SOME DISEASES AND PARASITES OF ALASKAN BIG GAME UNGULATES

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Introduction

Because of the variety and wide ecological and geographical distribution of wild ungulates in Alaska it is impractical to attempt a definitive consideration of their diseases and parasites during the time allotted each speaker. I might also note that our knowledge is not up to the task because there are still many herds (Yakutat moose, Steese-Forty Mile caribous, etc.) and a few species about which we know little (Mountain goat) or nothing (Elk) in this regard. Accordingly, I will restrict my remarks today to a brief synopsis of wildlife disease and parasite research in Alaska, followed by a more detailed accounting of a few better known and/or more interesting problems we have recently encountered in ungulates.

Historical Resume

The first published accounts of which I am aware are those of Dall (1872, 1874) in which he describes species of barnacles and "lice" (amphipods) recovered from whales taken in Alaskan waters. Lucas (1899) investigating the cause of fur seal mortality on the Pribilof Islands implicated as a major contributing factor a hookworm later described as Uncinaria lucasi by Stiles (1901). Fur seal disease studies have been continued to date by various workers, principally Olsen (1952-1962). Parasitological evidence bearing on the migration of Pacific salmon caught in Alaska was first considered by Ward (1908). This line of research has been more vigorously pursued in recent years (Margolis, 1956) with the advent of more active competition between American and Japanese fisherman for Bristol Bay red salmon.

Hadwen (1922) published a series of papers dealing principally with reindeer pathogens, but except for occasional statements of uncertain significance scattered through administrative reports over the years since then by the Federal custodians of various reindeer herds, our understanding of contemporary events (particularly reindeer-caribou epidemiological interactions) is, for the most part, necessarily based on information obtained forty odd years ago. Philip (1938, 1939) investigated the occurence of tularemia in Alaska and first demonstrated its presence here in rabbit ticks.

With the formation of the Zoonotic Disease Section of the Arctic Health Research Center wildlife disease research in Alaska has proceeded to date at a greatly accelerated pace. Since 1949 Dr. R. L. Rausch and his coworkers (Schiller, Babero, Fay, Williamson, Huntley, etc.), and many other workers around the world studying material collected by this group, have published approximately 100 papers, or about half of the Alaskan publications to date. These studies are based on only part of the material collected from about 30,000 autopsies (personal communication) and include representative samples of almost all of the vertebrate components (except marine fish) of most of the ecological systems in Alaska. One of their more noteworty findings is the recognition of Echinococcus multilocularis as an endemic North American form.

This typically eurasian tapeworm matures essentially harmlessly in dogs and foxes, but undergoes larval development in rodents and also man usually with eventually fatal results. The current epidemic of this parasite in an apparently limited area of the mid-western United States, whenit has previously been known only in the far north, should be of special interest of wildlife workers in other states, where foxes and wild rodents are common. The recognition and isolation of a strain of Brucella in Arctic caribou by Huntley, et al. (1963) is also an important contribution of The Arctic Health Research Laboratory.

Workers at the Aeromedical Laboratory, Ft. Wainwright, have made significant contributions to helminthology and medical entomology during the past ten or so years. A recent monograph by one of these, Hopla (1965) on Alaskan fleas is a definitive work.

Since the fall of 1959 the Alaska Department of Fish and Game has been pursuing a modest program principally concerned with the pathogens of the more important big Game ungulates, especially moose and caribou, but also including all other vertebrate groups, except amphibia. Hundreds of hunter-killed moose have been available for selected observations and extensive cllections of caribou have been made both in South-central and Arctic Alaska. Several species of parasitic worms previously unknown in Alaskan caribou have been found and in cooperation with The Animal Disease Eradication Division of The U.S.D.A. and the Arctic Health Research Center, we have demonstrated the presence of Brucella in South-central and foot rot in Arctic Alaskan caribou at low endemic levels the past few years. We are currently engaged in a cooperative experimental study of the "Alaskan strain" of Brucella in penned reindeer with the two organizations indicated above.

Some of our observations on the ecology of parasitism in moose, especially in relationship to other host species, are also of interest. A comprehensive catalog of the diseases and parasites of Alaskan vertebrates is being prepared jointly with Dr. W. L. Jellison of The Rocky Mountain Laboratory (U.S.P.H.) and is nearing completion. This will include only formally published information of which about 200 entries are scattered throughout the world literature, including The Pakistan Journal of Scientific Research.

The foregoing brief resume, while providing some idea of the more active individuals and institutions, and their accomplishments, fails to indicate many areas of almost total ignorance. Practically all of the effort in Alaska has been directed, with few notable exeeptions, toward helminths or arthropods. Only recently has bacteriological research been prosecuted to any great extent.

Protozoan parasites are essentially unknown even though they have been readily found in the few instances when people have looked for them. Fisheries parasitology, particularly the ecological approach, which has commanded so much attention from Russian fisheries technicians is an essentially virgin field in Alaska. One notable exception to this statement is the detailed studies of Margolis (1956) on identification of racial stocks of salmon by peculiarities of their helminth fauna. No doubt the coming years will witness the discovery in our wildlife of many unexpected pathogens or host-parasite interactions. Indeed, only a few

years ago in an article dealing in part with Arctic caribou (Rausch, 1951) it was concluded that, "Infectious diseases can hardly survive in such a moving herd....." This conclusion, of course, fails to meet the test of more recent observations, unless we assume that the diseases we now know to occur in the Arctic and elsewhere are recent introductions.

I would now like to use the remaining time to discuss in greater detail some of our unpublished findings in caribous and moose.

Caribou

Brucellosis

At the present time this host species is of particular interest principally because of the essentially epidemic occurence of brucellosis in the Arctic herd. With the exception of the report by Huntley et al. (loc. cit.), all of the following data on brucellosis which I will discuss only in general terms will be considered in detail at another time in reports published jointly by The Arctic Health Research Center, U. S. Department of Agriculture, and Alaska Department of Fish and Game.

Since the report of Huntley et al. (loc, cit.) serological reactor incidence rates have risen from an initial 14 per cent to a level of 20-30 per cent in similarly random samples and 50 per cent in one small sample of selected animals. At the same time the equivalent rates in the Nelchina herd of southcentral Alaska have varied from about 1 per cent to 4 per cent. About 75 sera from the small herd on the Alaska Peninsula have all tested negative. Too few sera from the Steese-Forty Mile herd have been tested to date with indefinite results to regard with confidence the data thus far obtained. With one exception hundreds of moose sera, principally from Matanusaka Valley animals, have all been non-reactors as have bison sera collected from the Big Delta herd.

The disease in wild caribou judging from serological titre values in usually mild although occasional cases of sterility (massive orchitis), abortion and/or placental retention, and crippling (arthritis) have been bacteriologically confirmed, sometimes in association with low titres. Placental retention first observed in the Arctic herd by Lent (1963) has varied from 20 per cent to 16 per cent (1964) and 3 per cent (1965), and has been found to occur in non-reactor as well as reactor animals. The much poorer condition of the Arctic caribou during the springs of 1963 and 1964 than this year suggests nutritional deficiency as an additional possible cause of placental retention and/or abortion. However, it should be kept in mind that bacteriologically confirmed infections of brucellosis sometimes yield no titres and that nutritional deficiencies can interfere with immune responses including antibody formation.

In spite of the relatively large numbers of infected animals in the Arctic and the heavy utilization of this herd by many native villages, less than ten clinical cases of brucellosis conceivably derived from caribou or reindeer have been recorded. While about half of the two hundred odd residents of Anaktuvuk Pass are serological reactors only one significant case of disease has occurred. Evidently the Alaskan strain of *Brucella* (considered by some to be a new strain of *B. suis*) is seldom very virulent in humans.

Foot Rot

Over the years there have been vague reports from time to time of numbers of crippled animals in the Arctic herd. As we now know some of these are likely attributable to joint infections by Brucella which probably has been endemic in caribou of North America since they migrated here from Eurasia. However, in August 1961, we received reports from oil exploratory crews in the Arctic of crippled and dead or dying animals in certain localities. We were fortunate in being able to obtain the use of a helicopter for a day from one of the oil companies and succeeded in examining a few sick or dead animals near Umiat on the Colville River. One of these was of particular interest. A severely limping cow was collected and her extremely poor condition was immediately evident. Examination of the carcass revealed a well developed, ulcerous lesion between the toes of the extremely swollen, right front hoof. Internally a large lesion was found at the base of the tongue and areas of the lungs apppared necrotic. Subsequent histo-pathological examination by Dr. R. L. Rausch revealed large numbers of necrobacillary like organism in the alveoli of the affected areas of the lungs and hoof. Attempts to culture the organism failed on this occasion but Spherophorus necrophorus was isolated at a later date from similar material. To date we have never encountered a situation where cripples constituted more than a very small (1-2 per cent) fraction of the herd. The infection is likely only serious in animals in poor condition at which time it evidently may become generalized and subsequently fatal.

The presence of brucellosis and necrobacillosis in our caribou herds, and reindeer as well, appears to be only a minor problem at present. However, in the future if either of these species reach population levels comparable to those reported in the past, these diseases will likely constitute significant hazards whenever epidemidogical factors (in addition to host population densities) are favorable. In this regard our present understanding of the epidemiology of brucellosis in wild populations is indeed sketchy. Perhaps we will witness epidemics of this disease recurring with more or less regularity as reported in semi-wild range cattle in South America by Rosenbusch (1947).

Moose

To many Alaskan residents "getting your moose" is a prime requirement in preparing for the coming winter. Because of great hunter interest and and wide distribution of this species, we have had the opportunity to examine many hunter-killed specimens in the field and in the laboratory. A variety of parasites and pathological conditions have come to our attention and we would like to briefly consider some of these at this time.

Hydatid Disease:

As most of you no doubt know, this condition is caused by the larvae of the canine tapeworm, Echinococcus gravulosus. The larval stage develops in various herbicores and also some omnivores including man. The worm becomes sexually mature in dogs and wolves, but not foxes. The larva or hydatid cyst most often locates in the lungs, but rarely lodges in other organs (liver, heart, brain) of the intermediate host. The distribution of the parasite in wild ungulates is directly related to the abundance of wild canines. As a consequence moose on the Kenai Peninsula rarely carry hydatid

cysts while those of the Matanuska Valley rarely reach maturity without becoming infected. While wolves no longer exist on the Kenai and loose dogs are rare, the Matanuska Valley although free of wolves has many loose farm dogs of which there are several feral packs. We have recovered the adult worm from road killed dogs in the area and wonder how many sub-clinical cases of pulmonary hydatidosis occur in the farm population of the area. At least one has been recently reported. This is one of the few instances in Alaska at the present time where there is a domestic-wild animal problem involving disease transmission.

The classification of lung infections of hydatids in wild animals as a disease condition without qualification follows in most instances theoretical, rather than functional considerations. We have never seen an instance in the hundreds of moose examined in which the presence of hydatid cysts in the lungs was correlated with abnormal condition or behavior. Indeed the heaviest infection we have seen involving about as much parasite volume as lung volume in both lungs, was carried by an adult, Matanuska Valley cow in very good condition accompanied by a fat calf and carrying an apparently normal December embryo. Some published reports to the contrary, (Allen and Mech, 1963 and elsewhere) evidently are based on arbitrary assumptions used in an illogical fashion. It seems unfortunate that even scientific debate of wolf predation carries the "taint" of ill considered arguments. And yet, it is clear that even if we arbitrarily consider all pulmonary hydatidosis in moose significant disease, the solution is most obviously not predation by wolves as Allen and Mech (op. cit.) infer. If eradication of moose hydatidosis is a worthy goal, the only practical method is extermination of wolves and feral dogs that harbor the adult, egg producing stage of the hydatid organism. Killing of hydatid bearing moose by wolves will only result in more, and not less, infection.

This is not the only instance in recent times where this kind of unfortunate choice of material has been made to illustrate the removal of diseased wild animals by predation. Pruit, (1960), who for some years studied caribou in Canada, made a film of the yearly events in a caribou's life. In it he shows a wolf killing a caribou which was found to be diseased when examined internally. The animal had a very moderate pulmonary hydatid infection. We've seen this many times in otherwise healthy caribou. It seems clear that if we are to successfully lead the public to better conservation practice by scientific findings and their rational application, we must indeed avoid irrationality, especially in our arguments directed to the public.

The Rumen Fluke

Another parasitic worm in moose (and caribou) of particular interest is the rumen fluke, Paramphistomum sp.(?) (probably P. cervi). Although known in North American moose since at least 1942 this parasite has received little attention by workers in this country. The worm is common in Alaskan moose in swampy habitat in different parts of the State. At present it is commonly found in caribous only on the Alaskan Peninsula and is very rare (only one infection observed) elsewhere. The somewhat cursory studies by Peterson (1955) and others in this country led him to conclude: "Apparently P. cervi has no major effect on the adult moose population." In view of the inadequacy of North American studies and the clear

association of P. cervi with extensive mortality or pathology in domestics, and also on occasion wild species elswwhere in the world, Peterson's (op. cit.) conclusion seems premature. Observations on mortality and pathology have been reported by Butler and Yeoman (1962, cattle, Tanganyika); Deiana et al. (1962, goats, Sardinia); Katiyar and Varshney (1963, sheep and goats, India); Pav (1962, Cervus elaphus, Dama dama, Capreolus capreolus and Ovis musimon, Czechoslovakia); Seyfarth (1938, moose, Germany) and Zadura (1960, Cervus elaphus, Poland) and others from all the continents. Part of the reason for Peterson's seemingly casual consideration of the "rumen fluke situation" in moose may involve the apparent lack of understanding at that time of the pathological mechanism involved. In spite of the observations of Seyfarth (op. cit.) who observed severe denudation of the rumen lining in moose calves, it appears that the principal site of pathology is the upper small intestine which becomes severely ulcerated in heavy infections. The immature flukes which are liberated from the metacercarial cyst in the duodenum "graze their way" back up into the rumen thus causing ulceration and hemorrhaging. The simple observation that an apparently healthy adult animal may harbor large numbers of flukes in the rumen, may only indicate that the animal acquired the infection over a long period, a few flukes at a time. In this way the host would have an opportunity to recover between successive small doses of the worm and yet in the end seemingly represent without qualification the effects of a heavy infection. Whether this in fact can happen only can be determined through experimentation which we hope to do in the future. While it does not seem probable that rumen fluke infections commonly have a "major effect" on moose populations, it appears likely that on occasion, and in restricted areas, it no doubt does cause significant mortality or decreased productivity. The epidemiological complexities involved rule out any simple solution to this interesting wildlife disease problem.

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