animals and by 1993 the herd topped 1,000 (Collins et al. 2003). The herd's growth rate the first 5 years was 38% per year—the highest increase for any caribou herd on the continent and exceeding the

theoretical maximum for caribou (Hinkes and Van Daele 1993, 1996). The chief reason for the extremely rapid increase was a high percentage of females (82%) compared to males in the transplant population (Valkenburg et al. 2001). But there were other factors in the rapid early growth of the population. Cows were reproducing as 2-year-olds rather than at age 4—one indication that the pristine habitat was excellent—and predation was very low because wolves were absent on the peninsula and brown bears hadn't yet recognized newborn calves as prey (K. Taylor, personal communication, 2008; Hinkes and Van Daele 1996; Collins et al. 2003). An assessment of available habitat on the peninsula suggested that it could probably support up to 1,100 caribou with little effect on range quality and the management plan called for a maximum of 1,000 caribou in the herd (Hinkes and Van Daele 1993, USFWS 1994).

Photo by Ken Taylor, ©1988 ADF&G

FIGURE 32. Sedated caribou in cargo nets are transported inside a single-engine otter aircraft from the Alaska Peninsula to the Nushagak Peninsula in 1988.

The 1994 management plan called for hunting to be opened when the population reached 1,000, and hunting to continue for as long as at least 600 caribou were in the herd, with a harvest objective of 10% of the population annually. In 1995, 100 permits were issued for local residents and 38 caribou were reported killed by hunters that year. From 1995 through 2000, 3–4% of the estimated population was reported taken each year by local subsistence hunters (Collins et al. 2003), although actual harvest may be 2 to 3 times the reported harvest. Peak estimated harvest was 136 in 2000 (Valkenburg et al. 2003).

After 1996 the Nushagak herd's growth slowed, growing only 1% during 1996–1998. The population peaked around 1,400 caribou in 1997, then declined to an estimated 1,037 in 2000 (Collins et al. 2003). Beginning in 2000 the herd began a rapid decline. In 2006 the population was estimated to be 546 caribou. A January 2008 survey found 556 caribou and managers were hopeful the population had stabilized (Andy Aderman, USFWS Togiak National Wildlife Refuge Wildlife Biologist, personal communication, 2008). The 1994 management plan calls for hunting to be closed when the population dips below 600. No caribou harvest occurred in 2006 and 2007.

The reasons for the steep decrease in the population of Nushagak caribou are not clear. Calf production and the physical condition of caribou have declined (Collins et al. 2003) as has lichen biomass on the peninsula. This suggests that the 8 years (1994–2001) the herd size exceeded the population objective of 1,000 took a toll on habitat quality and carrying capacity

(Aderman 2006). However, the population curve of the Nushagak herd has corresponded with that of the much larger nearby Mulchatna herd, suggesting that regional health or climate issues may also have had a role (A. Aderman, personal communication, 2008).

Twenty years after the Nushagak Peninsula caribou transplant, its success over the long-term remained in question. Spectacular growth of the herd during the first 10 years was followed by an abrupt contraction during the next 10. As of 2008, the main objective of creating a herd that provides a reliable subsistence harvest for local residents had not been achieved. But the transplant reestablished caribou in their former range on the peninsula in substantial numbers, providing hope that future growth would lead to a more stable, huntable population.

References – Caribou

ADERMAN, A. R. 2006. Monitoring lichen cover and utilization following caribou reintroduction to the Nushagak Peninsula, southwest Alaska. Progress report. U. S. Fish and Wildlife Service. Dillingham, Alaska. 27pp.

ALASKA DEPARTMENT OF FISH AND GAME. 1978. Alaska Wildlife Management Plans – Southwest Region. Juneau, Alaska.

ALASKA GAME COMMISSION. 1952. Investigation to determine practicability of reestablishing caribou on the Kenai Peninsula. Federal Aid in Wildlife Restoration Quarterly Report. 7(2):60–63.

ALLEN, J. A. 1901. Description of a new caribou from Kenai Peninsula. Alaska. Bulletin of the American Museum of Natural History. Volume 14, Article 10, pp. 143–148.

BURRIS, O. E. AND D. E. MCKNIGHT. 1973. Game transplants in Alaska. Wildlife Technical Bulletin No. 4. Alaska Department of Fish and Game. Juneau, Alaska. 57pp.

COLLINS, G. H., M. T. HINKES, A. R. ADERMAN, AND J. D. WOOLINGTON. 2003. Population growth, movements, and status of the Nushagak Peninsula Caribou Herd following reintroduction, 1988–2000. Rangifer. Special Issue No. 14:143–151.

GLENN, L. P. 1967. Caribou report. Alaska Dept. of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-15-R-1 & 2, Juneau, Alaska.

HEMMING, J. E. 1971. The distribution and movement patterns of caribou in Alaska. Alaska Department of Fish and Game, Game Technical Bulletin #1. 60pp.

HINKES, M. T. AND L. J. VAN DAELE. 1993. Population growth and status of the Nushagak caribou herd following reintroduction on the Togiak National Wildlife Refuge 1988–1993. Appendix II, 8pp. *in* 1994 Final Nushagak Peninsula caribou management plan. U.S. Fish and Wildlife Service. Dillingham, Alaska.

_____. 1996. Population growth and status of the Nushagak Peninsula caribou herd in southwest Alaska following reintroduction, 1988–1993. Rangifer. Special Issue No. 9: 301–309.

Hinkes, M. T., G. H. Collins, L. J. Van Daele, S. D. Kovach, A. R. Aderman, J. D. Woolington, R. J. Seavoy. 2005. Influence of population growth on caribou herd identity, calving ground fidelity, and behavior. Journal of Wildlife Management. 69(3):114–1162.

Jones, R. D. 1966. Raising caribou for an Aleutian introduction. Journal of Wildlife Management. 30(3):453–460.

Klein, D. R. 1967. The introduction, increase, and crash of reindeer on St. Matthew Island. Journal of Wildlife Management. 32(2):350–367.

Lentfer, J. W. 1965. Caribou report. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-6-R-5 and 6, Juneau, Alaska.

Leopold, A. S. and F. F. Darling. 1953. Effects of land use on moose and caribou in Alaska. Transactions of North American Wildlife Conference. 553–562.

McDonough, T. 2007. Units 7 & 15 caribou management report. Pages 1–13 *in* P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Juneau, Alaska.

Palmer, L. J. 1938. Management of moose herd on Kenai Peninsula. Research Project Report March, April, and May 1938. Unpublished manuscript. Kenai National Wildlife Refuge Files, Soldotna, Alaska. 40pp.

Porter, R. P. 1893. Report on population and resources of Alaska at the Eleventh Census: 1890. U.S. Dept. of Interior. Census Office.

Selinger, J. 2003. Units 7 & 15 caribou management report. Pages 1–33 *in* C. Healy, editor. Caribou management report of survey and inventory activities 1 July 2000–30 June 2002. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 2005. Units 7 & 15 caribou management report. Pages 1–19 *in* C. Brown, editor. Caribou management report of survey and inventory activities 1 July 2002–30 June 2004. Alaska Department of Fish and Game. Juneau, Alaska.

Spencer, D. L. and J. B. Hakala. 1964. Moose and fire on the Kenai. Proceedings of Tall Timbers Fire Ecology Conference. 3:11–33.

Spraker, T. 1992. Reintroduction of Caribou to the Central and Southern Kenai Peninsula, 1985–86. Alaska Department of Fish and Game Division of Wildlife Conservation Wildlife Technical Bulletin #9. 21pp. Juneau, Alaska.

_____. 1993. Units 7 & 15 caribou management report. Pages 1–14 *in* S. Abbott, editor. Caribou management report of survey and inventory activities 1 July 1990–30 June 1992. Federal Aid in Wildlife Restoration. Study 3.0 Grants W-23-5 and W-24-1. Alaska Department of Fish and Game. Juneau, Alaska.

_____. 1995. Units 7 & 15 caribou management report. Pages 1–21 *in* M. V. Hicks, editor. Caribou management report of survey and inventory activities 1 July 1992–30 June 1994. Federal Aid in Wildlife Restoration. Study 3.0 Grants W-24-1 and W-24-2. Alaska Department of Fish and Game. Juneau, Alaska.

U.S. Fish and Wildlife Service. 1988. Caribou Reintroduction Cooperative Agreement between U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, and cooperative village authorities of Manokotak, Twin Hills, and Togiak. 5pp.

_____. 1994. Final Nushagak Peninsula caribou management plan. U.S. Fish and Wildlife Service. Dillingham, Alaska.

U.S. Fish and Wildlife Service, ADF&G 1994. Environmental Assessment for removal of caribou from Adak Island, Alaska. Homer, Alaska. 43pp.

Valkenburg, P., R. A. Sellers, R. C. Squibb, J. D. Woolington, A. R. Aderman and B. W. Dale. 2003. Population dynamics of caribou herds in southwestern Alaska. Rangifer. Special Issue No. 14:39–50.

Williams, J. C. and V. Tutiakoff, Jr. 2005. Aerial survey of barren-ground caribou at Adak Island, Alaska in 2005. U.S. Fish and Wildlife Service Report. AMNWR 05/14. 10pp. Homer, Alaska.

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Dall Sheep

Kodiak – 1964 to 1967

The idea of a Dall sheep (*Ovis dalli*) transplant in Alaska first came up when the Territorial Legislature established its stocking program in 1925. In December 1950, Clarence J. Rhode, Regional Director of the U. S. Fish and Wildlife Service, compiled a list of transplant proposals received up to that time. Two sheep transplants were listed; one was for sheep to be introduced on Kodiak Island. This project was not given serious consideration at that time because of the need for further investigation and the obvious expense of such a transplant.

Because of renewed local interest, the Alaska Department of Fish and Game, through Federal Aid in Wildlife Restoration Project W-11-D-2, conducted a feasibility study of the proposed transplant of Dall sheep to Kodiak Island. Field observations of the range were made at various times of the year and climatic records were examined to obtain knowledge about snow conditions on prospective winter ranges (Burris, personal files). A range analysis had previously been conducted on Kodiak Island. Although this study indicated that a transplant would likely be unsuccessful, public interest at Kodiak was not to be denied.

Agreements were prepared and approved by the U. S. Bureau of Sport Fisheries and Wildlife Refuge Supervisor to allow the removal of sheep from the Kenai National Moose Range and their subsequent release on Kodiak National Wildlife Refuge. An agreement was also made with the U. S. Forest Service to allow the removal of sheep from USFS property on the Kenai Peninsula.

The first attempt to capture Dall sheep was made in September 1964 (Burris, personal files). Several techniques were considered, such as erecting traps, snaring along established trails, immobilizing sheep with drugs at natural licks and several other possibilities. The method which seemed to hold the most promise was immobilizing the sheep with drugs administered from a helicopter.

Problems with drugs and dosages were encountered during the first attempt in 1964 and the project was cancelled after the project leader was injured. One ewe sheep was captured and released on Kodiak Island that year. Another attempt to refine techniques or devise new ones was made in February 1965 (Burris, personal files). Different drugs were employed and an attempt was made to capture the animals by herding them into deep snow. Sernylan was found to have considerable promise but later proved to be unavailable in sufficient quantities. Attempts to drive the sheep into deep snow met with little success.

A second full-scale attempt to capture Dall sheep was made in May 1965 (Nichols 1968). Again the technique was to administer immobilizing drugs from a helicopter. Effective dosages of succinylcholine chloride were determined and this drug was employed throughout the second attempt.

Twenty sheep were captured and 13 were transported and released on Kodiak Island (Nichols

1968). Six of the 20 died from the effects of the drug and stress of handling and holding. In the course of routine testing for brucellosis and other diseases, it was determined that 1 sheep had a suspect test for brucellosis and this animal was not transplanted.

Effective dosages of succinylcholine chloride were between 15 and 25 mg; 20–25 mg were required for larger adult ewes, while dosages of 15–20 mg were satisfactory for lambs and young rams. The lambs were approximately 1 year old and weighed 43–57 pounds. Adults weighed 110 to 125 pounds. Two- to three-year-old rams suitable for transplanting were approximately the same weight as adult females. Immediately after the effects of the immobilizing drug had begun to wear off, tranquilizers were administered to prepare them for the helicopter flight to the airstrip. Once there, they were restrained by placing soft leather collars about their necks and tethering them to trees. Within a short period of time the animals would cease struggling and lie quietly.

Transportation of the animals to Kodiak Island was accomplished with an ADF&G Grumman Goose. Animals which were held at the airstrip were hobbled and loaded aboard the airplane and released on the beach at Uganik Bay. Transportation and release were well coordinated and on the last day the animals captured in the morning were released in the afternoon.

Mortality after the animals were released was high. At least 7 of the sheep had died by 22 May 1965. The high mortality was attributed to the relatively poor physical condition of the sheep that season.

In 1967, 2 additional sheep were captured on the Kenai Peninsula and transplanted on Kodiak Island (Nichols 1968). As in 1965, attempts to capture sheep resulted in excessive mortality. It was recommended at that time that no further sheep transplants be attempted until adequate capture techniques were perfected.

A report on the transplant, received in the summer of 1966, indicated that a ram, ewe and newborn lamb had been seen at the headwaters of Barling Bay, approximately 30 miles (48 km) from the release site at Uganik Bay (Burris, personal files). Scattered sightings were reported through the mid 1970s but sheep did not survive on Kodiak. The transplants failed.

References – Dall sheep

NICHOLS, L. 1968. Dall sheep report. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration Progress Report. Project W-15-R-2 and 3. Juneau, Alaska.

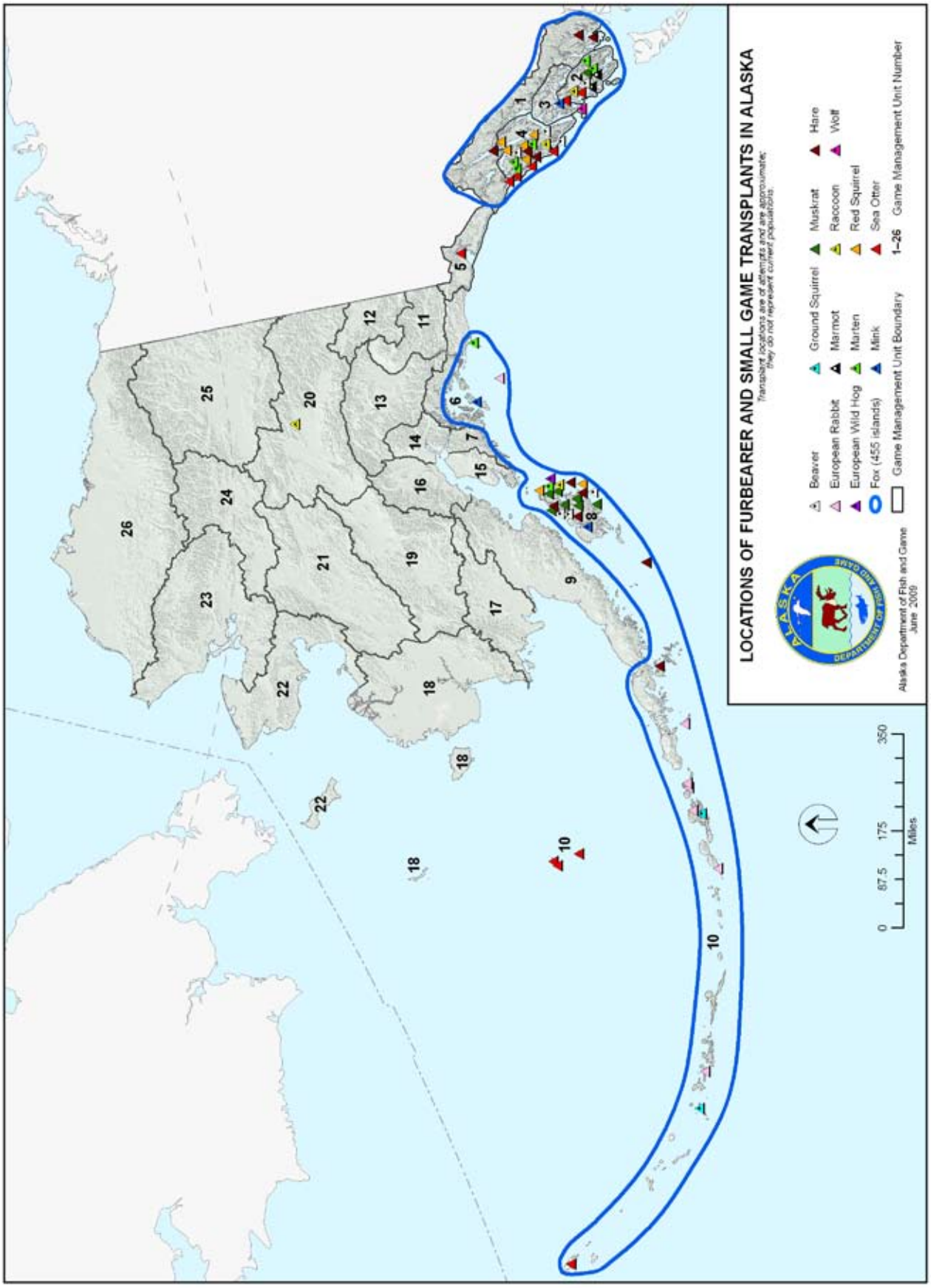

FIGURE 33. **Approximate locations of furbearer and small game transplant efforts in Alaska**

FURBEARERS AND SMALL GAME

Because early Russian settlers recognized the potential of the Aleutian Islands for raising foxes, transplants of these furbearers were the earliest of game transplants in Alaska (Murie and Scheffer 1959). The release of foxes on unoccupied islands continued after purchase of Alaska by the United States, and this practice was extended to several other furbearer species. These transplants, motivated by the high economic value of furs, began to decrease as the fur market declined in the late 1940s. More recently, the U. S. Fish and Wildlife Service and the Alaska Department of Fish and Game reinstituted furbearer transplants with the goal of reintroducing sea otters into former ranges.

Few of the furbearer transplants made in the 1900s could be considered successful. Many were made to marginal habitats and, even though introductions of the transplanted species were successful, resulting populations were not capable of supporting large harvests or even attracting trapping effort. Even in instances where harvestable populations resulted from introductions, for example martens (*Martes americana*) in Southeast Alaska and beavers (*Castor canadensis*) on Kodiak Island, declining wild fur markets resulted in only slight utilization of these populations.

Not only were many transplants of furbearers failures, but in several instances these introductions were detrimental to the native fauna. For example, depredations by foxes on ground nesting bird populations in the Aleutian Islands have had a tremendous impact on several avian species (Murie and Scheffer 1959). The Aleutian Canada goose (*Branta canadensis leucopareia*), which for many years was considered to be in imminent danger of extinction, represents an outstanding example of how transplants can "backfire." Transplanted foxes and unintentionally introduced rats (*Rattus norvegicus*) have drastically reduced this island nesting subspecies. In another documented case, foxes were first introduced in 1895 on Green Island within Prince William Sound (Bailey 1993) and by 1908 Green Island had lost all of its indigenous mammals except one species of shrew (*Sorex* spp.) (Elkins and Nelson 1954).

The motives underlying past transplants of small game species like hares, rabbits, and squirrels are less evident than those for furbearers, but it is clear that many such introductions were made to provide food for carnivorous furbearers and additional hunting opportunities for local residents.

Fox

Transplanting foxes to Alaska islands as a form of fur farming for commercial gain began 250 years ago and became a common practice in the early 1900s. Detrimental effects on the islands' native fauna were not considered. In fact, in most cases, islands with bird and marine mammal colonies were prized as providing a natural and ready source of "food" for the introduced foxes.

The arctic fox (*Vulpes lagopus*) was native on some islands in the Bering Sea and Arctic Ocean that were connected to the mainland at least during the winter. Red fox (*Vulpes vulpes*) occurred naturally on islands that were at one time connected to the mainland by a land bridge during periods of reduced sea levels. The red fox is indigenous to the eastern Aleutians (Fox Islands) at least as far west as Umnak Island and to some of the large islands south of the Alaska Peninsula. It was also native to Kodiak, Afognak, and Shuyak (Bailey 1993). Nearly all fox introductions in Alaska were of arctic ("blue") foxes with a few islands in the early years stocked with dark color phases ("silver" and "cross" foxes) of the red fox (Murie and Scheffer 1959, Bailey 1993).

From the earliest fox transplants conducted by the Russian-American Company in the mid 1700s through the end of fox farming in the 1930s, stocking of Alaska islands with foxes was almost exclusively a private commercial enterprise. Governments sanctioned the activity but apparently were not actively involved in the transplants. Bailey (1993) produced a comprehensive report on the introduction of foxes to Alaska islands. He found records that arctic or red foxes (and sometimes rodents as fox food) were introduced on at least 455 Alaska islands beginning in 1750 (Attu) and extending through the 1930s. Approximately 180 islands stocked with foxes were in Southeast Alaska, 73 islands were in the Gulf of Alaska and Prince William Sound, 51 islands were in the Kodiak Archipelago, and 63 islands were off the south side of the Alaska Peninsula. The remaining 88 were Aleutian islands (Bailey 1993). In 1882 the U.S. government began leasing islands for fox farming. The peak number of licenses issued was 431 in 1931, although the economic heyday of the Alaskan fox farming industry came during the previous decade when about 36,000 pelts were produced at a value of $6 million. The fox farm industry collapsed during the Great Depression and did not recover. World War II made trappers' access to the Aleutian Islands difficult. After the war pelt prices remained too low for island farming to be profitable (Bailey 1993).

On 388 islands east of Kodiak, foxes disappeared naturally when abandoned by trappers or they were removed by trappers when fur prices declined. No introduced foxes remain on islands in Southeast Alaska and Prince William Sound. Various reasons likely contributed to the demise of foxes where they died out naturally. Among them are starvation after destruction of bird colonies or the end of feeding by fur farmers and trappers; predation by bears; competition from river otters or other carnivores; inbreeding on small islands; disease; and, in at least one case, tsunamis (Bailey 1993).

The detrimental effects of introduced foxes on nesting birds in the Aleutian Islands was first comprehensively described by Olaus Murie (1936, 1937). Among the birds that disappeared from fox islands were colonies of Cassin's auklet, ancient murrelets, storm petrels, common eiders and ptarmigans (Bailey 1993). Vegetation on islands with foxes also declined when nutrients from the excrement of nesting birds was no longer available. Beginning in 1949, the U. S. Fish and Wildlife Service began eradicating introduced foxes from islands to restore nesting habitat for the Aleutian Canada goose (see page 121). Since then a systematic fox eradication program has been conducted on the islands of the Alaska Maritime National Wildlife Refuge. By 2008 introduced foxes had been eradicated from 42 islands of the refuge (Steve Ebbert, 2008, USFWS Alaska Maritime National Wildlife Refuge Wildlife Biologist, personal communication, 2008) (Table 1). Methods of eradication included poisoning (prior to 1972),

TABLE 1. Islands from which transplanted foxes were eliminated by personnel of the Alaska Maritime National Wildlife Refuge and U.S. Department of Agriculture, Wildlife Services, as of 2007

ISLAND	YEAR FOX-FREE	ISLAND LOCATION
Adugak	1983	Aleutians
Agattu	1964	Aleutians
Alaid	1975	Aleutians
Amatignak	1991	Aleutians
Amchitka	1949	Aleutians
Amlia	2001	Aleutians
Amukta	1983	Aleutians
Attu	1999	Aleutians
Avatanak	2004	Aleutians
Big Koniuji	1985	Alaska Peninsula
Bird	1984	Alaska Peninsula
Caton	2006	Aleutians
Carlisle	1990	Aleutians
Chernabura	1994	Alaska Peninsula
Elma	2007	Aleutians
Gareloi	1996	Aleutians
Great Sitkin	1998	Aleutians
Herbert	1993	Aleutians
Igitkin	1988	Aleutians
Inikla	2006	Aleutians
Kagalaska	1997	Aleutians
Kagamil	1994	Aleutians
Kasatochi	1984	Aleutians
Kiska	1986	Aleutians
Little Koniuji	1993	Alaska Peninsula
Little Sitkin	2000	Aleutians
Little Tanaga	1989	Aleutians
Nizki	1969	Aleutians
Poperechnoi	1988	Alaska Peninsula
Rat	1984	Aleutians
Sequam	1996	Aleutians
Segula	1995	Aleutians
Semisopochnoi	1997	Aleutians
Simeonof	1994	Alaska Peninsula
Tanaga	2004	Aleutians
Ugamak	1992	Aleutians
Ukolnoi	1995	Alaska Peninsula
Ulak	1991	Aleutians
Uliaga	1984	Aleutians
Umak	1991	Aleutians
Ushagat	1987	Kodiak Archipelago
Yunaska	1993	Aleutians

Source: S. Ebbert, USFWS Alaska Maritime National Wildlife Refuge

trapping and shooting, and biological control. In the latter method, sterilized red foxes were introduced on islands with arctic foxes with the result that arctic foxes eventually disappeared through apparent competitive exclusion (Bailey 1993). Large, and in some cases spectacular, increases in bird numbers have been documented on islands after the disappearance or removal of foxes (see Bailey 1993:38–39, Byrd et. al. 1994). Approximately 30 Alaska islands continue to harbor populations of introduced foxes.

Although initially a commercial success, fox transplants in Alaska must be considered failures both because of the ultimate demise of the commercial aspects of fox farming and the disastrous consequences for indigenous island fauna and flora.

Muskrat

The first attempt to transplant muskrats (*Ondatra zibethicus*) in Alaska was in 1913 when animals from the Nushagak area were transported to several of the Pribilof Islands (Elkins and Nelson 1954). This operation was a complete failure (Preble and McAttee 1923).

During the summer and fall of 1925, personnel of the Alaska Game Commission conducted a muskrat transplant from the Copper River area to the Kodiak area according to the 1926 Executive Officer's Report to the Alaska Game Commission. Of the 100 animals shipped from Cordova, 30 were lost in transit. The remaining 70 were released at the following locations in the Kodiak Archipelago: Clark's Lake, Kodiak Island; Potatopatch Lake, Kodiak Island; Monk's Lagoon, Spruce Island; Litnik Lake, Afognak Island; and various ponds on Whale Island. In 1929, as a result of a nuisance complaint on Long Island, 29 muskrats were captured and later released on the Buskin River, Kodiak Island and at Afognak Lake, Afognak Island (Alaska Game Commission 1931).

The 1943 Executive Officer's Report to the Alaska Game Commission described the Kodiak populations as "Excellent; abundant and spreading." In 2008, 65 years later, even though muskrats are well established on the Kodiak Archipelago, the trapping effort and harvest is so low that this transplant must be considered an economic failure.

An attempt by the Alaska Game Commission in 1929 to introduce muskrats on Prince of Wales Island in Southeastern Alaska was the last recorded muskrat transplant in the state. Although a report by Elkins and Nelson (1954) lists 2 different releases during this operation it appears that there was only 1 such release. About 18 muskrats were captured at Haines and transported to Klawock Lake (Alaska Game Commission 1931). Some of these animals were lost en route because of inclement weather. Although a few of the muskrats were still surviving in 1937 the transplant was considered a failure in the 1942 Executive Officer's Report to the Alaska Game Commission.

Beaver

Alaska's first recorded beaver (*Castor canadensis*) transplant occurred in 1925 (Elkins and Nelson 1954). Under a program authorized by the Territorial Legislature, the Alaska Game Commission circulated bids to capture beavers for transplants to Kodiak Island. The contract was eventually let at $50.00 per beaver delivered to Cordova for a maximum of 40 beavers. Thirty-four animals were delivered but 10 escaped or died before release on Kodiak. Seven of the remaining 24 were liberated at Clark's Lake and 17 were released into the streams entering Kalsin Bay (Elkins and Nelson 1954). This transplant eventually resulted in a harvestable population of beavers on Kodiak Island.

Because of the already apparent success of the 1925 transplant of beavers to Kodiak Island, the Alaska Game Commission, using Territorial funds, decided to extend beavers to Raspberry Island near Kodiak. Twenty-one beavers trapped near Cordova were released on Raspberry Island in 1929 (Elkins and Nelson 1954).

Beavers are well established on Kodiak, Afognak, and Raspberry islands. Even though the season and bag limits are liberal, harvest and effort remain relatively low. In the late 1990s and early 2000s about 15 trappers a year took an average of 3 beavers each; a total harvest of just less than 50 beavers a year. Most beaver pelts are kept on Kodiak for personal use or sold locally (Van Daele and Crye 2007).

Concurrent with the Kodiak transplant, attempts were made to move beavers to Baranof and Chichagof islands in Southeast Alaska. Although this project was organized in the same fashion as the Kodiak transplant, it was stymied in 1925 because no satisfactory bids were received and in 1926 because the contractor failed to capture beavers. A second contractor in 1926 was no more successful than the first, but a third contract in 1926 resulted in 10 beavers being captured on Prince of Wales Island. These animals were released near Goddard Hot Springs on Baranof Island in 1927 (Elkins and Nelson 1954).

Beaver populations grew slowly on Baranof and their range was confined to northern parts of the island. In the 1980s and early 1990s they began entering the drainages of the watershed for the City of Sitka (Young 1992). Although Burris and McKnight (1973) give no specifics of a beaver transplant to Chichagof, Young (1992) assumes that one occurred prior to statehood, perhaps about the same time as the Baranof transplant. Beaver populations on Chichagof remained low and prior to 2007 trapping for beaver was never opened on Baranof and Chichagof.

Timber harvest in the valley bottoms of Chichagof and northern Baranof islands in the 1970s through 1990s may have improved beaver habitat due to deciduous alder and willow regrowth in the mostly coniferous forest. Beginning in 2000, some roaded areas on these islands sustained repeated damage from flooding caused by beaver dams. Nuisance permits increased in the early 2000s on Baranof and Chichagof and sometimes exceeded the total number of beaver trapped during the open season on Admiralty Island. Because of that, in 2006 ADF&G recommended opening up the islands to beaver trapping. The Board of Game agreed and the first beaver trapping seasons on Baranof and Chichagof islands occurred in the winter of 2007–2008 (Mooney 2007).

Undoubtedly there have been other beaver transplants of minor consequence in Alaska, but adequate documentation of such transplants is lacking. For example, in the 1929 report by the Alaska Game Commission to the Territorial Legislature it is noted on page 7 that "The beaver placed on Kruzof Island under 1925 Project No. 3 are fulfilling all expectations in the increase and spread to surrounding areas." With no further information available it must be assumed that this was a mistaken reference to the beavers transplanted to Baranof Island in 1927. Another even more questionable report indicated that beavers had been released at Yakutat Bay. Beavers do not presently occur there.

Marten

Transplants of marten (*Martes americana*) in Alaska commenced in 1934 with a program proposed by the Alaska Game Commission through the Bureau of Biological Survey and the Civil Works Adminis-tration (Alaska Game Commission 1935). The Federal Emergency Relief Administration provided an allotment of funds to the Office of the Governor for this program designed to provide jobs for unemployed Alaska Natives. This program, which had goals for transplanting martens, deer, and rabbits, employed a maximum of 86 persons from the period December 1933 until May 1934. The first project was a marten transplant. Crews stationed near Ketchikan on Behm Canal and near Petersburg at Thomas Bay captured 17 martens which were released on Prince of Wales Island (10) and Baranof Island (7). Despite the relatively small number of animals released, these transplants were successful in establishing marten on these islands (Elkins and Nelson 1954).

Elkins and Nelson (1954) reported that 2 marten transplants were conducted in the early 1940s, one to Kayak Island in the Gulf of Alaska and the other to Patterson Island near Prince of Wales Island in Southeast Alaska. According to a trapper's report from Kayak Island in the winter of 2007–2008, marten were plentiful there (Dave Crowley, ADF&G Area Wildlife Biologist—Cordova, personal communication, 2008). It is unknown whether martens remain on tiny Patterson Island.

Efforts to introduce martens on Chichagof Island were initiated in 1949 when 2 males and 4 females obtained from Baranof Island were released there (Elkins and Nelson 1954). In 1950 a project initiated by the Alaska Game Commission and financed under Federal Aid in Wildlife Restoration Development Project W-4-D-1 resulted in the capture of 1 marten near Ketchikan and its subsequent release at Pelican on Chichagof Island on 19 March 1951 (Nelson 1951b). Three additional martens were purchased from Mr. John Swiss of Polly Creek, Alaska, and released at Pelican on 30 April 1951 (Nelson 1951b). Later that year 6 more martens were released at Gould Harbor and Pelican. In February 1952, 3 martens from Wrangell and 1 from Petersburg were released at Pelican. One more marten was released at the same site that year, bringing the total released on Chichagof to 21 (Elkins and Nelson 1954).

Despite the low number transplanted, the Chichagof marten population rapidly occupied most of the island. Part of the explanation for the rapid expansion may be that the officially introduced population got an unofficial boost from private citizens. Loyal Johnson, former

Area Wildlife Biologist for ADF&G in Sitka, said a local Baranof Island trapper admitted to him that he would take to Chichagof Island and release any female martens still alive in his traps (L. Johnson, personal communication, 2008). Because marten have delayed implantation of eggs, females trapped in the fall would already be pregnant and so would give birth on Chichagof Island, augmenting the marten numbers more quickly.

Marten populations fluctuate in Southeast Alaska based on the cycles of abundance of the small mammals that are their primary prey. Marten harvests fluctuate based on market price and on furbearer populations. The increase in logging roads in the 1970s on Baranof and Chichagof islands made many interior areas of those islands accessible to trappers. Previously, trappers relied mostly on shoreline trapping from boats. Boats are still the prime mode of transportation in marten harvests on Baranof and Chichagof with roaded access accounting for half to a quarter of the harvest during the early 2000s. Record fur prices in recent years have resulted in higher harvests. Reported harvests rose from 755 marten in 2001 to 2,231 in 2006 (Mooney 2007).

On Prince of Wales Island during the same period marten harvest ranged from a low of 323 to a high of 1,067. About 60% of martens are taken by trappers using the extensive road system of the island. Rising prices have increased harvest and activity in the early 2000s (Porter 2007).

Martens on Baranof, Prince of Wales, and Chichagof islands are well-established. Unfortunately, however, periodic low fur prices, the rather low quality of pelts from this area and decreasing trapping activity over the years have undermined the original purpose of these transplants. Martens, like all furbearers, contribute only slightly to the economy of Southeast Alaska now, and from the standpoint of economic gain these transplants must be considered marginally successful. However, viewed from the standpoints of providing regular recreational trapping opportunities and incidental income for a number of Southeast Alaska residents, the transplants were successful.

After completion of the Chichagof Island transplant, efforts were initiated under Federal Aid in Wildlife Restoration Development Project W-4-D-3 to introduce marten from the Lake Minchumina area to Afognak Island (Nelson 1952b). This effort was conducted in a more efficient manner than earlier marten transplants, and all animals were taken from an area which had traditionally produced high quality marten furs. The sex and age of each animal was determined and each was ear-tagged prior to release. In September 1952, 8 martens were released on Afognak Island. Five more were transplanted on 29 October, 5 on 5 December and 2 on 29 December. Eight of these 20 animals were males and the rest were females.

In 2008 marten populations appeared to be healthy and productive across Afognak Island. Although no harvest records are available, the limited number of trappers who target marten are consistently successful. Hunters, loggers, and fishermen commonly see martens in all forested areas of Afognak, but there are few reports from other islands (Larry Van Daele, ADF&G Area Wildlife Biologist—Kodiak, personal communication, 2008).

Mink

There have been only 3 reported transplants or, more properly, "stockings," of mink (*Neovison vison*) in Alaska.

After several unsuccessful attempts to purchase live-caught, wild mink from the Cordova area, officials of the Alaska Game Commission and U. S. Fish and Wildlife Service agreed that mink reared on fur farms should be used in their transplants. As a result, 24 mink (16 females and 8 males) from the Petersburg Fur Experiment Farm were released 20 December 1951, on Montague Island in Prince William Sound (Nelson 1951a). This introduction resulted in harvestable mink populations. Harvest data for mink are not collected. However, as with other areas in Prince William Sound, low pelt prices during the 1980s and the isolation of Montague may have kept harvests low and allowed mink numbers to increase. However, this increase may have been slowed or reversed in 1989 because of mortality caused by the *Exxon Valdez* oil spill (Crowley 2007).

Mink from the Petersburg Fur Experiment Farm were also used in a transplant to Karluk Lake on Kodiak Island. On 28 October 1952, 16 females and 8 males were released at this site (Nelson 1952b). Mink sign was seen around Karluk Lake for 2 or 3 years following this transplant, but it now appears that this attempt failed.

In 1956, 10 mink (6 females and 4 males) from the Experiment Farm were released on Strait Island in Southeast Alaska (Nelson 1957). Strait Island is fairly isolated and seldom visited, much less trapped. The status of mink on the island was unknown in 2008 (R. Lowell, ADF&G Area Wildlife Biologist—Petersburg, personal communication, 2008). As mink are ubiquitous in Southeast Alaska any mink on Strait Island may also have arrived naturally, so it would be difficult to determine if the transplant was a success.

Sea Otter

In the 1950s and 1960s many attempts were made to reestablish sea otters (*Enhydra lutris*) on their former ranges in Alaska and elsewhere. A vast amount of effort was expended in developing techniques and moving otters from well-established populations in the Aleutian Islands to habitats formerly occupied by this species. Initial efforts in the mid 1950s by personnel of the U. S. Fish and Wildlife Service resulted in the introduction of 26 sea otters from Amchitka Island to St. Paul and Otter Islands in the Pribilof Island group and the movement of 5 Amchitka otters to Attu Island (Kenyon and Spencer 1960). The Pribilof transplant seemed initially to be a success.

A 1968 release of 57 otters by ADF&G in the Pribilof Islands augmented the 26 that were released in the 1950s. Neither Pribilof transplant appears to have succeeded. Otters were reported very rare in the Pribilofs in the early 1990s (USFWS 1994). By 2008 there was no resident breeding population of otters in the Pribilofs (Angela Doroff, USFWS Marine Mammal Biologist, personal communication, 2008).

After statehood, ADF&G undertook extensive sea otter transplants in cooperation with the Atomic Energy Commission (AEC). At the time, the AEC was planning a series of underground nuclear tests at Amchitka Island in the Aleutians, to be conducted during 1965, 1969, and 1971. Staff of the U.S. Fish and Wildlife Service and ADF&G convinced the AEC that funding removal of sea otters from harm's way in the proposed blast area and transplanting them to some of their former ranges would be a worthy project (Jerold Deppa, former ADF&G wildlife biologist—Ketchican, personal communication, 2008). Although not formally stated as such, the transplant was a *de facto* mitigation measure for the nuclear tests. An unknown but significant number of otters and other animals died as a result of the tests. Otters from Amchitka were transplanted to Southeast Alaska during 1965–1969 and to Canadian and U.S. coastal waters farther south in subsequent years (Table 2).

Improvements were made in capture techniques and better systems were developed for holding animals on Amchitka Island and transplanting animals with aircraft. Transplants in 1966 resulted in the movement of 10 otters to Yakutat Bay and 20 otters to Khaz Bay near Sitka (Schneider 1973). The 1966 Yakutat Bay transplant grew substantially over time, particularly in the late 1990s and early 2000s, to an estimated 1,500 in 2005 (Gill and Burn 2007).

Jerry Deppa, a former game biologist for ADF&G in Ketchikan, coordinated release of the sea otters in Southeast Alaska in 1968 and 1969 and described the operation. Sea otters were captured with gill nets deployed among kelp beds in Amchitka waters. Once captured, the animals were held in large plywood holding tanks on the island. Pumps circulated sea water through the tanks. For transport, individual bathtub-like kennels were fashioned from galvanized steel approximately 18 inches wide by 36 inches long by 8 inches deep, with hinged, perforated, angle-iron tops covered by netting. The kennels were designed to be stackable and to fit through the rear door of a Grumman Goose amphibious aircraft. They could also hold several inches of water to keep the otter inside more comfortable (J. Deppa, personal communication, 2008).

No chemical sedation of animals was used throughout the project. An unknown number of otters drowned after becoming entangled in nets during the capture phase of the transplants (J. Deppa, personal communication, 2008).

Otters were flown from Amchitka 60 at a time in C-130 Hercules transport planes to Annette Island, Sitka, or Gustavus airports in Southeast Alaska. Upon arrival, 30 otter kennels were loaded–10 per plane–into 3 waiting Grumman Goose aircraft, which had had their seats removed, and were flown to the release sites. Once the planes landed on the water, the otters were set free one-at-a-time through the plane door by opening the hinged kennel top and letting the animals slide out. While the first load of 30 was deployed, volunteers at the airport dowsed with sea water the second group of 30 that were awaiting their turn. The water seemed to reassure and calm any distressed otters (J. Deppa, personal communication, 2008). Despite the considerable cleanup that planes required after otter flights, Alaska Airlines, Webber Air in Ketchikan, and the U.S. Fish and Wildlife Service all made their Grumman Goose aircraft available at short notice throughout the summer for the transplants.

In Sitka, a submerged, floating, chicken-wire pen secured to a private dock was used as a holding pen for otters that arrived in suspect physical condition. Three or 4 sea otters were held there and fed

crab for a couple of weeks. One otter died of suspected respiratory problems. The others recovered and were released at Biorka Island near Sitka (J. Deppa, personal communication, 2008).

During the summer of 1968, a plane load of otters left Amchitka for Southeast Alaska about once every 2 weeks. The operations resulted in the introduction of approximately 300 sea otters to former ranges in Southeast Alaska (Table 2). Khaz Bay on the west coast of Chichagof Island received the most transplanted sea otters. In 1969 an additional shipment of 58 otters was released at Khaz Bay, bringing its total of transplanted animals to 194.

With the transplant of 403 sea otters between 1965 and 1969 to 7 sites in Southeast Alaska, otters became reestablished in that region. The population grew at an estimated rate of 20% a year into the 1990s as it spread along the archipelago. Surveys in 2002 and 2003 estimated 7,500 sea otters in Southeast Alaska (Bodkin and Esslinger 2008). The population appeared in the early 2000s to have limited its range expansion to outside coast waters and not to have moved into inner, protected waters of the archipelago (USFWS 2008). Although the overall population seemed no longer to be increasing, some redistribution of the population was occurring. For instance, numbers of otters in Glacier Bay were increasing due to substantial immigration of otters during the most recent decade (USFWS 2008).

Also in 1969, efforts were extended to repopulate former sea otter ranges south of Alaska (Schneider 1973). That year British Columbia received 29 otters which were introduced into coastal waters near Vancouver Island. At the same time Washington State accepted a shipment of 29 otters to be transplanted into coastal waters off the Olympic Peninsula. Unfortunately, 13 of these 29 sea otters died shortly after being transplanted, apparently as a result of shock.

Efforts to expand sea otter populations outside Alaska continued in 1970 with British Columbia, Washington and Oregon receiving 14, 30, and 29 animals, respectively. Oregon was the recipient of an additional 63 sea otters in 1971 and British Columbia received 46 more animals in 1972. The 60 otters for the 1970 and 1972 transplants to British Columbia were captured in Prince William Sound near Montague and Green Islands. All otters for Washington and Oregon and the 29 otters transported to British Columbia in 1969 were taken near Amchitka Island.

Two of these reintroduction programs were successful. The Oregon effort failed when all 93 animals died within a few years of the transplant. In Washington the transplant was a success. Sea otters in Washington waters inhabit the northwest coast of the Olympic Peninsula and the western part of the Strait of Juan de Fuca. The estimated number of animals was about 750 in 2004 (Lance et al. 2004). The British Columbia population had an estimated growth rate of 18.5% a year from 1977 to 1995, similar to the introduced population in Southeast Alaska. After 1995, the rate of increase slowed somewhat. A 2004 estimate of the population was 3,185 otters in British Columbia waters, mostly along the coast of Vancouver Island (Nichol et al. 2005).

Sea otter reintroductions have been controversial with some fishermen because shellfish numbers – crabs, clams, and abalone – have declined following the return of sea otters. On the other hand, sea otters have also reduced sea urchin populations, allowing kelp beds to become reestablished in North Pacific coast waters. Healthy kelp forests typically are evidence of greater biological diversity in the marine coast ecosystem.

TABLE 2. Numbers of sea otters transplanted in/from Alaska, 1955–1972

RELEASE SITE	1955	1956	1959	1965	1966	1968	1969	1970	1971	1972	TOTAL
ALEUTIANS											
Attu Island		5									5
PRIBILOFS											
Otter Island	19[a]										19
St. Paul Island			7								7
St. George Island						57					57
SOUTHEAST ALASKA											
Yakutat Bay					10						10
Khaz Bay				23	20	93	58				194
Yakobi Island						30					30
Biorka Island						48					48
Barrier Island						55					55
Heceta Island						51					51
Cape Spencer						25					25
BRITISH COLUMBIA											
Vancouver Island							29	14		46	89
WASHINGTON							29[b]	30			59
OREGON								29	63		92
TOTAL	**19**	**5**	**7**	**23**	**30**	**359**	**116**	**73**	**63**	**46**	**741**

[a] None believed to have survived.
[b] At least 13 died shortly after release.
Note: 1955 to 1959 (31 sea otters) by USFWS, 1965 to 1972 (710 sea otters) by ADF&G. In some cases one or two of the above animals died near the time of the release.
Source: (Schneider 1973) as presented in Burris and McKnight (1973).

Raccoon

Releases of raccoons (*Procyon lotor*) were made by private individuals in several locations within Alaska, mostly for purpose of fur farming. With one exception, the animals do not appear to have persisted, and as commercial enterprises the transplants were unsuccessful.

A few raccoons have been released in the Fairbanks area; apparently these were pets that either escaped or were released for other reasons. One such animal survived through a winter in the vicinity of the Fairbanks municipal dump only to be taken by a trapper the following winter (Robert Rausch, ADF&G wildlife biologist, personal communication, Burris and McKnight 1973). Another raccoon was trapped the next year near Fairbanks.

Long Island, near Kodiak, was the site of another raccoon transplant (Murie and Scheffer 1959). Fur farmers imported these animals from several Midwestern states sometime prior to 1936. Van Daele and Crye (2007) report that raccoon sightings on Kodiak were rare in the early 2000s.

Two transplants of raccoons occurred in Southeast Alaska. However, neither transplant established populations useful for trapping.

In 1941 a private individual placed 8 raccoons from Indiana on Singa Island in El Capitan Passage off the west coast of Prince of Wales Island (Elkins and Nelson 1954). In terms of establishing a raccoon population, this transplant was successful and raccoons occupied Singa, El Capitan, and perhaps other parts of this area for many years. Sylvia Geraghty, a longtime resident of Tokeen on El Capitan Island until 2001 said raccoons still inhabited the island when she left, but was uncertain about other islands. Geraghty had heard reports in the 1980s and 1990s of raccoons as far away as Staney Creek and Shakan Bay on northwest Prince of Wales Island. Geraghty described them as a dark-pelaged variety whose tails did not appear to have rings. They seemed to be surviving mostly on crabs, mussels and other shellfish they found in intertidal areas (Sylvia Geraghty, Wrangell resident, personal communication, 2008).

The last known introduction of raccoons occurred in 1950 when an unknown number of animals were released or escaped on Japonski Island near Sitka (Elkins and Nelson 1954). This introduction resulted in a population of raccoons that briefly spread to nearby Baranof Island. The raccoons did not survive long however, and by 2008 no raccoon sightings on Baranof or Japonski had been reported for 40 years (Phil Mooney, ADF&G Area Wildlife Biologist—Sitka, personal communication, 2008).

It is fortunate that most raccoon transplants were not successful. The impact of this introduced species on native furbearers and populations of ground nesting birds is not known and large numbers of raccoons, like foxes, would likely have proven detrimental to native fauna. Under state game regulations, as a nonindigenous species that is capable of surviving in Alaska in the wild, raccoons cannot legally be brought into the state without a permit from the department. Beyond concerns about their effects on native fauna, raccoons harbor the rabies virus. It is desirable to keep this potential source of rabies out of Alaska.

Red Squirrel

Red squirrels *(Tamiasciurus hudsonicus)* were often introduced as a food source for transplanted martens, even though several studies in Alaska and elsewhere have shown that squirrels do not necessarily comprise a significant portion of a marten's diet (Lensink et al. 1955, Buskirk and Ruggiero 1994, Ben-David et al. 1997, Flynn et al. 2004). It is not likely that red squirrel transplants have greatly influenced the outcome of marten introductions.

In 1930, Baranof Island received a transplant of 55 red squirrels live-trapped in the Juneau area (Alaska Game Commission 1931). The same year 50 squirrels from Juneau were transported to Basket Bay (25 animals) and Whitestone Harbor (25 animals) on Chichagof Island. Introductions to Chichagof Island were bolstered in 1931 when 40 more squirrels from the Juneau area were released at Patterson Bay (Alaska Game Commission 1935).

In 2008, squirrels were abundant on Chichagof and on Baranof Island, where they had spread to the southern tip of the island not long after the transplant. ADF&G biologist Loyal Johnson marked a red squirrel during the 1980s and found it traveled more than 2 miles in a day to return to the original trapping site. This helps explain squirrels' ability to distribute themselves in good habitat as population densities increase. From 1980 through 2008, a succession of ADF&G Sitka wildlife biologists came to believe that squirrels are at least partly responsible for diminished stocks of blue grouse (now called dusky grouse) and ptarmigan on Admiralty, Baranof, and Chichagof islands during that time. Squirrels probably also play a predatory role on passerine birds' eggs and hatchlings, although the magnitude of their effect has not been determined. In spring 2003, biologists found a squirrel midden containing fresh blue grouse egg shells on Admiralty Island. Squirrels spread to Admiralty probably from an unauthorized release by a private citizen in the late 1970s. The first documented sighting was at Young Bay in 1980 (P. Mooney, personal communication, 2008). Johnson said (personal communication, 2008) he heard that a private citizen live-trapped squirrels in the Juneau area and released them on Admiralty about that time.

A red squirrel transplant consisting of 47 animals captured in the Anchorage area was conducted in July and August 1952 to Afognak Island a few months prior to the marten transplant on that island (Nelson 1952a). This transplant resulted in excellent squirrel populations but it is questionable whether it affected the ultimate success of the marten introduction. Also in 1952, 24 squirrels from the Anchorage area were released on Cape Chiniak, Kodiak Island (Nelson 1952a). This introduction was not successful in establishing a red squirrel population.

Marmot

The Alaska Game Commission, apparently with the objective of establishing a harvestable fur resource, transplanted hoary marmots (*Marmota caligata*) to Prince of Wales Island in 1930 and 1931. On 26 August 1930, 3 marmots trapped in the Juneau area were released near Klawock, and in September 1931, 5 pairs from the same source were released on the west coast of Prince of Wales Island (Alaska Game Commission 1935). The transplants failed. Marmots

did not exist on Prince of Wales in 2008 and residents could not recall any ever being reported seen there (Jim Baichtal, U.S. Forest Service, personal communication, 2008).

Ground Squirrel

Ground squirrels (*Spermophilus undulatus*) from mainland sources were transplanted to Unalaska Island in the Aleutian Chain in 1896 or 1897 (Murie and Scheffer 1959). In 1920 some of these squirrels were transported to Kavalga Island, where they subsequently increased in number. Bailey (1993) lists 12 other islands off the Alaska Peninsula and in the Kodiak Archipelago, where ground squirrels were present but he could find no documentation of transplants. The objectives of these transplants are unknown, but probably they were implemented in order to provide a food source for foxes.

Wolf

Four wolves (*Canis lupus*) approximately 19 months old (2 males and 2 females) were released on 27 October 1960, at Coronation Island in Southeast Alaska by personnel of the Alaska Department of Fish and Game (Merriam 1964). An additional female was released there in April 1963. The goal of this transplant was "to determine the impact of wolves on a deer population which previously had not been subjected to predation." By 1964 these wolves had increased to about 12 animals and were having an obvious influence on this deer population (Merriam 1964). By 1970, however, natural mortality had extirpated this isolated wolf population (Harry Merriam, ADF&G game biologist—Petersburg, personal communication, Burris and McKnight 1973).

Hare and Rabbit

Numerous releases of hares and rabbits have been made in a variety of locations throughout Alaska (Table 3). Although most of these transplants were failures, several have produced harvestable populations.

Arctic hares (*Lepus othus*) were introduced to Chirikof Island in 1891, but disappeared probably because foxes had been transplanted there in 1888 (Bailey 1993).

The first successful transplant was conducted in 1934 under the direction of the Alaska Game Commission (Elkins and Nelson 1954). Five hundred and fifty-eight snowshoe hares (*Lepus americanus*), captured along the Alaska Railroad near Anchorage, were released on Kodiak and Afognak islands. This transplant was very successful, and in 1952 hares from Kodiak Island were captured and introduced to the adjacent Woody and Long islands (Elkins and Nelson 1954). These introductions were also successful.

Table 3. Releases of snowshoe hare and European rabbit in Alaska

Area of Release	Date	Number of Animals Released	Source of Animals	Population Status 2008
Snowshoe hare				
Chirikof Island [a] (arctic hare)	1891	Unknown	Unknown	No animals remaining
Smeaton Island (Behm Canal)	1923	18	Washington	No animals remaining
Admiralty Island, Pt. Retreat (Barlow Islands)	1924	20	Washington	No animals remaining
Otstoia Island (Peril Strait)	1924	20	Washington	No animals remaining
Cape Island (Prince of Wales)	1924	24	Anchorage	No animals remaining
Village Island (Zimovia Strait)	1924	20	Anchorage	No animals remaining
Kodiak & Afognak Islands	1934	558	Anchorage	Harvestable population
Woody Island (Kodiak)	1952	12	Kodiak Island	Harvestable population
Long Island (Kodiak)	1952	6	Kodiak Island	Harvestable population
Popof Island (Shumagin Islands)	1955	15	Kodiak Island	Harvestable population
European Rabbit				
Umnak Island (Aleutians)	1930[b]	Unknown	Domestic	No animals remaining[a]
Tangik, Poa[a] (Aleutians)	Unknown	Unknown	Unknown	Small population
Kanaga Island[a] (Aleutians)	pre 1936	Unknown	Unknown	No animals remaining
Rabbit Island (Aleutians)	1940[b]	Unknown	Umnak Island	Harvestable population
Hog Island (near Unalaska Island, Aleutians)	1940[b]	Unknown	Unknown	Harvestable population
Middleton Island (Gulf of Alaska)	1954	3 females, 1 male	Domestic	Harvestable population

[a] From Bailey (1993); [b] Approximate date

Source: Burris and McKnight (1973) unless noted otherwise

In 1955 snowshoe hares were again taken from Kodiak Island, this time for introduction to Popof Island in the Shumagin Island group (Nelson 1955a). This operation was conducted by personnel of the Kodiak National Wildlife Refuge, and although the release consisted of only 15 hares, a substantial population had developed as early as 1960.

Several European rabbit introductions have been successfully accomplished in Alaska by the release of domestic rabbits that then established populations in the wild. One such release occurred at Nikolski Village on Umnak Island in the Aleutian Chain about 1930, according to Arthur J. Harris, a resident of Nikolski (personal communication to Burris and McKnight 1973). Harris also stated that about 1,940 rabbits from Umnak Island were placed on an adjacent small island (Ananiuliak), now commonly called Rabbit Island. Rabbits also occur on Hog Island near Unalaska (Robert Jones, USFWS, personal communication, Burris and McKnight 1973). Although Burris and McKnight (1973) reported harvestable populations on Umnak in 1973, 20 years later Bailey (1993) said indigenous foxes had apparently eliminated the hares on the island.

Another rabbit transplant reported by Bailey (1993) occurred on Kanaga Island (before 1936), but the rabbits disappeared from Kanaga because foxes were present. Bailey also reports Nysewander et al. (1982) found European rabbits present on Poa and Tangik islands but he could find no documentation of transplant dates.

An initial hare transplant to Middleton Island in Prince William Sound prior to 1918 was a failure, probably because of the presence of introduced foxes (Bailey 1993). When Middleton Island received a transplant of domestic rabbits (3 females and 1 male) in 1954 (O'Farrel 1965), foxes were absent (Bailey 1993). These rabbits, which were kept as semi-domestic pets under the houses of island residents, had increased to 50 by the fall of 1955 and to approximately 200 by the summer of 1956. Major fluctuations in numbers have occurred since then, and a noticeable die-off occurred in February 1961, when the population numbered some 3,600 to 7,000 animals (O'Farrel 1965). Estimates made in the summer of 1962 placed the population at about 5,000 rabbits, but it dropped to about 3,000 animals during the 1962–1963 winter. In 2008 an estimated 2,000–3,000 rabbits roamed Middleton (D. Crowley, personal communication, 2008).

A private citizen was accused of illegally releasing 35 rabbits on Montague Island in Prince William Sound in 1993 (Valdez Star 1993). A hunter reported seeing a rabbit on Montague in the early 2000s but since then no evidence of surviving rabbits has been found on the island (D. Crowley, personal communication, 2008). Several transplants of hares and rabbits attempted in Southeast Alaska apparently were unsuccessful (Table 3).

European Wild Hog

Eight European wild hogs (*Sus scrofa*) from California were transplanted to precipitous and heavily forested Marmot Island near Kodiak in July 1984 by a private citizen, Reed Oswalt, who intended to establish a population for wild boar hunting. Oswalt had also applied for a 55 year state grazing lease for the entire 18-square-mile (47-square-kilometer) island. Oswalt

released the hogs on a 40-acre parcel of private land he owned but they soon spread throughout the island. Four seabird colonies were on the island as well as the largest sea lion rookery in the Gulf of Alaska. (In 1990 the entire west coast of the island was designated a state Special Use Area with limited access to minimize disturbance of the rookery.) The state issued the grazing permit but only for one year with the conditions that there be no evidence of overgrazing, erosion, or deteriorating vegetation in that time, and that no animals be allowed to go feral (i.e. all animals must be under direct control of the owner).

An inspection by ADF&G staff the following year found severe damage to vegetation from rooting hogs. A subsequent Department of Natural Resources lands evaluation determined that grazing was an unrealistic activity on Marmot Island. Consequently, an extension to the grazing permit was denied. The owner was directed to remove all animals from state lands but was unwilling or unable to do so. A note in ADF&G files indicates that at least 2 wild hogs were observed on the island in 1992. At that time the division determined "removing even a few animals would require a great deal of effort on the rugged island terrain," and that it did not have the money or staff time available for the task (ADF&G unpublished memos in files, Division of Wildlife Conservation headquarters, Juneau).

Time seems to have accomplished what it was difficult for ADF&G to do. In 1998, a hunter killed what was to be the last pig seen on the island. ADF&G Kodiak biologists surveyed Marmot in winter 2006 and found no fresh tracks or rooting activity. As of 2008, sea lion researchers stationed on Marmot each summer had not reported a sighting for over 10 years (John. Crye, ADF&G wildlife biologist—Kodiak, personal communication, 2008). It appears the unauthorized wild boar enterprise on Marmot Island ended about 15 years after the transplant.

References – Furbearers and Small Game

Alaska Game Commission. Annual Reports, 1925 to 1937. Juneau, Alaska. Mimeo.

Bailey, E. P. 1993. Introduction of foxes to Alaskan islands—History, effects on avifauna, and eradication. United States Department of the Interior, Fish and Wildlife Service. Resource Publication 193. Washington, D.C. 55pp.

Ben-David, M., R. W. Flynn, and D. M. Schell. 1997. Annual and seasonal changes in diets of martens: evidence from stable isotope analysis. Oecologia 111:280–291.

Bodkin, J. L. and G. E. Esslinger. 2006. Sea otter population briefing, Southeast Alaska 1969–2003; data summary and initial interpretation. U.S. Geological Survey, Alaska Science Center report. 24pp.

Burris, O. E. and D. E. McKnight. 1973. Game transplants in Alaska. Wildlife Technical Bulletin No. 4. Alaska Department of Fish and Game. Juneau, Alaska. 57pp.

Buskirk, S. W., and L. F. Ruggiero. 1994. The American marten. Pages 7–37 in L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski, editors. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Forest Service General Technical Report RM-254.

Byrd, G. V., Trapp, J. L., and C. F. Zeillemaker. 1994. Removal of introduced foxes: a case study in restoration of native birds. Transactions North American Wildlife and Natural Resources Conference 59:317–321.

Crowley, D. W. 2007. Unit 6 furbearer. Pages 82–90 *in* P. Harper, editor. Furbearer management report of survey and inventory activities 1 July 2003–30 June 2006. Alaska Department of Fish and Game. Project 7.0. Juneau, Alaska.

Elkins, W. A. and U. C. Nelson. 1954. Wildlife introductions and transplants in Alaska. Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

Flynn R. W., T. V. Schumacher, and M. Ben-David. 2004. Abundance, prey availability and diets of American martens: Implications for the design of old-growth reserves in Southeast Alaska. Final Report. Alaska Department of Fish and Game. Juneau, Alaska.

Gill, V. A. and D. M. Burn. 2007. Aerial surveys of sea otters in Yakutat Bay, Alaska, 2005. U. S. Fish and Wildlife Service, Marine Mammals Management Office. Technical Report MMM 2007-01. 18pp.

Kenyon, K. W. and D. L. Spencer. 1960. Sea otter population and transplant studies in Alaska, 1959. U. S. Fish and Wildlife Service, Special Scientific Report – Wildlife No. 48. 29pp.

Lance, M. M., S. A. Richardson, and H. L. Allen. 2004. Washington State recovery plan for the sea otter. Washington Department of Fish and Wildlife, Wildlife Program. Olympia, Washington. 91pp.

Lensink, C. J., R. 0. Skoog and J. L. Buckley. 1955. Food habits of marten in Interior Alaska and their significance. Journal of Wildlife Management 19(3):364–368.

Merriam, H. R. 1964. The wolves of Coronation Island. Proceedings 15th Alaskan Science Conference. College, Alaska. pp. 27–32.

Mooney, P. 2007. Unit 4 furbearer. Pages 64–74 *in* P. Harper, editor. Furbearer management report of survey and inventory activities 1 July 2003–30 June 2006. Alaska Department of Fish and Game. Project 7.0. Juneau, Alaska.

Murie, 0. J. 1936. Biological investigations of the Aleutians and Southwestern Alaska. Unpublished field notes, U.S. Fish and Wildlife Service, Washington. D.C. 320pp.

_____ 1937. Biological investigations of the Aleutians and Southwestern Alaska. Unpublished field notes, U.S. Fish and Wildlife Service, Washington. D.C. 254pp.

Murie, 0. J. and V. B. Scheffer. 1959. Fauna of the Aleutian Islands and Alaska Peninsula. North American Fauna No. 61. U.S. Fish and Wildlife Service, Washington, D. C.

Nelson, U. C. 1951a. Stocking mink on Montague Island. Federal Aid in Wildlife Restoration. Project W-D-2, Alaska. Completion Report.

_____. 1951b. Quarterly progress report-development. Federal Aid in Wildlife Restoration. Project W-4-D-2, Alaska. Vol. II, No. 1.

_____. 1952a. Quarterly progress report-development. Federal Aid in Wildlife Restoration. Project W-4-D-3, Alaska. Vol. III, No. 1.

_____. 1952b. Quarterly progress report-development. Federal Aid in Wildlife Restoration. Project W-4-D-3, Alaska. Vol. III, No. 2.

_____. 1955a. Quarterly progress report-development. Federal Aid in Wildlife Restoration Project W-4-D-5. Alaska, Vol. V, No. 3 and 4.

_____. 1957. Quarterly progress report-development. Federal Aid in Wildlife Restoration Project W-4-D-7. Vol. VII, No. 1–4.

NICHOL, L. M., J. C. WATSON, G. M. ELLIS, AND J. K. B. FORD. 2005. An assessment of abundance and growth of the sea otter population (*Enhydra lutris*) in British Columbia. Canadian Science Advisory Secretariat Research Document 2005/094. 26pp.

NYSEWANDER, D. R., D. R. FORSELL, P. A. BAIRD, D. J. SHIELDS, G. J. WEILER, AND J. H. KOGAN. 1982. Marine bird and mammal survey of the eastern Aleutian Islands, summers of 1980–81. Unpublished report. U. S. Fish and Wildlife Service. Anchorage, Alaska. 134pp.

O'FARREL, T. P. 1965. The rabbits of Middleton Island, Alaska. Journal of Mammology 46(3): 525–527.

PORTER, B. 2007. Unit 2 furbearer. Pages 41–51 *in* P. Harper, editor. Furbearer management report of survey and inventory activities 1 July 2003–30 June 2006. Alaska Department of Fish and Game. Project 7.0. Juneau, Alaska.

PREBLE, E. A. AND W. L. MCATEE. 1923. A biological survey of the Pribilof Islands, Alaska. North Am. Fauna No. 46. U. S. Biological Survey, Washington, D. C.

SCHNEIDER, K. B. 1973. Sea otter distribution and abundance in Alaska. Unpublished report (processed). Alaska Dept. of Fish and Game files. 5 pp. & maps.

U. S. FISH AND WILDLIFE SERVICE. 1994. Conservation plan for the sea otter in Alaska. Marine Mammals Management. Anchorage, Alaska. 44 pp.

_____. 2008. Sea otters draft stock assessment report, Southeast Alaska. Marine Mammals Management. Anchorage, Alaska. 5 pp.

VALDEZ STAR. 1993. Seward man charged in Montague rabbit release. 14 January 1993.

VAN DAELE, L. J. AND J. R. CRYE 2007. Unit 8 furbearer. Pages 97–106 *in* P. Harper, editor. Furbearer management report of survey and inventory activities 1 July 2003–30 June 2006. Alaska Department of Fish and Game. Project 7.0. Juneau, Alaska.

YOUNG, E. L. 1992. Game Management Unit 4. Pages 35–42 in S. M. Abbott, editor. Furbearers survey and inventory management report 1 July 1989–30 June 1991. Federal Aid in Wildlife Restoration. Project W-23-3 and W-23-4, Study 7.0. Alaska Department of Fish and Game. Juneau, Alaska.

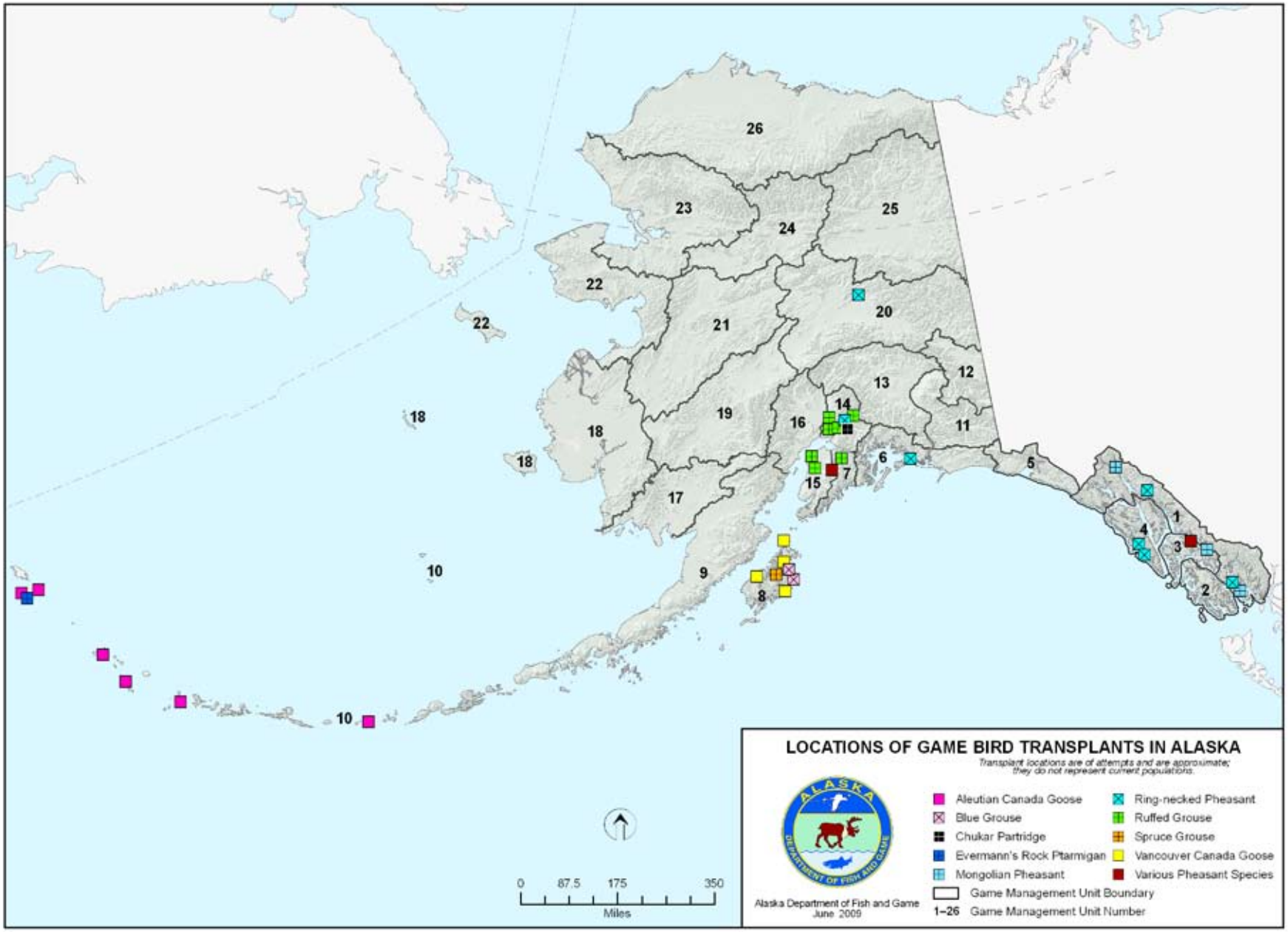

FIGURE 34. Approximate locations of game bird transplant efforts in Alaska

GAME BIRD TRANSPLANTS

In spite of numerous attempts to transplant various exotic game bird species into Alaska, there have been no successful exotic game bird transplants to date. This is contrary to the history of game transplants on the North American continent, where the introductions of such exotic species as the ring-necked pheasant (*Phasianus colchicus*), and chukar (*Alectoris graeca*) and gray partridges (*Perdix perdix*) have highlighted successful transplants.

Pheasant and Chukar Partridge

Although the Alaska Game Commission reported in March 1931 that "private and cooperative enterprises have resulted in the establishment of small colonies of wild Chinese or ring-necked pheasants in the vicinity of Juneau and Sitka," the earliest documented game bird transplant was in 1934. That year, 225 ring-necked pheasants from Washington state were released at Sitka and at Goddard Hot Springs on Baranof Island (Elkins and Nelson 1954). This attempted introduction of pheasants and those that followed throughout the state from 1934 to 1942 were complete failures (Table 4).

Between 1942 and 1957, there was only one recorded game bird transplant in Alaska, an unsuccessful attempt by a private citizen to introduce pheasants to the Fairbanks area (Burris personal files). Other releases of pheasants have been made from time to time by private individuals. Birds from these attempted introductions are occasionally seen and stimulate further transplants of pheasants. However, the inability of pheasants to survive in Alaska has been clearly demonstrated by transplants in the Matanuska Valley. Following one such effort in 1938, transplanted ringnecks increased for several successive favorable years and were still being seen in the mid 1950s (Weeden 1965). After one or two severe winters, few pheasants could be located in the valley and interest in stocking them diminished.

The unsuitable Alaska climate did much to quash interest of the citizenry in pheasant transplants, and government transplant programs during the 1950s also digressed from game bird introductions. In 1950, Clarence J. Rhode, Regional Director of the U. S. Fish and Wildlife Service, established 5 priorities for game animal transplants. Introductions of exotic game birds were assigned the lowest priority and pheasant transplants ceased.

Only one attempt has been made to establish chukar partridges in Alaska. In 1938, 17 adult chukars were released in the Matanuska Valley. It is doubtful that they ever reproduced and by 1943 all had died (Elkins and Nelson 1954).

TABLE 4. Pheasant transplants in Alaska

Area of Release	Variety	Date	Number of birds released	Source of birds	Population status
Juneau	Chinese or Ring-necked	1930	Unknown	Unknown	No birds remaining
Sitka	Chinese or Ring-necked	Prior to 1931	Unknown	Unknown	No birds remaining
Baranof Island, Goddard Hot Springs, and Sitka	Ring-necked	1934	225	Washington	No birds remaining
Ketchikan	Ring-necked	1936	100	Washington	No birds remaining
Cordova	Ring-necked	1936	Unknown	Unknown	No birds remaining
Matanuska Valley	Ring-necked	1938	Unknown	Unknown	No birds remaining
Fairbanks	Unknown Unknown	1936 1952	Unknown Unknown	Unknown Unknown	No birds remaining
Matanuska Valley	Mongolian	1938	500	Wisconsin	No birds remaining
Ketchikan	Mongolian	1939	12	Washington	No birds remaining
Petersburg	Mongolian Mongolian Brown-eared Nepal, Kaleege	1939 1940 1940 1941	75 60 12 12	Washington Washington Wisconsin Wisconsin	No birds remaining
Kenai Lake, Cooper Landing	Mongolian Reeves Cheer	1940 1940–1942 1940	87 50 4	Washington Wisconsin Wisconsin	No birds remaining
Wrangell	Mongolian Mongolian	1940 1940	100[a] 32	Unknown	No birds remaining
Haines	Mongolian	1942	46	Washington	No birds remaining

[a] Some duplication may be involved in this release as the available records do not correspond.

Source: Executive Officer's report to the Alaska Game Commission, 1 January 1943 to 3 November 1943. Table is as presented in Burris and McKnight (1973)

Canada Goose

Aleutian Islands – 1971 to 1995

Transplants of Aleutian Canada geese (*Branta canadensis leucopareia*) are examples of successful programs undertaken to restore populations of an endangered species. The geese are thought to have nested on most of the Aleutian Islands and the islands near the Alaska Peninsula prior to Russian arrival in the mid 1700s (Byrd 1998). With the stocking of foxes on most of those islands beginning in 1750 (see section on Furbearer transplants, page 99), nesting populations of geese and other birds plummeted and breeding populations of geese were extirpated on many islands. By the mid 1900s Aleutian Canada geese were nearly extinct and were placed on the endangered species list in 1967. The estimated population was fewer than 800 birds in 1975 (Allen 1998). Hunting of them was prohibited on their wintering areas in California and coastal Oregon, as well as in Alaska.

Remnant populations of the geese were discovered on Buldir (1962), Kiliktagik (1979), and Chagulak (1982) (Byrd 1998)–islands that apparently never had fox introductions (Bailey 1993). A first step in restoring the population was to remove foxes from islands which historically had reports of nesting geese. The U.S. Fish and Wildlife Service began fox eradication in 1949 on Amchitka Island and continued in the 1960s and 1970s with Agattu and Nizki-Alaid. Foxes on Skagul Island were apparently trapped out or died out naturally by the 1940s. Yunaska was cleared of foxes in 1993 (see Table 1, page 101).

Reintroductions of Aleutian Canada geese by the USFWS occurred on Amchitka, Agattu, Nizki-Alaid, Little Kiska, Skagul and Yunaska islands (Table 5, page 128). Releases of captive-reared birds and translocated wild geese at Agattu and Nizki-Alaid resulted relatively rapidly in reestablished populations of geese, in part because the extreme western Aleutians do not have nesting bald eagles, a known goose predator (Gibson and Byrd 2007). At sites farther east, eagles may have prevented transplanted geese from reestablishing populations on Little Kiska, Skagul, and Yunaska. The same was true at Amchitka with early releases of captive-reared and translocated geese, but enough birds ultimately were released at Amchitka, possibly aided by pioneering birds from farther west, to result in a small established population (G.Vernon Byrd, USFWS—Alaska Maritime NWR, personal communication, 2008). Geese also have pioneered and are now established on Attu Island (Gibson and Byrd 2007).

The initial reintroductions were tried with captive-reared geese mixed with a few wild birds from Buldir (to lead migrations) because so few wild geese were available to move. The captive geese were raised in Maryland, North Dakota, and Amchitka (Byrd 1998). From 1971 to 1982 more than 1,000 geese were released on Amchitka, Agattu, and Nizki-Alaid, but the captive-reared geese fared poorly, probably because they were unable to make the long migration to California. Many geese were lost at sea (Byrd 1998). Beginning in 1980, wild males from Buldir were paired with captive-reared females before transplanting and results improved. Increasingly, more wild geese from the growing Buldir population were moved to Agattu and Nizki-Alaid in the 1980s. By 1984 geese were nesting on Agattu, and in 1987 the first nest was documented on Nizki-Alaid (Byrd 1998). In 1990 the population was estimated at 6,200 geese and the species was reclassified from endangered to threatened (Allen 1998).

Transplants of wild geese from Buldir Island occurred on Nizki-Alaid from 1981 through 1992, on Little Kiska Island from 1988 through 1992, and on Skagul and Yunaska islands during July and August 1994 and 1995 (Table 5). For 5 of the years during 1989–1995, border collies were used to help capture geese on Buldir (Fig. 35). With up to 22 human observers walking abreast 5 to 15 meters apart through geese rearing habitat, as many as 3 dogs at a time encircled flightless geese, flushed them from vegetation, or herded geese to biologists who captured them by hand or with long-handled fish landing nets (Williams 1993, 1995). In 1995, the goose population on Buldir had grown large enough that dogs were not needed to round up sufficient geese for the transplant (Williams et al. 1995). After capture, geese were taken to the *MV Tiglax* in specially designed backpacks. On the *Tiglax* birds were aged, sexed, banded and transferred to poultry crates lined with a mixture of straw and cedar chips for transport to their new island homes. Geese were regulary tube-fed with a nutritional formula mixed with water during transport and prior to release (Williams 1993, 1995; Williams et. al. 1995). Originally, all birds during the 1994 and 1995 transplants were to be taken to Yunaska Island. However, because of foul weather during one of the transplant trips each year, the team leaders decided to take the geese to Skagul Island, a nearer, alternate transplant site (Williams 1995, Williams et. al. 1995). No mortalities of geese during the capture and transplant operations occurred during 1992 and 1995. Three geese died during handling in 1994 (Williams 1993, 1995; Williams et al. 1995).

Although the transplants to Little Kiska, Yunaska, and Skagul islands do not appear to have been successful, Aleutian geese populations continued to grow through the 1990s. With a population estimated at over 40,000, Aleutian Canada geese were removed from the endangered species list in 2001.

Kodiak Archipelago – 1973, 1975, 1986

Prior to the 1970s there were no records of Canada geese (*Branta canadensis*) nesting or wintering in the Kodiak Archipelago even though the climate and habitats of Kodiak are similar to those in Southcentral and Southeast Alaska where Canada geese are abundant (Campbell et al. 1987). In August 1973, in the first step of a multi-year proposal, ADF&G transplanted 13 geese to Kodiak. The objective was "to establish a viable, wild population of birds for the eventual benefit of waterfowl hunters in the area, and for the esthetic enjoyment of people on the island" (Timm 1973). The geese (5 adults and 8 young) were from a flock of Vancouver Canada geese (*B.c. fulva*) captive-reared in Juneau and shipped to Kodiak on a U.S. Coast Guard (USCG) plane. They were banded and their wings clipped before release on a float plane lake within the city of Kodiak. The birds were to be held captive there, but their young would be allowed to fly free with the hope they would colonize other areas nearby (Timm 1973). These birds slowly disappeared over the next few years (McCrary and Allread 1983).

A second group of 16 Vancouver geese (7 wild and 9 captive-reared) was shipped from Juneau to Kodiak in 1975 and released in Terror Bay on Kodiak Island. Shortly after release they apparently traveled to Zachar Bay, 25 miles (40 km) southwest. Small numbers of Vancouver Canada geese were seen in Zachar Bay through the mid 1980s and were presumed to be part of the 1975 group or its descendants (Campbell et al. 1987). ADF&G did not follow through with the multi-year transplant plans proposed in 1973 because of budgetary reasons and difficulties

coordinating with the U.S. Fish and Wildlife Service, which managed the Kodiak National Wildlife Refuge.

Following continued interest from the public and a favorable reaction from the U. S. Fish and Wildlife Service stating that a transplant was consistent with the objectives of the National Waterfowl Management Plan (McCrary and Allread 1983, Schreiner 1983), ADF&G developed a second proposal to transplant geese to Kodiak (ADF&G 1986). During a 31-hour nonstop operation in July 1986, more than 200 Vancouver Canada geese were transplanted from Southeast Alaska to the Kodiak Archipelago.

On 20 July 565 molting geese were captured in Fool's Inlet in Seymour Canal, Admiralty Island by herding them with a helicopter into nets (drive traps) on the beach. Of those netted, 212 were removed from the flock for the transplant. One bird suffered a broken wing in the capture and died. It was the only mortality. The geese were banded and put into poultry crates, 4 to a crate, transported by skiff to the USFWS vessel M/V *Surfbird* and taken to Juneau. During the boat ride crews fed and watered the geese through an esophageal tube. Two birds escaped while in transport. In Juneau the geese were put on a U. S. Coast Guard C-130 transport plane and flown to Kodiak. The birds were caught at 1315 on 20 July, arrived in Juneau at 0300 on 21 July, and departed Juneau in the C130 at 1300 on 21 July (Campbell et al. 1987; Dan Rosenberg 2008, ADF&G wildlife biologist, personal communication, 2008).

U.S. Fish and Wildlife Service

FIGURE 35. A border collie and its handler capture an Aleutian Canada goose on Buldir Island.

Arriving in Kodiak at 1530 on 21 July, the birds were loaded immediately into float planes (one appropriately a Grumman Goose) and flown to Spiridon Bay on the west side of Kodiak Island and Big Bay on northwest Shuyak Island at the northern end of the Kodiak Archipelago. All the birds were released by 2015 on 21 July (D. Rosenberg, personal communication, 2008). One hundred ten adults were released at Weasel Cove, Spiridon Bay. A second release of 91 adults and 8 goslings occurred in Big Bay. All released birds were banded with aluminum USFWS bands and colored coded plastic bands. One bird at Shuyak escaped during banding. Five geese were fitted with backpack radios (Campbell et al. 1987).

Rosenberg (personal communication, 2008) estimates that the cost—for commodities, travel, contracts including air charter and equipment—was $19,800 for the transplant. However, ADF&G staff time both in the capture area and Kodiak were not included in the cost. State Fish and Wildlife Protection staff assisted with reconnaissance and transport in Kodiak. USFWS conducted aerial reconnaissance flights, provided use the M/V *Surfbird*, provided several field hands in Southeast Alaska and Kodiak and assisted with monitoring. USCG provided a C-130 for transporting birds and biologists from Juneau to Kodiak. Volunteers from the Kodiak Game Bird Association also helped with many facets of the transplant. Monitoring activities by ADF&G and USFWS following the transplant are also not included in the cost estimate. The 1986 transplant was the first project funded with monies received from the Alaska Waterfowl Conservation Stamp (Duck Stamp) Program.

By the first winter after the transplant, the geese had split up into several smaller flocks but most remained within 25 miles (40 km) of the release sites. The geese are most detectable during winter on coastal waters when survey conditions and logistics are difficult, and periodic winter inventories were not done. The lack of data in the late 1980s precluded decisions about opening a hunting season, but eventually reports from agency staff and the public indicated that local geese had increased and expanded from Shuyak and Afognak islands to southern Kodiak Island (Tom Rothe, ADF&G Migratory Bird Program coordinator, personal communication, 2008) .

Within a few years birds were observed nesting on Shuyak Island and by the late 1990s geese were nesting and molting in many areas on Shuyak and appeared to be on the island year-round. The fate of the Spiridon Bay birds is less well known. Geese have been observed throughout the Kodiak Archipelago, but since the transplant most winter observations have come from the Old Harbor area, including Sitkalidak Island on southeastern Kodiak. In March 2002 the USFWS counted 1,081 Canada geese near Old Harbor (Gull Cape to Kaguyak Bay), which were suspected to be Vancouvers (i.e. large and dark) resulting from the transplant. However, this has not been confirmed genetically and the geese may have originated elsewhere (D. Rosenberg, personal communication, 2008). Besides Shuyak, there are few confirmed observations of nesting geese in the archipelago. However, a banded bird, released as a gosling in Big Bay on Shuyak in July 1986, was shot by a hunter near Old Harbor in November 2006. The incident supports the possibility that at least some, if not all, Old Harbor wintering birds have origins in the transplant (L. Van Daele and D. Rosenberg, personal communications, 2008).

Because the Kodiak goose transplant was requested and assisted by local hunters and viewers, there was strong support in the community to keep the goose season closed until the stocked population

flourished. By 2005 Canada geese were widespread and reported as abundant in some parts of the archipelago, and interest in a hunting season increased (T. Rothe, personal communication, 2008). In late 2005 local hunters, the Kodiak Fish and Game Advisory Committee, and members of the federal subsistence committee developed a proposal for a conservative Canada goose season.

Twenty years after the transplant, hunting was finally opened for Canada geese in the Kodiak Archipelago (Game Management Unit 8) in 2006. The season extended 8 October–22 January, with limits of 1 per day, 2 in possession. In addition, the primary road system was closed by Emergency Order to reduce harvest and promote wildlife viewing in populated and accessible areas near the city. Reliable harvest data for geese are not available for Unit 8, but reports from the public and local biologists indicate the season has been popular. However, harvest has been modest because birds are widely distributed in remote areas (T. Rothe, personal communication, 2008).

Native Game Birds

Although introductions of exotic game birds were a low priority for the U. S. Fish and Wildlife Service in 1950, several transplants of a native species, the spruce grouse (*Dendragapus canadensis*), were attempted by the agency (Table 5). These transplants, to Kodiak Island in 1957 and 1959, were made from grouse captured on the Kenai Peninsula and were unsuccessful (Weeden 1965).

Because enthusiasm for the establishment of another game bird on Kodiak Island existed after statehood, the Alaska Department of Fish and Game attempted to introduce blue grouse (*Dendragapus obscurus*), now called dusky grouse, there in 1962, 1963, and 1964 (Weeden 1965). It appears now that this introduction failed.

Ruffed Grouse

More successful transplants of a native game bird, ruffed grouse (*Bonasa umbellus*), occurred in the late 1980s and 1990s. Ruffed grouse are indigenous in Alaska north of the Alaska Range from McGrath to Tok and in some areas of Southeast Alaska. Becasuse good ruffed grouse habitat, including aspen and other early succession forest species, also occurs south of the Alaska Range, hunters and others expressed an interest in introducing ruffed grouse elsewhere in the state.

Matanuska Valley – 1988 to 1990

In 1981 the ADF&G developed a proposal to introduce ruffed grouse into the Matanuska Valley to expand hunting and viewing opportunities. ADF&G biologist and upland bird enthusiast Nick Steen had observed that the valley had habitat similar to ruffed grouse habitat in Midwestern states and proposed the transplant. No ADF&G funds were available for a transplant however, and the proposal languished for several years. In fall of 1987 the Alaska chapter of Safari Club

International provided a $2,500 grant to ADF&G to fund a 1-year transplant operation with $1,500 for an additional year available if the initial effort was successful. It was and the project lasted 3 years. An additional $300 was provided in the second year by the Alaska Waterfowl Association. ADF&G contributed salary for Steen and other staff and aircraft time was donated for aerial tracking.

Along with its goal to establish huntable grouse populations in the Matanuska and Susitna valleys, the department's objectives included developing efficient capture and handling techniques that reduced stress and mortality for birds. The goal was to release a minimum of 100 birds (Steen 1995).

Over the 3 years (1988, 1989, and 1990) of the project, a total of 143 ruffed grouse were captured north of the Alaska Range and 140 were released at 4 sites in the Matanuska and Susitna valleys in Southcentral Alaska – near Sutton, Willow, Big Lake, and Hayfield Road. Three of the captured birds died before release (Steen 1995).

The birds were captured near the Parks Highway about 50 miles (81 km) south of Fairbanks from mid September until first snowfall in early October each year. An initial attempt to lure entire broods into traps using a recording of a lost chick was unsuccessful, so biologists used lily pad traps with drift fences to guide the birds to the traps. Traps were covered with conifer boughs to conceal them from predators and to protect trapped birds from inclement weather (Steen 1995).

Two young birds died from capture-related stress, and one died of injuries incurred from flying into a window after escaping inside a building. The 2% capture-related mortality rate was much less than the 12% encountered in a capture operation in the lower 48 (Backs et al. 1985). Steen (1995) attributes the low rate to modified handling techniques such as using heavy, welded wire instead of chicken wire on traps, confining and moving birds in individual containers to reduce competition and stress, and feeding birds melon for its high water and sugar content.

A number of birds were fitted with radio collars during the second and third years to track movements and determine causes and rates of mortality. Birds were tracked until April 1991 using 2 types of radios. As in studies of other game birds, it appears the type of radio used affected mortality rates. Grouse with heavier, bib-mounted radios were killed at a faster rate than those with lighter radios attached with elastic straps. Birds of prey killed most of the grouse in cases where cause of death was evident. Fat reserves on most dead birds were abundant, indicating the birds had found good habitat. Most radio-equipped grouse stayed within 3 miles (5 km) of their release site, but 30% moved more than 5 miles. Five birds moved between 5 and 10 miles (8–16 km) and one traveled 23 miles (37 km). Two birds without radios moved 24 miles (39 km) before they were killed.

By 1995 at least 35 grouse broods had been reported south of the Alaska Range by the public. Birds had been sighted in widely dispersed areas and as far south as Fort Richardson near Anchorage.

TABLE 5. Native game bird transplants in Alaska

Species and Area of Release	Year	Number of Birds Released	Source of Birds	Population Status 2008
Chukar Partridge				
Matanuska Valley	1938	17	Wisconsin	No birds remaining
Spruce Grouse				
Kodiak area	1957 and 1959	31	Kenai Peninsula	No birds remaining
Blue Grouse (now called dusky grouse)				
Kodiak area Chiniak Peninsula	1962 1963 and 1964	30	Southeast Alaska	No birds remaining
Aleutian Canada Goose				
Amchitka Is.	1971–1987	558	captive-reared, wild (Buldir Is.)	Small population established
Agattu Is.	1974–1984	1,052	captive-reared, wild (Buldir Is.)	Healthy nesting population
Nizki-Alaid Is.	1981–1992	684	captive-reared, wild (Buldir Is.)	Healthy nesting population
Little Kiska Is.	1988–1992	282	Buldir Is.	No geese remaining
Yunaska Is.	1994–1995	173	Buldir Is.	Apparently no geese remaining
Skagul Is.	1994–1995	168	Buldir Is.	No geese remaining
Vancouver Canada Goose				
Kodiak Island	1973, 1975	13, 16	Southeast Alaska	Unknown
Kodiak Island Shuyak Island	1986	110 99	Southeast Alaska	Huntable populations
Ruffed Grouse				
Matanuska Valley	1988–1990	140	Interior Alaska	Huntable population
Kenai Peninsula	1995–1997	232	Interior Alaska	Huntable population
Evermann's Rock Ptarmigan				
Agattu Island	2003–2006	75	Attu Island	Nesting population

Sources: Byrd 1998, G. V. Byrd and S. Ebbert 2008, pers. comm., Steen 1995 and 1997, Campbell et. al. 1987, Williams 1993, 1995, Williams et al. 1995; Pre-1973 information from Burris and McKnight (1973).

Ruffed grouse hunting south of the Alaska Range (Game Management Units 13, 14, and 16) was opened immediately as ruffed grouse were grouped with other grouse in regulation. In 1991, Units 13, 14, and 16 small game regulations separated ruffed grouse from other grouse with a lower bag limit of 2 per day and 4 in possession. Those limits were still in place in 2007.

Although ADF&G keeps no harvest records for small game, increasing hunter interest and personal reports from hunters indicate ruffed grouse are regularly taken in the area. After the transplant, a chapter of the Ruffed Grouse Society (RGS) formed in Anchorage and had grown to approximately 500 members in 2007 (Nick Steen, former ADF&G Wildlife Biologist, personal communication, 2007).

A recent report by the RGS called the Matanuska Valley transplant "the most successful such [ruffed grouse transplant] project ever conducted…Ruffed grouse have been sighted approximately 80 miles (129 km) from the original release site and have already occupied much of what was originally considered suitable habitat" (RGS 2007). Among the places ruffed grouse have been reported are Alyeska ski area 30 miles (48 km) south of Anchorage and the Beluga powerplant in Tyonek across Cook Inlet from the release sites (N. Steen, personal communication, 2007).

Kenai Peninsula – 1995 to 1997

The success of the Matanuska Valley grouse transplant immediately inspired sportsmen on the Kenai Peninsula and in Anchorage to encourage ADF&G to do a ruffed grouse transplant to the Kenai Peninsula. However, review and revision of the Division of Wildlife Conservation's transplant policy delayed action on the request. The new policy, adopted in 1995, required certain steps to be taken prior to transplanting wildlife within Alaska (see Appendix B), including scoping and feasibility reports and public review and technical analysis of the feasibility report. The final step in the transplant process is approval of the ADF&G Commissioner. The grouse transplant received commissioner approval in July 1995. Funds were contributed by the RGS. The ADF&G provided staff salaries.

Most of the highest potential ruffed grouse habitat on the Kenai Peninsula is within the boundaries of the Kenai National Wildlife Refuge. U.S. Fish & Wildlife Service policies prohibit transplanting of nonindigenous species to the refuge so refuge staff opposed releasing grouse on the refuge. However, they did not object to releases on state and private lands in the area (Steen 1997).

The goal was to establish huntable grouse populations on the Kenai Peninsula, and as in the previous transplant, ADF&G's objectives included developing efficient capture and handling techniques causing the least stress and mortality for birds, and capturing and releasing a minimum of 100 birds (Steen 1997).

As with the previous transplant, lily pad traps and drift fences were used to trap birds over a 3-year period. Birds were captured at 3 sites north of the Alaska Range in 1995: Gold Creek,

35 miles (56 km) northwest of Fairbanks; Nenana Ridge, 40 miles (64 km) south of Fairbanks; and Clear Air Force Base, 80 miles (129 km) south of Fairbanks. In 1996 and 1997 birds were trapped only at Clear. Trapping occurred in late September all years (Steen 1997).

Two hundred and forty-three ruffed grouse were captured over the 3 years. Losses included 2 escaped and 3 killed in the traps by predators. Four birds died apparently due to record high temperatures during the 1995 trapping period. One more died in transit in 1996 and another that year from an unidentified illness that was apparent at the time of capture. No captured birds died during 1997. The 2.5% mortality rate was slightly higher than experienced during the Matanuska Valley transplant, but significantly lower than experienced elsewhere (Steen 1997). After capture, birds were taken to Anchorage and then to Kenai before a final road trip to the 3 chosen release sites – the primary site on Atkins Road in the Sterling corridor, Quartz Creek north of the community of Sunrise, and Captain Cook State Park.

Transportation of the birds from the capture sites to release sites for both the Kenai and Matanuska Valley ruffed grouse transplants was provided free by a number of companies and individuals. As is often the case when opportunistically using donated and volunteered services, some methods were interesting and unusual. Birds traveled in freight trucks and air charter planes, on the Alaska Railroad between whistle stops, and a few were escorted by a postmaster and state troopers during legs of their journey (N. Steen, personal communication, 2007).

Of the 232 grouse successfully released, 30 were fitted with radio collars in an attempt to get information on survival, reproduction, and dispersal. However, birds with radio collars died at an even greater rate than during the Matanuska transplant. Only 3 birds survived more than 8 months. Biologists consequently got little data from the collared birds and recommended that, in subsequent transplants in areas of high predation, radios should be used only if other methods of data gathering were not available (Steen 1997).

Based on the limited radiotracking data, ruffed grouse on the Kenai moved less their first year than those transplanted to the Matanuska Valley. Most birds stayed within 5 miles (8 km) of their release site, with a few dispersing as many as 7 miles (11 km), and 2 traveling 12 miles (19 km).

By the end of 1997, ADF&G had received 7 reports of brood sightings. Drumming counts were done the first 5 years after the transplant then discontinued. Birds have been seen in areas remote from the release sites but the success of the Kenai ruffed grouse transplant was still being debated in 2007 (N. Steen, personal communication, 2007). Ten years after the transplant, birds on the Kenai are not as abundant or widespread as those in the Mat-Su valleys were at a similar interval.

Nevertheless, the goal of establishing a huntable population seems to have been met. Within a year of the transplant the Federal Subsistence Board (followed shortly by the state Board of Game) established a distinct season and bag limit for ruffed grouse. The bag limit of 1 bird per day and 2 in possession established then was still in effect in 2007.

Evermann's Rock Ptarmigan

Agattu Island, Aleutians – 2003 to 2006

Evermann's Rock Ptarmigan (*Lagopus muta evermanni*) is a subspecies of rock ptarmigan endemic to the Near Islands group in the Aleutian chain (Attu, Agattu, Nizki-Alaid, Shemya). Rock ptarmigan were reported to inhabit Agattu before 1886 by Aleuts, but Olaus Murie did not find them there in 1936 (Alaska Maritime National Wildlife Refuge website, http://alaskamaritime.fws.gov/wildlife.htm, accessed 2008). Following fox transplants during the mid 1800s, Evermann's rock ptarmigan were eliminated from all the Near Islands except Attu, where about 1,000 birds are thought to have survived in that island's mountainous terrain seldom used by foxes. Although foxes were eradicated from all the Near Islands except Shemya by the late 1970s, ptarmigan had not recolonized those islands from Attu by 2002. In 2003, USFWS staff at the Alaska Maritime National Wildlife Refuge began a program to transplant ptarmigan from Attu to Agattu to restore the birds to part of their known range. Funding was provided by the U.S. Missile Defense Agency and other support was provided by the U.S. Coast Guard LORAN station on Attu and the U.S. Air Force on Shemya (Steve Ebbert, USFWS Alaska Maritime National Wildlife Refuge wildlife biologist, personal communication, 2008).

During the 4 years of the program, 2003–2006, approximately 75 ptarmigan were captured on Attu and moved to Agattu. Capture methods included noose poles, carpet snares, decoys, calls, and driving into drift nets. The most effective method was stalking ptarmigan with a 20-foot

Photo courtesy Brad Benter

FIGURE 36. An Evermann's rock ptarmigan is stalked with a noose pole on Attu Island in 2006.

pole (Fig. 36) equipped with a noose of monofilament line and snaring the birds in the noose (S. Ebbert, personal communication, 2008). During 2005 and 2006, researchers stationed on Agattu Island confirmed nesting of reintroduced birds and estimated at least 25 nesting pairs on the island. The transplant was considered a success and an important step toward decreasing the risk to the subspecies' survival and restoring island fauna in the Alaska Maritime refuge (S. Ebbert, personal communication, 2008).

References – Game Birds

Alaska Department of Fish and Game. 1986. Introduction of Canada Geese to the Kodiak Archipelago. Draft Plan. Alaska Department of Fish and Game, Game Division, Anchorage, Alaska. 25pp.

Allen, D. B. 1998. Request for information on the Aleutian Canada goose: Notice of status review. Federal Register: 9 April 1998. Volume 63, Number 68. Pages 17350–17352.

Backs, S., P. D. Major, C. H. Eisfelder and J. S. Thompson. 1985. Techniques for trapping and restocking ruffed grouse in Indiana. Miscellaneous Publication. Indiana Department of Natural Resources. Indianapolis, Indiana. 13pp.

Bailey, E. P. 1993. Introduction of foxes to Alaskan islands – History, effects on avifauna, and eradication. United States Department of the Interior, Fish and Wildlife Service. Resource Publication 193. Washington, D.C. 55pp.

Byrd, G. V. 1998. Current breeding status of the Aleutian Canada goose, a recovering endangered species. Pages 21–28 *in* D. H. Rusch, M. D. Samuel, D. D. Humburg, and B. D. Sullivan editors. Biology and management of Canada geese. Proceedings International Canada Goose Symposium. Milwaukee, Wisconsin.

Campbell, B. H., D. H. Rosenberg, and T. C. Rothe. 1987. Canada goose transplant to Kodiak. Pages 51-55 in Waterfowl. Vol. XVII, Part XIII Annual report of survey-inventory activities. Federal Aid in Wildlife Restoration. Project W-22-5. Job 11.0. Alaska Department of Fish and Game. Juneau, Alaska. 55pp.

Elkins, W. A. and U. C. Nelson. 1954. Wildlife introductions and transplants in Alaska. Proceedings 5th Alaska Science Conference. 21pp. (mimeo)

Gibson, D. D. and G. V. Byrd. 2007. Birds of the Aleutian Islands, Alaska. Series in Ornithology #1. The Nutall Ornithological Club and the American Ornithologist' Union.

McCrary, J. and K. Allread. 1983. Letter to ADF&G Commissioner Don Collinsworth. 31 May. 3pp.

Ruffed Grouse Society. 2007. Ruffed grouse conservation plan approved. Pages 20–22 in Ruffed Grouse Society Volume 19, Issue 1, Spring 2007.

SCHREINER, K. M. 1983. Letter from U. S. Fish and Wildlife Service Regional Director to D. Kelso, ADF&G Deputy Commissioner. 13 September. 2pp.

STEEN, N. 1995. Matanuska Valley ruffed grouse transplant 1988–1990. Final report. Alaska Department of Fish and Game. Juneau, Alaska. 9pp.

_____. 1997. Kenai Peninsula ruffed grouse transplant 1995–1997. Final report. Alaska Department of Fish and Game. Juneau, Alaska. 8pp.

TIMM, D. E. 1973. A proposal for establishing Vancouver Canada geese on Kodiak/Afognak Islands (GMU 8). Alaska Department of Fish and Game. Anchorage, Alaska. 8pp.

WEEDEN, R. B. 1965. Grouse and ptarmigan in Alaska – their ecology and management. Federal Aid in Wildlife Restoration. Project Report. Project W-6R-5. Alaska Department of Fish and Game, Juneau, Alaska.

WILLIAMS, J. C. 1993. Banding, translocation, and monitoring of Aleutian Canada geese in 1992. U.S. Fish and Wildlife Service Report AMNWR 93/11. 23pp.

WILLIAMS, J. C. 1995. Banding, translocation, and monitoring of Aleutian Canada geese in 1994. U.S. Fish and Wildlife Service Report AMNWR 94/12. Adak, Alaska. 34pp.

WILLIAMS, J. C., C. STUDDS, AND L. OLSON. 1995. Banding, translocation, and monitoring of Aleutian Canada geese in 1995. U.S. Fish and Wildlife Service Report AMNWR 95/06. Adak, Alaska. 33pp.

CONCLUSION

From the time of its earliest occupation by Europeans, Alaska has been an example of the ability of humans to alter the natural fauna of a landscape. Alaska's many islands and lands, exposed only recently (in geologic terms) by receding glaciers, have offered abundant unfilled ecological niches which people have displayed an obsession to fill. Because the majority of game transplants attempted have been made to areas previously lacking similar endemic species, a large proportion of these attempts have resulted in viable populations of the introduced species.

Results of many of these transplants are difficult to assess. In some instances the introduction of only a few animals resulted in tremendous rewards in the form of food and recreational opportunities for the citizens of the state. However, most transplants have generated few benefits for people and some have been detrimental to other species and habitats.

Introductions of Sitka black-tailed deer to Kodiak Island and the Prince William Sound area must be considered outstanding successes. The Berners Bay and Copper River moose transplants, and the Baranof and Revillagigedo mountain goat transplants, are other examples of successful introductions of an endemic big game species into new areas. Elk transplants to Afognak and Etolin islands and plains bison introductions in the Interior successfully established huntable populations of exotic species that to this point appear to be more beneficial than detrimental. Many other transplants of big game have resulted in only limited populations capable of sustaining insignificant harvests. Still others have failed completely.

Furbearer transplants, although popular in concept and attempted often, have essentially failed to provide any practical benefits. Even on Kodiak Island, where introduced beaver populations have sustained a substantial harvest, benefits accrued may be offset by adverse effects on salmon spawning. Marten introductions to Prince of Wales, Baranof, and Chichagof islands are marginally beneficial economically but provide opportunities for recreational trapping. Reestablishment of sea otter populations in former ranges will provide little economic benefit to people but from an aesthetic viewpoint may be considered to have accrued desirable results. Numerous fox introductions in the Aleutians and other Alaska islands were far more detrimental than beneficial; many populations of ground nesting birds have been severely reduced, some species nearly to the point of extinction, as a result of fox predation.

Although several hare and rabbit transplants have resulted in huntable populations, utilization is too slight to consider these ventures unqualified successes. Exotic game bird transplants can only be judged absolute failures and a waste of effort and money. Native game bird transplants such as those of Canada geese to Kodiak and ruffed grouse to the Matanuska Valley and Kenai Peninsula are recent efforts that have a modest initial success in expanding a species' range and opening additional hunting opportunities.

A compelling desire to undo the wrongs of the past and to correct nature's errors or oversights may provide impetus to reestablish locally extirpated populations or to move an endemic species into heretofore unoccupied ranges. Transplants of caribou onto the Kenai and Nushagak

peninsulas, muskoxen onto the Alaska mainland, sea otters to Southeast waters, Aleutian Canada geese and Evermann's rock ptarmigan to the Aleutians, and the pending wood bison restoration in Interior Alaska typify this type of transplant. It may be that the majority of transplants in the future will be for this reason. Along with restorations and reintroductions, undoing transplants may play a larger role in future wildlife management in Alaska. For instance, eradicating foxes from islands where they were previously transplanted has reversed detrimental effects to endemic bird populations.

Possibilities always exist that transplants will be conducted by agencies in deference to influential groups or individuals without regard to the merits or disadvantages of such an introduction. History is replete with examples and the potential dangers of such ill-advised activities. However, current safeguards against such introductions, such as ADF&G's Wildlife Transplant Policy of 1995, may be adequate. Required review by department biologists and federal authorities responsible for the welfare of wildlife resources should minimize or alleviate problems. More problematic may be unauthorized introductions by private individuals or organizations on private and public lands that have potential to adversely affect endemic plants and animals, such as the wild boar introduction to Marmot Island, raccoon introduction to Sea Otter Sound, or red squirrel introduction to Admiralty Island.

At the time of the writing of the first edition of *Game Transplants in Alaska* in 1973, it seemed to the authors that few opportunities for game transplants remained in the state. Since then, however, 10 big game and 5 game bird transplants have occurred and another big game transplant is pending. It is tempting now to echo their opinion that in the early years of the 21st century few transplant opportunities remain, particularly with more rigorous government criteria and guidelines in place. Nevertheless, future circumstances are impossible to predict. Human impatience with the long-term nature of population cycles and dynamics; the desire to restore or replace species diminished or extirpated by past overexploitation, natural events, or habitat degradation; and the desire to profit economically from wildlife all may contribute to renewed transplant activity in the future.

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APPENDIX A: TERRITORIAL STATUTES

Alaska Territorial Statutes, Chapter 25, Stocking of Public Lands.

(Originally enacted in 1925)

Section

10. Program adopted
20. Projects enumerated
30. Department to carry out program
40. Stock and offspring property of state
50. Unlawful taking
60. Penalty for violation of sec. 50 of this chapter

Sec. 16.25.010. Program adopted. There is adopted a program of stocking lands in the state with valuable game and fur-bearing animals which do not at present occur on these lands. (sec. 39-7-1 ACLA 1949)

Sec. 16.25.020. Projects enumerated. The stocking program is divided into the following projects:
(1) Roosevelt elk to Kenai Peninsula, Hinchinbrook and Kruzof Islands, and the Kodiak-Afognak Island group;
(2) elk to Copper River Valley region;
(3) muskrats to Kodiak-Afognak group;
(4) beaver to Baranof and Chichagof Islands;
(5) beaver to Afognak and northeast portion of Kodiak;
(6) deer to Afognak-Kodiak Island group;
(7) spruce hens, arctic hare, snowshoe rabbits, mountain sheep, mountain goat and caribou to Kodiak-Afognak Island group;
(8) marten to Prince of Wales Island group, and to Zarembo Island;
(9) marten to Prince William Sound Islands;
(10) beaver to Yakutat Coastal Plain Region, including Lituya Bay;
(11) marten to Afognak and northeast portion of Kodiak Island;
(12) muskrats to portions of southeastern Alaska and Seward Peninsula;
(13) beaver to Chilkat Valley;
(14) varying hares to southeastern Alaska;
(15) moose to Kodiak-Afognak Island group;
(16) beaver to Zarembo Island;
(17) varying hares to Kodiak-Afognak Island group;
(18) marten to Baranof and Chichagof Islands;
(19) red squirrels to Zarembo, Admiralty, Baranof, and Chichagof Islands, and to the Prince of Wales Island group, including Sitka Park;
(20) red squirrels to Afognak and northeast portion of Kodiak group;
(21) varying hares to Prince William Sound Islands;
(22) mountain goats to Prince William Sound Islands;
(23) mountain goats to southeastern Alaska Islands;

(24) elk and deer from interior North America to the Tanana Valley;
(25) mink to St. Lawrence Island;
(26) buffalo to interior Alaska;
(27) marmot to Prince of Wales Island;
(28) Siberian blue squirrel to Seward Peninsula;
(29) reindeer to Unalaska Island;
(30) blue grouse to Prince of Wales Island;
(31) reindeer, between Yukon and Kuskokwim Deltas, commonly known as Hooper Bay-Nelson Island District ;
(32) Chinese, ring-neck or Mongolian pheasants to Baranof or Kruzof Islands. (sec. 39-7-1 ACLA 1949)

Sec. 16.25.030. Department to carry out program. The department shall carry out the projects set forth in secs. 10 and 20 of this chapter by obtaining the animals and placing them on the lands designated. At least one project shall be undertaken in each division every two years. The department shall establish the priority of the projects. (sec. 39-7-2 ACLA 1949)

Sec. 16.25.040. Stock and offspring property of state. When the state stocks lands with game animals, game birds or fur bearing animals, they and their offspring are the property of the state until the governor, by public proclamation, declares that they are public property. (sec. 39-7-3 ACLA 1949)

Sec. 16.25.050. Unlawful taking. It is unlawful to willfully take, attempt to take, catch, kill, or possess a stocked animal or offspring. (sec. 39-7-3 ACLA 1949)

Sec. 16.25.060. Penalty for violation of sec. 50 of this chapter. A person violating sec. 50 of this chapter is guilty of a misdemeanor, and upon conviction is punishable by a fine of not more than $250, or by imprisonment for not more than six months, or by both. (sec. 39-7-4 ACLA 1949)

APPENDIX B: TRANSPLANT POLICY

DIVISION OF WILDLIFE CONSERVATION
ALASKA DEPARTMENT OF FISH AND GAME

WILDLIFE TRANSPLANT POLICY

The Division of Wildlife Conservation's mission is to conserve and enhance Alaska's wildlife and to provide for a wide range of uses for the greatest benefit of current and future generations of people. Alaska is comprised of a variety of ecosystems containing an abundance and natural diversity of fish and wildlife resources. This wildlife transplant policy will contribute to 1) the conservation of Alaska's native wildlife and their habitats; 2) the restoration and maintenance of wildlife diversity; 3) the protection of the state's rich natural heritage; and 4) the enhancement of wildlife values for the benefit of the people.

The division recognizes that wildlife transplants may be a valuable tool for introducing, supplementing, establishing, or reestablishing wildlife populations. However, the division also recognizes that transplants may negatively impact Alaska's ecosystems by harming indigenous species, damaging habitat, or introducing diseases or parasites. Every wildlife transplant poses different risks and benefits, and each must be evaluated on its own merits. The purposes of this wildlife transplant policy are to 1) identify concerns that must be appraised; and 2) establish a protocol for systematically evaluating those concerns to ensure that public benefits from transplants substantially outweigh ecological and socioeconomic risks.

To be considered for approval and authorization by the Commissioner of Fish and Game, all transplant proposals must include a thorough public and department review of a transplant feasibility assessment including biological and social risk analyses. A "wildlife transplant" means physically moving animals from one place to another with the intent of introducing, supplementing, establishing, or reestablishing a viable population of the transplanted wildlife species.

Transplant Evaluation Criteria

To be considered for approval, all transplant proposals must demonstrate convincing evidence that the following criteria are likely to be met.

1. There is sufficient suitable habitat at the release site to support a viable population.

2. Changes in interspecific competition or predation will not significantly, adversely affect a population of an indigenous species within the potential range of the transplanted species.

3. Significant adverse habitat alteration within the likely range of the transplanted species will not occur.

4. A disease or parasite capable of adversely affecting a population of an indigenous species will not be introduced.

5. Adverse genetic changes affecting a population of an indigenous species will not occur.

6. Socioeconomic effects will be considered and adverse impacts minimized.

7. New and substantial public benefits will be realized.

8. Compatibility with the goals of adjacent land managers will be considered.

9. State costs for the transplant and subsequent management will be commensurate with benefits, and adequate funding and staffing are likely to be available.

10. Extraordinary management actions are not likely to be required to control a population of the transplanted species or to realize benefits.

11. An adequate plan will be prepared for monitoring and management of the transplanted species and for its control or eradication, if feasible, should unforeseen adverse impacts occur.

12. Adequate public access to the population of the transplanted species will be assured.

Procedures for Transplant Proposals:

Transplant proposals require four steps: a scoping report, a feasibility assessment (including biological and social risk analyses), public and department review, and a formal department transplant plan. The first step is to submit a brief scoping report (not to exceed three single-spaced pages) to the Director of the Division of Wildlife Conservation for review. This report must 1) identify the species proposed for the transplant; 2) identify the transplant category (see Transplant Guidelines below); 3) identify the source of the transplant; 4) identify the initial transplant location; 5) describe the benefits to be derived from the transplant; 6) describe the extent of public support for the transplant; 7) describe potential ecological risks associated with the transplant; and 8) estimate costs associated with the transplant.

Following review of the scoping report, the director will decide whether it is in the best interest of the state to proceed with consideration of a transplant. If the director decides to proceed, the director will order the division to initiate development of a feasibility assessment or require the proponent of the transplant to prepare the feasibility assessment. A feasibility assessment must be a comprehensive document and address all "transplant evaluation criteria" and "transplant guidelines" listed in this policy. The director will, in the director's discretion, request additional information or identify other issues to be addressed in the feasibility assessment based on the scoping report.

If a feasibility assessment is prepared, the director will appoint a Transplant Review Committee to formally evaluate the feasibility assessment. The Transplant Review Committee will consist of no fewer than four nor more than eight specialists, including the area biologist responsible for the area at the initial transplant site and other individuals with expertise in population dynamics, habitat relationships, interspecific relationships, population genetics, diseases and parasites of potentially affected species. The composition of the committee will reflect, to the extent practical, the biological expertise required for evaluating individual proposals. The committee may include nondepartmental specialists, or the committee may seek additional advice and recommendations of specialists from other agencies, educational institutions, or organizations.

The Transplant Review Committee shall provide public notice of the proposed transplant and provide 30 days for public review of the feasibility assessment. The committee shall hold at least one public hearing in the vicinity of the transplant and one in the nearest major regional center. Within 60 days of the last public hearing, the committee shall consider the feasibility assessment and public comment and submit a report of its findings and recommendations, in writing, to the director.

If the Transplant Review Committee, by unanimous agreement, finds that a proposed transplant is likely to effect a significant reduction in the range, distribution, habitat, or pre-existing human use of an indigenous species, the transplant is prohibited. If the committee finds that no significant reduction is likely, or if unanimous agreement cannot be reached, the director will approve or disapprove the proposed transplant within 30 days after receiving the committee's report.

If the proposed transplant is approved by the director, the division shall prepare a detailed transplant plan and itemized budget. The detailed transplant plan will be submitted to the Commissioner of Fish and Game for final approval and authorization before a transplant of a wildlife species within the state may proceed.

Transplant Guidelines

Department consideration of each transplant proposal will be guided by the following list of transplant categories, which are arranged in increasing order of overall risk. Proposals that fall into higher risk categories will be expected to meet more stringent standards of proof of conformance to the transplant evaluation criteria described above.

1. Intrastate reintroduction: Transplant of an indigenous species from one region of the state to another region where the species was locally extirpated will generally be supported after thorough consideration of the evaluation criteria listed above.

2. Interstate/international reintroduction: Transplant of an indigenous species that was previously extirpated from the state may be supported after consideration of evaluation criteria and rigorous testing for diseases and parasites.

3. Intrastate transplant: Introduction of a species indigenous to one region in the state to a new location within the state will be reviewed and may be supported on a case by case basis relative to the evaluation criteria and the potential for public benefits while minimizing long-term adverse ecological impacts.

4. Interstate/international transplant of indigenous species: Transplant of an indigenous species from another state (or nation) to a new range in Alaska will generally be opposed due to potential adverse biological impacts, including introduction of diseases and parasites and alteration of population genetics.

5. Island transplant: Introduction of a species indigenous to the state to islands where it does not naturally occur will generally be opposed. Introductions to unoccupied islands have caused serious adverse effects in Alaska and elsewhere. Indigenous island flora and fauna are particularly vulnerable to ecological problems caused by introductions.

6. Nonindigenous species: Introduction of a species not indigenous or previously not present in the state is prohibited from being introduced. The scientific literature is replete with examples of serious environmental problems caused by the introduction of species not indigenous to an area. Examples of environmental problems include the introduction of diseases and parasites, competition with and predation on native species, and habitat degradation. Restricting the introduction of species not indigenous or previously not present in the state will help protect Alaska's natural wildlife species diversity and minimize the potential for adverse ecological impacts.

7. Transplant exposed to disease or parasites: A transplant from any population with a history of exposure to pathogenic diseases or parasites not known to occur in Alaska and that may cause harm to an indigenous species is prohibited.

Wayne L. Regelin — July 7, 1995

Wayne L. Regelin, Director
Division of Wildlife Conservation

Date

APPENDIX C: CHRONOLOGY OF TRANSPLANTS

TABLE C1. Big game transplant efforts in Alaska, in chronological order

YEAR	LOCATION	SPECIES	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
1916–1923	Prince William Sound	Sitka black-tailed deer	24	Sitka area	Est. new huntable population	Thriving, hunted
ca. 1920	Willoughby Island, Glacier Bay	Sitka black-tailed deer	unknown	Hoonah area	Enhance winter survival	A few animals persist
1923	Homer Spit	Sitka black-tailed deer	7	Sitka area	Est. new huntable population	No animals remaining
1923	Baranof Island	Mountain goat	18	Tracy Arm	Est. new huntable population	Thriving, hunted
1924	Kodiak archipelago	Sitka black-tailed deer	14	Sitka area	Est. new huntable population	Thriving, hunted
1926, 1927–1928	Kruzof Island	Roosevelt elk	8	Washington state	Est. new huntable population	No animals remaining
1928	Delta	Plains bison	22	Montana	Est. new huntable population	Thriving, hunted
1929	Afognak Island	Roosevelt elk	8	Washington state	Est. new huntable population	Thriving, hunted
1934	Kodiak archipelago	Sitka black-tailed deer	9	Rocky Pass, SE Alaska	Augment previous transplant	Thriving, hunted
1934	Yakutat	Sitka black-tailed deer	12	Rocky Pass, SE Alaska	Est. new huntable population	Expanding range, hunted
1935–1936	Nunivak Island	Muskox	31	Greenland	Reestablish muskoxen in state	Thriving, hunted
1937	Revillagigedo Island	Roosevelt elk	4	Washington state	Est. new huntable population	No animals remaining
1949–1957	Copper River Delta	Moose	24	Southcentral Alaska	Est. new huntable population	Thriving, hunted, expanded range along coast

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TABLE C1, CONTINUED. Big game transplant efforts in Alaska, in chronological order

YEAR	LOCATION	SPECIES	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
1950	Copper River Valley	Plains bison	17	Delta herd	Est. new huntable population	Thriving, hunted
1951–1956	Taiya Valley, Lynn Canal mainland	Sitka black-tailed deer	13	unknown	Est. new huntable population	No animals remaining
1951–1954	Sullivan Is., Lynn Canal	Sitka black-tailed deer	8	unknown	Est. new huntable population	Low numbers, hunted
1952–1953	Kodiak Island	Mountain goat	17	Seward area	Est. new huntable population	Thriving, hunted
1954–1956	Chichagof Island	Mountain goat	25	Unknown	Est. new huntable population	No animals remaining
1958–1959	Adak Island, Aleutians	Caribou	24	Nelchina herd	Est. new huntable population	Thriving, hunted
1957–1959	Kalgin Island	Moose	6	Kenai Peninsula ?	Est. new huntable population	Thriving, hunted, exceeding range capacity
1958, 1960	Berners Bay	Moose	15, 6	Mat-Su valleys	Est. new huntable population	Low, hunting suspended
1962	Gravina Island	Roosevelt elk	8	Afognak Is.	Est. new huntable population	No animals remaining
1962	Chitina	Plains bison	35	Delta herd	Est. new huntable population	Low numbers, stable, hunting suspended
1963, 1964	Revillagigedo Island	Roosevelt elk	9, 14	Afognak Is.	Est. new huntable population	No animals remaining
1963–1964	Chickamin River	Moose	15	Chickaloon Flats	Est. new huntable population	No animals remaining
1964–1967	Kodiak	Dall Sheep	16	Kenai Peninsula	Est. new huntable population	No animals remaining

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TABLE C1, CONTINUED. Big game transplant efforts in Alaska, in chronological order

YEAR	LOCATION	SPECIES	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
1965–1966	Kenai Peninsula	Caribou	44	Nelchina herd	Reestablish huntable population	Thriving, hunted
1965, 1968	Farewell	Plains bison	18, 20	Delta herd	Est. new huntable population	Below range capacity, hunted
1966–1967	Kodiak Island	Moose	7	Southcentral mainland	Est. new huntable population	No animals remaining
1967–1968	Nelson island	Muskox	23	Nunivak Island	Transplant experiment, extend range	Thriving, hunted
1969	Barter Island (North Slope)	Muskox	52	Nunivak Island	Reintroduce to historic range	Depressed, hunting limited
1970	Kavik River (North Slope)	Muskox	12	Nunivak Island	Reintroduce to historic range	Depressed, hunting limited
1970	Seward Peninsula - Feather River	Muskox	36	Nunivak Island	Reintroduce to historic range	Thriving, hunted
1970	Cape Thompson - NW Alaska	Muskox	36	Nunivak Island	Reintroduce to historic range	Stable, limited hunting
1977	Cape Thompson - NW Alaska	Muskox	34	Nunivak Island	Augment earlier transplant	Stable, limited hunting
1978	Kupreanof Island - SE Alaska	Sitka black-tailed deer	10	Admiralty Island	Population recovery	Stable, hunted
1981	Seward Peninsula - Port Clarence	Muskox	37	Nunivak Island	Augment earlier transplant	Thriving, hunted
1983	Revillagigedo Island - Swan Lake/Mt. Reid	Mountain goat	17	Misty Fjords - Quartz Hill/ Cleveland Peninsula	Est. new huntable population and mitigate mining impacts on source population	Thriving, hunted

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TABLE C1, CONTINUED. Big game transplant efforts in Alaska, in chronological order

YEAR	LOCATION	SPECIES	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
1983	Kenai Peninsula - Cecil Rhode Mt.	Mountain goat	12	Mountains north of Kenai Lake	Augment low population for hunting and viewing	Thriving, hunted
1985–1986	Kenai Peninsula	Caribou	80	Nelchina herd	Reestablish huntable population and augment existing herds	Thriving, hunted
1987	Etolin Island	Roosevelt and Rocky Mtn. elk	50	Oregon	Est. new huntable population	Thriving, hunted, expanded to other islands
1988	Nushagak Peninsula	Caribou	146	Northern Alaska Peninsula herd	Reestablish herd in former range for local hunting and viewing	Low numbers, hunting suspended
1989	Mt. Juneau	Mountain goat	11	Whiting River - Tracy Arm	Reestablish goats for viewing	Stable, low numbers
1991	Revillagigedo Island - Deer Mt.	Mountain goat	15	Misty Fjords - Quartz Hill	Establish population for hunting and viewing	Thriving, hunted

TABLE C2. Big game transplant efforts in Alaska, by species

YEAR	LOCATION	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
SITKA BLACK-TAILED DEER					
1916–1923	Prince William Sound	24	Sitka area	Est. new huntable population	Thriving, hunted
ca. 1920	Willoughby Island, Glacier Bay	unknown	Hoonah area	Enhance winter survival	A few animals persist
1923	Homer Spit	7	Sitka area	Est. new huntable population	No animals remaining
1924	Kodiak archipelago	14	Sitka area	Est. new huntable population	Thriving, hunted
1934	Kodiak archipelago	9	Rocky Pass, SE Alaska	Augment previous transplant	Thriving, hunted
1934	Yakutat	12	Rocky Pass, SE Alaska	Est. new huntable population	Expanding range, hunted
1951–1956	Taiya Valley, Lynn Canal mainland	13	unknown	Est. new huntable population	No animals remaining
1951–1954	Sullivan Is., Lynn Canal	8	unknown	Est. new huntable population	Low numbers, hunted
1978	Kupreanof Island - SE Alaska	10	Admiralty Island	Population recovery	Stable, hunted
MOUNTAIN GOAT					
1923	Baranof Island	18	Tracy Arm	Est. new huntable population	Thriving, hunted
1952–1953	Kodiak Island	17	Seward area	Est. new huntable population	Thriving, hunted

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TABLE C2, CONTINUED. Big game transplant efforts in Alaska, by species

YEAR	LOCATION	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
1954–1956	Chichagof Island	25	Unknown	Est. new huntable population	No animals remaining
1983	Revillagigedo Island - Swan Lake/Mt. Reid	17	Misty Fjords - Quartz Hill/ Cleveland Peninsula	Est. new huntable population and mitigate mining impacts on source population	Thriving, hunted
1983	Kenai Peninsula -Cecil Rhode Mt.	12	Mountains north of Kenai Lake	Augment low population for hunting and viewing	Thriving, hunted
1989	Mt. Juneau	11	Whiting River - Tracy Arm	Reestablish goats for viewing	Stable, low numbers
1991	Revillagigedo Island - Deer Mt.	15	Misty Fjords - Quartz Hill	Establish population for hunting and viewing	Thriving, hunted
ROOSEVELT ELK					
1926, 1927–1928	Kruzof Island	8	Washington state	Est. new huntable population	No animals remaining
1929	Afognak Island	8	Washington state	Est. new huntable population	Thriving, hunted
1937	Revillagigedo Island	4	Washington state	Est. new huntable population	No animals remaining
1962	Gravina Island	8	Afognak Is.	Est. new huntable population	No animals remaining
1963, 1964	Revillagigedo Island	9, 14	Afognak Is.	Est. new huntable population	No animals remaining
ROOSEVELT AND ROCKY MOUNTAIN ELK					
1987	Etolin Island	50	Oregon	Est. new huntable population	Thriving, hunted, expanded to other islands
PLAINS BISON					
1928	Delta	22	Montana	Est. new huntable population	Thriving, hunted

Table continues next page

TABLE C2, CONTINUED. Big game transplant efforts in Alaska, by species

YEAR	LOCATION	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
1950	Copper River Valley	17	Delta herd	Est. new huntable population	Thriving, hunted
1962	Chitina	35	Delta herd	Est. new huntable population	Low numbers, stable, hunting suspended
1965, 1968	Farewell	18, 20	Delta herd	Est. new huntable population	Below range capacity, hunted
MUSKOX					
1935–1936	Nunivak Island	31	Greenland	Reestablish muskoxen in state	Thriving, hunted
1967–1968	Nelson Island	23	Nunivak Island	Transplant experiment, extend range	Thriving, hunted
1969	Barter Island (North Slope)	52	Nunivak Island	Reintroduce to historic range	Depressed, hunting limited
1970	Kavik River (North Slope)	12	Nunivak Island	Reintroduce to historic range	Depressed, hunting limited
1970	Seward Peninsula - Feather River	36	Nunivak Island	Reintroduce to historic range	Thriving, hunted
1970	Cape Thompson - NW Alaska	36	Nunivak Island	Reintroduce to historic range	Stable, limited hunting
1977	Cape Thompson - NW Alaska	34	Nunivak Island	Augment earlier transplant	Stable, limited hunting
1981	Seward Peninsula - Port Clarence	37	Nunivak Island	Augment earlier transplant	Thriving, hunted

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TABLE C2, CONTINUED. Big game transplant efforts in Alaska, by species

YEAR	LOCATION	NUMBER OF ANIMALS	SOURCE POPULATION	REASON(S) FOR TRANSPLANT	POPULATION STATUS 2008
MOOSE					
1949–1957	Copper River Delta	24	Southcentral Alaska	Est. new huntable population	Thriving, hunted, expanded range along coast
1957–1959	Kalgin Island	6	Kenai Peninsula ?	Est. new huntable population	Thriving, hunted, exceeding range capacity
1958, 1960	Berners Bay	15, 6	Mat-Su valleys	Est. new huntable population	Low, hunting suspended
1963–1964	Chickamin River	15	Chickaloon Flats	Est. new huntable population	No animals remaining
1966–1967	Kodiak Island	7	Southcentral mainland	Est. new huntable population	No animals remaining
CARIBOU					
1958–1959	Adak Island, Aleutians	24	Nelchina herd	Est. new huntable population	Thriving, hunted
1965–1966	Kenai Peninsula	44	Nelchina herd	Reestablish huntable population	Thriving, hunted
1985–1986	Kenai Peninsula	80	Nelchina herd	Reestablish huntable population and augment existing herds	Thriving, hunted
1988	Nushagak Peninsula	146	Northern Alaska Peninsula herd	Reestablish herd in former range for local hunting and viewing	Low numbers, hunting suspended
DALL SHEEP					
1964–1967	Kodiak	16	Kenai Peninsula	Est. new huntable population	No animals remaining

APPENDIX D: PHARMACEUTICALS

Some of the pharmaceuticals mentioned in this report are still used by the Alaska Department of Fish and Game (ADF&G) and some are no longer used, for various reasons, often simply because a safer and more effective alternative has been developed. Pharmaceuticals mentioned that are not currently used by the department include naloxone, M 50-50, and Narcan®, which have all been replaced by naltrexone; Tranvet®; succinylcholine chloride, which is no longer used in animals since better tranquilizers have developed; and sernylan, the purpose for which ADF&G now uses ketamine. Modern information for pharmaceuticals mentioned in this report that ADF&G's wildlife managers still use are listed in the table below (Table D1). Historical information about who produced pharmaceuticals used and where they were obtained for specific transplant operations is not available.

TABLE D1. Modern information for pharmaceuticals identified in this report as administered to wildlife during transplant operations and currently still used by ADF&G, including current generic name, brand name, and manufacturer.

GENERIC NAME	BRAND NAME	MANUFACTURERS
acepromazine	PromAce® Acepromazine Maleate (generic)	Fort Dodge Butler
carfentanil CII	Wildnil™	Wildlife Pharmaceuticals brand no longer available, currently only purchased as a compounded substance from WP subsidiary ZooPharm.
etorphine CII	M-99™	Wildlife Pharmaceuticals brand no longer available, currently only purchased as a compounded substance from WP subsidiary ZooPharm.
ivermectin	Ivomec® (generic)	Merial Butler, various
ketamine CIII	Ketaset®, Vetalar® Ketaject® KetaVed™ VetaKet® Ketamine HCl (generic)	Fort Dodge Phoenix Vedco Lloyd Labs Boehringer Ingelheim Vetmedica various, ZooPharm
naltrexone	Trexonil™	Wildlife Pharmaceuticals brand no longer available, currently only purchased as a compounded substance from WP subsidiary ZooPharm

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Table D1, continued. Modern information for pharmaceuticals identified in this report as administered to wildlife during transplant operations and currently still used by ADF&G, including current generic name, brand name, and manufacturer.

Generic name	Brand name	Manufacturers
xylazine	AnaSed®	Lloyd Labs
	Cervizine®	Wildlife Pharmaceuticals brand no longer available, currently only purchased as a compounded substance from WP subsidiary ZooPharm
		Bayer
	Rompun®	Fort Dodge
	Sedazine™	Phoenix
	Xyla-Ject®	Boehringer Ingelheim Vetmedica
	Xylazine HCl (generic)	Butler
		VetTek
		Others