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JUNEAU, ALASKA

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DISEASE AND PARASITE STUDIES

by

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WORK PLAN SEGMENT REPORT

FEDERAL AID IN WILDLIFE RESTORATION

STATE:	Alaska	TITLE:	Big Game Investigations
PROJECT NO:	W-15-R-2 and 3	TITLE:	Disease and Parasite Investigations
WORK PLAN:	P		
JOB NOS:	1	TITLE:	Caribou and Reindeer
	2	TITLE:	Sheep
	3	TITLE:	Alternate Host Species
	4	TITLE:	Radiological Survey

PERIOD COVERED: January 1, 1967 to December 31, 1967

ABSTRACT

Caribou and Reindeer

Brucellosis reactor prevalence rates remained about the same in the Arctic and Nelchina caribou herds, i.e. 9.5% and <1.0% respectively. The prevalence of placental retention among animals observed on the Arctic calving grounds declined from 1.5 to 0.5% this year.

Sheep

None.

Alternate Host Species

None.

Radiological Survey

Spring rises in the average amounts of Cesium-137 in rumen content samples over those of the previous spring were observed in animals from the Nelchina and Arctic herds. Rumen samples from the Alaska Peninsula herd showed a decline in Cs-137 in the spring of 1967 over those of 1966. Similar changes in muscle Cs-137 were observed in Arctic and Alaska Peninsula animals (ie. rise and decline respectively), but the Nelchina muscle samples showed a slight average decline.

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OBJECTIVES

To determine the incidence and distribution of potential pathogens in Alaskan wildlife species and alternate or reservoir hosts.

To determine whenever possible or practical the extent that such organisms may contribute to mortality or lowered productivity or economic value of affected wildlife species.

To determine the extent that wildlife pathogens depreciate the value of game animals for use as food by humans or may be a threat to domestic animal industry.

To assist other agencies in determining the levels of Strontium-90, Cesium-137 and other radioactive fallout contaminants in Alaskan wildlife species and vegetation.

Job No. 1: Caribou and Reindeer

PROCEDURES

At the present time the primary effort in rangiferine disease studies is focused on the long term study of brucellosis in caribou. In this respect we are continuing our close cooperation with the Animal Disease Eradication Division, U.S. Department of Agriculture who are monitoring the disease in reindeer. In these studies the following specific procedures are emphasized.

1. Serological surveillance of brucellosis prevalence in major caribou herds particularly those in the Nelchina and Arctic areas.

2. Confirmation by isolation of suspected brucellar infections.

3. Serological studies on potential reservoir host species.

4. Aerial surveillance of the occurrence of animals displaying gross symptoms (ie. limping, retention of afterbirth) of brucellosis during calving.

5. Surveillance from the ground of concentrations of animals during the spring and fall migrations through Anaktuvuk Pass in the Arctic to detect and collect specific animals for bacteriological and/or other studies.

6. Routine autopsies of animals taken for subsistence purposes by native or sport hunters or specifically for the purposes of various scientific studies (eg. radiation studies, disease and parasite studies, etc.).

7. Examination of specimens submitted to our laboratory by the public.

8. Preparation of a definitive bibliography on the "Diseases, Parasites and Disorders of Caribou and Reindeer".

9. Publication of data at suitable intervals.

FINDINGS

A. Serological Studies:

The data derived from our serological studies on several herds are summarized in Table 1. These data lead to the following tentative conclusions:

1) There have been no significant changes in the prevalence rates for brucellosis in the herds sampled in 1967. The Arctic rate remains at just under 10 percent (ie. 1966, 8%; 1967, 9.5%). The Nelchina rate remains at a very low value (ie. 1.5%, 1966; <1%, 1967). There is no evidence to date of the disease in the herds on the Alaska Peninsula or Adak Island.

2) There does not appear to be any significant difference regarding infection with brucellosis between animals taken at Anaktuvuk Pass and those taken to the west in the Kobuk River area. However, whether or not animals taken at Anaktuvuk Pass are always representative of the Arctic herd as a whole remains to be seen.

B. Calving Ground Aerial Surveys:

The results of the June, 1967, aerial survey on the Arctic calving ground are presented in Table 2. It appears that the prevalence of placental retention and related symptoms again declined (ie. 0.56, 1967 vs. 1.6, 1966). Whether or not this is a consequence of the apparent decline in female reactors (ie. 12.3, 1966 vs. 9.3, 1967) is debatable considering the sampling limitations of the serological data. While there can be little doubt that at least some of the birthing problems are caused by brucellosis, other causative factors can not be ruled out.

It is noteworthy that a case of hemorrhagic perineum was observed for the first time on the Nelchina calving grounds in June, 1967, by caribou work plan personnel.

There did not appear to be any significant change in the number of "limpers" sighted on the Arctic calving grounds in 1967.

C. Studies on Migratory Concentrations: Anaktuvuk Pass

The main northerly, spring caribou migrations through Anaktuvuk Pass occurred after the period of time we spent there this past year. Consequently we did not have the opportunity to inspect many groups of "spring" animals or individuals for signs of disease or specific lesions. However, during mid-October we witnessed the largest fall migration since 1958. Approximately ten thousand or so animals came by the village during a period of about four days during which time the villagers took about 300 animals. The native hunters agreed that they were generally in much better condition (eg. fatter) than they had been for several years. While various common parasites were, as always, readily evident, few lesions or individuals of particular interest were encountered. Only two "limpers" were seen prior to the start of the hunt. These were not collected in deference to the native hunters belief that it was essential in order to insure that the herd would not turn back to allow some animals to pass the village before disturbing the main herd.

Of particular interest was a large adult bull with an advanced

case of orchitis-epididymitis. Field cultures were made from this specimen and the isolate has been tentatively identified as Brucella suis biotype rangiferi.

Another animal, an adult cow, yielded an interesting example of a presumed embryological abnormality. All save the last molar of the right mandible were missing. The opposing maxilla and teeth presumably in response to a long-term lack of physical opposition had hypertrophied down into the space normally occupied by the missing mandibular teeth. The animal was in otherwise good condition.

A presumed case of infectious mastitis was observed but attempts at field isolation of a causative organism failed.

The native hunters, most of whom are very keen eyed and cooperative in respect to reporting or bringing in samples of abnormalities, failed to call to my attention any instances of lesions, etc. and I can only conclude that they failed to see any.

D. Specimens Submitted by Sport-hunters:

As usual a variety of specimens were submitted to us during the hunting season by sport-hunters concerned with the palatability of their presumably diseased game. Much of this material is either in such poor condition that definite diagnoses are impossible or it involves very common conditions (eg. cysticerci, papillomas, fibromas, etc.), of little special interest at this time. However, a noteworthy specimen occasionally comes to hand.

An adult, male caribou taken about December 1 near Mile 164 on the Richardson Highway had a swollen carpal joint. Attempts at culture and subsequent histological examination failed to reveal a pathogen. However, histo-pathological studies by the Alaska Medical Laboratories revealed "acute and chronic change (s) most consistent with an arthritis of probable bacterial origin". The hunter reported the animal to be of "lean condition" typical of male caribou early in the winter after the October rut. Considering the fact that brucellosis is known to occur in the Nelchina herd and that species of Brucella are known to cause arthritis in other ruminants, it seems safe to conclude that the present case is an example of brucellar arthritis caused by Brucella suis biotype rangiferi.

E. Bibliographic Studies:

During the past year the "first compilation" of "A Bibliography of the Diseases, Parasites and Disorders of Caribou and Reindeer" was prepared and xerox copies were distributed to most North American personnel working with these species. It is hoped that these workers will submit for inclusion in the bibliography items I have missed. The "first compilation" contained about 237 entries and an additional 50 or

Table 1. Prevalence of brucellosis serological reactors in several caribou herds in 1967.

Herd	Area	Negative		Positive						
		Sex	Total	Total	Percent[3]	Titres				
						1:25	1:50	1:100	1:200	1:400
Arctic	Anaktuvak Pass	M	34	2	5.9	1	---	---	1	---
		F	29	4	13.8	1	3	---	---	---
		Both	63	6	9.5	2	3	---	1	---
	Kobuk River	M	38	5	13.5	2	1	---	1	1
		F	47[1]	3	7.0	---	1	1	1	---
		Both	85	8	9.8	2	2	1	2	1
	Both Areas	M	72	7	9.9	3	1	---	2	1
		F	76	7	9.3	1	4	1	1	---
		Both	148	14	9.5	4	5	1	3	1
Nelchina		M	12	None						
		F	22	None						
		Both	38[2]	None						
Alaska Peninsula		M	3	None						
		F	7	None						
		Both	10	None						
Adak		M	5	None						
		F	2	None						
		Both	7	None						

1-Includes 3 animals from Point Hope.
2-Includes 4 animals of unknown sex.
3-Percent of total tested.

Table 2. Prevalence of Various Abnormal Animals in the Arctic Calving Herd, 1967.

Condition	Sample Size	Number	Percent
Placental retention and/or hemorrhagic perineum	2832[1]	16	0.45
"Limpers"	2832[4] plus	14[3]	<0.5

1-Includes only animals with calves or those showing the condition but without calf.

2-Includes three cows without live calves.

3-Includes one cow with live calf.

4-Includes all those examined for placental retention plus hundreds of others, (ie. males, yearlings, etc.).

so entries have now come to hand. I plan to eventually publish the bibliography as part of a paper on the parasites of Alaskan caribou now being prepared for joint publication with Mr. Ronald O. Skoog.

F. Publications:

A paper, "The Diseases and Parasites of Alaskan Wildlife Populations, Part I. Some Observations on Brucellosis in Caribou", has been accepted for publication in the April, 1968 issue of "The Bulletin of the Wildlife Disease Association". This covers the first phase of our rangiferine brucellosis studies done in cooperation with personnel of the U.S. Department of Agriculture and the Arctic Health Research Center. Within the next year or so we expect to prepare another paper on our more recent studies on brucellosis in wildlife in Alaska.

A paper on the parasites of caribou is now being prepared.

Job No. 2: Sheep

PROCEDURES

Studies on the diseases and parasites of sheep will be carried out and published jointly with members of the sheep work plan. The procedures we will employ may be summarized as follows:

1. The primary emphasis of our studies will be focused on several study areas now being selected.

2. All animals collected for studies on reproduction population dynamics, nutrition, etc. will be routinely autopsied in the field. Some organ systems or other selected materials will be brought into the laboratory for closer inspection in those instances where an adequate examination can not be accomplished under field conditions.

3. Specimens from hunter-killed sheep will be handled as they come in on a volunteer basis or solicited from the public whenever situations arise which require large numbers of samples (eg. jaws).

4. Fresh fecal pellet samples will be collected on the study areas at intervals in order to follow changes in intensities of parasitic infections. These will also be collected in other areas as time allows.

5. Routine bacteriological, parasitological, etc. methods will be employed in the laboratory to evaluate specimens that come to hand. Selected material will be referred to specialists for histo-pathology.

6. A definitive bibliography on the parasites, diseases and disorders of wild sheep will be prepared and kept up to date.

7. Significant research accomplishments will be published at irregular intervals.

FINDINGS

During the past year our new sheep biologists have been concerned with preliminary survey work and have not yet initiated long term life history studies in selected areas. Consequently no collecting activities involving disease and parasite studies have been carried out. Several animals which died during transplant activities were autopsied in the field by personnel of the Sheep Work Plan with negative results.

Continuing bibliographic endeavors during the past year have added a number of new entries to the sheep disease bibliography. We now have 134 original citations which will be done up into a preliminary bibliography to be distributed at the second meeting of the Northern Sheep Research Council in May.

Job No. 3: Alternate Host Species

PROCEDURES

Field collections of host species will be conducted largely in conjunction with other investigations. Members of all divisions of the Department, as well as the public and other state or federal organizations, have been requested to send in suspected pathological specimens or in certain instances to obtain material of special interest. Such material will be handled in our laboratory, or in some cases referred to other specialists for diagnosis. At the present time special emphasis is being placed on the following host species:

1. Moose

The success of the long-term, penned-moose nutritional studies on the Kenai Peninsula will in part depend on an adequate knowledge of the levels of parasitism in the experimental animals. Because preliminary state-wide studies already clearly demonstrate several differences in kinds and/or numbers of parasites in moose in different areas, one can only conclude that the moose pen area may also exhibit its own peculiarities in this regard.

Because moose are probably the most sought-after species and

of great importance to all subsistence hunters, we will continue to get a variety of material from hunters and during specific life history studies by our moose work plan biologists.

2. Bison

The frequent close association between bison and domestic animals in the Big Delta farming area is one of the few instances in Alaska in which wildlife may be a potential source of diseases for domestic animals. Accordingly, it is important that whenever bison are available for examination (eg. controlled hunts, road kills, transplants, etc.) that appropriate studies (eg. autopsy, collection of blood samples, etc.) be made.

3. Blacktail Deer

In S.E. Alaska and Prince William Sound blacktail deer are an important big game ruminant for both sporting and subsistance purposes. For this reason we are continuing our studies on this species, in progress since 1960, but only on a limited basis. We still know relatively little about the parasites and diseases of the blacktail in many areas of the state (eg. Kodiak, the extreme sourthern or western parts of S.E. Alaska).

4. Carnivores

At present we are soliciting carcasses of wolves, coyotes and wolverines taken in S.E. Alaska. There is no published data on the parasites of these predatory species in that area. However, the (wolves and coyotes?) are involved in the transmission of parasites to blacktail deer and in one instance (ie. Echinococcus) also a human parasite. These studies were initiated in 1960 and will be continued until adequate sampling has been accomplished.

In conjunction with the lynx life history study we have undertaken to study the levels of parasitism in this species in central Alaska from one population high to another. Relatively little is known about the parasites of lynx anywhere. We have an unusual opportunity to get quantitative as well as qualitative information.

Sled dogs, though not a wild species, nevertheless in many cases exist under semi-wild conditions. For example, in many places they commonly are fed uncooked parts of game animals which are the normal prey of wolves. Accordingly, it is possible to obtain some insight into the question of whether wolves suffer infectious diseases transmitted to them from their prey species by studying the diseases of sled dogs which are fed on uncooked game. There is added interest when such diseases are also transmissable to man.

5. Marine Mammals

Many native Alaskans subsist to a large extent on marine mammals. Some marine species are also important fur-bearers or trophy animals. Since 1960 we have engaged in casual investigations on the parasites of a variety of marine mammals from Alaskan waters. We have also cooperated with other agencies engaged in biological studies on these species in Alaskan or other waters.

6. Miscellaneous host species

All species of fish and game which are prey species for various predators harbor parasites peculiar to themselves, but also the intermediate stages of parasites which mature in the predators which feed on them. In some instances these intermediate (larval) stages are of greater importance to man or beast than are those parasites peculiar only to prey species. For example, the larval stages of various tapeworms which mature in fish-eating birds or fish, may render desirable food species of fish unfit for human consumption. Some of these may occasionally infect man when partly cooked fish are eaten as is the habit of some native or non-native groups. Most if not all of our small game or sportsfish species may be involved in these detracting host-parasite relationships. Many of the inquiries we get from the public regarding the palatability of presumably infected wildlife involve these host species. We will continue to deal with this kind of material on a casual, time-available basis.

Much of the material to be covered in a pamphlet on the "Common Diseases and Parasites of Fish and Game" now being prepared for general distribution will involve parasites of various sportsfish and small game commonly encountered by sportsmen.

FINDINGS

During the past year data on parasites or disease conditions were obtained from 373 representatives of the host categories indicated above. Many of the observations involved common and otherwise uninteresting parasites or disease conditions. Items of special interest are summarized below.

1. Moose

Only one moose specimen of special interest came to hand this year. The greatly enlarged right hock joint of a young cow was "completely abscessed" and yielded a pure culture of Staphylococcus sp. This is the first instance of this organism being implicated in moose disease in Alaska.

We are continuing to collect moose sera for serological testing.

The 142 samples collected this past year, principally from animals from the Matanuska Valley, were all negative for the brucellosis agglutination test. As yet we have no clear cut evidence of this disease naturally occurring in Alaskan moose populations.

Other moose specimens submitted by sportsmen involved various more or less common parasites or conditions of which the following are representative: fibroma, cysticerci, normal liver changes associated with the rut, long-toed, etc. These do not merit further comment at this time.

Preliminary attempts to discover the natural molluscan host of the moose rumen fluke, Paramphistomum sp., failed. Several hundred snails from ponds commonly frequented by moose failed to reveal any amphistome cercaria when carefully examined. The various species of molluscs encountered in "moose-swamps" have been referred to specialists for identification.

2. Bison

There were no opportunities to work with bison in 1967.

3. Blacktail Deer

Several blacktail deer from islands in Prince William Sound were examined in 1967 by Mr. Loyal Johnson, Game Biologist, Cordova. A small trichostrongylid roundworm, as yet not found in deer in S.E. Alaska was found. Unfortunately all of the specimens from these animals were lost in a fire which destroyed a warehouse in which the specimens were being temporarily stored.

A yearling doe with a clearcut pneumonia of unknown etiology was taken by a Petersburg hunter in November.

A male fawn taken at Gambier Bay, Admiralty Island, in November exhibited a diarrhea associated with a moderate infestation of a tapeworm, Moniezia sp.

4. Carnivores

Sixty-five lynx were autopsied during 1967. In addition to the five species of parasites (ie. 2 tapeworms and 3 roundworms) commonly found in this host, a species of acanthocephalan was found for the first time in one animal. This material will be written up in detail at the end of the study when we have followed the local lynx population into a new high.

Eleven wolves from S.E. Alaska were examined. The adult stages of two common species of tapeworms, Taenia hydatigena and/or T. krabbei, were present in ten of the wolves in moderate numbers.

5. Marine Mammals

All of our effort on marine mammals in 1967 has been expended on working up for publication a collection of 287 specimens of nasal flukes (Nasitrema spp.) from 11 species of whales and porpoises. These were obtained by Mr. Dale Rice, Marine Mammal Biologist, Fish and Wildlife Service, from 12 of 53 individuals examined by Mr. Rice or his co-workers. Several new species of Nasitrema have been encountered in this study. Only two other reports concerning four species of Nasitrema from oriental porpoises are available in the world literature. Probably most porpoises and whales which come into the hands of scientists are saved for the skulls and thus not examined for this kind of parasite which necessarily involves damaging the skull.

6. Miscellaneous Host Species

A variety of fish, birds, and fur-bearers were examined for parasites or disease conditions. Some of these data are briefly summarized below.

Thirty-four rainbow trout from two lakes near the Alcan Highway south of Delta Junction were nearly completely free of parasites. These are landlocked waters which prior to being stocked in recent years were barren of fish life. Two of 25 rainbows from Jan Lake harbored light infections of Proteochephalus sp. (?). Nine large rainbows (16-18 inches long) from Little Donna Lake were not infected with either ecto- (ie. copepods) or endoparasites, and several dozen other large fish were free of ectoparasites.

Twenty whistling swans which were found dead on the beach near Yakutat harbored only very few parasites. It was concluded by our waterfowl biologist that the swans were "beaten to death" in heavy surf during a severe storm.

Seven beaver taken along the Chatanika River harbored a few trichostrongylid stomack worms, Travassosius americanus, a common parasite of beaver elsewhere in Alaska and North America.

A short publication on a collection of parasites from shorebirds taken along the Lower Kvichak River in 1960 was jointly prepared with Dr. Gerald Schmidt, Dept. Biology, Colorado State College.

Job No. 4: Radiological Survey

PROCEDURES

Samples of muscle and rumen contents from 5 adult caribou are taken twice a year from each of three Alaskan caribou herds. About March 15th and October 15th collections are made from the Arctic, Nelchina

and Alaska Peninsula caribou herds. Samples of lichen and sedge are gathered at established collecting stations in each area when the fall caribou samples are taken. These are all forwarded to the Environmental Radiation Section, U.S. Public Health Service, Las Vegas, Nevada, for quantitative analyses of radioactive fallout contaminants and interpretation of the resultant data.

FINDINGS

The most recent report from the U.S. Public Health Service summarizes the data on caribou and reindeer through spring, 1967. This information is tabulated in Tables 1 - 4. The comments of this agency on their findings are as follows. "This report transmits to you material prepared from the National Center for Radiological Health environmental surveillance program in Alaska. Many of the samples were collected by or in cooperation with the State of Alaska, Department of Fish and Game, and the Fish and Wildlife Service, Department of the Interior."

"All analyses in this report were performed by the National Center for Radiological Health, Southwestern Radiological Health Laboratory in Las Vegas, and include gamma spectroscopy for Cesium-137 and other gamma emitting radionuclides, and radiochemical analyses for Strontium-89 and Strontium-90."

The data in the tables are all reported in units of picocuries per kilogram wet weight, with the exception of caribou and reindeer bone samples for which Strontium-89 and Strontium-90 are reported in picocuries per gram of ash. A picocurie is defined as that quantity of a radionuclide which is disintegrating (changing) at the rate of 2.22 atoms/minute.

For radionuclides which were determined by gamma spectroscopy, ND is used throughout the report for not detectable. The detection limit for different radionuclides determined by gamma spectroscopy varies with the sample size, the concentration of other radionuclides present in the sample, and other factors. No single detection limit can be given for different radionuclides.

The reported concentrations are not directly related to daily radionuclide intake since it is necessary to obtain ancillary information of the amounts of meat consumed in the diet and the relative role of other foods in the diet. Caribou and reindeer were selected since they appear to provide most of the daily intake of Cesium-137 for certain Eskimo villages.

In FRC Report No. 7, Section 4.9, the Federal Radiation Council states the following on the Alaskan situation:

"Although the Federal Radiation Council did not set a specific RPG for Cesium-137, in either report No. 1 or No. 2, it did state in the memorandum for the President (Federal Register, September 26, 1961): 'The characteristics of Cesium-137 lead to direct comparisons with whole body exposure for which recommendations by the Council have already been made.' This implies that the RPG would be 0.5 rem in a year to the whole body of individuals in the general population when the doses can be measured directly, or an average of 0.1 rem to a suitable sample of the population group, when direct measurement is not practicable. Therefore, an annual average body burden in adults of 3,000 nanocuries and 1,000 manocuries would be estimated to result in these respective doses. The body burdens of Cesium-137 in the groups of interest are being measured directly. If a comparison with the guidance provided by the FRC is to be made, the applicable RPG is 0.5 rad per year and the corresponding annual average body burden is 3,000 nanocuries of Cesium-137 in adults."

Assuming a steady state condition and the assumptions made by the Advisory Committee from the Division of Medical Sciences, National Academy of Science[2], a body burden of 3,000 nanocuries of Cesium-137 corresponds to a continuous daily intake level of 21,000 picocuries per day and a body burden of 1,000 nanocuries corresponds to a daily intake level of 7,000 picocuries per day. The average consumption of caribou meat by natives who depend on this meat as a main portion of their diet is approximately 0.8 kilograms.[3,4]

[2]Implications to Man of Irradiation by Internally Deposited Strontium-89, Strontium-90 and Cesium-137. A report of an Advisory Committee from the Division of Medical Sciences: National Academy of Sciences - National Research Council, Washington, D.C. Federal Radiation Council, Washington, D.C., December 1964.

[3]Hanson, W.C. Strontium-90 and Cesium-137 in Alaskan Arctic Ecosystems. Hearings before the Subcommittee on Research Development and Radiation, Joint Committee on Atomic Energy, U.S. Congress, June 29 and 30, 1965, pp. 35-54.

[4]Heller, C.A. The diet of some Alaskan Eskimos and Indians. J. Amer. Dietetic Assoc. 45:425-428 (November 1964).

Consequently, continuous consumption of meat with a Cesium-137 concentration of 9,000 picocuries per kilogram would be expected to lead to an average body burden of 1,000 nanocuries of Cesium-137 for a suitable population group. As shown in the attached tables, the Cesium-137 concentrations of caribou and reindeer meat vary seasonally, reaching a maximum in early spring. The actual body burdens depend on the hunting habits of the natives which are extremely variable. However, the average Cesium-137 body burdens of a suitable sample would not be expected to exceed 1,000 nanocuries or 3,000 nanocuries in an individual, if the average Cesium-137 concentrations in caribou or reindeer meat obtained from animals killed in early spring are below 9,000 picocuries per kilogram. In the literature[5] to date no individual Cesium-137 body burdens of Alaskans determined through actual measurements (whole body counting) have been reported above 3,000 nanocuries.

The results reported here will continue to be published in Radiological Health Data and Reports, a monthly publication of the Department of Health, Education and Welfare.

In general, the Average Cesium-137 concentrations in caribou and reindeer muscle have followed previous seasonal variations. Notable exceptions are the C-1, C-2, and C-3 herds. The former seem to show a consistent increase in levels since early winter, 1965, the middle a slight decreasing trend, and the latter a large decrease since March 1965. These changes may be related or due to sampling conditions or characteristics, feeding habits and availability of food, the type of food, etc. Further observation is needed before such trends can be defined.

[5]Chandler, R.P. and Snavely, D.R. Summary of Cesium-137 and Strontium-90 Concentrations Reported in Certain Alaskan Populations and Foodstuffs 1961-1966. Radiol. Health Data Rep. 7 (12):675-689 (December 1966).

Table 1. Summary of Radionuclide Concentrations in Caribou Rumen Content Samples.

Sampling Dates	Number of Samples	pCi/kg wet weight				
		^{89}Sr	^{90}Sr	^{137}Cs		
		Average[a,b]	Average[a,b]	Average[a]	Minimum	Maximum
Caribou						
Arctic Herd (C-1)						
December 63	3	500	4,440	4,430	3,980	4,770
May 64	5	< 5	1,680	4,440	4,000	6,000
August 64	5	40	1,700	1,470	970	2,299
October 64	5	< 5	4,500	5,080	4,400	6,100
December 64	5	< 5	4,020	4,100	1,800	6,300
April 65	5	---	---	8,400		
September 65	5	---	---	4,700		
November 65	5	---	---	5,600		
March 66	5	---	---	6,200		
October 66	5	---	---	7,900		
May 67	5	---	---	19,000		
Nelchina Herd (C-2)						
November 63	5	400	5,150	4,880	1,100	7,430
April 64	5	< 5	1,550	8,400	2,500	12,000
August 64	1	<5	346	8,900		
October 64	9	<5	207	3,030	550	4,500
December 64	5	< 5	4,430	7,200	4,300	9,000
March 65	5	---	---	8,600		
July 65	5	---	---	5,100		
September 65	5	---	---	7,600		
December 65	5	---	---	6,500		
March 66	5	---	---	4,900		
November 66	5	---	---	7,200		
March 67	5	---	---	7,100		
Peninsula Herd (C-3)						
December 63	5	1,550	5,700	7,920	4,020	12,300
April 64	5	<5	1,370	1,840	1,400	2,600
July 64	5	<5	311	690	620	740
September 64	5	< 5	825	5,890	1,500	13,300
December 64	5	3,120	2,410	4,900	2,200	8,000
August 65	5	5	487	770		
September 65	5	---	---	6,600		
November 65	5	---	---	8,100		
March 66	5	---	---	9,900		
November 66	5	---	---	7,000		
April 67	5	---	---	2,500		

Table 2. Summary of Radionuclide Concentrations in Reindeer Rumen Content Samples.

Sampling Dates	Number of Samples	pCi/kg wet weight				
		89 Sr	90 Sr	137 Cs		
		Average [a,b]	Average [a,b]	Average [a]	Minimum	Maximum
Reindeer						
R-1						
December 63	4	< 5	5,600	4,650	3,760	5,360
December 64	5	<5	4,480	5,400	2,300	7,900
R-2						
December 64	1	<5	3,910	6,900		
R-3						
September 64	1	<5	315	10,900		
December 64	3	<5	5,810	5,500	5,200	5,700
R-4						
September 64	1	5	1,710	5,770		
December 64	5	<5	2,440	1,900	1,100	2,700
November 65	5	-	---	5,000		
February 66	5	-	---	7,400		
July 66	5	-	---	710		
May 67	5	-	---	6,370		
R-5						
November 65	5	-	---	5,600		
June 66	5	-	---	3,800		
November 66	5	-	---	8,200		
R-8						
September 64	5	5	3,060	3,600	2,500	4,510
December 64	5	5	4,040	5,400	1,100	10,000
January 66	5	-	---	6,000		
April 66	5	-	---	14,000		
August 66	5	-	---	1,100		
April 67	5	-	---	9,510		
R-9						
September 64	4	<5	720	1,070	660	1,900
November 64	5	-	---	4,400	1,700	8,500
R-10						
June 66	5	-	---	5,900		
November 66	5	-	3,190	12,000		
April 67	5	-	---	13,800		
R-11						
December 64	5	<5	4,930	4,600	2,400	7,400

[a] Indicates samples composited before analysis.

[b] Dash indicates no analysis.

Table 3. Summary of Radionuclide Concentrations in Caribou Muscle Samples.

Sampling Dates	Number of Samples	pCi/kg wet weight				
		^{89}Sr	^{90}Sr	^{137}Cs		
		Average[a,b]	Average[a]	Average	Minimum	Maximum
Caribou						
Arctic Herd (C-1)						
December 63	3	< 5	17	4,860	3,750	5,680
May 64	5	<5	400	13,800	5,000	21,000
August 64	5	< 5	40	700	400	1,000
October 64	5	< 5	19	6,880	5,200	11,000
December 64	5	<5	19	3,900	1,400	5,300
April 65	5	< 5	22	9,600	6,300	14,000
September 65	5	<5	11	7,720	4,000	12,000
November 65	5	<5	1	6,220	4,300	7,400
March 66	5	< 5	26	18,400	16,000	22,000
October 66	5	< 5	9	17,000	10,000	25,000
May 67	5	-	-	25,800	21,000	31,000
Nelchina Herd (C-2)						
November 63	5	5	33	21,800	16,900	26,400
April 64	5	10	54	5,560	2,600	10,000
August 64	1	< 5	31	14,300		
October 64	9	5	20	4,220	650	6,200
December 64	5	< 5	30	14,000	7,900	22,000
March 65	5	<5	48	27,600	16,000	39,000
July 65	5	<5	7	4,000	1,600	7,300
September 65	5	<5	26	8,160	5,900	10,000
December 65	5	< 5	33	17,200	14,000	22,000
March 66	5	< 5	30	14,800	12,000	17,000
November 66	5	<5	22	13,000	11,000	14,000
March 67	5	< 5	2	13,800	11,000	17,000
Peninsula Herd (C-3)						
December 63	5	10	84	44,800	33,600	57,700
April 64	5	<5	14	14,800	12,000	18,000
July 64	4	<5	5	1,680	1,400	2,000
September 64	5	< 5	11	4,630	1,200	9,250
December 64	5	<5	31	18,000	8,700	31,000
August 65	5	<5	4	2,000	820	3,200
September 65	5	<5	15	18,000	11,000	32,000
November 65	5	<5	7	20,100	12,400	25,000
March 66	5	<5	18	43,800	41,000	46,000
November 66	5	<5	5	20,000	18,000	25,000
April 67	5	< 5	1	15,800	13,000	18,000

Table 4. Summary of Radionuclide Concentrations in Reindeer Muscle Samples.

Sampling Dates	Number of Samples	pCi/kg wet weight				
		^{89}Sr	^{90}Sr	^{137}Cs		
		Average[a,b]	Average[a]	Average	Minimum	Maximum
Reindeer						
Kotzebue Herd (R-1)						
December 63	4	<5	31	7,190	6,730	7,540
September 64	5	<5	74	3,340	2,300	4,900
December 64	4	<5	268	23,000	13,000	30,000
Selawik Herd (R-2)						
December 64	1	<5	578	34,000		
Buckland & Candle Herd (R-3)						
September 64	2	<5	68	19,600	13,400	25,800
December 64	4	<5	64	14,000	5,100	32,000
Shismaref Herd (R-4)						
September 64	3	<5	38	8,490	7,660	10,100
December 64	5	<5	68	12,000	4,000	29,000
March 65	5	<5	25	18,000	13,000	24,000
September 65	5	<5	14	6,000	4,000	8,100
November 65	5	<5	25	16,800	14,000	22,000
February 66	5	<5	55	18,600	15,000	23,000
July 66	5	<5	59	3,560	3,000	4,100
May 67	5	<5	16	16,600	13,000	20,000
Teller Herd (R-5)						
December 64	5	<5	66	35,000	25,000	47,000
November 65	5	<5	90	27,000	23,000	35,000
June 66	5	<5	25	19,000	17,000	21,000
November 66	5	<5	9	26,000	19,000	35,000
Golovin Herd (R-6)						
December 64	5	5	96	19,000	11,000	30,000
Stebbins (R-7)						
December 64	5	5	86	30,000	14,000	37,000
Nunivak I. Herd (R-8)						
September 64	5	<5	75	7,050	5,000	9,200
December 64	5	<5	128	25,000	9,800	35,000
April 65	5	-	28	31,200	27,000	34,000
August 65	35	<5	--	7,700	4,000	15,000
January 66	5	<5	90	27,200	25,000	31,000
April 66	5	<5	21	33,400	32,000	34,000
August 66	5	<5	38	6,680	4,400	9,500
April 67	5	<5	20	32,400	26,000	46,000

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