

COLORADO MOOSE: REINTRODUCTION AND MANAGEMENT

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ABSTRACT: Moose (*Alces alces shirasi*) were trapped in Utah in 1978, Wyoming in 1979 and in 1987, and were released in two mountain parks in north central Colorado. The 24 moose released in 1978 and 1979 have increased to approximately 250 animals statewide by 1988 despite known illegal loss of 40 moose. Emigration of over 100 km from the original release site has established additional breeding populations. A moose management unit was established, and limited hunting for 3 to 5 bulls annually began in 1985. In 1987, 12 additional moose were trapped in Wyoming and released approximately 50 km northeast of the original release site to establish a second herd and to increase expansion potential. A management plan, developed in 1986-87, outlines current and future population estimates, inventory, habitat monitoring, harvest projections, public concerns, public relation efforts to reduce illegal kill, consumptive and nonconsumptive uses, current and future management plans, game damage, and future reintroductions in Colorado.

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Moose sightings have been documented in Colorado for over 100 years. Moose were slowly expanding their range southward in the Rocky Mountain area (Geist 1971). This southward movement has been associated with recently established moose populations in southern Wyoming and northern Utah. Many wildlife experts believed that in time moose would establish sustaining populations in Colorado. In fact, documented moose sightings in northcentral Colorado prior to 1978 may have been the first immigrants in the natural establishment of a population.

Reintroduction and establishment of viable moose populations in Colorado have been considered for over 20 years prior to 1978. In the winter of 1974-75, the Colorado Division of Wildlife and Routt National Forest first examined the feasibility of a moose reintroduction into northern Colorado. In 1976, moose biologists from Idaho and Wyoming assisted Colorado with on-site inspection and evaluation of several potential moose habitat sites (Denney 1976).

The Gunnison River area of south central Colorado was determined to be ideal moose habitat. North Park, an inner mountain valley in north central Colorado (approximately 400,000 ha), was considered the second best site due to its location just south of the Wyo-

ming border. There was some concern that moose transplanted into North Park might emigrate north into southern Wyoming.

In 1977, a moose reintroduction plan and environmental analysis were prepared by the Colorado Division of Wildlife and approved by Routt National Forest. The Big Bottom area of the Illinois River in North Park, Colorado, was selected as the release site due to political problems in the Gunnison River area.

STUDY AREA

Eighty-five percent of the Big Bottom release site is public land consisting of willow (*Salix spp.*), aspen (*Populus tremuloides*), spruce (*Picea spp.*), fir (*Abies spp.*), and lodgepole pine (*Pinus contorta*) habitat types. Eight willow species were identified in the release site and adjacent ranges:

Drummond Willow (*Salix drummondiana*).

Geyer Willow (*Salix geyeriana*)

Diamond Leaf Willow (*Salix planifolia*).

Barren-ground Willow (*Salix brachycarpa*).

Yellow Willow (*Salix lutea*).

Mountain Willow (*Salix monticola*).

Scouler Willow (*Salix scouleriana*).

Wolf Willow (*Salix wolfii*).

Moose carrying capacity of the release site, based solely on the riparian willow habitat type within that site, was estimated to be 150 moose at a 50 percent annual utilization of new growth. A conservative winter carrying capacity estimate for the entire southern end of North Park was determined to be about 300 moose.

METHODS

The Colorado Division of Wildlife began by sampling public opinion regarding the reintroduction of moose in North Park. Division personnel personally contacted ranchers and other landowners located in and adjacent to the proposed release area. The general public was surveyed through use of television, telephone, letters, and public meetings. Ninety-five percent of the responding public supported the proposed reintroduction. The supporting public's primary concern was the possibility of competition for food and space between moose, mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*).

Division big game wildlife specialists maintained that potential competition would be insignificant because of differences in feeding habits and habitat preferences between the three species (Denney 1976). In the winter months, when species competition would be most critical, the moose with their ability to negotiate deeper snow and their use of dense timber stands would be wintering in different areas than deer or elk. This view was confirmed when flying aerial big game inventory counts. Moose are consistently observed wintering in deeper snow areas than deer or elk. Winter competition does not seem to be a concern in Colorado (Duvall and Porter 1987).

The next task was to secure necessary funding. This proved to be more difficult than anticipated. In 1976, the Joint Budget Committee of the Colorado state legislature refused to allocate the requested \$15,000 from the Wildlife Cash Fund for the 1977-78 pro-

posed moose reintroduction. The legislators did say, however, that the program could go forward if state funds were not used.

Consequently, the Division of Wildlife elected to proceed with the project and sought necessary funding through private sources. A special account, The Moose Fund, was established, and the Farley Foundation donated \$5,000. Numerous other organizations, including National Wildlife Federation, Wildlife Management Institute, Safari Club International; Colorado cooperations, including Energy Fuels, Colorado Fuel and Iron, and Public Service Company of Colorado; sporting organizations; and many private individuals joined in donating the required funds for the 1977-78 reintroduction.

Additional funding necessary to cover expenses of the 1978-79 supplemental reintroduction were provided from sale of bumper stickers by the Loyal Order of the Moose, by a grant from Shikar Safari Club International, and by direct purchase and subsequent donation of radio transmitters by Safari Club International.

In addition to funding, the Denver Chapter of Safari Club International acquired insurance to cover any moose damages, other than personal injury, not specifically covered by Colorado's wildlife damage laws.

The 1978 Release

The Utah Division of Wildlife Resources agreed to furnish moose for the initial reintroduction into Colorado. In March of 1978, 12 moose were immobilized with M-99 on the north slope of the Uinta Mountains and transported to the release site. The transplant herd consisted of four adult bulls, seven adult cows, and one cow calf. All moose were checked for Brucellosis (*Brucella abortus*) and Leptospirosis (*Leptospira pomona*, *hardjo*, *grippotyphosa*). All 12 were fitted with telemetry transmitters on neck collars and ear tagged with individual numbers.

The moose were released into an enclosure approximately one hectare in size on the

Big Bottom of the Illinois River in North Park. They were held in the enclosure for several days to allow them to acclimate after transport and to become familiar with their surroundings. Following their release into the wild, they were allowed several weeks to adapt to their new environment before radio tracking and collection of dispersal data began (Nowlin 1985).

The 1979 Release

The Wyoming Game and Fish Department agreed to furnish the second group of moose for transplant to Colorado in 1979. In January of 1979, 12 moose were captured at Moran Junction, Wyoming, using an alfalfa-baited corral trap. The Wyoming herd consisted of one adult bull, six adult cows, three yearling cows, and two cow calves. The animals were moved individually through cattle chutes. Blood was sampled and checked for disease as had been done with the moose from Utah in the 1978 release. All were radio collared, ear tagged, loaded into four-horse stock trailers, and driven to the North Park release site. None were immobilized.

The moose from Wyoming were released into the same North Park area as the 1978 transplant. They were not held in an enclosure, but were released directly into the wild. After several weeks in their new environment, collection of data began on their movements.

The 1987 Release

In 1983-84 a supplemental release of moose was proposed (Schoonveld, unpub. rep.) for the Laramie River Valley in order to expand the moose population eastward. The Laramie River Valley lies to the north and east of North Park and is connected with North Park through several mountain passes and drainages. The Laramie drainage contains habitat components virtually identical with North Park, but is smaller in area (approximately 75,000 ha).

In February of 1987, 12 moose were captured in alfalfa-baited corral traps at Jackson Hole, Wyoming. This supplemental herd included two adult bulls, eight adult cows, and two cow calves. Blood samples from all moose were disease checked. All moose were ear tagged and fitted with radio telemetry collars.

The moose were transported without immobilization in four-horse trailers to the Laramie River Valley. They were released directly into the Roosevelt National Forest.

RESULTS

Movements

Moose were located by sight and radio telemetry signals, pursued by foot, four-wheel drive, snowmobile, and aircraft.

The 1978 Release - all moose stayed within 5 km of the release site during the winter of 1978. By spring, exploratory movements had settled into more definitive movements indicative of established home ranges. The moose dispersed farther over the summer of 1978, but all 12 remained within 12 km of the release site throughout 1978.

The 1979 Release - again the transplanted moose stayed within a few km of the release site and did not have any significant interaction with the 1978 transplants during the winter of 1979. By spring this population had adapted to the new area as movement patterns stabilized into a home range. During the summer of 1979, the 1978 and 1979 transplanted populations merged into one herd.

Most of the transplanted moose were still within 24 km of the release site by winter of 1980. One cow and her calf had moved to the Laramie River Valley, approximately 50 km to the northeast, and one cow was located 40 km south on Willow Creek in Middle Park.

The 1987 Release - by mid-summer of 1987, the Laramie River moose were still within 12

km of the release site. In the fall of 1987, two moose had left the area; one young bull moved 50 km into North Park and a cow wandered 60 km northwest into Wyoming.

Population

In addition to movements, data were collected on population numbers, bull:cow ratios, calf:cow ratios, and mortality.

There were 31 moose in the herd originally transplanted to Colorado counting calves dropped by already pregnant cows. During their first season in North Park, the herd showed a calf:cow ratio of 53 calves per 100 cows and no twinning. The moose responded well to their new environment. With ample space and forage, by 1980 the cows showed a twinning rate of 17 percent, and the calf:cow ratio averaged 95 calves per 100 cows. By fall of 1980, there were 58 moose on the ground in North Park (Nowlin 1985).

In 1981, data collection was not as complete. The radio telemetry collars began failing, and less time was committed to radio tracking.

An aerial survey was flown each subsequent winter with a helicopter from 1982 through 1988. Counts varied with winter conditions and observer competency, but proportions of the total estimated population ranged from 50 to 77 percent. Calf:cow ratios were estimated from 48 to 100 calves per 100 cows, and bull:cow ratio estimates ranged from 47 to 67 bulls per 100 cows.

A POP-II population model (Bartholow 1985) was developed for the North Park moose herd in 1985-86 (Duvall 1986). The population estimates in North Park were difficult to project because moose 2-1/2 to 3-1/2 years old emigrated from the area. Mortality figures were placed in the model to simulate the emigration loss of young moose. The model contained the herd structure and composition as existed in 1981 with 100 percent knowledge of the herd. The model was updated with annual inventory data from 1982 through 1988 and projected through 1995.

The total moose population in Colorado, as of the winter of 1988, was estimated at 250 animals with 170 of those moose in North Park.

Moose sightings have been reported in Grand County (Fraser, Willow Creek, Rocky Mountain National Park), east of the Laramie River Valley, South Park, Gunnison, Leadville, Yampa, and west of Denver. A resident population, with documented production, has become established in Middle Park approximately 50 kilometers south of North Park.

DISCUSSION

Illegal Kill and Public Relations Efforts

The most significant problem faced by the moose transplanted to Colorado, as with many moose populations, has been a high illegal kill. A survey of other states and provinces with moose populations indicated problems in all cases with illegal killing of moose, particularly during elk hunting seasons. As of December 1987, 40 Colorado moose had been killed illegally, while nine accidental deaths had been caused by vehicle collisions or fence entanglements.

Since 1978, the Colorado Division of Wildlife has taken extensive precautions to avoid or moderate the illegal kill of moose in Colorado. Television and radio news reports, newspaper and magazine articles, road signs, posters, and pamphlets have informed the public about the presence of moose. Flyers distinguishing moose and elk identification were mailed to all limited elk hunting license holders for the North Park and nearby hunting areas each year. During hunting seasons, additional law enforcement officers, biologists, and public relations personnel worked in known moose areas to contact hunters and to deter illegal killing of moose.

No moose kills were documented in 1978 or 1979. Three moose kills were documented in 1980; in 1981, eight moose were killed, including a cow and calf that had emigrated to the Laramie River drainage.

Since 1981, the Division of Wildlife has documented from 4 to 6 illegal moose kills annually. These numbers are expected to increase as the moose population grows in size and distribution. Investigations of illegal kills have shown that most "hunters" are killing moose for the sake of killing, and others are simply unable or unwilling to discern moose from elk.

Management

The Colorado Division of Wildlife had an informal agreement with the U. S. Forest Service to consider a limited hunting season in North Park when the moose population reached a verifiable 100 animals. In 1985, the population reached 100 animals; a moose hunting season was proposed and established.

The nine-day moose season, set for November, avoided the rut and followed deer and elk seasons. Five licenses for mature bulls only (antler length 15 cm or better) were awarded in 1985 through random computer selection from mail-in applications. All licenses were for Colorado residents only. A moose hunt questionnaire was developed and sent to all moose hunt licensees to establish data on Colorado moose hunting. Three bulls were harvested in 1985. In 1986 and 1987, three bull licenses were allowed, and each year three bulls were harvested.

Since establishing a moose season, all successful hunters have been required to present their moose to Division of Wildlife personnel for examination within 48 hours following the close of the season. Successful moose hunters are not allowed to apply again for a moose license in Colorado.

Management Plan

In 1986-87, the Colorado Division of Wildlife developed a moose management plan for the North Park Data Analysis Unit (Duvall and Porter 1987). The management plan contains the history of the reintroductions, data on animal movements, dispersal, aerial inventory data, reproduction, and mor-

talities from harvest and illegal and accidental kills.

The plan projected five management alternatives. The alternatives were based on post season moose population levels, varying from 110 to 1000 moose; a minimum bull:cow ratio of 50 bulls per 100 cows with a yearly average of 60 calves per 100 cows; and an objective of harvesting 9 percent of the bulls and 3 percent of the cows and calves.

Due to input from other resource agencies and public meetings, the Colorado Division of Wildlife chose the alternative which specified a minimum population of 300 moose in North Park. The POP-II model projected that the population would reach 300 animals by 1995. Habitat degradation was not predicted, and habitat manipulation was not required in order to achieve any of the five management alternatives.

Habitat Monitoring and Game Damage

Biologists established browse transects in willow riparian areas for annual monitoring of utilization by moose. Using 50 percent utilization of annual willow growth as a point of reference, if more than 50 percent usage is determined, increased harvest of moose can be recommended.

Game damage to private agricultural property was considered prior to the first moose reintroductions. In the 10 years since transplanted moose arrived in Colorado, not a single incident of game damage by moose has been reported. However, if moose damage does occur, Colorado's big game damage laws and prevention techniques would apply.

Future Management Implications

The moose management plan for the North Park Data Analysis Unit (Duvall and Porter 1987) was approved by the Colorado Wildlife Commission in 1987. The moose population in North Park will be increased to 300 animals post-hunt.

When the population reaches a verifiable 300 moose, public meetings will be held to

discuss future population sizes, hunting seasons, habitat monitoring efforts, nonconsumptive use, and big game damage. Input will be solicited from landowners, recreationists, sporting organizations, other natural resources agencies, and the general public.

Other areas of the state are now being considered for future moose transplants; several communities have already requested moose releases in their localities. As moose populations grow and expand in areas such as the Laramie River Valley and Grand and Routt counties, moose management plans will be developed specifically for those areas, as has already been done for North Park. Moose populations are expanding from the three original transplants. If additional transplants supplement the current expansion, moose may eventually be located in favorable habitat statewide.

Presently, the most obvious benefit of the moose reintroductions for Colorado residents is nonconsumptive recreation. The public enjoys observing moose in the wild and photographers, naturalists, school groups, and nature lovers utilize moose year-round.

CONCLUSIONS

The techniques utilized in the three introduction attempts allowed the Colorado Division of Wildlife to arrive at the following conclusions. Corral trapping of moose was easier, more efficient, less stressful, and physically less taxing on the animals than capture by immobilization. Immobilizing moose during transport proved unnecessary as all animals remained calm and, in fact, laid down whenever the trailers were in motion.

It was not necessary for the moose to be introduced to their new environment by way of enclosures; instead they could be released directly into the wild. The majority dispersed slowly and occupied contiguous areas. Use of radio telemetry was of tremendous benefit in the initial follow-up of all three releases.

Given suitable unoccupied habitat and

excellent nutrition, the Colorado moose increased their productivity, and many cows produced twins. Illegal kill was somewhat alleviated with added law enforcement protection and public relations efforts. This control was necessary to allow the population to establish itself and increase. Aerial inventory with a helicopter in good snow conditions gave consistently good population estimates (ranging from 50 to 78% of the total herd), good bull:cow and calf:cow ratios, and good long-term trend data.

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REFERENCES

- BARTHOLOW, J. 1985. POP-II System Documentation. Fossil Creek Software, Fort Collins, CO. 64 pp.
- DENNEY, R. N. 1976. A proposal for the reintroduction of moose into Colorado. Colorado Division of Wildlife, Denver, CO. 57 pp.
- DUVALL, A. 1986. 1986 DAU management objectives and POP- II population simulation: Moose, North Park, DAU M-1. Colorado Division of Wildlife, Fort Collins, CO.
- _____, and S. PORTER. 1987. Moose management plan: North Park Data Analysis Unit (M-1). Colorado Division of Wildlife, Fort Collins, CO. 31 pp.
- GEIST, V. 1971. Mountain sheep: A study in behavior and evolution. Univ. of Chicago Press, Chicago, IL. 383 pp.
- NOWLIN, R. A. 1985. Distribution of moose during occupation of vacant habitat in north central Colorado. Ph.D. Disserta-

tion, Dept. of Fisheries and Wildlife
Biology, Colorado State University,
Fort Collins, CO. 60 pp.