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DALL SHEEP DISEASES AND PARASITES

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Project Progress Report
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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Kenneth A. Neiland

Project No.: W-17-10 Project Title: Big Game Investigations

Job No.: 6.6R Job Title: Dall Sheep Diseases and Parasites

Period Covered: July 1, 1977 to June 30, 1978

SUMMARY

The reported decline of a local Dall sheep population near Russell Glacier at the head of the White River in the Wrangell Mountains was briefly investigated. It was confirmed that an area of past, apparently substantial, use (judging from fecal pellet analysis) was not currently being used. Analysis of fecal pellets for helminth eggs, coccidid and particularly lungworm larvae suggested that animals which had previously used the area were not heavily infected.

Dall sheep are the second most commonly infected host of *Sarcocystis* among wild Alaskan ruminants. About half of the samples of myocardium examined were infected by relatively low numbers of sarcocysts.

A second attempt to collect helminth parasites, particularly lungworms, from the Siberian snow sheep (*Ovis nivicola*) was frustrated by logistic and equipment problems. Two yearlings collected on Teelan Island, on the Taygonos Peninsula, were heavily infected by lungworms. Circumstances did not permit collection of taxonomically useful specimens or of gastrointestinal parasites.

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BACKGROUND

Dall sheep are an important component of the wild ruminant fauna of Alaska. They have great value as trophy animals hunted by resident and guided, nonresident sportsmen, but also have some importance in a few localities for subsistence purposes by rural people.

Among wild ruminants, the members of the "sheep" family are notorious for their susceptibility to certain parasite and/or disease conditions. Lungworm infections which become secondarily involved by bacteria resulting in "lungworm-pneumonia" are commonplace in bighorn sheep in Canada and the "continental" United States. The same species of lungworm, i.e. *Protostrongylus stilesi*, and presumably the secondary complications, also are commonly found in Dall sheep throughout Alaska.

So-called "lumpy jaw," a disease of the mandibles, also occurs widely in Alaskan Dall sheep, sometimes in severe form. And at least one species of the protozoan parasite, *Sarcocystis*, several species of which are now recognized as highly pathogenic in domestic and several other wild ruminants, also has been commonly found in the myocardium of Dall sheep.

Because of these parasitic or disease conditions known to occur in Dall sheep, and also because one might expect others as yet unknown, it appears prudent to investigate these particular aspects of Dall sheep biology.

OBJECTIVES

To qualitatively and quantitatively evaluate diseases and parasites as potential limitations to Dall sheep populations on the Kenai Peninsula and Dry Creek study areas.

PROCEDURES

All sheep collected in sheep research studies will be subjected to a careful necropsy. Samples of presumed pathological conditions and parasites will be preserved and analyzed in the laboratory.

Serum samples from collected sheep will be tested for presence of antibodies for a variety of bacterial and viral diseases.

Mandibles from hunter-shot and collected sheep will be analyzed to determine the incidence of mandibular disease.

FINDINGS

During this reporting period our activities on sheep disease were divided between three subprojects. We investigated a reported decline of a population located near Russell Glacier at the head of the White River. We continued our survey on the prevalence of *Sarcocystis* in sheep and other big game ruminants. And we spent one month in eastern Siberia under the auspices of the Environmental Protection Treaty in an attempt to complement our earlier observations in 1975 on the parasites of snow sheep, *Ovis nivicola*. Each of these topics is treated separately below.

A Reported Population Decline

Early in 1977 I was contacted by Mr. Douglas Vaden, a guide who operates a big game hunting service on the upper reaches of the White River. He reported that in the preceding year or so he had noticed a substantial reduction in the number of sheep, particularly ewes, in part of the area in which he had hunted for a number of years. He requested that we look into the matter and offered us the use of his camp facilities, horses and light aircraft free of charge. We made arrangements to visit the area in late June. According to Mr. Vaden the specific area of decline was located near the Russell Glacier at the head of the White River in the general area of Wiley Creek and Flood Creek. With relatively little time available for this unscheduled field trip we decided to focus our attentions on: 1) a brief, aerial survey of the area; 2) apparent use of range and 3) collection of fecal pellets for observations on parasites.

On 23 June we spent about 2 hours in Vaden's Cessna 180 looking for sheep on both sides of the White River near the Russell Glacier. We saw a few animals on the west and north side of the river near Flood and Lime Creeks, but none at all were seen on the east and south side from the glacier downriver past Wiley Creek and Sheep Creek.

Then we spent a day on the lower slopes near Wiley Creek and found abundant signs of past use by sheep, but no signs of any sheep there presently. Heavy deposits of fecal pellets were found in areas normally used by sheep for feeding or lying-up. However, there were no fresh deposits; most of the pellets were weathered. And there were no signs of recent grazing or of past overutilization.

Analysis of samples from 56 sets of fecal pellets revealed relatively low levels of parasitism. A few coccidial oocysts were found in 39.2 percent of the samples and 28.5 percent contained low numbers of nematode eggs of several species. Only 1.7 percent of the fecal samples contained protostrongyline lungworm larvae. Accordingly it seems safe to conclude that the apparent reduction of the population did not occur as a result of verminous pneumonia, a well-known cause of mass mortality in wild sheep elsewhere.

Prevalence of *Sarcocystis*

The currently available data on the prevalence of *Sarcocystis* spp. in various wild Alaskan ruminants are summarized in Table 1. Even though the sample is small, it appears likely that Dall sheep may be the second most frequently infected host species. And the infections were somewhat less frequent, and also relatively less intense than those seen in caribou (*Rangifer tarandus*) the most frequently infected species.

It has been demonstrated that at least one of the forms occurring in caribou undergoes sexual development in beagle dogs (Neiland 1978). This strongly infers that the natural wild host of the sexual stages is the wolf *Canis lupus*. We have not yet determined whether the form in sheep is the same as that in caribou or if canids are the definitive host. However, at various times of the year the ranges of caribou and sheep overlap and they most certainly are exposed to one another's parasites. If the form in sheep is conspecific with that in caribou, the substantial differences in prevalence and intensity of infection between the two hosts may be due to differences in exposure, susceptibility and/or pathogenicity. Assuming that wolves are the definitive host, it is likely that wolves spend more time with caribou than sheep and contaminate caribou range more heavily with infective sporocysts. Only in areas of range overlap could sheep be exposed. It is common experience that susceptibility to infectious or parasitic agents varies widely between host species. Pathogenicity of such agents also varies widely between host species. If we are dealing with a parasite which is essentially one of caribou and well adapted to this host, one might reason that the parasite would have a higher pathogenicity in a host to which it was not as well adapted. And as a consequence more intense infections in the secondary host might be so pathogenic that such animals would not remain in the population to be sampled. As a result both the apparent prevalence and intensity of infections would be lower than otherwise. We expect during the coming year to be able to experimentally investigate the susceptibility of and pathogenicity in sheep of the species of *Sarcocystis* which occurs in caribou myocardium.

Some species of *Sarcocystis* commonly found in domestic sheep are highly pathogenic in that host (see Heydorn et al. 1975 for a review of current knowledge). *Sarcocystis ovicanis* (Heydorn et al. 1975), as the specific epithet indicates, utilizes sheep and dogs as the intermediate and definitive hosts, respectively. Its effects on sheep can be summarized as follows. After ingesting *S. ovicanis* sporocysts, lambs become anorectic, weak and die. Pregnant ewes fed 10^5 to 10^6 sporocysts of *S. ovicanis* develop pyrexia (42C), become ataxic and abort.

Further, a naturally-occurring, sporozoan-induced encephalomyelitis in sheep has been reported in the United States, Ireland and Australia. Affected sheep had myelomalacia (Dubey 1976).

Studies on *Ovis nivicola*

Preliminary findings on the parasites of the "Siberian bighorn" or "snow" sheep, *Ovis nivicola*, in extreme eastern Siberia were reported by Neiland (1975). Four common species of trichostrongylid parasites of

Table 1. Summary of prevalence of *Sarcocystis* in Alaskan wildlife, March 15, 1978.

Species	Area	Number Examined	Number Infected
Bison	Big Delta herd	29	1
Blacktail Deer	SE Alaska	20	4
Caribou	Western Arctic herd	55*	51*
	Porcupine herd	6	6
	Delta herd	1	1
Carnivores	Interior Alaska	2	-
Moose	SE Alaska	11	1
	Interior Alaska	14	2
Mountain Goats	SE Alaska	6	2
Seals	N Pacific & Bering Sea	30	-
Sheep	Alaska Range, Region III	25	14

* All samples of heart tissue infected. Negative results based on samples of skeletal muscle only. The recently born fawns from infected dams, all negative, not included.

the gastrointestinal tracts of wild sheep, and an evidently unknown species of *Protostrongylus* (lungworm) were found in a ewe and a lamb. The lungworm was of special interest because of the relatively advanced, well-nodulated stage of infection seen in the lamb. Because of various considerations regarding the probable date of birth of the lamb and the time required for development of pathogenic changes following exposure to infective larvae, it was concluded that the lamb was probably prenatally infected. It has recently become clear that prenatal infection by *Protostrongylus stilesi* may commonly occur in *Ovis canadensis*. But it has not been possible to determine whether or not this occurs in *Ovis dalli*. It is considered that *O. dalli* and *O. nivicola* probably evolved from a common ancestor and their respective parasite faunas appear very similar, if not identical. We consider that evidence of prenatal transmission of lungworm in *O. nivicola*, and also *O. canadensis*, makes it highly likely that the same occurs in *O. dalli*.

In any event, we were desirous of obtaining complete specimens of the lungworm of *O. nivicola* and also of investigating the prevalence of it and other parasites in snow sheep elsewhere in eastern Siberia. Another opportunity to work with this animal came about in 1977. We spent about three weeks in August 1977 in a field camp near Teelan Point on the Taygonos Peninsula which protrudes into the Shelikov Gulf of the northeastern Sea of Okhotsk. Essentially unexploited populations of snow sheep and brown bear (*Ursus arctos*) occur in the area. A brief ornithological reconnaissance in 1971 by the Soviet scientist Dr. Arcenii Krechmar was the only biologic work on land in the area prior to our visit in 1977. Dr. Krechmar was the leader of our field party and we returned to his campsite of 1971, about 15 miles north of Teelan Point, as he had had easy access to snow sheep near his field camp in 1971.

We were transported from Magadan to the Taygonos Peninsula on a 200-ft. Soviet Fisheries patrol vessel. And, we took with us a 14-ft. river skiff with an outboard motor in order to be able to more effectively work the surrounding area out of walking distance of camp. We were particularly interested in visiting Teelan Island, a reputed haunt of snow sheep, which is connected at low tide to Teelan Point. However, inclement weather on land, and particularly on sea, seriously interfered with our acquisition of snow sheep for necropsy. And our problems were further compounded by the topographic and floristic character of the area. The immediate coastline in both directions from the bay on which we camped is comprised of one set of sea cliffs after another with occasional short beaches where small creeks drain into the sea. One can not proceed on foot along the beach for any great distance.

Inland the country is broken and boggy or heavily vegetated by one of the botanical scourges of mankind, the stone pine, *Pinus pumilla*. Making one's way through a belt of stone pine is only less taxing than forcing through a tropical bamboo forest. After such an experience one has a much softened attitude toward an Alaskan alder thicket.

During Dr. Krechmar's previous sojourn on the Taygonos Peninsula during the month of August 1971, he had had a month of nearly uninterrupted good weather...calm and sunny. During three weeks in August 1977, we had nearly uninterrupted bad weather--rain, fog and wind--at sea and on

land. And it seriously interfered with our efforts on land and, except for two separate days near the end of our stay, prevented our movement by water to Teelan Point.

Sheep were not to be found in the areas near base camp where Krechmar had seen them in 1971. It soon became apparent to us that if there were any number of them left in that part of the country, they must be down to the south on Teelan Point and perhaps on Teelan Island where commercial seal hunters had told Krechmar sheep had been seen in 1975.

With only three field days left the weather broke and the sea was calm. In less than 1 hour we made it by skiff to Teelan Point and into a narrow bight where we made a "spike camp." We saw a few sheep on top of Teelan Mountain which falls off a thousand feet into the sea on its southern side. Our plan for the next day was for me to go around the east side while Krechmar went around the west side. If I ran into sheep, all would be well and good. If he ran into them, he would haze them my way. I had permits to collect three for necropsy and museum specimens. But the plan didn't work. When Krechmar peeped over a ridge into a large meadow on the southwest flank of Teelan Mountain he saw at least 100 snow sheep of all ages and both sexes. However, they responded to his harassment by running over the edge into the sea cliffs. That is all save four which eventually came running by me some 400 yards distance, only to also disappear into the cliffs. The next day we were to return to base camp to pack up for our return to Magadan. But, that was not to be either; the sea was far too rough and windy for our small craft.

We were picked up instead by the patrol vessel for our return to Magadan at the appointed time and place. And it appeared that snow sheep necropsies would have to wait for another time. But I had not taken Krechmar's determination into full account. We had shot a moose (*Alces alces*) early during our stay on Taygonos and cached most of it, "Siberian style," in a nearby creek. The plan was to stop on our way back to Magadan and solicit the help of the crew to pack the meat down to the beach. This accomplished, Krechmar took off in the speedboat for Teelan Island after having arranged for the patrol vessel to anchor up nearby. He returned with two yearling snow sheep and explained that evidently all or most of the animals we had disturbed on the mountain had moved to the island.

It was soon evident that I had two prize specimens for my particular purposes. Both animals had very extensive lungworm lesions, but of a gross appearance unlike those in Dall sheep or in the two snow sheep I had examined in 1975. Since we were scheduled to arrive at Magadan about 4:00 a.m. of the day on which we would depart at midnight for Khabarovsk on our way home, I planned to spend the day in the laboratory at the Institute of Biological Problems of the North (our sponsoring agency in Siberia). I would work up the gastrointestinal fauna there in the lab and would try to take care of the lungworm dissections during the two days enroute to Magadan. But I could not foresee and did not take into account two impediments to my plan. The electric illuminator for the dissecting microscope was broken and I had to attempt the dissections with the aid of a feeble reading lamp. But what made the more or less delicate dissections essentially impossible was the constant "pitch and

toss" of the ship as we headed across the Sea of Okhotsk. The dissections had to be done on relatively small pieces of lesion immersed in water in a petri dish. And of course everything just sloshed to and fro, in and out of the field of view and focus of the scope. While we obtained a great number of small and large fragments of adult lungworms, we just could not find any males or parts thereof showing the copulatory bursa, the key morphologic structure in protostrongyline taxonomy. In 1975, working with daylight illumination in a field camp on "terra firma," we had obtained partial specimens of seven males with intact bursae.

Our plans for the gastrointestinal fauna did not fare any better. During our last night at sea the patrol vessel was diverted from our course directly back to Magadan. As a result we were delayed more than 12 hours in our arrival back in Magadan where our departure from the vessel was further delayed. We finally got ashore with 4 hours to pack, attend a final dinner in our honor, and make a 1-hour drive to the airport. And the unworked "guts" of the snow sheep went over the side, parasites and all.

We plan to return to the Taygonos Peninsula in 1979. We will camp more strategically and will plan in advance to return to Magadan with several days to spare for laboratory work. Today's hindsight is tomorrow's foresight.

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