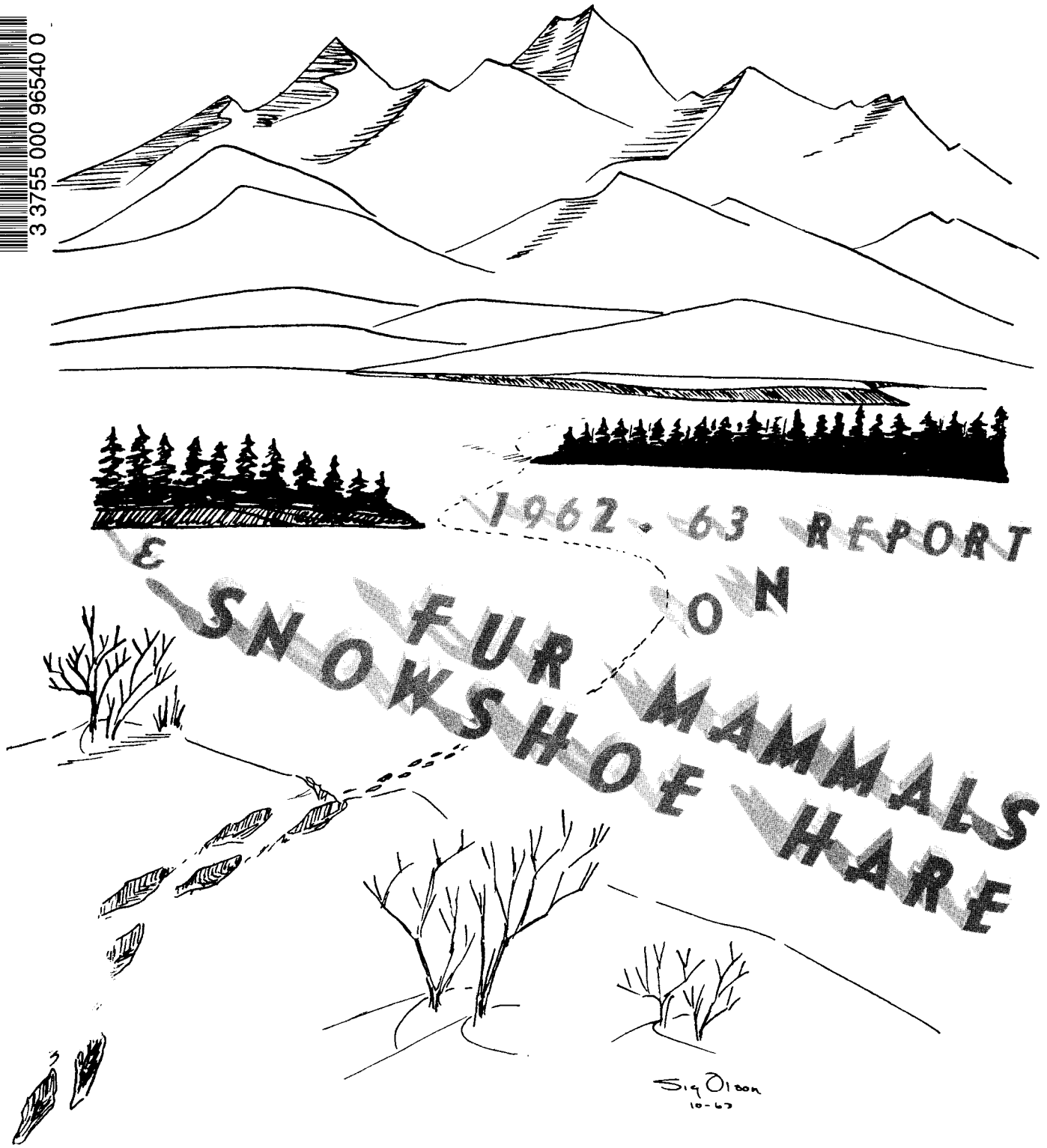

ALASKA DEPARTMENT OF FISH AND GAME

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JUNEAU, ALASKA

ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

STATE OF ALASKA
William A. Egan, Governor

DEPARTMENT OF FISH AND GAME
Walter Kirkness, Commissioner

DIVISION OF GAME
James W. Brooks, Director
Don H. Strode, Federal Aid Coordinator

FUR MAMMAL REPORT
AND
SNOWSHOE HARE REPORT

by

John J. Burns
Jerry L. Hout
Albert W. Erickson
David L. Chesemore
Frank B. Day

Volume IV
Annual Project Segment Report
Federal Aid in Wildlife Restoration
Project W-6-R-4, Work Plan G & H

The subject matter contained within these reports is often fragmentary in nature and the findings may not be conclusive; consequently, permission to publish the contents is withheld pending permission of the Department of Fish and Game.

(Printed January 1964)

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TABLE OF CONTENTS

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 1

PERIOD COVERED: July 1, 1962 to June 30, 1963

ABSTRACT

An initial comparison of characteristics among selected populations of mink in Interior Alaska, was begun with specimens from two areas. The samples consisted of 57 mink from the Aniak area and 50 from the Fort Yukon area. Fort Yukon is the type locality for the subspecies Mustela vison ingens, found north of the Alaska Range. The samples were qualitatively and quantitatively compared to determine taxonomic affinities or differences. The type and degree of variation in cranial measurements and body length, as well as pelage characteristics, indicated that the sample of mink from the Aniak area was subspecifically distinct from the topotype specimens. They have been designated as Mustela vison aniakensis.

RECOMMENDATIONS

Certain areas of interior and western Alaska are noted for their production of large numbers of high quality mink, while other areas have only poor production. In addition to environmental differences between areas, differing rates of production may also be due to inherent differences among the various populations of mink.

This study is an attempt to recognize affinities and differences between the various populations of mink, as a step toward a better knowledge of the interaction of environment and heredity. It is assumed that significant taxonomic differences have their basis in heredity, which may also affect characteristics of reproduction. This study should be continued until samples of mink from the major areas of production are analyzed.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 1

PERIOD COVERED: July 1, 1962 to June 30, 1963

OBJECTIVES

To develop methods and criteria for age and sex determination of mink by skull characteristics, eliminating the need for aquiring entire carcasses; to compile information on the habitat requirements of mink in different areas of Alaska; and to clarify the taxonimic status of Mustela vison ingens.

TECHNIQUES

Mink carcasses were obtained from various areas in Alaska including Nunivak Island, Aniak, Fort Yukon, Beaver, Selawik, the Seward Peninsula, and the Yukon-Kuskokwim Delta. Standard body measurements were recorded for all specimens, and the skulls, femurs and bacula were processed by boiling. Stomachs were preserved for analysis at a later date. Skulls were measured using dial calipers, and data were recorded to the nearest hundredth of a millimeter. Measurements recorded are those outlined by Hall (1951), with the addition of cranium width (outlined by Bährens, 1961).

Of the several areas from which mink carcasses were obtained, only two groups were chosen for comparison at this time. These are a sample of 57 mink from the Aniak area, and 50 from the Fort Yukon area.

It was decided to begin a taxonomic analysis of Mustela vison ingens with these two samples for the reasons that Fort Yukon is the type locality from which Osgood (1900) described the subspecies; and the sample of specimens from Aniak exhibited a high degree of variation from the Fort Yukon (topotype) specimens.

The following pairs of measurements were chosen for a comparison: Cranium width and basilar length (of Hensel), interorbital breadth and depth of skull at the posterior borders of M1, breadth and length of M1, basilar length (of Hensel) and breadth of rostrum, and orbitonasal length and zygomatic breadth.

For purposes of this report, analyses of the above pairs of measurements plotted on scattergrams are discussed. A more thorough treatment including bivariate analysis, consideration of the allometry coefficient (k, in the allometry equation $y = bx^k$, Huxley, 1932), and a more satisfactory statistical treatment will be made when time permits.

It will be noted that the variance and standard deviation in Tables 1 and 2 are logarithmic. This is the result of calculations made using logarithms of the empirical data, borrowed from another method of treatment.

FINDINGS

Recognizable qualitative differences exist between mink from certain geographical areas within what is generally termed Interior Alaska. Mink from the Fort Yukon area are noted for their large size, and long thick underfur. They accordingly command high prices. Mink from the Aniak area are smaller (by approximately 13 per cent), have shorter, silkier fur, and a less dense pile.

These differences are not only qualitative, but are apparent upon quantitative comparison. It must be kept in mind that in mink (as will as other mammals), the larger animals possess a smaller brain than the smaller animals in relation to their total size. Thus, in a statistical comparison, such as presented here, the differences observed are not of the true magnitude revealed by bivariate allometrical comparison. However, the present treatment of data indicate differences of high significance.

Basilar Length (of Hensel) and Cranium Width

The scattergrams (Figures 1a and 2a) show signigicant differences in this variate pair of measurements for both male and female mink from the Aniak and Fort Yukon areas. Basilar length and cranium width are larger in the mink from the Fort Yukon area. Between the two samples of males there is no overlap, while in the females, the values although greater for the

Fort Yukon mink are more closely grouped. The important difference between the two samples of females is in the slope of the curve, indicating a different relationship of basilar length to cranium width. The differences in slope contradict any claim to the possibility that the female specimens from Fort Yukon are merely larger members of the same population of mink.

Interorbital Breadth and Depth of Skull at the Posterior Borders of M1

Comparison of this pair of measurements (Figures 1b and 2b), for both males and females indicate that in both sexes the Fort Yukon mink are larger than those from the Aniak area. For both sexes, the relationship of breadth to depth of skull is again different in the two populations.

M1, Breadth and Length

As was expected in a comparison of dentition, there is not the range of variation exhibited in the other pairs of measurements being considered. As was true of interorbital breadth and depth of skull, the relationship of length and width of M1, is different for the two mink populations (for both sexes), as observed in differences in the slope of the curve (Figures 3 and 4).

Basilar Length and Breadth of Rostrum

There was no overlap in this variate pair of measurements between male specimens from either population. Male mink from Fort Yukon had both a greater average basilar length and a wider breadth of rostrum. Among females there was some overlap, but again the slope of the curves was different between areas.

Orbitonasal Length and Zygomatic Breadth

The orbitonasal length of both males and females fell between rather narrow limits. On the basis of this measurement alone there was a considerable degree of overlap between the two populations. When plotted against zygomatic breadth, the resulting scattergrams showed no overlap as this measurement was much greater for the sample from the Fort Yukon area. The slope of the curves for males was quite similar, while for females it was significantly different.

Tables 1 and 2 illustrate the range in measurements, and their mean values. Among male mink from the two sample areas there was only a slight degree of overlap between the ranges of three measurements; length and breadth of M1 (as would be expected in dentition, which is not as variable as other characteristics), and orbitonasal length (the dimensions of which are controlled to a large degree by characteristics of dentition).

Skull characteristics of the smaller animals of both groups, the females, more closely approximated each other. There was some overlap in the ranges of most of the characters considered.

It will be noted however, that in no case did the mean value of a skull character from the Aniak sample exceed that of the same character from the Fort Yukon sample. This is significant in view of the narrow range between which measurements of similar characteristics occurred in each sample.

Total Length

As mentioned previously, small mink will have skulls which are larger, in proportion to total body size, than the skulls of bigger animals. A discussion of the total length of mink from the two sample areas is included here to present a more complete picture of their differences.

The mean total length of males from the Aniak area ($\bar{x}$ = 53.1 cm, S = 3.118), was much less than the mean total length of males from Fort Yukon ($\bar{x}$ = 62.9 cm, S = 3.525). The mean total length of females from the Aniak area was 48.3 cm (S = 2.402), while the value for females from Fort Yukon was 55.1 cm (S = 2.362).

CONCLUSIONS

The subspecies of mink found throughout Alaska, north of the Alaska Range (*Mustela vison ingens* Osgood) is noted for its extreme large size and excellent fur qualities. This subspecies has received little attention, and within large areas of its supposed range, no specimens have been secured and analyzed. The central Kuskokwim River region, in the vicinity of Aniak, is one such area. Mink from this region are unique in that they are the smallest produced north of the Alaska Range. These mink vary both qualitatively and quantitatively to the extent that on the subspecific level, they bear no resemblance to the topotype specimens from Fort Yukon. In

Table 1. Comparison of Skull Measurements of Male Mink from the Aniak and Fort Yukon Areas of Interior Alaska.

	Skull Measurement	Maximum	Minimum	N	Mean	Log S^2	Log S
Aniak Area							
	Cranium width	29.9 mm	27.0 mm	27	28.4 mm	.00011	.0105
	Interorbital breadth	14.5	12.4	27	13.6	.00030	.0173
	Depth of skull	16.2	14.3	27	15.2	.00023	.0152
	Breadth M1	6.6	5.5	27	6.1	.00038	.0195
	Length M1	4.1	3.1	27	3.6	.00096	.0310
	Basilar length	61.0	54.9	27	58.5	.00019	.0138
	Breadth of rostrum	18.6	15.2	27	17.3	.00038	.0195
	Orbitonasal length	20.1	17.1	27	18.5	.00044	.0210
	Zygomatic breadth	38.4	31.9	27	35.5	.00040	.0200
Fort Yukon Area							
	Cranium width	33.8	30.0	26	32.1	.00015	.0123
	Interorbital breadth	18.3	15.0	27	16.4	.00050	.0223
	Depth of skull	18.2	16.4	27	17.5	.00023	.0152
	Breadth M1	7.1	6.2	27	6.7	.00030	.0173
	Length M1	4.8	4.0	27	4.4	.00046	.0214
	Basilar length	69.7	62.6	27	66.9	.00019	.0138
	Breadth of rostrum	22.7	19.0	27	20.5	.00038	.0195
	Orbitonasal length	21.0	18.1	25	19.8	.00032	.0179
	Zygomatic breadth	45.7	40.3	25	43.3	.00020	.0142

Table 2. Comparison of Skull Measurements of Female Mink From the Aniak and Fort Yukon Areas of Interior Alaska.

	Skull Measurement	Maximum	Minimum	N	Mean	Log S^2	Log S
Aniak Area							
	Cranium width	28.6	24.9	30	26.9	.00017	.0131
	Interorbital breadth	14.6	11.4	29	12.7	.00071	.0267
	Depth of skull	15.2	13.0	29	14.1	.00035	.0187
	Breadth M1	6.3	5.1	30	5.5	.00055	.0234
	Length M1	3.7	2.7	30	3.2	.00130	.0360
	Basilar length	58.5	50.7	30	55.0	.00031	.0176
	Breadth of rostrum	18.1	14.5	30	16.1	.00055	.0234
	Orbitonasal length	18.7	15.5	28	17.2	.00048	.0219
	Zygomatic breadth	35.6	30.4	28	32.7	.00041	.0202
Fort Yukon Area							
	Cranium width	31.0	27.7	24	29.4	.00013	.0114
	Interorbital breadth	15.8	13.7	24	14.6	.00030	.0173
	Depth of skull	16.5	14.5	24	15.6	.00021	.0145
	Breadth M1	6.4	5.6	24	6.1	.00026	.0161
	Length M1	4.0	3.1	24	3.7	.00065	.0255
	Basilar length	62.5	55.0	24	59.9	.00021	.0145
	Breadth of rostrum	19.7	17.1	24	18.4	.00030	.0173
	Orbitonasal length	18.9	16.9	24	18.0	.00013	.0114
	Zygomatic breadth	40.4	36.0	24	38.0	.00026	.0161

Figure 1b.

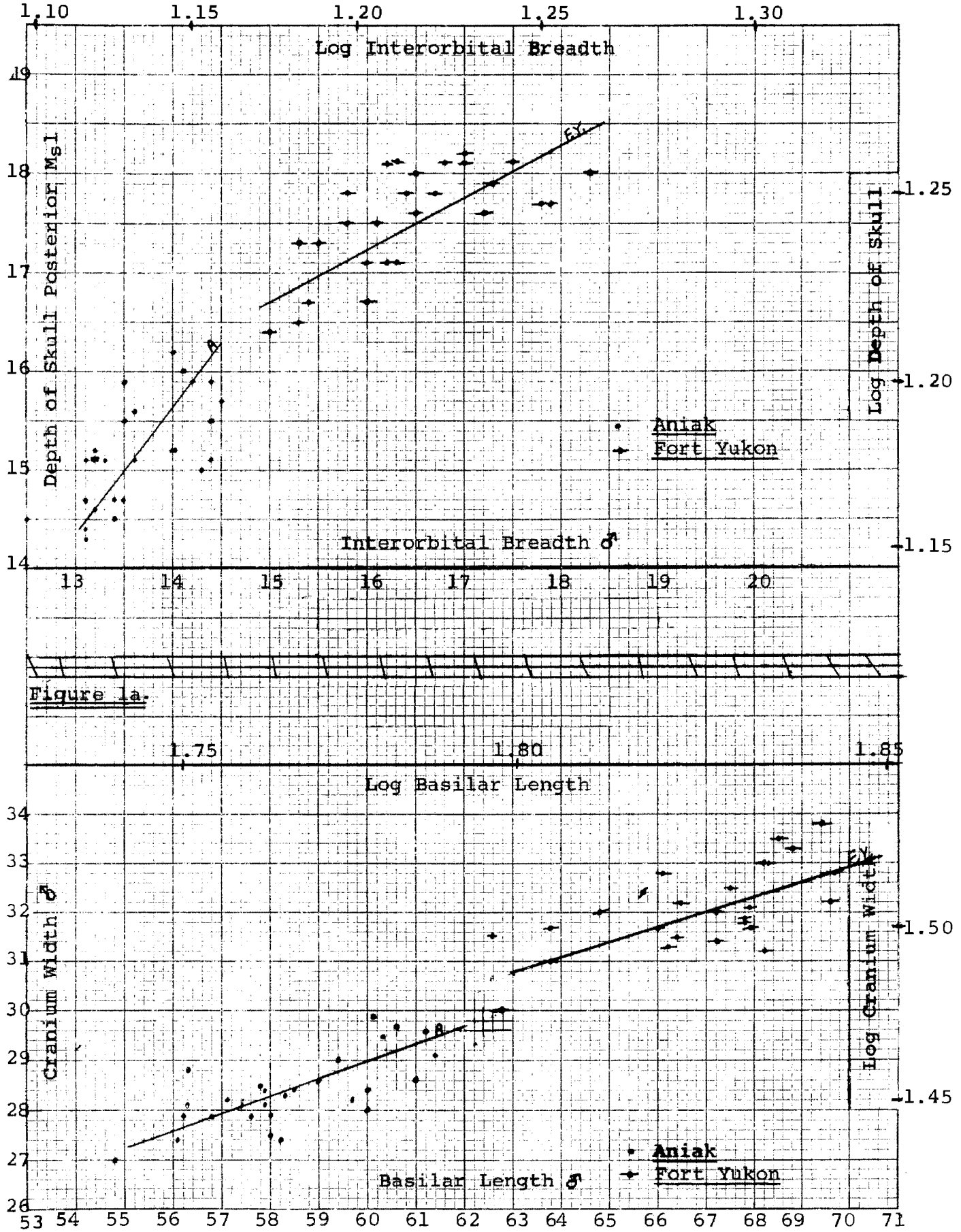

Figure 1a.

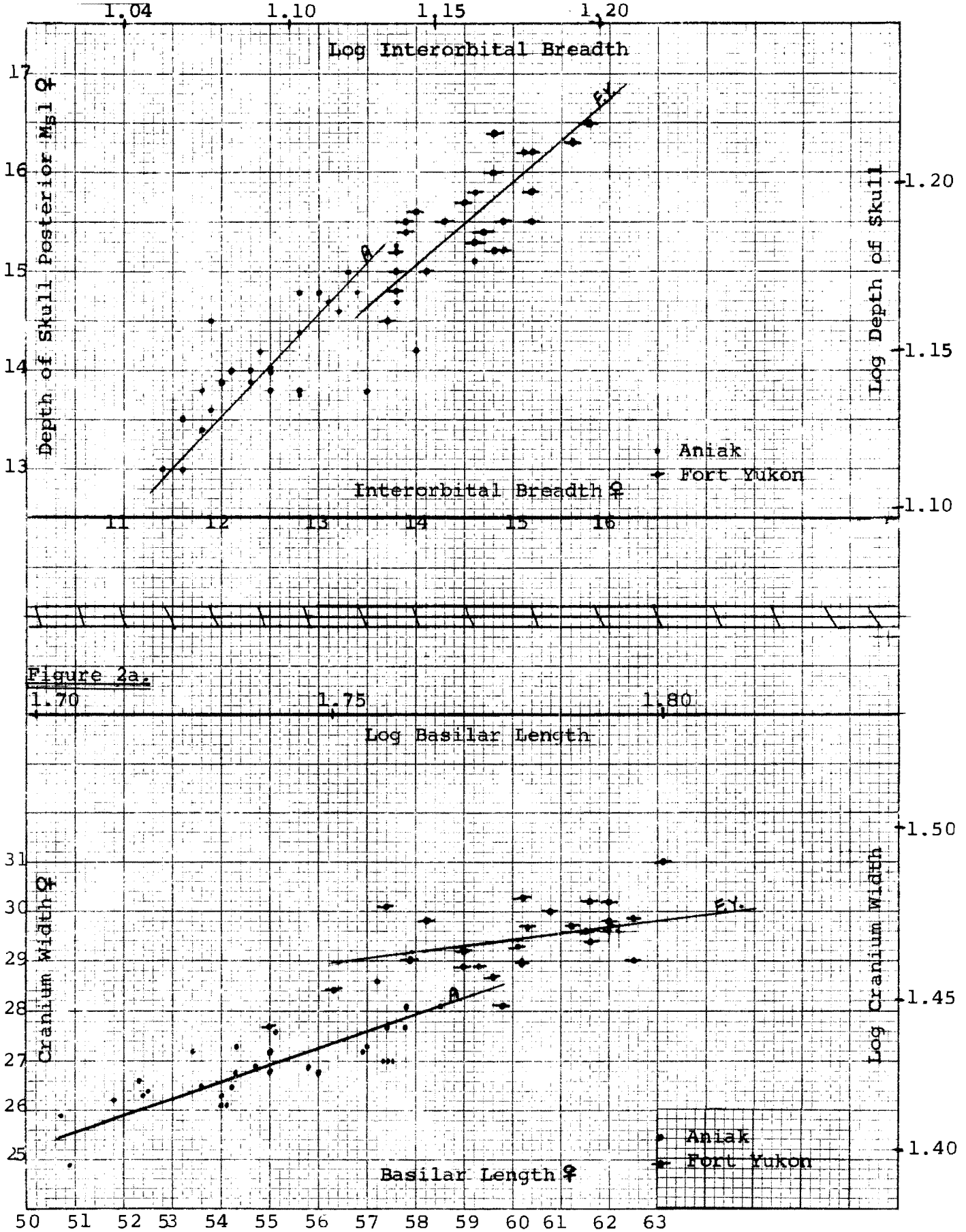
1.04
1.10
1.15
1.20
Log Interorbital Breadth
Depth of Skull Posterior Msl ♀
17
16
15
14
13
Log Depth of Skull
1.20
1.15
1.10
F.Y.
♂
♀
Aniak
Fort Yukon
Interorbital Breadth ♀
11
12
13
14
15
16

Figure 2a.

1.70
1.75
1.80
Log Basilar Length
Cranium Width ♀
31
30
29
28
27
26
25
Log Cranium Width
1.50
1.45
1.40
F.Y.
♂
♀
Aniak
Fort Yukon
Basilar Length ♀
50
51
52
53
54
55
56
57
58
59
60
61
62
63

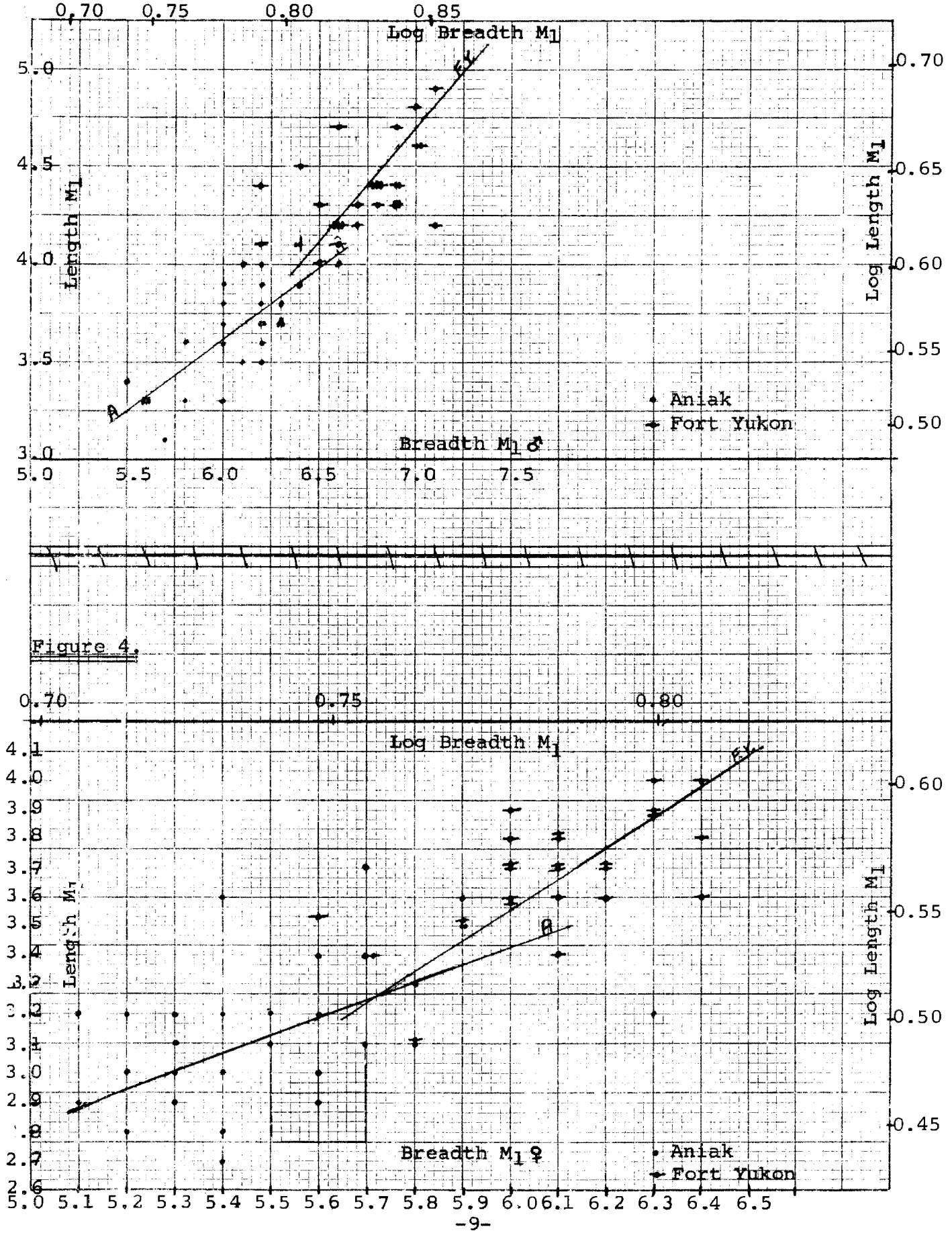
0.70
0.75
0.80
0.85
Log Breadth M1
5.0
4.5
4.0
3.5
3.0
Length M1
0.70
0.65
0.60
0.55
0.50
Log Length M1
Aniak
Fort Yukon
Breadth M1 ♂
5.0
5.5
6.0
6.5
7.0
7.5
0.70
0.75
0.80
Log Breadth M1
4.1
4.0
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
Length M1
0.60
0.55
0.50
0.45
Log Length M1
Breadth M1 ♀
Aniak
Fort Yukon
5.0 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.9 6.0 6.1 6.2 6.3 6.4 6.5

Figure 4.

light of the kind and degree of differences exhibited between the two populations of mink considered, I feel that the sample from the Aniak area is subspecifically distinct, and have chosen to call it Mustela vison aniakensis.

ACKNOWLEDGEMENTS

I am indebted to the many trappers from Fort Yukon and Aniak, that sent in mink carcasses for examination. I am especially thankful to Conservation Officer, Leroy Bohuslov, who personally acquired all of the specimens from trappers in the village of Aniak.

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LITERATURE CITED

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WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 2-a

PERIOD COVERED: July 1, 1962 to June 30, 1963

ABSTRACT

A study area was selected on the Moose Range and due to the lack of beaver activity on the Range, another study area was selected and studied across Cook Inlet on the Susitna drainage. This initial study disclosed little conflict between salmon and beaver and revealed the use of beaver impoundments as nursery areas by salmon fry. Observations of the use of beaver ponds by other wildlife forms further demonstrated their beneficial aspect. Waterfowl were observed on the two study areas utilizing the ponds for nesting and rearing of broods as well as feeding and resting areas. Moose and various species of fur bearers were observed in and around these ponds.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 2-a

PERIOD COVERED: July 1, 1962 to June 30, 1963

OBJECTIVES

1. To assemble historical records on beaver of the Kenai Moose Range and concurrent pertinent records of other animal life with particular emphasis on moose, waterfowl, and salmon.

2. To record habitat conditions existing in various successional stages of the beaver dams with respect to the suitability of these conditions for moose, waterfowl, and salmon.

3. To determine present populations of beaver and the three major animal species of concern under various habitat conditions.

4. To develop management recommendations toward securing a satisfactory balance between beaver numbers and location and maintenance of desirable habitat of the three major species.

TECHNIQUES

Surveys were completed to determine distribution and concentration of beaver on the Kenai Moose Range and two areas were selected for more intensive study. These studies were designed primarily to show use and suitability of the habitat afforded by beaver ponds to various wildlife species and to determine what conflict might exist between beaver dams and migrating salmon.

Due to the near absence of dams across known salmon streams on the Moose Range, one area for study was selected outside of the range. The site on the Moose Range was located on the Skilak Glacier Flats at the head of Skilak Lake. This area contained four ponds and was believed to be a silver salmon, Oncorhynchus kisutch, spawning area. The second site was located at Whiskey Lake which drains into the Yentna River on the west side of Cook Inlet. Springs draining into the lake have been dammed by beaver creating two large ponds over excellent red salmon, Oncorhynchus nerka, spawning grounds.

In early September, prior to the time of the food gathering activity of the beaver, various techniques of aerial census of beaver were tested on the Kenai Moose Range. The method adopted employed the use of a supercub flying at 60 mph at an elevation of 500 feet above the streams, while recording into a tape recorder the number of lodges, food piles, and dams, and the general characteristics of the stream and vegetation. Time of start and termination of each stream survey and the exact time of observation of each lodge or food pile was noted to determine the numbers of colonies per mile. A food pile, with fresh cutting and with an associated lodge, was designated as an active colony.

Periodic trips were made to the beaver impoundments under study to observe salmon spawning activity, noting any interference of beaver dams to salmon passage, numbers and species of salmon and time of spawning.

FINDINGS

Test-netting with variable mesh gill nets produced catches of silver salmon and Dolly Varden, Salvelinus malma, fry in the Skilak ponds and red salmon fry and fingerlings in the Whiskey Lake impoundments. A total of 1,171 spawning red salmon were counted in the Whiskey Lake beaver ponds. Salmon were observed entering this area by utilizing a side channel around the main dam, forcing their way through a loosely constructed small dam. The upper pond in this system was blocked by a large dam with no overflow or seepage. Salmon made no attempt to approach this dam. After opening this dam and allowing approximately 50 salmon of each sex through, the dam was closed. This area will be checked next spring to determine egg survival.

All ponds in the two study areas were tested for temperature, dissolved oxygen and pH and were found to be well within the tolerance limits of salmon and trout.

Waterfowl were observed utilizing the ponds as feeding and brooding areas. Broods of pintail, green-winged teal, goldeneye, merganser and trumpeter swan were found in the beaver impoundments. Other forms of wildlife common around the ponds included mink, muskrat and moose. Moose were commonly observed feeding on the aquatic plants, willow and aspen in and around the beaver ponds.

In early October a trip was made to the study area to observe the last of the salmon spawning activity and to census the beaver colonies on the Kenai National Moose Range.

The aerial census method, previously described, was used on all the major drainages of the Kenai Moose Range and resulted in a count of 27 active beaver colonies in 246 stream miles flown.

The peak of spawning occurred in the Whiskey Lake beaver impoundments during the first week of October. A total of 507 live and 528 dead red salmon were counted in the three study impoundments at this time.

The lower dam in this area has washed out, lowering the water level 13 inches over the spawning grounds. This lowered water level appeared to facilitate the capturing of salmon by bear. Only 50 fish could be obtained as a measurement sample, the other dead fish being too mutilated for measuring.

During this October visit a marked increase in the numbers of ducks on the beaver ponds was noted; mallards and mergansers being the most common with smaller numbers of green-winged teal, goldeneye and trumpeter swan present. All the ducks, with the exception of the teal, were observed feeding on the carcasses of the spawned out salmon.

Current effort is being directed at writing a description of the Moose Range and an analysis of the weather in this area is being made to determine if a correlation exists between it and beaver numbers in the area.

SUBMITTED BY:

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WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 3

PERIOD COVERED: July 1, 1962 to June 30, 1963

ABSTRACT

During this segment, reproductive tracts of 248 lynx and 42 wolverines were acquired for study. Sixty-four per cent of the specimens of each species were males.

Forty-nine female wolverine tracts acquired during 1961 were examined grossly for determinations of productivity. Thirty-five per cent were adults. Macroscopic embryos or fetuses were recovered from eleven specimens with kill dates ranging from November 23 through March 12. Two other specimens, one taken March 10 and the other at an unknown date, had recently whelped. Embryo and fetus counts averaged 2.9 with individual counts ranging from 1 to 5. Placental scar counts obtained from nine tracts averaged 2.2 scars per tract.

RECOMMENDATIONS

None relative to management.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 3

PERIOD COVERED: July 1, 1962 to June 30, 1963

OBJECTIVES

To determine factors relating to the breeding biology and productivity of lynx and wolverines.

TECHNIQUES

Reproductive tracts from lynx and wolverines were obtained from carcasses purchased from trappers and from wolverines taken on hunting permits.

Uterii were frozen and testes and ovaries preserved in formalin for future study. Wolverine uterii obtained during the previous segment were examined grossly for embryos, fetuses and for placental scars of past pregnancies.

FINDINGS

During this segment 248 lynx and 42 wolverine specimens were obtained. Sixty-four per cent of the specimens of each species were males.

Table 1 presents a summary of the breeding biology data found in examinations of 49 wolverine uterine tracts collected during 1961. The tracts of 17 or 35% were judged to be from adults. Macroscopic embryos or fetuses were recovered from eleven specimens. Kill dates for these ranged from November 23 through March 12. Two other specimens were judged to have whelped recently. Their uterii were blood engorged and distended. One of these was taken March 10, the other at an unknown date.

Table 1. Summary of Uterine Examinations of 17 Adult Wolverines

Specimen Number	Date Taken	Placental Scars Left	Placental Scars Right	Embryo-fetus Left	Embryo-fetus Right	Embryo-fetus size	Remarks
62-4	11/23/61	1	0	3	1	2 mm.	
62-11	1/7/62	1	1	0	0		
62-22	1/10/62	1	0	1	1		
62-147	1/30/62	0	0	2	2	??	Uterus preserved intact
62-138	1/?/62	0	0	1	0	??	Uterus preserved intact
62-179	2/4/62	0	0	2	1	2 mm.	
62-137	2/15/62	0	0	0	2		Uterus preserved intact
62-364	3/5/62	1	2	2	1	2 mm.	
62-315	3/8/62	-	-	1	0	40 mm.	
62-368	3/10/62	1	0	0	0		Uterus blood engorged - recent whelping
62-376	3/10/62	1	2	0	0		
62-492	3/12/62	1	2	3	2	2 mm.	
62-148	?/?/62	1	1	3	1	2 mm.	
62-377	Winter/62	-	-	-	-		Portion of tract recent whelping
E-217	1/?/62	0	0	-	-		Pregnant but embryos missing
E-212	1/?/62	0	0	1	0	??	Uterus preserved intact
E-207	?/?/62	2	2	-	-		Pregnant but embryos missing

Ten specimens, for which accurate embryo or fetus counts were believed to have been obtained, showed a mean productivity rate of 2.9 young with individual counts ranging from 1 to 5. Placental scar counts obtained for nine specimens averaged 2.2 scars per tract.

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WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 5

PERIOD COVERED: July 1, 1961 to May 31, 1963

ABSTRACT

Preliminary data collection has been completed. Analysis of data and completion of examination of fox carcasses remain to be accomplished.

The white fox has decreased in importance to the Eskimo trapper due to lowered value of pelts, increased employment in the area and greater dependence upon state and federal welfare income.

Den ecology studies suggest long term use of dens, which ultimately alters the soil and vegetation complex in the denning areas.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: G TITLE: Fur Mammal Investigations

JOB NO.: 5

PERIOD COVERED: July 1, 1961 to May 31, 1963

OBJECTIVES

To determine the life history, distribution and abundance of the white fox in north coastal Alaska.

To examine factors affecting availability and value of this fur animal to local trappers.

TECHNIQUES

From base at the Arctic Research Laboratory, Barrow, Alaska various studies dealing with the white fox were conducted. Aircraft, weasels, and boats all were used to place the investigator in the field during all portions of the year where observations and specimens dealing with the white fox project were obtained. Much of the information dealing with trapping techniques, economic importance, and utilization of the fox population by Eskimo trappers was obtained primarily through personal contact with local residents in the Barrow area and a questionnaire which was sent to 39 trappers in Barrow Village. An extensive review of the existing literature also gave the investigator some insight into the past history of the white fox in Alaska and the existing economic situation of the outlying native villages. Over 400 white fox carcasses were collected from native trappers for detailed autopsy and a large volume of summer data were collected by the investigator dealing with food habits, den ecology, and summer distribution during the 11 weeks spent in the field during the summer of 1962.

FINDINGS

Although this is termed a completion report, actually the only portion of the white fox study that has been completed at this time is the collection of raw data in the form of numerous specimens and volumes of field notes on the white fox project. The following statements must be interpreted with the preceding statement well in mind.

Economic Importance

The white fox is the only furbearer that occurs in large enough numbers to be economically important in the trapping industry on the arctic coastal plain of northern and western Alaska. In 1962, white fox pelts brought an average of 17 dollars each in Barrow, Alaska but in 1963, had declined to a value of only $12.50. Almost all fur trading at Barrow is in exchange for goods from local traders. Few pelts are sent outside to fur auctions where higher prices could be obtained because of this dependence upon credit at the local stores during times when no money is available to the Eskimo family. It is likely that if pelts were sent outside, the loss of credit with local traders would handicap the individual Eskimo family that depends solely on subsistence hunting and perhaps on some income from trapping and welfare aids. Presently there is little trapping pressure on the white fox population because of the low fur prices of the pelts, the relatively high rate of employment in Barrow Village, and the various federal and state "aids" which all effectively decrease the need and desire of the Eskimo to trap intensively for a livelihood.

Life History

Almost all the data on life history is incomplete at this time. This data will be analyzed after the remaining carcasses of the white fox have been dissected. Den ecology was studied in detail and has and will produce some interesting ecological and physical relationships. Fifty fox dens were examined during the past summer with a distinct relationship between soil type, topography, and permafrost depth being noted. After a den is established, it apparently is used year after year, as shown by the intricate den structure and large sizes of the larger dens found, contrasting to those of very simple construction. A marked change in vegetation types at the "older" dens also helps substantiate the idea that these dens are used year after year. This prolonged use of a den probably changes the soil fertility at the den site, allowing different plants to grow well in a more fertile area.

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WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-4 TITLE: Alaska Wildlife Investigations

WORK PLAN: H TITLE: Snowshoe Hare Investigations

JOB NO.: 1

PERIOD COVERED: July 1, 1962 to June 30, 1963

ABSTRACT

During the period covered, several preliminary investigations of the physiological condition of snowshoe hares at high population levels were carried out.

These investigations indicated that:

1. Hares which had been live-trapped showed a significantly higher incidence of low blood glucose levels than hares which had been shot.
2. That the relationship between blood glucose and blood phosphate may be an important indication of the susceptibility of the snowshoe hare to hypoglycemic shock.
3. That snowshoe hares taken from areas of high population density seem especially prone to hypoglycemic shock.

RECOMMENDATIONS

Blood analyses must be carried out on a full-time basis in order to obtain information enough for statistical significance. The time spent in collecting samples, in course work, and in travel between the University and this investigator's homestead, made it impossible to obtain results of any more than preliminary significance.

In order to obtain as complete a picture as possible of the physiological condition of the snowshoe hare one should determine at least the levels of blood glucose, phosphorus,

urea, and total protein (including albumin/globulin ratio). It is the opinion of this investigator that analyses for cholesterol, calcium, and possibly chloride ion might also be of significance.

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OBJECTIVES

To determine as accurately as possible the physiological condition of the snowshoe hare in the free, wild state by measurement of several blood constituents.

TECHNIQUES

Two methods were used to collect blood samples from snowshoe hares.

1. The hare was shot with a twelve gauge shotgun using high-velocity shells loaded with number four shot. This seemed to kill the animal almost instantly, which was necessary in order to obtain a reasonably accurate picture of the physiological condition of the animal just before death. The hare was then decapitated and 400 microliters of blood were collected in a micro test tube for the subsequent analyses. It was possible, in most cases, to collect the required amount of blood from the arteries in the neck within a minute of the time the animal was shot.
2. In the cases in which the hares were live-trapped, blood was usually collected in sufficient quantity by nicking the inner surface of an ear with a razor edge.

For best results in the subsequent analyses, whole blood should be centrifuged as soon as possible. The serum or plasma (in most of the analyses either serum or plasma could be used)

could then be stored at 2° centigrade for up to a week. If the sample were quick frozen, it could be kept at -10° to -20° centigrade for a month or more. It was found to be very difficult to freeze the whole blood rapidly enough to prevent extensive hemolysis.

The analysis for glucose was carried out spectrophotometrically using GLUCOSTAT, an enzymatic reagent prepared by Worthington Biochemical Corporation, Freehold, New Jersey, which is specific for glucose and thus eliminated error due to other reducing substances in the blood. An ultramicro technique developed by Beckman/Spinco Corporation was used which allowed duplicate analyses to be done for glucose on 20 microliters of serum or plasma.

The analysis for phosphorus was carried out on a protein-free filtrate, the serum or plasma protein having been precipitated with trichloroacetic acid. The phosphorus was treated to form a highly colored complex which allowed spectrophotometric measurement of the phosphate concentration. Duplicate analyses for phosphorus could be carried out on 40 microliters of serum or plasma using the Beckman/Spinco Ultramicro Analytical System.

FINDINGS

Blood glucose levels from hares which had been shot were compared with levels from trapped animals. The results from 16 trapped hares and 14 shot hares were as follows:

	0-50mg%	50-100mg%	100-150mg%	more than 150mg% glucose
Trapped hares	37%	25%	13%	25%
Shot hares	0%	7%	79%	14%

The above figures represent the percentage of hares in each category within the indicated range of blood glucose levels.

Even though a small total sample is represented, it is the opinion of this investigator that the indicated figures have significance. It is interesting to note that almost the whole sample of shot hares had blood glucose levels within the "normal" range of 100 to 150mg%. On the other hand, only a small portion of the hares which had been live-trapped fell within the same range. Care was taken to treat the trapped

hares gently, and those taken into captivity were given food and water ad libitum. Even with fairly gently handling, however, the hares often, without apparent warning or reason, would go into hypoglycemic shock and convulsions which inevitably led to death within an hour. It appears, then, that if the hare is left in the trap for more than a very short time, his state of panic will lead to wide departure from normal in the level of blood glucose.

During the winter and early spring, samples were collected only from hares which had been shot. A total of 79 samples were collected. Of these, 15 had been frozen as whole blood and were so badly hemolyzed that no accurate analyses could be made. It was found that temperatures of 30° below zero Farenheit were not sufficiently cold to avoid hemolysis. The remaining 64 samples were centrifuged within 24 hours after being collected in most cases. A few samples had stood three days before centrifugation, but showed only light to moderate hemolysis. Analyses for glucose and phosphorus were carried out on all of the samples except those which had shown extensive hemolysis.

Glucose

	0-50mg%	50-100mg%	100-150mg%	150 or more mg%
Male hares; 31 samples	3%	33%	50%	14%
Female hares; 33 samples	6%	30%	58%	6%

Phosphorus

	100-400mg%	400-600mg%	600-800mg%	800 or more mg%
Male hares; 30 samples	23%	27%	37%	14%
Female hares; 29 samples	21%	45%	28%	7%

Unfortunately, as with the trapped and shot hare comparisons done during the fall months, the sample size is too small to be convincing proof of any definite relationship between glucose and phosphorus. In the samples analyzed, there seemed to be no

pattern indicating either high glucose with low phosphate levels, or vice-versa as was hoped would be found. It was interesting to note that one male and one female which died of hypoglycemic shock had blood glucose levels of 42 and 47mg% respectively. These blood samples from trapped animals were later analyzed for phosphorus and were found to have 107 and 135mg% respectively, both of which are quite low levels in comparison to the bulk of the sample. These, however, were the only analyses done on trapped animals for phosphorus. More such analyses could lead to some interesting results. It was interesting to note, also, that the three hares which had been shot and had had less than 50mg% blood glucose also had blood phosphorus levels of less than 400mg%. Most of the phosphorus levels seemed to fall between 400 and 800mg%, thus indicating that there may be some relationship between low glucose levels and low phosphorus levels. It seems possible that low levels of both phosphorus and glucose could indicate a condition in which there has been a recent extensive mobilization of glucose resulting in a severe depletion of liver glycogen. The fact that the blood phosphate would be depleted during this process would then be apparent in the observed phenomena. It is quite possible, also, that a severe shortage of food could lead to the same situation of low glucose and low phosphorus. Further studies on captive animals could lead to some very interesting observations.

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