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ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

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DISEASE, PARASITE & DATA COLLECTIONS

by

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Project W-15-R-1 and 2, Work Plan P

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WORK PLAN SEGMENT REPORT

FEDERAL AID IN WILDLIFE RESTORATION

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

PERIOD COVERED: January 1, 1966 to December 31, 1966

ABSTRACT

Caribou and Reindeer

Brucellosis reactor prevalence rates were about the same in the Arctic and Nelchina caribou herds during 1966 as the previous year. Half as many cows with retained placentas were observed on the arctic calving ground during 1966 as the previous year. Many limping animals were seen during July near the Colville River on the Arctic range.

Sheep

None.

Alternate Host Species

None.

Radiological Survey

Spring 1966 caribou and reindeer meat samples in most instances equaled or slightly exceeded previous high cesium-137 values obtained from seasonally comparable samples. Summer 1965 cesium-137 burdens of residents of Anaktuvuk Pass had declined about 30 percent from the summer of 1964. However, increasing cesium levels in caribou may result in some increase in humans, but probably not beyond the maximum safe level.

RECOMMENDATIONS

Caribou and Reindeer

We should continue to capitalize on the opportunity in the Arctic to study a brucellosis epidemic in a wild animal population. If the reindeer industry expands as planned, studies of this disease in Rangifer spp. will become even more important to caribou conservation and reindeer husbandry.

Sheep

None.

Alternate Host Species

None.

Radiological Survey

Surveillance should be continued until marked declines in contamination of caribou and as long as atmospheric-nuclear testing takes place.

WORK PLAN SEGMENT REPORT

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2 TITLE: Sheep

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4 TITLE: Radiological Survey

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Caribou and Reindeer

OBJECTIVES

To determine the pathogenic organisms present in caribou and reindeer, their prevalence and virulence, the extent or magnitude of the infections, and the effect of such upon selected populations. To evaluate the significance of brucellosis in the caribou and reindeer herds of Alaska, as related to individual animals, herd productivity, population fluctuations, and other game species. To investigate the occurrence of foot rot and other diseases in the Arctic caribou herd.

PROCEDURES

A cooperative study initiated last year with the Arctic Health Research Center to study diseases in the Arctic herd, and the work already in progress by the Alaska Department of Fish and Game on the Nelchina herd will be emphasized to complement the brucellosis work.

Insofar as possible, all animals examined will be weighed and measured and samples collected for aging, racial studies, and radioactivity work.

1. The prevalence of foot rot will be investigated in the Arctic herd with quantitative data being obtained in conjunction with other studies.

2. Brucellosis studies will involve the taking of blood samples for serological tests from hunters' kill from the Steese-Fortymile and Nelchina herds: each hunter will be given a vial and asked to bring back a sample of blood from the kill. Cooperative efforts will continue with regard to the penned reindeer experiment, and the Alaska Department of Fish and Game will supply half the feed required.

Carcasses from the Arctic will be examined to obtain data on pre- and postnatal mortality. Ground counts of short-yearlings during this same period will serve to measure calf mortality since the previous June.

3. General pathology studies will be continued on the Nelchina herd and expanded to include the Alaska Peninsula herd. Most of the Nelchina data will be obtained from hunter kills. That obtained from the Alaska Peninsula probably will be limited to the collections of obviously diseased animals observed during the radiological studies proposed for 1966.

FINDINGS

This year's data on brucellosis and the occurrence of "abnormal" animals in the Arctic calving herd are summarized in Tables 1 and 2. The Arctic reactor rate for this year is about the same (8.0 vs. 8.4) as that recorded in 1965. However, it must be kept in mind that the 1965 sample of 203 animals included 66 taken at Anaktuvuk Pass in October, none of which were reactors. An attempt to investigate reactor sampling error was accordingly initiated during the spring 1966 migration through Anaktuvuk Pass. One hundred and fifty-three serum samples were collected from subsistence hunter-kills throughout the entire migration from late April to early June. These were divided into three series of sub-samples according to the time of collection. The number of sera tested with number of reactors shown in parenthesis are as follows: 35 (9); 53 (8); 65 (4). Thus, while the overall reactor rate was about 13 percent, sub-sample reactor rates were about 25 percent, 14 percent, and 6 percent, respectively. Accordingly, it is assumed that the series of 66 negative animals taken in October 1965 may represent an improbable, though not impossible, sub-sample. An alternative to this hypothesis is that the October 1965 sample was made up of animals from the Porcupine Herd that were taking a more westerly path to the south than normal. Unfortunately, we have no information regarding the disease status of this Alaskan-Canadian herd. However, brucellosis has not been reported in Canadian caribou or reindeer even though a few cases are known in Eskimos of the Northwest Territories.

The prevalence rate of retained placentas (see Table 2) on the Arctic calving grounds in 1966 was about half the 1965 rate: 1.6 percent vs. 3.2 percent, respectively. While there seems to be little doubt that brucellosis is one of the important causes of this condition, the similar reactor prevalence rates for 1965 and 1966 suggest that other factors are also involved. Although it was not possible to make quantitative counts, it appeared that there were more than the usual number of non-pregnant cows on the calving grounds in 1966. Perhaps some of these animals aborted early during the winter thus affecting counts made late in June.

Table 1. The Prevalence of Brucellosis Reactors in some Alaskan Caribou Herds, 1966.

Herd	Sex	Negative	Positive						
			Total	Percent	1:20	1:40	1:80	1:160	1:320	Other
Arctic	M	134	9	6.3	7				2	
	F	50	7	12.3	3	1		1	4	
Both Sexes		184	16	8.0	10	1		1	4	
Adak	M	3	0							
	F	2	0							
Both Sexes		5	0							
Alaska Peninsula	M	7	0							
	F	5	0							
Both Sexes		12	0							
Nelchina	M	23	1	4.1				1		
	F	43	0							
Both Sexes		66	1	1.5				1		

Table 2. The Prevalence of Various Abnormal Animals in the Arctic Calving Herd, June, 1966.

Condition	Sample Size	Number	Percent
Retained After Birth	2058[1]	34[2]	1.6
"Limpers"	2058 plus[3]	14	0.7
Breach-Births		3	
Dead Calves	2058 plus	6	

1. Includes only cows with calves which were clearly examined.

2. Includes one cow without calf.

3. Includes all those examined for placental retention plus "hundreds" of other animals not accompanied by a calf (e.g. males, yearlings, pregnant cows, etc.).

The prevalence of "limpers" on the Arctic calving grounds was of the same order of magnitude in 1965 and 1966, i.e. <0.8 percent and <0.7 percent, respectively. However, observations made later in 1966 by Dr. Dale Guthrie, Department of Biology, University of Alaska, suggest that a somewhat serious situation had developed by mid-summer. Dr. Guthrie spent several weeks during late July on the Ikpikpuk River doing paleontological excavating. For about 36 hours on July 30 and 31, "tens of thousands" of caribou in many bands moved through the area from west to east over a four-mile front. After tiring of looking at antler size and conformation, Dr. Guthrie recalled some of my discussions with him on crippling and swollen joints in caribou. He then began to closely observe the individual bands in order to detect limpers, etc. He concluded as follows:

1. About 10 percent of over 2,000 animals were limpers, more of which were seen following than leading bands;

2. Crippling was about equally distributed between front and hind legs;

3. Front-leg limpers commonly displayed swollen joints, sometimes the size of grapefruits; probable brucellar hygromas;

4. Noticeable swellings were not detected in hind-leg limpers;

5. Only a few limpers displayed swollen hoofs; probably necrobacillary hoof rot;

6. There appeared to be many barren cows.

Dr. Guthrie's observations on "limpers" revealed a higher incidence than we have ever seen. Even during the small Itkillik River die-off in 1961, I saw only about 2 percent limpers during a day's reconnaissance with a helicopter. Our calving ground work has yielded lower incidence rates. However, there is no doubt that ground observations of relatively undisturbed animals are more accurate in this regard. Perhaps in the future we should make a greater attempt to make ground observations during calving and the late summer and early fall. If a helicopter is available, suitable collections and observations would be much easier to make in adequate numbers.

A variety of observations on the parasites of caribou were again made as a routine matter. However, no new species or other particularly interesting observations were made. Therefore, a detailed consideration of the parasitological data will not be made at this time.

Sheep

OBJECTIVES

To obtain information on occurrence and incidence of diseases and parasites, and influences on sheep populations.

PROCEDURES

1. Hunter killed animals: Prior to the 1966 hunting season the general hunting public, guides, and all other interested parties will be contacted via news releases. All sheep hunters will be requested to take a sample of pellets and the jaws from their kill and forward these to their nearest game office.

2. Independent field work: Over the next few years an attempt will be made to collect fresh pellet samples at random or from known animals over a few representative sheep ranges in Alaska. These efforts will complement the contribution of specimens by hunters.

3. Laboratory analysis: Standardized procedures will be used for the isolation of coccidia and lungworm larvae from fecal pellets. A review of the theory and interpretation of pellet sample data will be made.

FINDINGS

With the exception of a limited amount of literature survey work, due to the press of other studies, this Job was essentially inactive during the past calendar year. Now that we have finally succeeded in reactivating the Sheep Work Plan by hiring a leader, it is hoped that progress on sheep disease field studies through a cooperative effort can be achieved during the coming year.

Alternate Host Species

OBJECTIVES

To determine the incidence and distribution of potential pathogens in Alaskan wildlife species, and alternate host species.

To determine the extent that such organisms may contribute to mortality or lowered productivity or economic value in the host 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.

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. Material will be emphasized which offers the possibility of contributing information of greatest originality or immediate application to problems at hand. In each instance an effort will be made to correlate data on pathogens with all other variables.

FINDINGS

A limited amount of data was accumulated during the past year from specimens obtained from the public and through the activities of the moose, wolf, and lynx work plans. These data are separately considered below.

Moose

Materials from several moose were of special interest. Two animals collected on Ft. Richardson by Department personnel both displayed foot problems. An adult female had an infected right front foot in which the medial toenail was partly eroded away, and there was localized swelling of the associated joint. The U. S. Department of Agriculture diagnostic laboratory, Ames, Iowa, was unable to recover any infectious organism in culture, perhaps because of the unsuitability of the frozen specimen, and voiced the opinion that its general appearance suggested that the toe was lost through "mechanical injury." A yearling male had excessively elongated toenails on all four hoofs. This is the first time the "long-toe" syndrome has been observed in a yearling, and it suggests that the condition is the result of a rapidly developing, probably non-infectious, process. Moness (1956) reported this condition in a Wyoming moose and implicated selonium toxicity. Thus far however, several Alaskan "long-toe" specimens submitted for selenium analysis have failed to reveal excessive quantities of this element. Perhaps some toxic principle from a plant species only rarely (accidently) eaten by moose is involved. In any case, the condition though potentially, severely debilitating is uncommon.

One of seven moose collected on the Tanana Flats during June, 1966, exhibited a particularly gruesome secondarily infected tumor of the upper eyelid. This completely covered the eye and was diagnosed at Bassett Army Hospital, Ft. Wainwright, as a malignant, "reticulum cell sarcoma." Whether eventual metastasis would have resulted in fatal cancer of another organ system is conjectural. Certainly the animal would have been at some disadvantage with the sight of only one eye.

All seven of the moose collected including the one just described carried light to moderate (several thousand) infestations of rumen flukes and a few specimens of Setaria sp. were also encountered in one animal. Taeniid tapeworm larvae were common as usual.

Several other cases of taeniid larvae in moose submitted by hunters from other areas are uninteresting and not worth further comment at this time.

Wolves

For the past several years departmental studies on wolves in S. E. Alaska have provided the opportunity to collect the internal organ samples from 50 or so wolves for examination for parasites. Most of these have been stored in the freezer for later study and during the past year it has been possible to process a few of the samples. Fourteen of 15 animals (94%) yielded from 14-90 (average 41) heads of presumably two species of tapeworms: Taenia hydatigena and T. krabbei. The larvae of these commonly occur in the Sitka black-tail deer on islands and the mainland of S. E. Alaska wherever wolves occur. Moose probably also serve as an intermediate host for these parasites in the Taku and Stikine River drainages and the Yakutat area. Rausch and Williamson (1959) report the finding of the larvae of a related canine tapeworm, Echinococcus granulosus, in a mountain goat killed near Haines and in a deer taken on Baranof Island. We have found the adult worm only once in several wolves examined prior to those now under discussion and have never observed the larvae (hydatid) in 50 or so deer from S. E. Alaska. Rausch and Williamson (op. cit.) found species of Taenia in 91% of 200 wolves from central and northern Alaska but did not comment on the relative intensities of the infestations. There are no published accounts of the parasites of wolves in S. E. Alaska.

Lynx

As a continuation of our project on lynx parasites summarized in extenso in last years segment report, we have examined 18 animals this year. This represents only part of the organ samples collected, the remainder being held in the freezer for examination as time permits. All of these were infested with one or more of the five species of roundworms and tapeworms reported last year. A detailed analysis of these data and that from the remainder of the specimens yet to be examined will be made at a later time.

LITERATURE CITED

Honess, R. F. and K. B. Winter. 1956. Diseases of wildlife in Wyoming. Bull. 9, pp. 1-279.

Rausch, R. L. and F. S. L. Williamson. 1959. S H F A XXXIV. The parasites of wolves, Canis lupus L. J. Parsit. 45:395-403.

Radiological Survey

OBJECTIVES

To determine the levels of strontium-90 and cesium-137 in Alaska game species and in vegetation on game ranges in Alaska.

PROCEDURES

Samples of meat and rumen will be taken from five animals from each of three main caribou herds in Alaska four times each year. These samples will be collected in conjunction with other studies whenever possible. Vegetation (lichen and sedge) and bone samples will be taken once each year in each area.

Reports and published literature will be reviewed and summarized.

FINDINGS

The data available on caribou, reindeer, and vegetation in the most recent report (August 1966) from the U. S. Public Health Service, who are doing the analytical work, is summarized in Tables 1-4 and Figures 1-5 which are reproduced in toto from their report. During calendar year 1966 the number of collections was reduced to two each year per area.

The spring collection has a target date of, on, or about March 15. Accordingly, in addition to that reported last year, analytical results for the spring 1966 caribou collections and fall 1965 vegetation collections were available for the August 1966 U. S. Public Health report. The fall 1966 caribou and vegetation collections will be reported on next year.

DISCUSSION

The data indicate that the cesium-137 content of spring 1966 meat samples from most caribou and reindeer herds equaled or slightly exceeded previous comparable high points. The data on the amounts of this radionuclide in rumen contents indicate that only in the arctic caribou and some reindeer herds were new high levels reached. The data on cesium-137 in bone and vegetation are too scanty for any meaningful comparison to be made, as are all the data on strontium-90.

Hanson (1966) reported the most recent data available to me at this time on human cesium-137 in Alaska. He found that the July and August 1965 body burdens of Anaktuvuk Pass residents were about 30 percent less than comparable values during 1964. He also found a decrease from the previous year of about 25 percent in the cesium-137 content of caribou meat samples taken from Eskimo food caches during 1964 and 1965. Presumably, if the cesium-137 content of caribou meat has increased in 1966, as the data indicate, we can expect increased body burdens in humans to be reported in the near future. It is not expected, however, that these values will exceed so-called "safe levels."

LITERATURE CITED

Hanson, W. C. 1966. Cesium-137 body burdens in Alaskan Eskimos during the summer of 1965. Science, 153:525-526.

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Table 1. Summary Table of Radionuclide Concentrations in Caribou and Reindeer Muscle Samples.

Sampling Dates	Number of Samples	Concentrations in pCi/kg wet weight				
		^{89}Sr Average	^{90}Sr Average	^{137}Cs Average	^{137}Cs Minimum	^{137}Cs Maximum
Caribou						
Arctic Herd (C-1)						
December 63	3	[a]<5	[a]17	4,860	3,750	5,680
May 64	5	[a]<5	[a]400	13,800	5,000	21,000
August 64	5	[a]<5	[a]40	700	400	1,000
October 64	5	[a]<5	[a]19	6,880	5,200	11,000
December 64	5	[a]<5	[a]19	3,900	1,400	5,300
April 65	5	[a]<5	[a]22	9,600	6,300	14,000
September 65	5	[a]<5	[a]11	7,720	4,000	12,000
November 65	5	[a]<5	[a]1	6,220	4,300	7,400
March 66	5	[a]<5	[a]26	18,400	16,000	22,000
Nelchina Herd (C-2)						
November 63	5	[a]5	[a]33	21,800	16,900	26,400
April 64	5	[a]10	[a]54	5,560	2,600	10,000
August 64	1	<5	31	14,300		
October 64	9	[a]5	[a]20	4,220	650	6,200
December 64	5	[a]<5	[a]30	14,000	7,900	22,000
March 65	5	[a]<5	[a]48	27,600	16,000	39,000
July 65	5	[a]<5	[a]7	4,000	1,600	7,300
September 65	5	[a]<5	[a]26	8,160	5,900	10,000
December 65	5	[a]<5	[a]33	17,200	14,000	22,000
Peninsula Herd (C-3)						
December 63	5	[a]10	[a]84	44,800	33;600	57,700
April 64	5	[a]<5	[a]14	14,800	12,000	18,000
July 64	4	[a]<5	[a]5	1,680	1,400	2,000
September 64	5	[a]<5	[a]11	4,630	1,200	9,250
December 64	5	[a]<5	31	18,000	8,700	31,000
August 65	5	[a]<5	[a]4	2,000	820	3,200
September 65	5	[a]<5	[a]15	18,000	11,000	32,000
November 65	5	[a]<5	[a]7	20,100	12,400	25,000
March 66	5	[a]<5	[a]18	43,800	41,000	46,000
Reindeer						
Kotzebue Herd (R-1)						
December 63	4	[a]<5	[a]31	7,190	6,730	7,540
September 64	5	[a]<5	[a]74	3,340	2,300	4,900
December 64	4	[a]<5	[a]268	23,000	13,000	30,000
Selawik Herd (R-2)						
December 64	1	<5	578	34,000		

Table 1. Summary Table of Radionuclide Concentrations in Caribou and Reindeer Muscle Samples (Continued).

Sampling Dates	Number of	Concentrations in pCi/kg wet weight				
		^{89}Sr Average	^{90}Sr Average	^{137}Cs Average	^{137}Cs Minimum	^{137}Cs Maximum
Buckland & Candle Herd (R-3)						
September 64	2	[a]5	[a]68	19,600	13,400	25,800
December 64	4	[a]5	[a]64	14,000	5,100	32,000
Shishmaref Herd (R-4)						
September 64	3	[a]5	[a]38	8,490	7,660	10,100
December 64	5	[a]5	[a]68	12,000	4,900	29,000
March 65	5	[a]5	[a]25	18,000	13,000	24,000
September 65	5	[a]5	[a]14	6,000	4,000	8,100
November 65	5	[a]5	[a]25	16,800	14,000	22,000
February 66	5	[a]5	[a]55	18,600	15,000	23,000
Teller Herd (R-5)						
December 64	5	[a]5	[a]66	35,000	25,000	47,000
November 65	5	[a]5	[a]90	27,000	23,000	35,000
June 66	5	-	-	19,000	17,000	21,000
Golovin Herd (R-6)						
December 64	5	[a]5	[a]96	19,000	11,000	30,000
Stebbins (R-7)						
December 64	5	[a]5	[a]86	30,000	14,000	37,000
Nunivak I. Herd (R-8)						
September 64	5	[a]5	[a]75	7,050	5,000	9,200
December 64	5	[a]5	[a]128	25,000	9,800	35,000
April 65	5	[a]5	[a]28	31,200	27,000	34,000
August 65	35	[b]--	[b]--	7,700	4,000	15,000
January 66	5	[a]5	[a]90	27,200	25,000	31,000
April 66	5	[a]5	[a]21	33,400	32,000	34,000
St. Paul I. Herd (R-9)						
September 64	4	[a]5	[a]10	4,860	2,080	7,530
November 64	5	[b]--	[b]--	13,000	4,400	16,000
Nome Herd (R-10)						
June 66	5	-	-	22,000	17,000	27,000
Deering Herd (R-13)						
December 64	5	[a]5	[a]127	28,000	23,000	34,000

[a] Indicates samples composited before analysis.

[b] Dash indicates no analysis.

Table 2. Summary Table of Radionuclide Values in Alaskan Caribou and Reindeer Rumen Content Samples.

Sampling Dates	Number of Samples	pCi/kg wet weight				
		^{89}Sr	^{90}Sr	^{137}Cs		
				AVERAGE	Minimum	Maximum
Caribou						
Arctic Herd						
12/21/63	3	[a]500	[a]4,440	4,430	3,980	4,770
4/27-5/19/64	5	[a]<5	[a]1,680	4,440	4,000	6,000
8/20-8/29/64	5	[a]40	[a]1,700	1,470	970	2,200
10/2-10/23/64	5	[a]<5	[a]4,500	5,080	4,400	6,100
12/7-12/15/64	5	[a]<5	[a]4,020	4,100	1,800	6,300
4/14/65	5	[b]--	[b]----	[a]8,400		
9/20-10/2/65	5	[b]--	[b]----	[a]4,700		
11/16/65	5	[b]--	[b]----	[a]5,600		
3/23/66	5	[b]--	[b]----	[a]6,200		
Nelchina Herd						
11/24-11/25/63	5	[a]400	[a]5,150	4,880	1,100	7,430
4/24-4/26-64	5	[a]<5	[a]1,550	8,400	2,500	12,000
8/26/64	1	<5	346	8,900		
10/15/64	9	[a]<5	[a]207	3,030	550	4,500
12/8-12/9/64	5	[a]<5	[a]4,430	7,200	4,300	9,000
3/27/65	5	[b]--	[b]----	[a]8,600		
7/27-7/28/65	5	[b]--	[b]----	[a]5,100		
9/25-9/29/65	5	[b]--	[b]----	[a]7,600		
12/4/65	5	[b]--	[b]----	[a]6,500		
3/23/66	5	[b]--	[b]----	[a]4,900		
Peninsula Herd						
12/12-12/19/63	5	[a]1,550	[a]5,700	7,920	4,020	12,300
4/9-4/15/64	5	[a]<5	[a]1,300	1,840	1,400	2,600
7/11/64	5	[a]<5	[a]311	690	620	740
9/26-10/1/64	5	[a]<5	[a]825	5,890	1,500	13,300
12/14-12/17/64	5	[a]3,120	[a]2,410	4,900	2,200	8,000
8/26/65	5	[a]<5	[a]487	[a]770		
9/29/65	5	[b]--	[b]----	[a]6,600		
11/10/65	5	[b]--	[b]----	[a]8,100		
3/31/66	5	[b]--	[b]----	[a]9,900		
Reindeer						
R-1						
12/27/63	4	[a]<5	[a]5,600	4,650	3,760	5,360
12/15/64	5	[a]<5	[a]4,480	5,400	2,300	7,900
R-2						
12/15/64	1	<5	3,910	6,900		
R-3						
9/26/64	1	<5	315	10,900		
12/15/64	3	[a]<5	[a]5,810	5,500	5,200	5,700

Table 2. Summary Table of Radionuclide Values in Alaskan Caribou and Reindeer Rumen Content Samples (Continued).

Sampling Dates	Number of Samples	pCi/kg wet weight				
		^{89}Sr	^{90}Sr	^{137}Cs		
				AVERAGE	Minimum	Maximum
R-4						
9/25/64	1	<5	1,710	5,770		
12/15/64	5	[a]<5	[a]2,440	1,900	1,100	2,700
11/30/65	5	[b]--	[b]----	[a]5,000		
2/17/66	5	[b]--	[b]----	[a]7,400		
R-5						
11/30/65	5	[b]--	[b]----	[a]5,600		
6/16/66	5			[a]1,800		
R-8						
9/18/64	5	[a]5	[a]3,060	3,600	2,500	4,510
12/24/64	5	[a]5	[a]4,040	5,400	1,100	10,000
1/10/66	5	[b]--	[b]----	[a]6,000		
4/1/66	5	[b]--	[b]----	[a]14,000		
R-9						
9/24/64	4	[a]<5	[a]720	1,070	660	1,900
11/19-11/20/64	5	[b]--	[b]----	4,400	1,700	8,500
R-10						
6/13/66	5			[a]5,900		
R-11						
12/15/64	5	[a]<5	[a]4,930	4,600	2,400	7,400

[a] Indicates samples composited before analysis.

[b] Dash indicates no analysis.

Table 3. Summary Table of Radionuclide Values in Alaskan Caribou and Reindeer Bone Samples.

Specimens & Sampling Dates	Number of Samples	pCi/g ash		pCi/kg wet weight		
		^{89}Sr	^{90}Sr	^{137}Cs		
				AVERAGE	Minimum	Maximum
Arctic Herd						
12/21/63	3	[a]60	[a]225	170	120	210
4/27-5/19/64	5	[a]<5	[a]143	[b]----		
8/20-8/29/64	5	[a]<5	[a]137	[b]----		
10/2-10/23/64	5	[a]<5	[a]128	714	510	920
12/7-12/15/64	5	[a]<5	[a]125	[b]----		
Nelchina Herd						
11/24-11/25/63	5	[a]<5	[a]117	920	520	1,940
4/24-4/26/64	5	[a]<5	[a]143	[b]----		
8/26/64	1	<5	84	820		
10/15/64	9	[a]<5	[a]84	790	470	1,000
12/8/64	5	[a]<5	[a]69	[b]----		
Peninsula Herd						
12/12-12/19/63	5	[a]<5	[a]118	3,920	3,240	4,780
4/9-4/15/64	5	[a]<5	[a]116	[b]----		
9/26-10/1/64	5	[a]<5	[a]114	810	[c]ND	2,180
7/11/64	4	[a]<5	[a]115	[b]----		
12/14-12/17/64	5	[a]<5	[a]169	[b]----		
8/26/65	5	[a]<5	[a]776	[b]----		

[a] Indicates samples composited before analysis.

[b] Dash indicates no analysis.

[c] ND indicates not detectable.

Table 4. Table of Laboratory Analytical Results Alaskan Caribou and Reindeer Sampling Program Special Samples (Vegetation).

Sample Number	Sample Type	Location	Collection Date	Other Sample Information	Radionuclides Cs-137	Sr-89	Sr-90
FGV-1	Lichens	Nelchina Area	8/30/65		27,000	<5	13,000
FGV-2	Sedges	Nelchina Area	8/30/65		14,000	<5	4,410
FGV-3	Lichens	Alaska Peninsula Area	9/27/65		14,000	<5	6,420
FGV-4	Sedges	Alaska Peninsula Area	9/27/65		12,000	<5	470
FGV-4	Lichens	Anaktuvuk Pass	11/1/65		2,400	<5	7,100
FGV-6	Sedges	Anaktuvuk Pass	11/4/65		8,700	<5	2,700

FIGURE 1

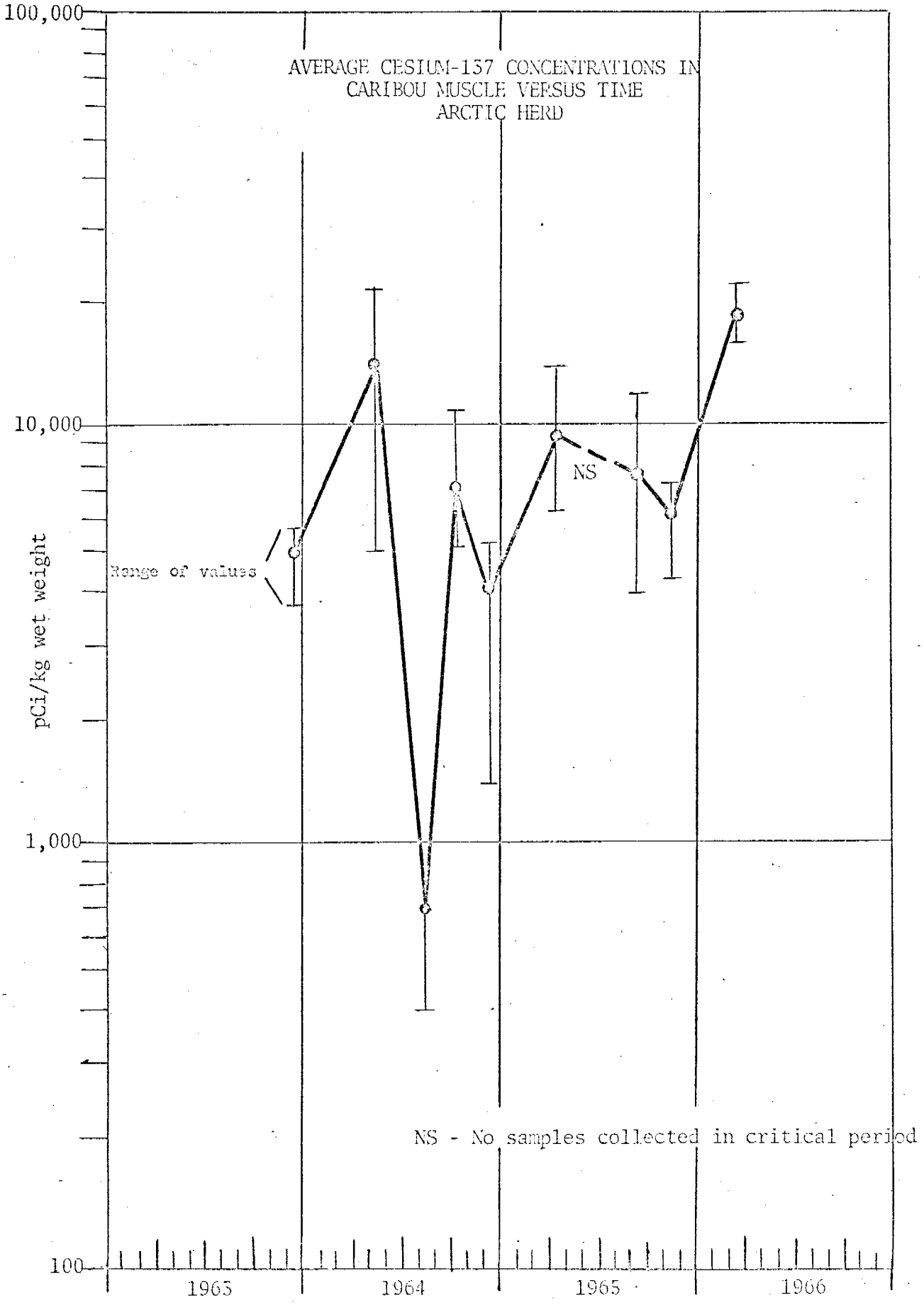

AVERAGE CESIUM-137 CONCENTRATIONS IN
CARIBOU MUSCLE VERSUS TIME
ARCTIC HERD
100,000
10,000
1,000
100
pCi/kg wet weight
Range of values
NS
NS - No samples collected in critical period
1963
1964
1965
1966

FIGURE 2

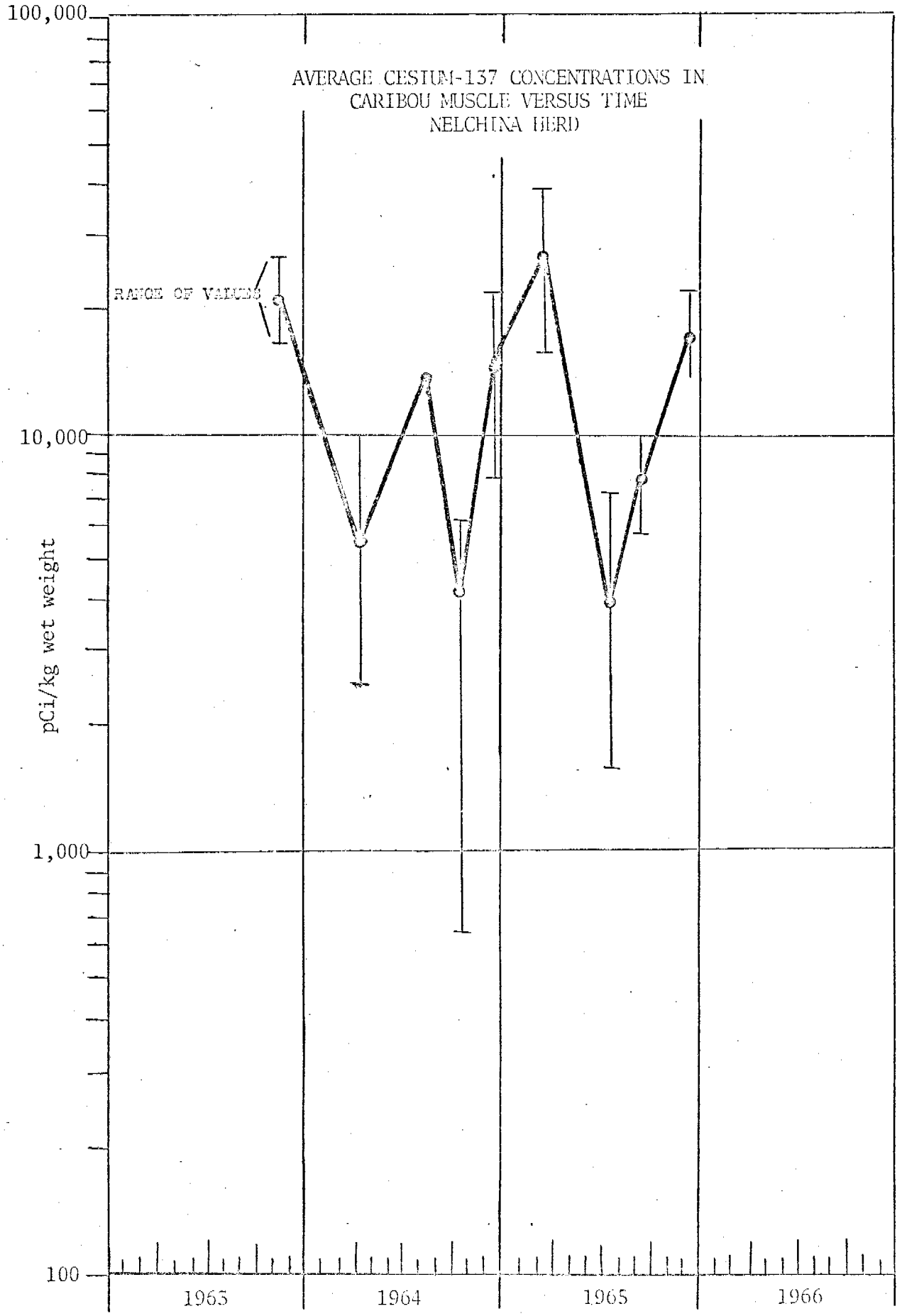

AVERAGE CESIUM-137 CONCENTRATIONS IN
CARIBOU MUSCLE VERSUS TIME
NELCHINA HERD
RANGE OF VALUES
100,000
10,000
1,000
100
pCi/kg wet weight
1963
1964
1965
1966

FIGURE 3

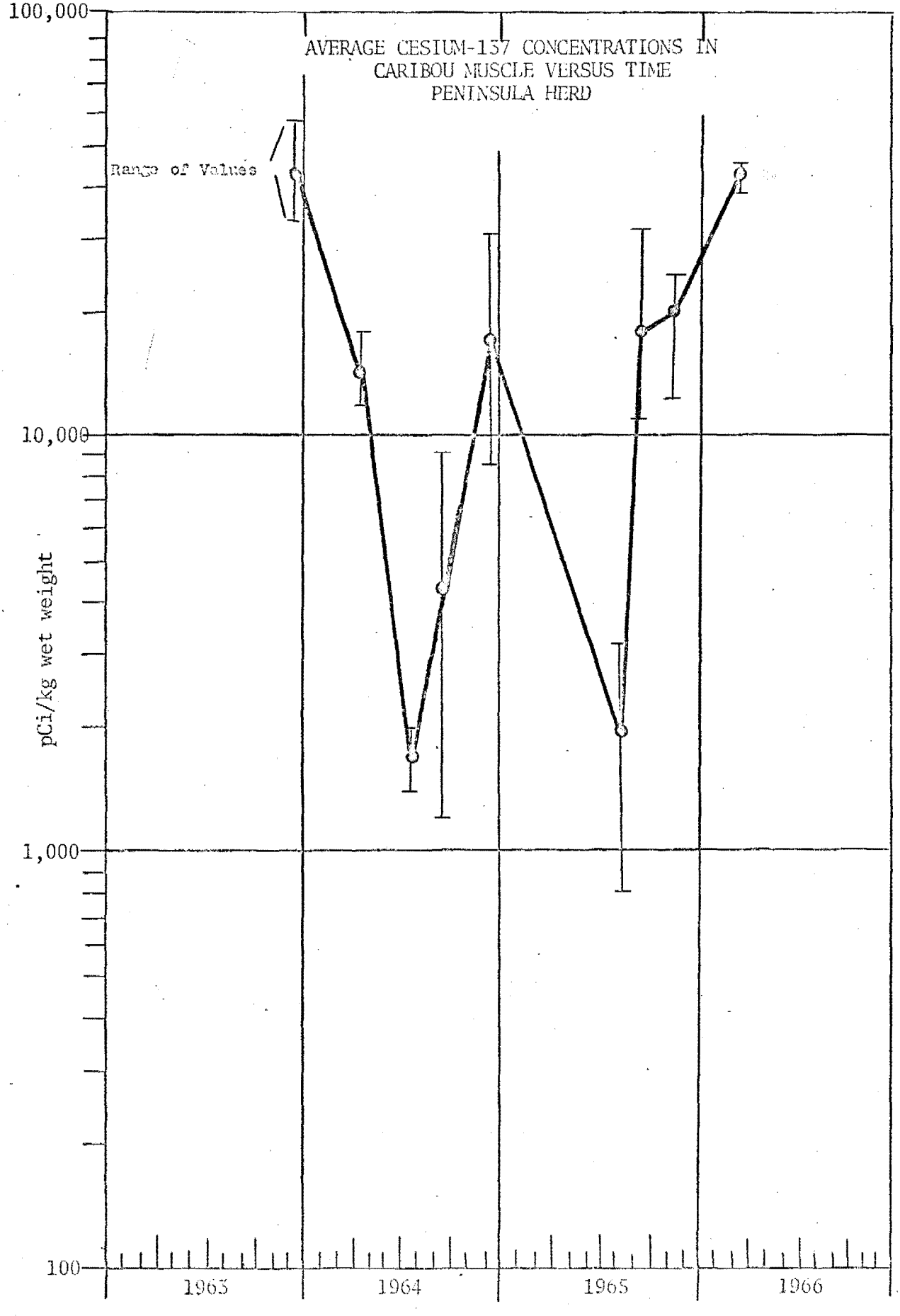

AVERAGE CESIUM-137 CONCENTRATIONS IN
CARIBOU MUSCLE VERSUS TIME
PENINSULA HERD
Range of Values
100,000
10,000
1,000
100
pCi/kg wet weight
1963
1964
1965
1966

FIGURE 4

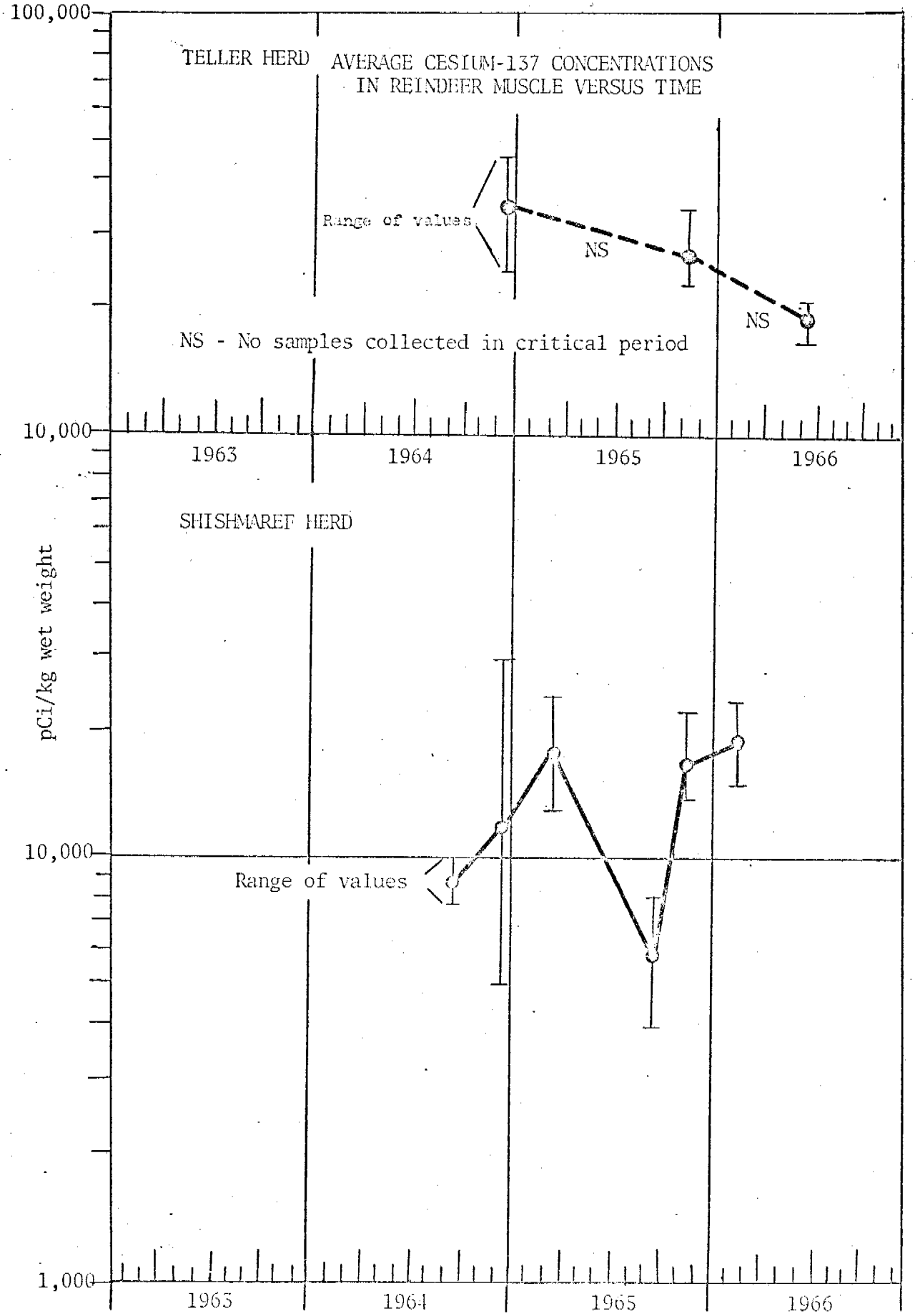
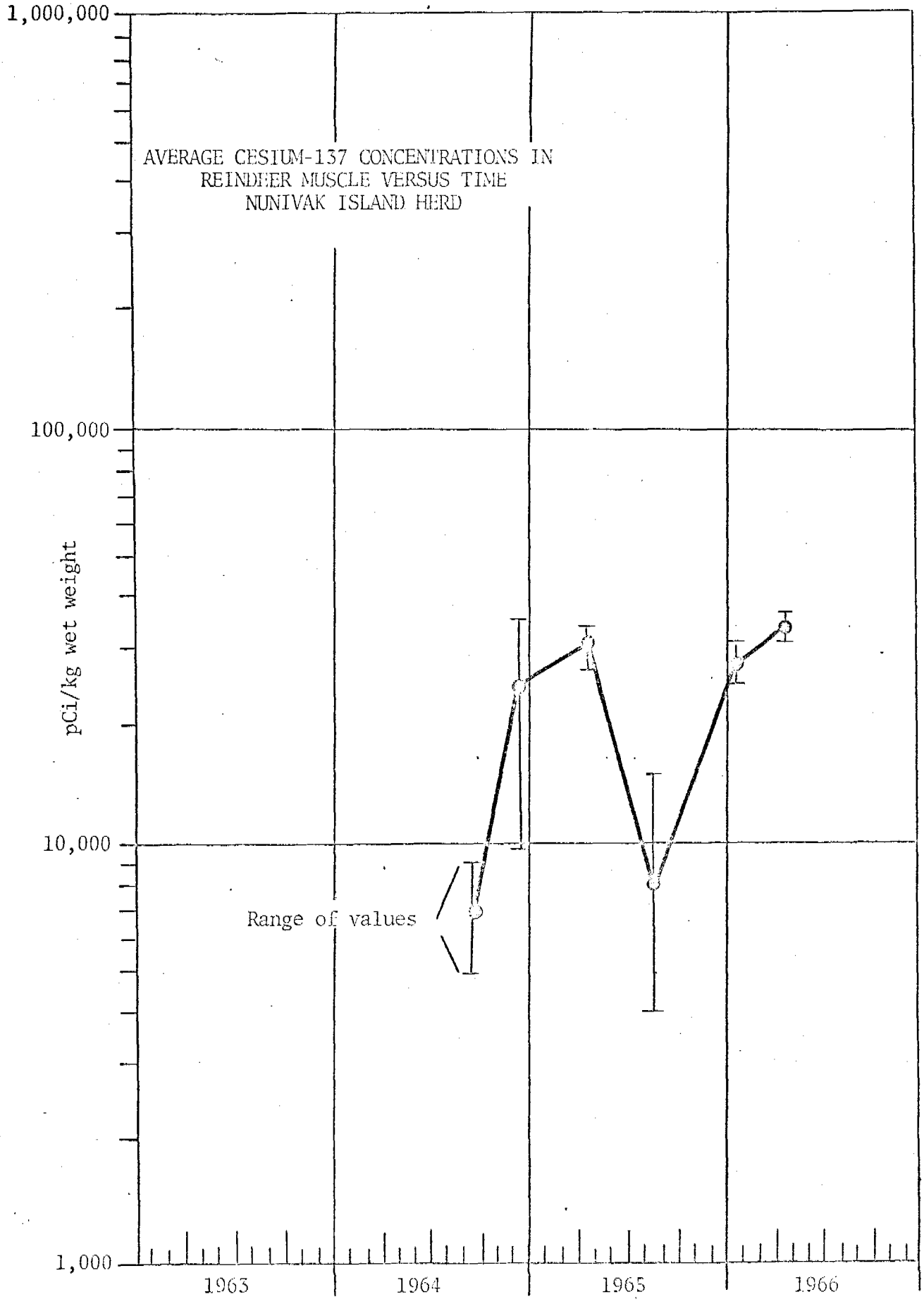

TELLER HERD
AVERAGE CESIUM-137 CONCENTRATIONS
IN REINDEER MUSCLE VERSUS TIME
Range of values
NS
NS
NS - No samples collected in critical period
100,000
10,000
1963
1964
1965
1966
SHISHMAREF HERD
pCi/kg wet weight
10,000
Range of values
1,000
1963
1964
1965
1966

FIGURE 5


AVERAGE CESIUM-137 CONCENTRATIONS IN
REINDEER MUSCLE VERSUS TIME
NUNIVAK ISLAND HERD
1,000,000
100,000
10,000
1,000
pCi/kg wet weight
Range of values
1963
1964
1965
1966