

Selkirk Mountains Woodland Caribou

Herd Augmentation in Washington

A Cooperative Interagency Plan

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EXECUTIVE SUMMARY

The Selkirk Mountain woodland caribou (*Rangifer tarandus caribou*) is listed by the U.S. Fish and Wildlife Service as an endangered species in the United States. It is also designated as an endangered species in Washington by the Washington Department of Fish and Wildlife. The recovery plan for the caribou (USFWS, original 1985; revised 1994) includes a task to establish caribou in the western portion of the Selkirk Ecosystem in Washington. Transplants to the western portion of the ecosystem are needed to achieve better distribution, greater abundance, and to enhance the probability of caribou recovery.

The augmentation project entails capturing caribou in separate, but genetically similar subpopulations in British Columbia, transporting the animals to Washington, releasing them into the wild, and monitoring the results. Previous herd augmentation efforts for the southern Selkirk caribou population involved transplanting caribou from healthy populations in British Columbia to the Ball Creek area of Idaho. A total of 60 caribou were transplanted: 24 in 1987; 24 in 1988; and 12 in 1990. Information and experience gained in the Idaho effort will be used to increase the chances for success of the Washington project.

Three potential sources for transplant animals in British Columbia will be considered: Revelstoke, Blue River/Wells Gray Park, and Prince George. British Columbia officials will determine the number and sources of transplant animals. The target number of animals for the first year will be 20-24 animals, with a sex ratio of 1 male: 4-5 females. Preferred age composition is males 3 years or younger, calves, yearlings, and adult females. Old-aged females or animals in poor condition will be excluded. Methods will follow those used in the Idaho augmentation effort, which experienced very low mortality rates. Animals will be captured in March, using net guns from helicopters. They will be held for tuberculosis and brucellosis testing and then transported to the release site in Washington.

Four potential release sites on the Sullivan Lake Ranger District of the Colville National Forest were evaluated. One site, Molybdenite Ridge was eliminated from consideration. Potential release sites, in order of preference are: Pass Creek, Mankato Mountain, and upper Sullivan Creek. All are within the Caribou Habitat Area, are currently managed as caribou habitat under the Colville National Forest Plan (U.S. Forest Service 1988), and will require no change in management to accommodate the augmentation effort. The final site selection will depend upon weather conditions and road access at the time of release.

Preliminary work (administrative, habitat mapping, caribou feeding trials) has been conducted during 1995 to facilitate the augmentation project. Pending funding approval, the first transplant will take place in March 1996. Caribou recovery is an interagency and international effort requiring public support and involvement. Law enforcement needs are identified in the augmentation plan and will emphasize prevention of accidental or intentional shooting. Information/Education needs are also addressed in the plan. Some of the information/ education efforts used during the Idaho augmentation effort, such as the "Adopt a Caribou" program, will be used in the Washington project.

INTRODUCTION

The southern Selkirk Mountains population of woodland caribou (*Rangifer tarandus caribou*) is the only population of woodland caribou which still regularly occurs in the conterminous United States (U.S.). The U. S. Fish and Wildlife Service listed the caribou as endangered in 1984 under the Endangered Species Act of 1973 (87 stat 884, 16 USC), as amended. The Idaho Fish and Game Commission listed caribou as a threatened or endangered species in the state in 1977. The Washington Department of Fish and Wildlife designated the species as endangered in 1982 (WDFW permanent Regulations, WAC 232-12-014). In British Columbia, the caribou is considered a Category Blue species of management concern that could potentially move into a Category Red status of threatened or endangered.

Information on the historical and current status of caribou in the southern Selkirk ecosystem is contained in the Selkirk Mountain Woodland Caribou Recovery Plan (USFWS 1994). A general description of caribou life history is provided by Jerry (1983), while Rominger and Oldemeyer (1989 and 1990) and Warren (1990) provide current information on caribou habitat requirements in the Selkirk Mountains.

When the woodland caribou was listed as endangered in 1984, the population was estimated to consist of only about 30 animals. To increase numbers and distribution, caribou from British Columbia were transplanted to Idaho in 1987, 1988, and 1990. Today, the population consists of an estimated 50 animals occurring as two herds, located in the Selkirk Mountains of northern Idaho and southern B.C. (Fig. 1).

The Selkirk Mountain Woodland Caribou Recovery Plan (USFWS, original 1985; revised 1994) includes a task to establish caribou in the western portion of the Selkirk ecosystem in Washington. Additional transplants to the western portion of the ecosystem are needed to achieve better distribution, greater abundance, and to enhance the probability of caribou recovery. Implementation of this recovery task requires an interagency planning effort to develop the augmentation plan, analyze potential caribou habitat, and to select appropriate release sites for caribou in Washington. Monitoring of radio-collared caribou in Idaho should continue to determine habitat use and mortality rates and causes.

An Environmental Assessment (Summerfield 1985a) and an Augmentation Plan (Summerfield 1985b) were written in 1985 for augmentation of the woodland caribou herd in Idaho. This 1996 Washington Augmentation Plan is a revision of the 1985 Idaho plan, and is specifically directed at establishing a woodland caribou herd in northeastern Washington on the Colville National Forest.

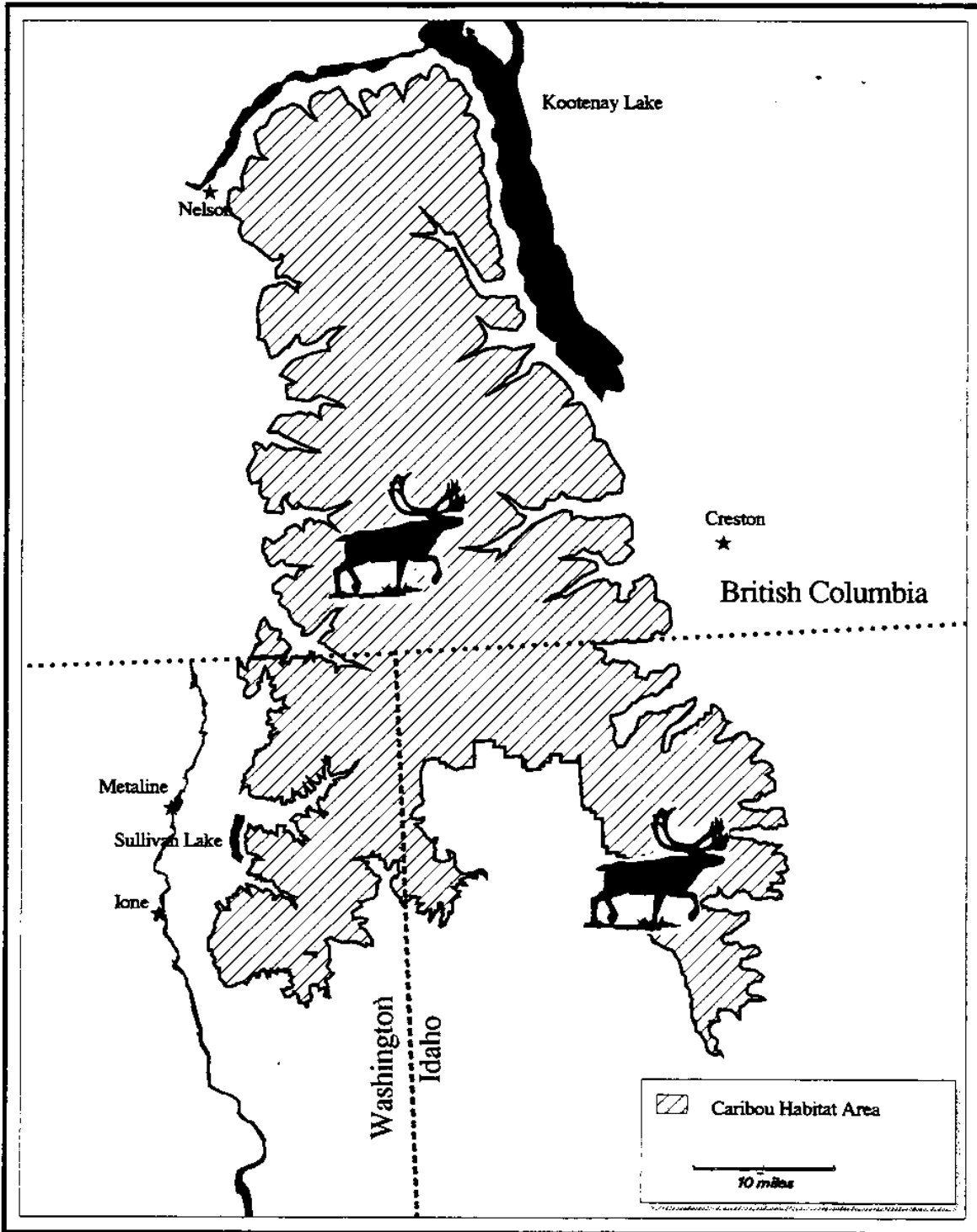


Figure 1. Selkirk Mountain woodland caribou habitat area and location of existing herds in British Columbia and Idaho.

PROJECT DESCRIPTION

The Woodland Caribou Herd Augmentation Project entails capturing caribou in separate, but genetically similar, subpopulations in British Columbia, transporting the animals to Washington, releasing them into the wild, and monitoring the results. Many previous caribou transplant attempts have occurred in North America using a wide variety of techniques. Some have been highly successful while others have failed. A summary of known transplant attempts is displayed in Appendix 1. The presence of meningeal brainworm (*Parelaphostrongylus tenuis*) has been responsible, at least in part, for 4 of the 6 documented failures. This parasite that is carried by white-tailed deer and kills caribou is not present in northern Idaho (Foreyt and Compton 1991) or Washington.

Previous herd augmentation efforts for the southern Selkirk caribou population involved transplanting caribou from healthy populations in British Columbia to the Selkirk Mountains of Idaho. A total of 60 caribou were transplanted from Revelstoke, Anahim Lake, and Blue River, B.C. to Ball Creek, Idaho: 24 in 1987, 24 in 1988, and 12 in 1990. Movements, habitat selection, natality, and mortality of the transplanted caribou have been monitored from 1987 to present (Servheen 1987, Servheen 1989, Compton et al. 1990, Warren 1990, Compton et al. 1991, Wakkinen et al. 1992, Compton et al. 1995, Wakkinen 1995) (Fig. 2).

The method used for the Idaho transplants was a quick-release strategy, in which animals were captured in B.C., held for a brief (72 hours) disease-testing period, transported to Idaho, and immediately released. A delayed-release method, where animals are confined at the release site prior to release, was tried first in the Idaho effort, but was determined to be unnecessary. The Idaho augmentation effort experienced very low mortality rates (3 of 63 animals died as a result of capture, handling, and transport). Based on experience gained from the three Idaho transplants, the current project will employ basically the same strategies. The following sections provide a more detailed description of potential capture sites, release sites, and project implementation methods.

Preparatory Work

Habitat Analysis. Preparatory work for the transplant was initiated in 1994-95 by the Washington Department of Fish and Wildlife with funding from U. S. Fish and Wildlife Service. Objectives of the work were to centralize geographic data for the Selkirk ecosystem, with emphasis on the Washington portion of the ecosystem. The habitat analysis was a cooperative effort among several agencies, including Washington Department of Fish and Wildlife, Idaho Department of Fish and Game, Colville National Forest, Idaho Panhandle National Forests, and British Columbia Ministry of Environment, Lands and Parks.

A wide variety of mapped information for the Selkirk ecosystem existed, but was housed in many different locations and formats and had not been unified into a single, continuous data

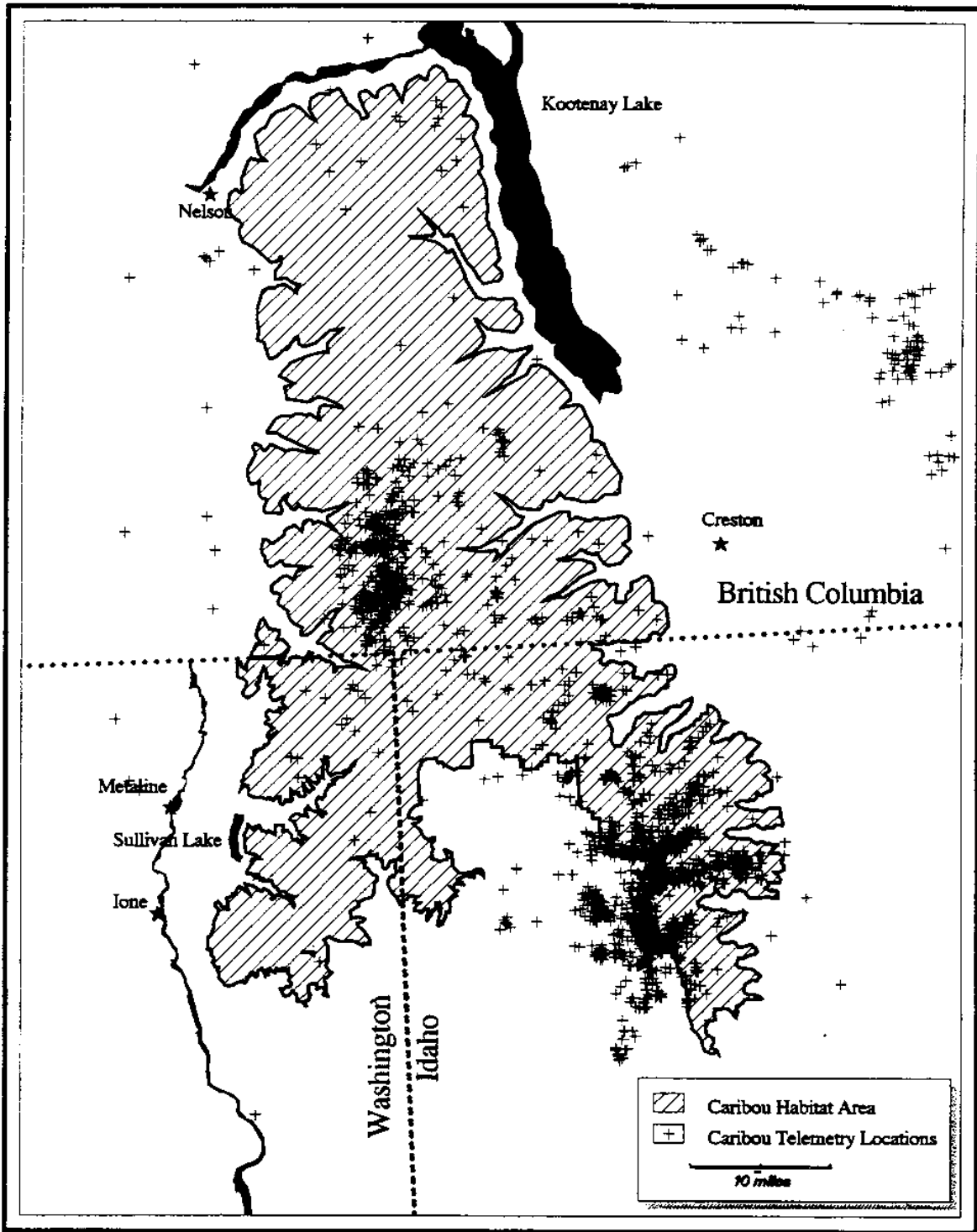


Figure 2. Telemetry locations of caribou transplanted from British Columbia to Idaho.

base. The Washington Department of Fish and Wildlife assembled Geographic Information System (GIS) data layers for the entire Selkirk ecosystem from the current multiple sources into a single map library. Because existing vegetation cover information was not adequate to model caribou habitat quality, Landsat remote sensing scenes for the Washington portion of the ecosystem were purchased and classified into vegetation cover types. The GIS data will be used to model caribou habitat quality and capability and to support the logistical needs of the reintroduction process. The map library will serve as an information base for future analysis of caribou radio telemetry data.

Verification of Caribou Habitat Model. Field investigations were conducted in 1995 to verify caribou habitat modeling predictions. Tame woodland caribou were used to investigate foraging behavior and habitat preferences as they relate to predictions generated from habitat modeling. Forage intake rates, daily activity budgets, and nutritional quality of primary forages will be compared among different quality caribou habitat types mapped in the recovery area in Washington. These activities were contracted with Washington State University, where tame caribou have been trained for conducting the experimental field trials.

Capture Sites

The British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch, will determine which B.C. caribou populations will be approved as a source of animals for the transplants. Three potential sites that will be considered for the capture of transplant caribou are Revelstoke, Blue River/Wells Gray Park, and Prince George (Fig. 3). In the Idaho transplant experience, few differences in survival rates and habitat use were found among transplant stock from these same source areas. No differences in mortality occurred in caribou from the different capture sites, indicating that although travel time was more lengthy from some sites, it apparently did not adversely affect the caribou.

Revelstoke. The first potential source of caribou is the Selkirk and Monashee mountains north of Revelstoke, British Columbia. This population is 190 air miles north of the U.S.- Canada border. The geographic closeness makes this population the most genetically similar to the Selkirk population and also reduces the transport time to about nine hours. Recent research and inventory shows this population to be increasing and of sufficient size to provide 12 animals annually for transplant to the U.S. Habitat selection patterns are similar to those of the southern Selkirk herd. The area has good road access, which will enable a holding site to be established relatively close to the capture site. Adequate road access in the capture area allows the holding pen to be nearby, thus reducing flying time from the capture site and reducing stress to the animals.

Blue River/Wells Grey Park. The second source of caribou is in the Blue River/Wells Grey Park area of central British Columbia, about 100 miles north of Kamloops, British Columbia, and 200 miles north of the U.S.- Canada border. Transportation time from this site to the

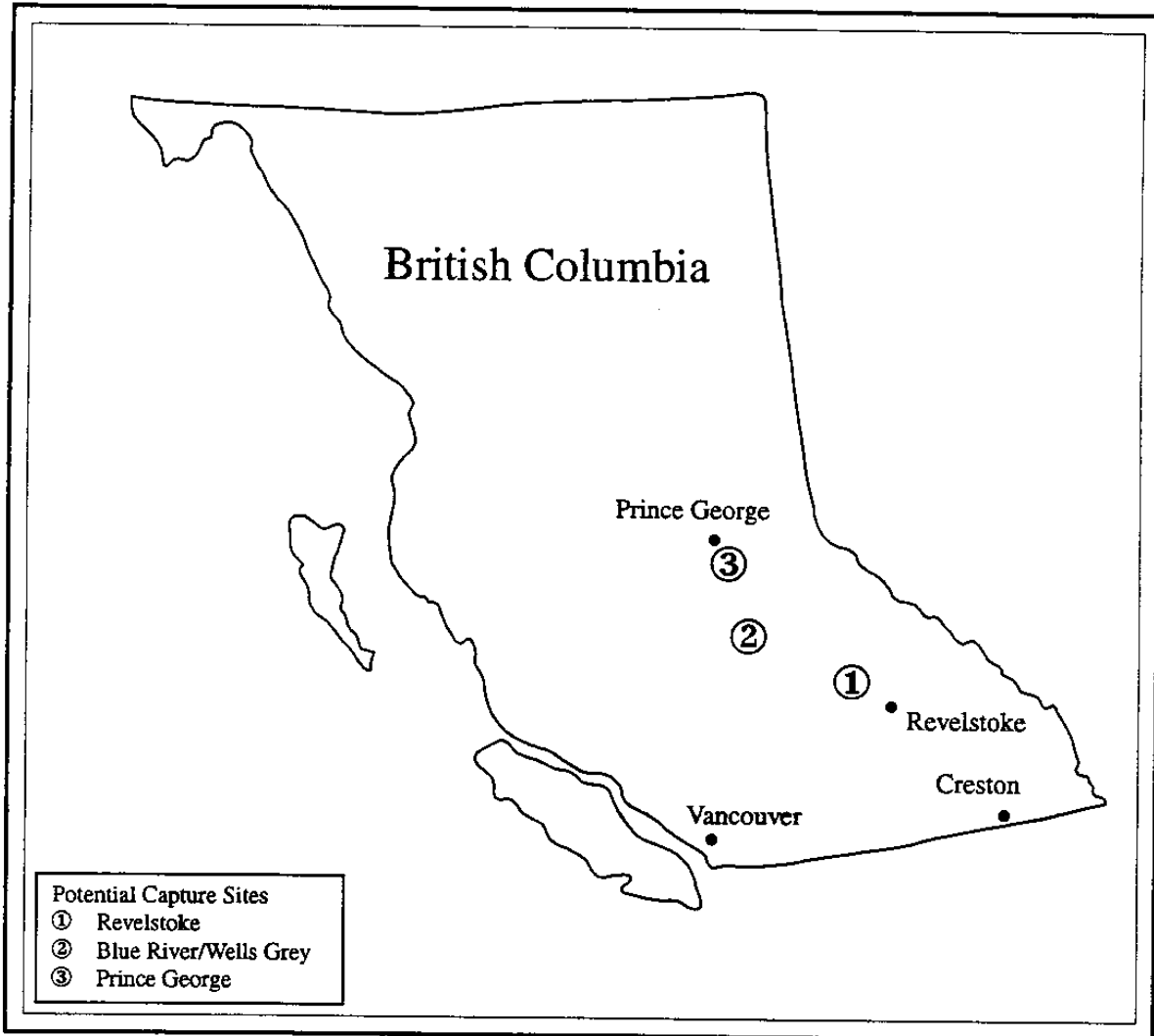


Figure 3. Potential sources of transplant caribou in British Columbia.

release site will be about 13 hours. The caribou population in this area is smaller than at Revelstoke, and will likely be able to supply 8 caribou annually. The caribou will likely come from within Wells Grey Provincial Park, since populations outside the Park are not doing as well as within. Habitat selection patterns are similar to those of the southern Selkirk population, although greater use of alpine tundra habitats has been observed. It is not clear why caribou are using the high elevation habitat in this area. It may be because it meets their life requisites, or they may use the high elevation habitat to avoid wolf predation and/or large populations of insects. Wolves remain in the lower elevations in this area because the snow is not deep and there are large prey populations. The high elevation habitat is more windblown and provides better protection from insects. The area has relatively poor road access, so it may be necessary to fly the animals some distance to the holding areas.

Prince George. The third source of caribou is in the northern Columbia Mountains area of central British Columbia, about 75 miles southeast of Prince George, British Columbia, and 315 miles north of the U. S.- Canada border. Transportation time from this site to the release site will be about 16 hours. The population in this area is about the same as Revelstoke. The site will likely be able to supply about 12 caribou annually. Habitat selection patterns are similar to those of the southern Selkirk population, although greater use of alpine tundra habitats has been observed, possibly due to wolf predation and greater insect problems, as in the Blue River/Wells Grey Park area. The area has relatively good road access, and it may be possible to capture animals relatively close to a holding site.

Considering the above analysis, and depending on final decisions by B.C. officials, these three populations will be the sources for transplant animals for the Washington augmentation program.

Release Sites

The original 1985 augmentation plan reviewed six sites in Washington: South Salmo River, Crowell Ridge, upper Sullivan Creek, Gold-Granite creeks, Molybdenite Ridge, and Pass Creek (Summerfield 1985b). In the 1985 analysis, the South Salmo River, Crowell Ridge, and Upper Sullivan Creek sites were eliminated from consideration because they were within 15 miles of the international border. The Gold-Granite creeks site was eliminated because of the high potential for human interaction due to excessive road access in the area. Two potential release sites were identified: Pass Creek and Molybdenite Ridge.

Recent field reviews and caribou research have resulted in consideration of four potential release sites for the Washington herd augmentation: Molybdenite Ridge, Pass Creek, Mankato Mountain, and the upper Sullivan Creek drainage (Fig. 4). Criteria used in the evaluation of potential release sites were habitat status (condition and availability), vehicular access (for the transport vehicles), proximity to the U.S./B.C. border (see Appendix 2, review of post-augmentation caribou movements), and landownership/management. An

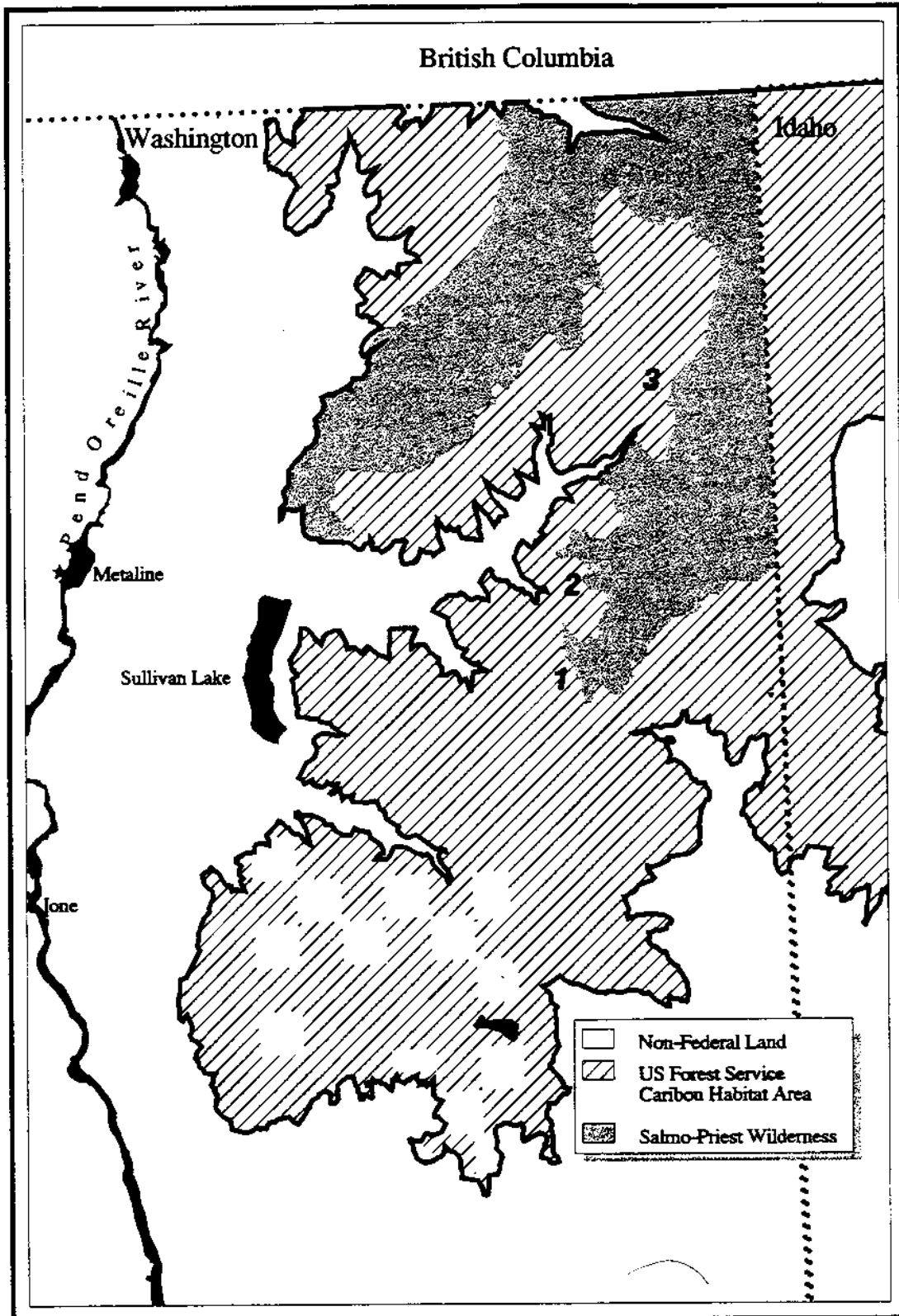


Figure 4. Potential caribou release sites on the Sullivan Lake Ranger District, Colville National Forest, Washington (1 = Pass Creek; 2 = Mankato Mountain; 3 = Upper Sullivan Creek).

assessment of caribou habitat on the Sullivan Lake Ranger District of the Colville National Forest reveals that, within the Caribou Recovery Area above 4,400 feet, there are almost 15,000 acres (18%) of target condition early winter habitat and almost 19,000 acres (23%) of target condition late winter habitat. Based on this assessment, habitat is not considered to be a limiting factor for the augmentation.

Molybdenite Ridge. Molybdenite Ridge was judged to have good early winter, late winter/calving, spring, and summer/rut habitat. This site is located farthest from the U.S./B.C. border, but is also closest to intermingled private land ownership. Access to the site is available from several different routes, which would facilitate transport of caribou, but would also create a potential security problem. This fact, combined with the site's proximity to intermingled private land ownership, resulted in the elimination of this area from further consideration.

Pass Creek. Pass Creek has excellent early winter habitat, marginal to adequate late winter/calving habitat, good to excellent spring habitat, and good summer/rut habitat. The site is located approximately four miles from intermingled private land, and is adjacent to the Salmo-Priest Wilderness Area. Excluding Molybdenite Mountain, it is the farthest from the U.S./B.C. border.

Mankato Mountain. A 1994 forest fire burned about 300 acres of late winter habitat at the Mankato Mountain site; however, the remaining late winter habitat appears adequate. The site still has good early winter, summer and spring habitat. This site has road access to facilitate transport of caribou and is located adjacent to the Salmo-Priest Wilderness Area.

Upper Sullivan Creek. Upper Sullivan Creek has adequate amounts of all seasonal habitats. Road access is good, with the potential of using one of three specific sites, depending upon weather conditions at the time of the transplant. It is the farthest from private land ownership and is in the immediate vicinity of the Salmo-Priest Wilderness Area. However, it is also closest to the U.S./B.C. border, increasing the chance that transplanted caribou may move back into British Columbia. Although caribou would still be within the Selkirk Ecosystem, movement of the animals from the U.S. back to Canada would counteract the intent of establishing a herd in Washington.

The Pass Creek, upper Sullivan Creek, and Mankato Mountain sites are all within the Caribou Habitat Area and are identified in the 1988 Colville National Forest Land and Resource Management Plan (U.S. Forest Service 1988) as being within Management Area 2 (caribou habitat emphasis). All three sites are adjacent to the Salmo-Priest Wilderness Area. These factors ensure that no change in management would be required to accommodate the augmentation effort in this area.

The preferred site for the release in order of preference is Pass Creek, Mankato Mountain, and upper Sullivan Creek. The final site selection will depend upon weather conditions and road access at the time of release.

Methodology

Capture. The capture locations, described above, will be in the vicinities of Revelstoke, Blue River/Wells Grey Park, and Prince George, British Columbia. The target number to capture the first year is 20-24 animals, with a sex ratio of 1 male: 4-5 females. The preferred age composition of captured animals will be males three years or younger, calves, yearlings, and adult females. Old-aged females or animals in poor condition will be excluded.

Animals will be captured during the late winter season, using net guns from helicopters. They will be tranquilized by hand injection of xylazine hydrochloride (brand name Rompun). Their antlers will be sawed off, and they will be hobbled, blindfolded, and transported via helicopter to the holding facility. Foam rubber goggles will be used beneath the blindfolds to prevent corneal abrasions. At the holding facility, they will be fitted with ear tags and mortality-sensing radio collars, inoculated with tuberculin, injected with vitamins A, B complexes, D and E, selenium, antibiotics, and a wormer (Ivermectin). Blood samples will be taken for pregnancy testing, disease titers, and genetic research.

Captured caribou will be tested for tuberculosis, brucellosis, and meningeal brainworm. They will be held in a quarantine corral for 72 hours while awaiting tuberculosis and brucellosis test results. They will be fed arboreal lichens and snow/water as needed. Human activity near the facility will be kept to a minimum.

Transport. All necessary permits and clearance will be secured prior to capture. This includes a permit for importing endangered species from the U.S. Fish and Wildlife Service, exception to designated port permit to enable crossing the border at Metaline Falls rather than the customary Blaine port, and a veterinary certification that the animals are disease free and the capture area is tuberculosis free. The animals will be transported in darkened 4-horse trailers provided with straw bedding and water. The Metaline Falls border crossing is about 20 miles from the release area.

Release. Animals will be released directly from the transport trailer immediately upon reaching the release site. Based on the Idaho experience, no holding corral or enclosure will be used at the release site; the transplanted animals will be free-ranging immediately upon release.

Monitoring. The Washington Department of Fish and Wildlife will assign a full time project biologist to monitor the transplanted caribou. All released caribou will be marked with mortality-sensing radio transmitters and numbered ear tags. Ground and aerial radio tracking will be employed to locate the animals weekly (weather permitting). The previous transplant project in Idaho revealed that caribou mortalities are higher during late summer. Because of high temperatures during this period and the resulting rapid deterioration of carcasses, it is often impossible to clearly detect the source of the mortality. Therefore, during late summer (August - September), monitoring will be more frequent (several times per week) to better identify the cause of mortalities occurring during this period. Objectives of the monitoring will be to determine movements and group dynamics of the released animals, habitat selection, and rates of survival, mortality, and natality.

Idaho. The Idaho Department of Fish and Game may also continue or expand monitoring of the existing caribou within the Idaho portion of the Selkirk Ecosystem by radio-collaring resident animals. This will allow for a comparison of survival rates with animals transplanted into Washington.

Annual Review. The Caribou Recovery Team will conduct annual reviews of the augmentation effort. If project monitoring identifies problems significantly affecting caribou survival, such as predation, excessive motorized vehicle access, or human-caused mortalities, the Recovery Team will develop recommendations to address the issue. The U.S. Fish and Wildlife Service will notify the appropriate lead agency of the action needed.

Law Enforcement

Enforcement efforts will emphasize prevention of accidental or intentional mortality through an intensive public and hunter education program. Preventative measures such as news releases, public information and education, road closure maintenance, and hunter contacts, will be concentrated in the caribou area prior to and during the general hunting seasons. Hunter education pamphlets will be distributed to local license vendors, schools, hunter education classes, sporting clubs, etc. Informational and warning signs will be posted along access routes in the caribou recovery area and agency personnel will maintain a visible presence during periods of peak hunter activity. To protect the appropriate area(s) and to detect any mortalities as quickly as possible, the radio-collared caribou will be monitored frequently during the general hunting season and other peaks of hunter activity.

Information/Education

Caribou recovery is an interagency and international effort requiring public support and involvement. Some of the information and education efforts that were used in Idaho and Washington during the Idaho augmentation will be used for the Washington project. These include distribution of printed information (factsheets, identification pocket cards), posting of signs in caribou habitat to warn hunters of caribou presence, and coordination of media features on caribou through news releases and field contacts. Audio-visual materials (slide series, videos) developed for the Idaho project will be revised for use with public groups, upon request. The "Adopt-A-Caribou" program led by the Idaho Department of Fish and Game, in which school children "adopted" transplanted caribou and decorated radio collars, would also be valuable in the Washington project and will be part of the funding proposals.

The Washington Department of Fish and Wildlife's Spokane-based information specialist will have lead responsibility for public and media involvement in the Washington augmentation project. Two public "open houses" were held in Pend Oreille County in the fall of 1995 to inform the public about caribou and the proposed Washington project.

Permits/Clearances

Washington Department of Fish and Wildlife, as lead agency for implementing the augmentation effort, will apply to the U.S. Fish and Wildlife Service for the appropriate Federal permits. These include: (1) exception to designated port permit; (2) import/export license; and (3) endangered and threatened species permit (scientific take permit). The Department will also apply to the British Columbia Ministry of Environment for approval to use caribou from British Columbia for the transplant effort. A health certificate from an approved British Columbia veterinarian will also be required to transport the animals across the border. This process will be coordinated by Washington Department of Fish and Wildlife's staff veterinarian, in accordance with Canada, British Columbia, and Washington regulations.

PROJECT BUDGET

The estimated budget for the augmentation effort is displayed in Appendix 3. Funding of the project will be a shared responsibility of all involved agencies. Funding may also be available from private sources and will be encouraged.

IMPLEMENTATION SCHEDULE

Initial preparatory work (administrative, habitat mapping, caribou feeding trials) for the augmentation was conducted in 1994-95. The first transplant is scheduled for March 1996. Subsequent transplants are planned in two successive years, unless animals are unavailable or weather does not permit capture. In the event that circumstances prevent transplant in one year, they would be planned for the next year. Monitoring will begin immediately after animals are transplanted.

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Appendix 1. Summary of previous caribou translocations.

Location	Date	Source	Techniques Used	Results
Red Lake Refuge, Minnesota	Oct. 1938 1940	Karns 1978	10 caribou (2 adult males, 4 male calves, 4 female calves) captured in Saskatchewan. 1 adult male released in 1938 with remnant wild herd. Remaining animals held in enclosure until 1940.	Failure. Wolf predation, poaching, <i>P. tenuis</i> suspected as causes of failure.
Liscombe Game Sanctuary, Nova Scotia	April 1939	Tufts 1939, Benson & Dodds 1977	9 females imported from Newfoundland 5 released immediately, 4 held and released later with 3 males.	Failure.
St. Matthew Island, Alaska	Aug. 1944	Klein 1968	29 reindeer (24 females, 5 males) released.	Population expanded to 6,000 animals in 1963; subsequently crashed to 42 animals in 1966.
Adak Island, Alaska	July 1958 1959	Jones 1966, Burriss & McKnight 1973	23 newborn calves reared in captivity for 2 months, then released.	Success. Population increased rapidly and is now hunted.
Mt. Katahdin, Maine	Dec. 1963	Dunn 1965	24 adult caribou (19 females, 5 males) imported from Newfoundland and immediately released.	Failure. Animals dispersed in the spring.
Kenai Peninsula, Alaska	May 1965 April 1966	Burriss & McKnight 1973	44 caribou (38 females and) 6 males captured in interior Alaska and immediately released on the Kenai. Included yearlings and adults.	Success. Population increased rapidly and is now hunted.
Cape Breton Highlands Nat'l Park, Nova Scotia	1968 1969	Dauphine 1975	51 caribou imported from Quebec and released.	Failure. Herd sighted frequently for one year, then declined and disappeared by summer 1972. <i>P. tenuis</i> suspected.
Great Cloche Island, Ontario	May 1969	Anderson 1971	14 reindeer from Norway held in enclosure formerly occupied by white-tailed deer.	Failure as a result of <i>P. tenuis</i> .

Appendix 1. Continued.

Location	Date	Source	Techniques Used	Results
Wisconsin	--	Trainer 1973	14 caribou maintained in same enclosure on game farm with white-tailed deer.	Failure as a result of <i>P. tenuis</i> .
Laurentide Park, Quebec	1969 1971 1972	I. Juniper in Karns 1978	81 caribou (progeny from a captive herd) released.	Success. Herd prospering.
Newfoundland	1961- 1982	E. Mercer, pers. comm.	23 individual releases involving all sex/age classes. Animals released immediately after capture. Some released on islands, some on mainland.	Nearly all releases successful. Some populations now hunted.
Salamajärvi National Park, Finland	Dec. 1981 1983	Nieminen & Laitinen	Wild forest reindeer captured and held in captivity. Calves born in captivity reared to 1.5 years old and released in the wild.	Reproduction occurring in the wild. Other results not available.
Ball Creek, Idaho	Mar. 1987 1988 1990	Compton, et al. 1995	60 caribou imported from British Columbia and immediately released in the southern Selkirk Mountains of northern Idaho.	Reproduction occurring in the wild. Original herd of 25 animals now numbers approximately 50 animals.
Maine	May 1989 April 1990	McCullough & Connery 1991	22 caribou captured in Newfoundland and held in captivity for 3.5 yrs. 12 captive-raised caribou released in 1989; 20 wild and captive-raised caribou released in 1990.	Failure as a result of <i>P. tenuis</i> and black bear predation.

POST-AUGMENTATION CARIBOU MOVEMENTS

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Post-release movements of woodland caribou are reported here to aid in the evaluation of transplant sites in the Washington portion of the Selkirks. Concern has been raised over the juxtaposition of existing woodland caribou herds in the Selkirk ecosystem to potential release sites. Considerable wandering was noted by woodland caribou after the first augmentation effort in Idaho. If augmented animals encountered other caribou in the course of their wanderings, they often became assimilated with that herd and were "lost" from the effort to establish a second herd in the Selkirks. This behavior was noted with the Stagleap herd in the Selkirks as well as the Goat River herd in the Purcell Mountains of British Columbia which is located to the northeast of the Selkirk release site.

As a quick summary, 3 transplants were conducted over 4 years. A total of 60 animals were released in Ball Creek, Idaho. The nearest "high quality" late winter habitat was located in the Myrtle Basin area, approximately 7 km to the west of the release site. Twelve animals from Anahim Lake and 12 animals from Revelstoke were released in 1987, 14 animals from Anahim Lake and 10 animals from Revelstoke were released in 1988 and 12 animals from Blue River were released in 1990. Anahim Lake is approximately 580 km northwest of the Selkirks, Blue River is about 420 km to the north-northwest, and Revelstoke is about 285 km to the north-northwest. Caribou from Anahim Lake are considered the "northern" ecotype. Blue River, Revelstoke, and the Selkirks are within the range of the "mountain" ecotype.

Movements have been analyzed and reported by Warren (1990) and Compton et al (1991). They summarize many aspects of the movements and behavior after the transplant. However, no

report included details of the maximum distance and direction of movements of individual animals. While home ranges and average activity radii explain some aspects of caribou movement, they do not account for the exploratory movements sometimes shown by these caribou. These long-range movements may be very important if the caribou encounter resident animals in the course of their wanderings. I also included a measure of "dispersal" in this analysis. I was specifically interested in long-range movements to the north, which is where the nearest caribou exist. I considered any movements north of the U.S./Canadian border to be dispersal movements with the possibility of encountering other caribou. The border is approximately 27 km north of the release site.

Methods

I calculated the maximum straight line distance that individual caribou moved from the release site within one year of their release. All animals were released at the same location in Ball Creek, Idaho. Comparisons were made within and between years and transplant stock using nonparametric Kruskal-Wallis statistics. Because of sample size restrictions, males and females of the same transplant stock and year were pooled. Therefore, because of the sex ratio of the transplants, it must be recognized that the results are largely driven by female movements. I also determined the number of animals that exhibited dispersal movements north of the US/Canada border within one year of their release. Comparisons were made within and between years and transplant stock using a Chi-square test.

Results

The maximum distance each animals moved within the first year of its release is reported in Appendix A. A Kruskal-Wallis comparison among groups of animals proved to be statistically different ($T=17.28$, $p=0.002$, $d.f.=4$). A multiple comparison test was used to identify differences

between pairs of transplant groups. Based on the mean rank of their movement, animals from Anahim Lake that were released in 1988 exhibited the least movements, followed by Blue River animals in 1990, Anahim Lake animals in 1987 and Revelstoke animals in 1988. Revelstoke animals released in 1987 exhibited the longest movements. Median movements and comparisons between groups are presented in Table 1.

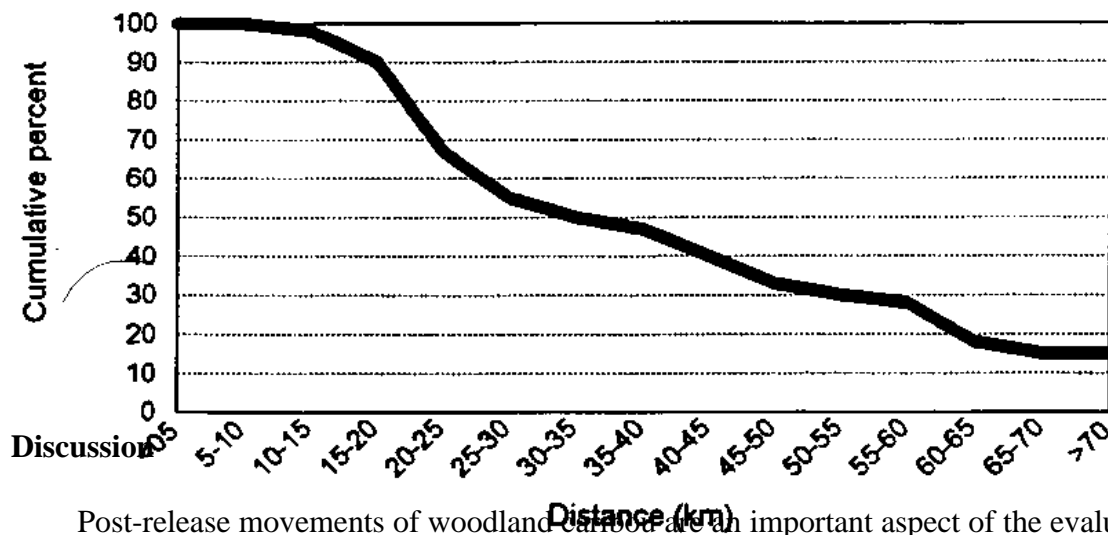
Table 1. Median movements of translocated caribou and comparisons of transplant groups. Groups with similar letters are not different ($p>0.05$).

<u>Origin</u>	<u>Year</u>	<u>N</u>	<u>Median movement (km)</u>	<u>Group comparisons</u>
Anahim Lake	1987	12	27.6	a,c,d
Revelstoke	1987	12	62.1	b
Anahim Lake	1988	14	20.1	a
Revelstoke	1988	10	36.9	b,c,d
Blue River	1990	12	22.9	a,c

Thirty animals exhibited dispersal movements north of the US/Canada border within the first year of their release. Six were from the 1987 Anahim Lake stock, 11 from 1987 Revelstoke stock, 3 from 1988 Anahim Lake stock, 6 from 1988 Revelstoke stock and 4 from Blue River 1990 stock. A chi-square test showed differences in the probability that animals from different groups would make this long-range movement ($X^2=9.154$, $p=0.07$, $d.f.=4$). Animals from the Anahim Lake 1988 stock made fewer long-range movements while the 1987 Revelstoke stock made more long-range movements to the north than expected.

I calculated the cumulative percent of all released animals relative to the maximum distance moved in their first year (Fig. 1). All animals moved at least 5 km from the release site, half of the animals moved at least 30 km, and about 15% moved more than 70 km.

Figure 1. Cumulative percent of woodland caribou relative to maximum distance moved from release site within the first year. For example, 100% of all caribou moved at least 5 km from the release site and 50% of all caribou moved at least 30 km from the release site.



Post-release movements of woodland caribou are an important aspect of the evaluation of another augmentation effort. The magnitude of caribou movements, confounded by their willingness to assimilate with existing herds, has the ability to dilute any attempt to establish another herd in the Selkirks. Fully half (30 of 60) of the animals released in Ball Creek moved north of the US/Canadian border within one year of their release, a distance of about 27 km. Caribou movements of up to 129 km were detected within the first year and 50% moved at least 30 km.

Intuitively, we expected animals that came from a relatively close area with similar habitat to move the least. Interestingly, the opposite was true. Animals from Revelstoke moved more than any other group. Animals from more geographically removed areas and dissimilar habitats moved less (Anahim Lake and Blue River). Perhaps as Warren (1990) suggested, experience with an area promotes searching patterns. Revelstoke caribou may have responded to familiar landforms and habitats which facilitated their searching behavior.

Is there an advantage in having some caribou established at or near a release site?

Revelstoke and Anahim Lake animals exhibited shorter maximum movements in the second year of the transplant when compared to the first. However, these differences were not statistically different. Additionally, over 40% (10 of 24) of the 1988 animals moved at least 27 km, which was far enough to possibly encounter another caribou. The presence of caribou at or near the release site will reduce movements but will not eliminate some long distance exploratory behavior.

Despite the documented long-range movements, many caribou returned to the release area and remained there for at least some time. Not all caribou that move into currently occupied habitat will remain. Of the 60 animals that were released in Ball Creek, 30 made "dispersal" movements to the north. Of these 30, 18 became assimilated with herds either in the Stagleap area of the Selkirks or the Goat River area of the Purcell Mountains. However, one must assume that as more caribou move into occupied habitat the likelihood of their loss to the augmentation effort will increase.

Two major conditions must be considered in choosing a release site: distance to other herds and distance to quality late winter habitat. Given the observed behavior of woodland caribou to assimilate with other herds, the close proximity of extant woodland caribou would increase the

likelihood of "losing" transplanted animals from the release site. However a lack of nearby adequate habitat would increase the stress the animals are already under because of capture and transport. A balance must be achieved in the selection of a release site in relation to these two parameters while still considering the long-term implications to resident woodland caribou.

Some key points from previous movement analyses are presented here.

From: Warren, C.C. 1990. Ecotypic response and habitat use of woodland caribou translocated to the southern Selkirk Mountains, Northern Idaho. Univ. of Idaho, Moscow. 194pp.

Bergerud and Mercer (1989) believed that translocations of woodland caribou within 50 km of an established herd failed due to dispersal from the release area and incorporation into the resident herd. Biologists working for the B.C. Wildlife Branch have noted that adult Anahim caribou, translocated approximately 100 km from their native areas in November, quickly returned to their herd. Young Anahim caribou, translocated to roughly the same site in late winter, became established in the new area (T. Smith, pers. comm.). These results suggest that learned behavior and experience with an area promote searching patterns. Revelstoke caribou apparently responded to the familiar landforms and habitat, which facilitated locating the Stagleap herd.

When translocated caribou encountered resident animals, they tended to remain in the area. Five of 11 caribou left the Stagleap herd area after coming into contact with resident animals, but 3 returned within 2 months, one died north of the west arm of Kootenay Lake (Figure 9), the fifth returned to the Two-Mouth area. Four of 5 caribou to reach the Goat River Herd remained in that area, contact with one was lost.

The difference in movement patters between years of translocations also reflects the stabilizing affect of encountering other caribou. With some 1987 caribou already established in previously unoccupied habitat, caribou translocated in 1988 were more likely to remain within the Two-Mouth Herd area.

Substantial movements of translocated caribou occurred during the spring and early fall, coinciding with traditional migration periods. Seasonal movements of Revelstoke caribou approximated their traditional use of elevation, although the directions of movement appeared to be influenced more by their searching behavior. Except for the timing of movement, little similarity was found between movements of Anahim caribou and the traditional migrations of their native

population. This was likely due to a lack of experience of some young animals and the affects of the other factors discussed above.

From Compton, B.B., P. Zager, and L. Allen-Johnson. 1991. Selkirk Mountains caribou transplant. Job Prog. Rept. Proj. No. E-3-7. Id. Dept. of Fish and Game. Boise. 47pp.

Our results of monthly and seasonal movements support Servheen (1989) who reported smaller home ranges and decreased exploratory movements with increasing tenure. However, our data suggest differences in movements still exist between translocated caribou (within Two Mouth Lakes subpopulation) and those of Stagleap. Interestingly, movements of translocated caribou which associated with the Stagleap subpopulation were consistent with those of the extant herd, regardless of tenure or transplant source. The potential immediate adoption of "resident" movement patterns by translocated individuals may partially explain why Blue River caribou AAR's (average activity radius) were similar to those of caribou established within the Two Mouth Lakes subpopulation. Similarly, Warren (1990) found that habitat use patterns were modified when translocated caribou associated with the extant herd.

Appendix A. First year maximum movements of translocated caribou following release in Ball Ck, Idaho.

<u>ID</u>	<u>SEX</u>	<u>STOCK</u>	<u>YEAR</u>	<u>DISTANCE (km)</u>
BA2	F	Anahim Lake	1987	6.1
BA1	F	Anahim Lake	1987	14.1
Y30	M	Anahim Lake	1987	14.9
Y38	F	Anahim Lake	1987	17.7
BA3	F	Anahim Lake	1987	19.3
Y32	F	Anahim Lake	1987	25.1
Y40	F	Anahim Lake	1987	30.1
Y44	M	Anahim Lake	1987	37.8
Y46	F	Anahim Lake	1987	37.8
Y37	F	Anahim Lake	1987	42.0
Y42	F	Anahim Lake	1987	49.9
Y28	F	Anahim Lake	1987	56.5
Y39	F	Revelstoke	1987	22.9
Y47	F	Revelstoke	1987	37.8
Y45	M	Revelstoke	1987	48.4
B2	F	Revelstoke	1987	55.2
Y49	F	Revelstoke	1987	59.7
Y43	F	Revelstoke	1987	59.7
Y31	F	Revelstoke	1987	64.5
Y26	F	Revelstoke	1987	70.1
Y50	F	Revelstoke	1987	76.4
Y36	F	Revelstoke	1987	89.0
Y41	F	Revelstoke	1987	93.7
Y27	M	Revelstoke	1987	108.1
O25	F	Anahim Lake	1988	14.1
O22	F	Anahim Lake	1988	15.7
O2	F	Anahim Lake	1988	15.7
O20	F	Anahim Lake	1988	15.8
O21	F	Anahim Lake	1988	16.8
O12	M	Anahim Lake	1988	16.8
O8	F	Anahim Lake	1988	18.1
O10	F	Anahim Lake	1988	22.0
O9	M	Anahim Lake	1988	23.6
O18	F	Anahim Lake	1988	25.0
O7	M	Anahim Lake	1988	32.7
O17	F	Anahim Lake	1988	32.7
O23	F	Anahim Lake	1988	42.8
O1	M	Anahim Lake	1988	60.7

Appendix A, Cont'd.

<u>ID</u>	<u>SEX</u>	<u>STOCK</u>	<u>YEAR</u>	<u>DISTANCE (km)</u>
O6	M	Revelstoke	1988	17.7
O4	F	Revelstoke	1988	18.5
O13	F	Revelstoke	1988	18.7
O16	F	Revelstoke	1988	20.5
O5	F	Revelstoke	1988	29.8
O15	F	Revelstoke	1988	43.9
O19	M	Revelstoke	1988	52.5
O11	F	Revelstoke	1988	56.2
O14	M	Revelstoke	1988	124.9
O3	M	Revelstoke	1988	129.1
G72	F	Blue River	1990	10.7
G62	F	Blue River	1990	11.5
G53	F	Blue River	1990	15.3
G61	F	Blue River	1990	17.9
G64	M	Blue River	1990	18.1
G63	M	Blue River	1990	22.3
G56	F	Blue River	1990	23.6
G60	M	Blue River	1990	39.9
G66	M	Blue River	1990	40.5
G68	F	Blue River	1990	58.7
G65	F	Blue River	1990	79.2
G58	F	Blue River	1990	91.7

Appendix 3. Estimated budget for the Washington caribou augmentation project.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Salaries						
Bio III @ 12 months	41,460	41,460	41,460	41,460	41,460	207,300
Bio I @ 12 months	25,560	25,560	25,560	25,560	25,560	127,800
Information Specialist	6,390	6,390	6,390			19,170
Remote Sensing Specialist	6,162	6,162				12,324
Subtotal	79,572	79,572	73,410	67,020	67,020	366,594
Benefits	22,295	22,295	20,609	18,628	18,628	102,455
Goods & Services						
Aerial Surveys 60 @ \$600/survey	36,000	36,000	36,000	28,800	28,800	165,600
Vehicle 36,000 mi @ \$.2/mi	7,200	7,200	7,200	7,200	7,200	36,000
Supplies, Misc	3,000	3,000	3,000	3,000	3,000	15,000
Animal med/lab @ \$200/animal	4,800	4,800	4,800			14,400
Contract						
Capture \$300/animal*24	7,200	7,200	7,200			21,600
Snow Plowing	3,500	3,500	3,500			10,500
Travel						
Capture Lodging/Food	5,320	5,320	5,320			15,960
Other Travel	2,000	2,000	2,000	2,000	2,000	10,000
Subtotal	170,887	170,887	163,039	126,648	126,648	758,109
Overhead	34,177	34,177	32,608	25,330	25,330	151,622
Equipment						
Satellite Transmitters 6@ \$5,000	30,000	30,000	30,000			90,000
Radio-transmitters 18 @ \$250	4,500	4,500	4,500			13,500
Receiver/Scanner	4,500					4,500
Truck	23,000					23,000
Trailer	15,000					15,000
Snowmobile	5,000					5,000
TOTAL COST	287,064	239,564	218,147	151,978	151,978	1,070,148