The History of Deer Research in Alaska

by

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Introduction

When I started reviewing information gathered on Sitka black-tailed deer in Alaska, it was evident that few formal research studies had been conducted on this subspecies or its habitat. Instead, the information base upon which it is now managed has been developed largely through trial-and-error application of techniques developed elsewhere. Our understanding of this animal would be poor indeed had it not been for the perseverance of a few astute, well-trained, dedicated individuals relying primarily upon their interpretation of personal observations and observations of laymen, weighted heavily with intuition.

To mention only those studies which would currently meet our collective standards for research would be to ignore the bulk of this information base. Consequently, I will treat briefly all information gathering activities dealing with deer and deer habitat which have occurred in Alaska since 1951 when formal biological studies of deer under the Federal Aid in Wildlife Restoration Act began. For convenience of presentation, I have segregated these investigations into three time periods --from 1951 to statehood (1960), from 1960 to 1970 (the first decade of State management), and from 1970 to the present (1977).

Research Conducted Prior to Statehood

Population studies--The first formally reported studies of deer populations were those of Sigurd Olson in 1951 [Nelson, 1951]. In his quarterly reports for that year, Olson reported several observations on fall movements of deer in relation to snow accumulations. The next year, Olson [Nelson, 1952] reported observations on fawning rates and spring movements from wintering areas. He also reported preliminary efforts to improve procedures for measuring harvests and hunting pressure through use of a hunter questionnaire administered in winter 1952. Already recognizing implications of winter-induced mortality, Olson conducted spring surveys to determine where winter deer mortality occurred in relation to the beach and found that winter-killed

carcasses were almost entirely restricted to the beach fringe. He also collected pelvises and skulls of winter-killed deer in an effort to develop a technique for distinguishing the sex of these deer on the basis of pelvic characteristics. Olson reported that sex of adults could be determined from the size and shape of the pelvis; the shape of the symphysis of the ishium distinguishes the sexes. Sex of fawns could not be distinguished using characteristics of the pelvic girdle alone, however. Olson established many of the winter mortality transects in 1952 which are still our major source of information on winter mortality.

In 1953, Olson intensified his efforts to gather and analyze data on hunter harvests. Using a questionnaire in southeastern Alaskan communities, he determined the magnitude of the harvest, analyzed distribution of hunting pressures, and computed hunter success ratios [Nelson, 1953]. Through contact with successful hunters, Olson gathered information correlating antler development with age of the animal and assessed the weight and physical condition of harvested animals. Magnitude and sex and age composition of winter mortalities were determined using the standardized transects established in 1952.

Efforts in 1954 were similar to those in 1953. But in January 1955, attempts were made to trap, mark, and release deer on Kupreanof Island [Nelson, 1955]. Five animals were captured that month. Winter mortality surveys were continued in 1955, as were harvest surveys. Also in 1955, Olson, in an initial attempt to census deer in Southeast, conducted winter beach counts from the air and from small skiffs.

David Klein, who had begun work for the U.S. Fish and Wildlife Service during 1954, reported trapping and ear-tagging 14 deer during winter 1955-56 [Nelson, 1956]. In 1956, Klein conducted composition counts from the time of fawning through fall in an attempt to document fawn losses. He also continued beach counts from the air and from skiffs.

In 1957, Klein selected and established what he termed "Representative Management Index Areas" for deer in Southeast. Essentially, this was a process of systematizing some of the previous surveys and incorporating new range surveys into a standard procedure for analyzing herd trends, harvests, and range quality. Klein used winter beach counts of live deer made from airplanes and boats, spring beach transect counts of winter-killed deer, and intensive surveys of hunter harvests to analyze herd condition. He also conducted studies of fawn/adult ratios during fall and winter to determine productivity of the herd and overwintering fawn survival [Klein, 1957]. To develop a technique for determining herd welfare and range conditions on the basis of harvested animals, Klein measured hunter-killed deer and found that there was a correlation between hind foot measurements and range conditions [Klein, 1957]. Klein's studies of harvests and winter mortality patterns continued through 1959, although he apparently ceased all tagging efforts and censuses of live deer.

Harvest studies in 1958 were intensified to provide insight into the chronological distribution of the deer harvest. Efforts that year also revealed that many bucks, at least in the northern parts of southeast Alaska, did not grow visible antlers until their third spring [Klein, 1958]. In fact, about a third of the "anterless" deer shot by Juneau hunters in 1958 were 1-1/2-year-old bucks. In 1959, Klein listed the parasites known to occur in Sitka black-tailed deer as well as reporting his then-routine population studies.

Range studies--The earliest documented surveys designed to assess range conditions for Sitka black-tailed deer were those by Olson in 1953 [Nelson, 1953]. He (and Klein beginning in 1955) apparently established and read transects designed to assess the degree of use of key browse species following winter use. In 1956, Klein expanded these efforts by initiating a study of the nutritive quality of various deer browse species [Nelson, 1956]. As part of his efforts in 1957 to standardize

procedures for assessing population trends and range conditions, Klein established permanent range plots and exclosures in 17 different sites [Klein, 1957]. He also established permanent browse inventory transects in each Deer Management Index Area. Using the line-intercept technique, Klein recorded the percentage of use and the vigor of browse plants along these transects. The transects were read annually through at least 1966.

Research Conducted from 1959 through 1970

Population studies--Following transfer of wildlife management authority to the State of Alaska in 1959, deer investigations initially remained essentially unchanged [ADF&G, 1960]. Winter beach counts from airplanes and boats continued as did the winter mortality surveys initiated by Olson in 1952. Harry Merriam, the State's new deer biologist in Petersburg, initiated fall, aerial, alpine composition counts and forest counts to augment numerical data from winter beach counts, although the forest counts were discontinued after 1 year. In 1959, Merriam also expanded data collections on deer harvests by conducting personal interviews with hunters and by collecting jaws from successful hunters for use in determining age composition of harvested animals [ADF&G, 1960].

These studies continued through 1960, but they were expanded to include Prince William Sound's transplanted deer population [ADF&G, 1961]. There, meat processors were contacted, and a temporary employee was hired to check hunters in the field in an effort to augment harvest information gathered through questionnaires. In southeastern Alaska, the State's parasitologist, Ken Neiland, reviewed parasitism in deer and proclaimed it to be "light." Paul G. Garceau, another State biologist in southeastern Alaska, analyzed wolf scats collected in 1958 and found that 95.5 percent contained deer remains [ADF&G, 1961]. Merriam measured metacarpal bones of harvested deer and found that their length was related to the sex and age of the animal. Early in 1960, results of the studies on deer mortality patterns conducted by Olson and Klein from 1952 until 1958 were published [Klein and Olson, 1960]. With the goal of assessing the effect of wolf predation on a deer population which had not previously been subjected to predation, 4 wolves approximately 19 months old (2 males and 2 females) were released in October, 1960 on Coronation Island in southeastern Alaska [Merriam, 1965a]. An estimate was made of the deer population on this Island, and vegetation transects were established and read to provide an opportunity to measure future vegetational changes resulting from lowered deer numbers [Merriam, 1965b].

Deer investigations in 1962 and 1963, in addition to the standard procedures developed earlier, were expanded to include population data from counts conducted along the Mitkof Highway [Merriam, 1963]. Merriam [1962] evaluated succinylcholine chloride administered with a crossbow as an immobilization technique and individually ear-tagged 28 deer during winter 1962. Some reproductive tracts were collected in 1962 for future analysis [Merriam, 1963]. Also in 1962, interviews were used in southeastern Alaska and on Kodiak Island to assess harvest [Merriam, 1963], but in 1963 the Kodiak biologist began to use a postal survey for harvest assessments [Merriam and Batchler, 1963].

As part of their continuing effort to develop techniques for assessing deer numbers, biologists on Kodiak Island conducted experimental aerial surveys of randomly selected plots in deer wintering areas and attempted track counts on other parts of the Island in 1963 [Merriam, 1965b]. Use of these techniques was discontinued after several years. In 1964, initial attempts were made to assess deer numbers using pellet group counts in Prince William Sound and southeastern Alaska [Merriam, 1965]. Transects were established in 1964 and read that year, in 1965, and again in 1966, at

which time the value of this technique was determined to be questionable because of the slow and variable rate of pellet decomposition [Merriam, 1966].

By 1964, the wolves on Coronation Island had increased to about 12 animals (an additional adult female had been released in 1963). Their influence on the island's deer population was obvious by this time, and the vegetation on Coronation Island was already reflecting improvement as a result of decreased browsing pressure [Merriam, 1965a].

Noteworthy new activities conducted or initiated in 1965 were the collection of stomach samples for food habits analysis, collection of reproductive tracts, and observation of deer feeding on Kodiak Island [Merriam, 1966]. Based on the latter observations, it was determined that fireweed (*Epilobium angustifolium*) was an important deer food during the summer months on Kodiak. Also during 1965, aerial alpine surveys were continued on Kodiak Island and in Prince William Sound; hunter interviews were conducted statewide to assess deer harvests. In 1966, these studies were continued with the exception that aerial surveys at Kodiak were conducted in winter rather than in the alpine during summer [Merriam, 1967]. Merriam, reporting in 1967, analyzed 14 recoveries from deer tagged from 1952 through 1965. All of these deer were recovered within a few miles of the tagging site.

Population studies from 1967 through 1969 continued with little deviation from techniques used in prior years. In 1967, however, a sample of deer jaws was collected from hunter kills in an attempt to determine the utility of sectioning incisors for age determination [Merriam, 1968]. Although no report of findings could be found, I understand [Merriam, personal communication] that cementum layers were correlated to the age of deer on Kodiak Island and tooth sectioning appeared at first to be a useful technique for age determination. However, it was later determined that application of this technique to southeastern provided unreliable results.

On the basis of his personal experience and the accumulated knowledge of that time, Merriam [1968] concluded that the best index of deer population levels was a combination of data showing hunter success/unit effort, winter mortality, range use, and age composition of harvested deer. He also concluded that winter severity is the major limiting factor to deer populations in Alaska. This interpretation had been alluded to in the reports of several of his predecessors and by Merriam in earlier reports, but this seems to be the first time that these concepts were clearly presented. Merriam reiterated these concepts in his report on 1969 studies and in a paper presented at the northwest section of the Wildlife Society in 1970. Perhaps they were most clearly expressed in the following excerpts from Merriam [1971b].

> "Since 1964 average winter temperature was lower than for many preceding years, deer losses were higher and hunter success poorer. Hunting is not considered sufficiently intensive to control deer populations in Alaska. Many areas receive little or no hunting, yet populations fluctuate in these areas similar to those which receive higher hunting pressure. The major contributing factor to these fluctuations is probably food availability as controlled by winter snow depths. Availability of the higher quality food species on the range is limiting."

Range studies--Like population studies, research on deer ranges followed previously developed patterns with the onset of statehood. Browse utilization plots and browse inventory transects established by Klein in 1957 were routinely analyzed from 1959 through 1966. Early in 1963, Klein completed his Ph.D. dissertation entitled "Interrelationships of Deer and Their Range in Alaska" [Klein, 1963]. This work, based on intensive field studies during 1959, 1960, and 1961, did much to elucidate

the ecology of the Sitka black-tailed deer in southeastern Alaska, particularly the relationships of the animal and its range.

Likely as a result of Klein's earlier studies, browse samples were collected in 1963 and 1964 and again in 1966 for protein content analyses [Merriam, 1965, 1967]. By this time, biologists were aware of the complex interactions of browse quality and quantity on herd welfare and were making major efforts to enhance their understanding of this relationship.

With an improved general understanding of deer ecology in the midsixties, State biologists' investigative efforts began to show redirection and improved coordination. It was apparent to Merriam that clearcut logging posed immediate- and long-term threats to the continued welfare of southeastern deer populations. As early as 1964 [Merriam, 1965b], he began to review existing records of logged areas as a preliminary step in establishing a research project to quantify the effects of logging on deer habitat. These efforts continued intermittently through 1968; sites for study were selected and their cutting dates established through review of existing records and core sampling [Merriam, 1968], but for various reasons the study never materialized.

Beginning about 1963, there was a tendency in the Alaska Department of Fish and Game (ADF&G) to selectively isolate specific questions to be resolved with intensive research efforts. The first such research study was initiated in June 1963 when the Forest Service experimentally sprayed a portion of Skowl Arm on Prince of Wales Island with a quarter-pound per acre of dichloro-diphenyl-trichloro-ethane (DDT) for controlling black-headed budworms. In cooperation with the Forest Service, Merriam [1965b] collected samples of *Vaccinium ovalifolium* and *Cornus canadensis*, important deer foods, before spraying and twice following spraying. He also collected deer before and after spraying to measure accumulations of DDT in tissues.

Analyses of plants and samples of skeletal muscle and adipose tissue reflected the following: First, immediately after spraying (July), plants showed high concentrations of DDT; by December of that year, concentrations had declined considerably. Second, following spraying, DDT was absent in muscle tissue as it had been prior to spraying, but it was present in adipose tissue. In March 1965, additional deer were collected in Skowl Arm, and DDT was still present in adipose tissue [Merriam, 1966].

Another study established in 1963 was designed to experimentally measure the effect of deer utilization on *Vaccinium*. By annually clipping selected plants [Merriam, 1965b], 20, 40, 60, 80 and 100 percent of utilization was simulated. By 1965, plants subject to 80 and 100 percent of simulated utilization annually evidenced some decrease in vigor. This study was continued through 1968 when Merriam drew these conclusions: First, there was no loss of vigor below 40 percent of utilization. Second, 60 percent of utilization resulted in 10 percent dead twigs. Third, 80 percent of utilization resulted in 50 percent dead twigs. And, fourth, 100 percent of utilization resulted in 80 percent dead twigs.

Merriam [1968] also initiated a study designed to compare snow accumulations under the forest canopy with accumulations in the open. He established a transect on Mitkof Island from sealevel to an elevation of 1,500 feet, periodically measured snow depths at elevation intervals of 100 feet in the open and under the timber canopy, and counted deer tracks between each elevation interval. After the first year, Merriam concluded that snow accumulation under a timber canopy was about half that in the open. He also concluded that, generally speaking, deer did not use areas where snow depths exceeded 12-15 inches. Later, Merriam [1971c] modified the first conclusion by stating that snow depths beneath the forest canopy are about a third to half of those found in open areas. He also stated, after further studies, that 18 inches of accumulated snow appeared to be the limit of deer use for an area [Merriam, 1977b].

In two other studies accomplished in cooperation with the USDA Forest Service, Merriam evaluated the effects of the herbicide 2-4-D on deer food species and tested the response of *Vaccinium ovalifolium* to fertilization with granular urea (46 percent nitrogen). Merriam concluded that application of 2 pounds per acre of 2-4-D to control red alder (*Alnus rubra*) resulted in a total kill of *Vaccinium ovalifolium* where it was not protected by a forest canopy. This herbicide also killed devilsclub (*Oplopanax horridus*) and rusty menziesia (*Menziesia ferruginea*), but none of the forbs were permanently affected. One fertilization study, which was initiated in May 1969 and involved treating 1,500 acres with 400 pounds per acre of urea, resulted in the conclusions that annual growth was 6.1-percent greater in fertilized areas and that protein content averaged 7.04 percent in control areas and 8.56 percent on fertilized areas [Merriam, 1971a]. Another fertilization experiment involved treatment in June 1970 of three 0.01-acre plots with 200 pounds, 400 pounds, and 800 pounds per acre of urea (46 percent nitrogen). Based on this experiment, Merriam [1973] concluded that addition of nitrogen to the soil had no influence on annual growth of *Vaccinium ovalifolium*. In still another study, rather poorly documented, Merriam [1971c] compared production of *Vaccinium ovalifolium* on good and poor deer winter ranges. On "good" ranges, production averaged 317 pounds per acre, dry weight, and on "poor" ranges it averaged 44 pounds per acre, dry weight.

Investigational Activities Conducted Since 1970

Although surveys and inventories designed to provide annual assessments of hunter harvest, hunting pressure, deer population trends, and habitat conditions have been continued to the present, the Alaska Department of Fish and Game essentially did no deer research from 1970 until July 1977. The single exception was an analysis of the two methods for calculating deer harvest data presented in use (hunter interviews and mandatory hunter report cards). This study [see Ballard and others in these proceedings] resulted in the conclusion that hunter interviews are the most efficient method of the two for gathering harvest data. Although harvest reports are superior to interviews as a means of gathering information on hunting effort and success at specific locations, these investigators suggested that the two systems be continued concurrently until sufficient data are acquired from the harvest reports to answer needs for information on hunting effort and success at specific locations.

Although the studies conducted by Dr. Barrett for U.S. Plywood Champion Papers, Inc. [Leopold and Barrett, 1972], were considered "reconnaissance surveys," I feel they should be mentioned here for several reasons. First and foremost, these studies represented an objective and independent review of existing information on deer ecology in southeastern Alaska. Second, Barrett conducted several field studies which contributed to our knowledge of deer ecology, particularly during the stressful winter months. In terms of deer mortalities since 1900, the winters of 1968-69 and 1970-71 were possibly two of the most severe, and many of the problems postulated by previous investigators actually came to pass. One of Barrett's conclusions was that:

> "On Admiralty Island, the key winter ranges are generally situated in mature conifer stands that have opened up enough to allow the growth of *Vaccinium* and other browse plants. To this extent, Alaska deer may be considered affiliates of climax forest vegetation rather than subclimax as is their normal relationship in more southerly ranges."

Arthur Bloom, a Forest Service fisheries scientist working in the Kadashan Bay area of Chichagof Island, independently conducted a study during the 1975-76 winter relating winter deer use to soil and forest community types [Bloom, 1978]. In

addition, he quantified and compared snow depths under various canopy types. Bloom concluded that, if large blocks of low-elevation timber in his study area were clearcut, the carrying capacity of its winter range for deer would decline.

Another study, by Billings and Wheeler of the Forest Service, is, I understand, still in progress. These investigators [see Billings and Wheeler in these proceedings] found that crude protein content of winter-collected samples of *Vaccinium ovalifolium* growing on different ecosystems varied considerably between ecosystems. Perhaps even more interesting were data indicating that the crude protein content of this forage plant was greater 200 feet into a stand than it was at the edge or in the open.

Conclusions or "State of the Art"

Because I feel strongly that this paper should serve as more than an annotated bibliography of documented Alaska deer studies, I would like to conclude with some personal beliefs regarding the "state of the art" and future research needs. The rather crude information upon which we base present deer management is barely adequate to fill current needs. The one obvious exception, of course, is our lack of understanding of the relationship between wolf populations and deer. Nevertheless, given current deer numbers, no further reductions in deer habitat, and no increased human demands upon this resource, we could continue to adequately "manage" deer forever.

I cannot state too strongly, however, that our present rather superficial understanding of deer ecology is altogether inadequate for meeting future needs. We are fortunate in Alaska in that the habitat base for our deer resource is still largely intact. It is apparent, though, that over much of this deer range unregulated timber harvesting could perhaps largely eliminate the species in harvestable or even observable numbers. It behooves all of us in the Department of Fish and Game and in the Forest Service to learn much more about this deer and its habitat requirements, particularly as they are affected by timber harvesting, so we can insist on long-term management of deer and timber consistent with the needs of future generations of Alaskans and other Americans. I sincerely hope that recently initiated cooperative studies by our agencies will ultimately provide the knowledge required for us to fulfill this public trust.

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SITKA BLACK-TAILED DEER:

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