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JUNEAU, ALASKA

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FURBEARER REPORT

by

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Volume VIII
Annual Project Segment Report
Federal Aid in Wildlife Restoration
Project W-13-R-2, Work Plan A

(Printed July, 1968)

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-13-R-2

TITLE: Small Game and Furbearer Investigations

WORK PLAN: A

TITLE: Furbearer Studies

JOB NO.: 1

TITLE: Status of Furbearer Resource Utilization and Research

PERIOD COVERED: July 1, 1966 to June 30, 1967

ABSTRACT

Most objectives of this job were not accomplished because time and personnel were not available.

Past studies indicated that the present marten season north of the Alaska Range opens significantly after marten are considered prime. A special season from February 1 to February 28 yielded 22 pelts for examination. All appeared to be prime and acceptable for the commercial market.

RECOMMENDATIONS

The marten trapping season should be opened October 20 and closed February 28. The present season north of the Alaska Range is November 1 to January 31.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-13-R-2 TITLE: Small Game and Furbearer Investigations

WORK PLAN: A TITLE: Furbearer Studies

JOB NO.: 1 TITLE: Status of Furbearer Resource Utilization and Research

PERIOD COVERED: July 1, 1966 to June 30, 1967

OBJECTIVES

1. Evaluate abundance and distribution of certain furbearers.

2. Determine the utilization of furbearers in selected areas.

3. Plan future activities to obtain information needed to resolve problems in furbearer resource management.

TECHNIQUES

Insufficient time and personnel were available to accomplish objectives one and two of this job. The third objective was accomplished in part.

The University of Alaska Cooperative Wildlife Research Unit study on marten conducted by Calvin Lensink indicated that marten pelts are prime earlier than the usual opening of trapping season in Interior Alaska.

Reports received from trappers during former marten seasons indicated that marten might be prime beyond January 31. To test this possibility, an area was selected around Lake Minchumina, where previous studies were done, and the marten season was extended through February 28 with the provision that trappers turn over the hides and skulls for examination.

FINDINGS

Twenty-two marten skins and seven skulls were presented for examination. All of the skins were leather and fur prime with no evidence of singeing or shedding of guard hair. The specimens were

presented so that skulls and sex of animals could not be matched with the hides.

Trappers report high marten populations in several locations in the interior of Alaska. There are few commercial trappers capable of taking large harvests of marten.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-13-R-2 TITLE: Small Game and Furbearer Investigations

WORK PLAN: A TITLE: Furbearers

JOB NO.: 2 TITLE: Harvest of Fur Animals in Alaska

PERIOD COVERED: July 1, 1966 to June 30, 1967

ABSTRACT

The harvest of furbearers for the 1965-66 season declined more than 12,000 peltries from the 1964-65 season. The harvest was the lowest since the 1961-62 season. The greatest reduction was in the muskrat harvest which was down 11,000 pelts from the 1964-65 season.

Harvest estimates were made for all species of furbearers based on the relationship between the number of beaver peltries sealed and the number exported since 1961.

The estimated furbearer harvest for the 1965-66 seasons is:

Beaver	11,426
Muskrat	27,100
Mink	16,000
Marten	7,500
Land Otter	4,010
White Fox	1,500
Other Fox	2,070
Lynx	6,210
Weasel	1,240
Squirrel	290

The estimated value of the harvest was $1,108,600. Mink was the most valuable species with the harvest valued at $347,600. The lynx harvest was the highest since 1929 and the value was the highest in many years.

Harvest estimates were made for each Game Management Unit. Numerous problems exist in making reasonably accurate harvest estimates for Game Management Units. The major cause of inaccuracy was biased and incomplete information from fur dealers.

RECOMMENDATION

1. Enforce the required submission of Fur Dealer's Reports to upgrade the quality of the basic data.

2. Initiate temporary and independent systems to determine the harvest of individual species for specific areas to check the accuracy of harvest estimates based on fur dealers' reports and fur export reports.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-13-R-2 TITLE: Small Game and Furbearer Investigations

WORK PLAN: A TITLE: Furbearers

JOB NO.: 2 TITLE: Harvest of Fur Animals in Alaska

PERIOD COVERED: July 1, 1966 to June 30, 1967

OBJECTIVES

To estimate the number of animals pelted annually in Alaska, excluding seals and sea otter, by species and area.

To determine the approximate value of these furs.

To improve systems used to obtain harvest data.

TECHNIQUES

Three data gathering systems are employed to determine the harvest of furbearers in Alaska. Licensed fur dealers are required to report purchases of all raw pelts. Persons shipping furs from Alaska are required to make a report on the kind and number of furs exported and each beaver pelt must be sealed before being transported from the State. Because fur dealers' reports and fur export reports are also required on beaver pelts, beaver sealing records are used to check the accuracy of fur dealers' reports and fur export reports. Each fur dealer must also prepare export permits for those furs which he purchases; therefore, the export reports serve as a check on the accuracy or completeness of the fur dealers' reports.

The reporting period was from October 1, 1965 to September 30, 1966. Reports received by the Department during the reporting period are coded for machine punching and compilation.

FINDINGS

Annual Harvest

Estimated annual harvest of furbearers for the 1965-66 season was down over 12,000 animals from the previous season. The greatest reduction occurred in mink, muskrat, marten, and white fox (Table 1). The estimates

Table 1. Furbearer Harvest and Approximate Value.

	1961-62		1962-63		1963-64		1964-65		1965-66	
	Number	Approx. Value $	Number	Approx Value $	Number	Approx. Value $	Number	Approx. Value $	Number	Approx. Value $
Beaver	15,187	330,000	19,619	400,000	14,046	281,000	8,556	165,600	11,426	228,500
Muskrat	36,000	45,000	85,000	85,000	49,000	49,000	38,800	40,700	27,100	27,100
Mink	9,000	270,000	22,000	660,000	22,500	500,000	18,400	435,600	15,800	347,600
Marten	4,500	67,500	8,000	128,000	6,200	93,000	10,400	127,600	7,510	112,600
Land Otter	3,500	59,500	3,000	66,000	2,300	57,000	3,270	85,000	4,010	112,300
White Fox	800	28,000	1,500	27,000	1,200	22,000	2,320	41,700	1,500	33,000
Other Fox	750	6,000	1,000	5,000	1,000	5,000	1,200	13,200	2,080	29,100
Lynx	1,100	17,600	2,500	32,500	4,700	47,000	4,650	102,300	6,210	217,400
Weasel	1,400	2,000	1,000	1,000	1,500	1,500	1,110	1,300	1,240	1,000
Squirrel	400	NA*	500	200	790	300	250	100	290	100
TOTALS	72,637	825,600	144,119	1,404,700	103,236	1,055,800	88,956	1,013,270	77,166	1,108,600

* Not available

for the 1965-66 season were made in the same manner as the estimates for the 1964-65 season. The relationship between the number of beaver harvested since 1961 to the number of beaver exported since 1961 is assumed to be the same as the relationship between the number of each species of fur animal harvested to the number of that species exported for that season.

When the harvest figures obtained from the beaver sealing program are compared with the beaver export records (Figure 1) it is obvious that the relationship between the number of beaver harvested and the number of beaver exported may vary greatly for any single year. Estimates of the harvest of other furbearers based on this information may also vary considerably from the actual harvest. There is presently no means of checking the accuracy of the estimate on species other than beaver.

Harvest of Furbearers by Game Management Unit

The location of the harvest (Game Management Unit) is determined by the trapper's residence. Export reports prepared by trappers and fur dealer reports list the address of the trapper. The trapper's residence is considered to be in the Game Management Unit where the furbearers were harvested. This assumption, when applied to the actual harvest of furbearers by Game Management Unit, is not always correct. For example, in Table 2 there is no harvest listed for Game Management Unit 11, except for beaver. Persons living in Game Management Units 6, 12, and 13 harvest furbearers from Unit 11. No one taking furbearers in Unit 11 resides there; therefore, no harvest is accredited to that unit.

There are other obvious errors. White fox are listed in the harvest for 13 Game Management Units, though white fox only occur in five Game Management Units.

To derive the estimates used in Table 2, the percentage of furs exported by trappers and purchased from trappers was established for each Game Management Unit. It was than assumed that this percentage represented the same percentage of the total estimated harvest listed in Table 1. An evaluation of this system is made in Table 3 where the number and percentage of the total harvest of beaver by Game Management Unit derived from beaver sealing documents is compared with the estimated harvest and percentage based on fur exported by trappers and fur purchased from trappers. There are substantial differences between the actual harvest and the estimated harvest. In some instances the reasons for the discrepancies are obvious. The estimated harvest for Unit 16 is much lower than the actual recorded harvest (Table 3). Beaver in Unit 16 are trapped by persons living in the more populated Game Management Units 7, 14, and 15. Conversely, the estimated harvest in Units 7, 14, and 15 is larger than the actual harvest. In many Game Management Units the reasons for the discrepancies are not known.

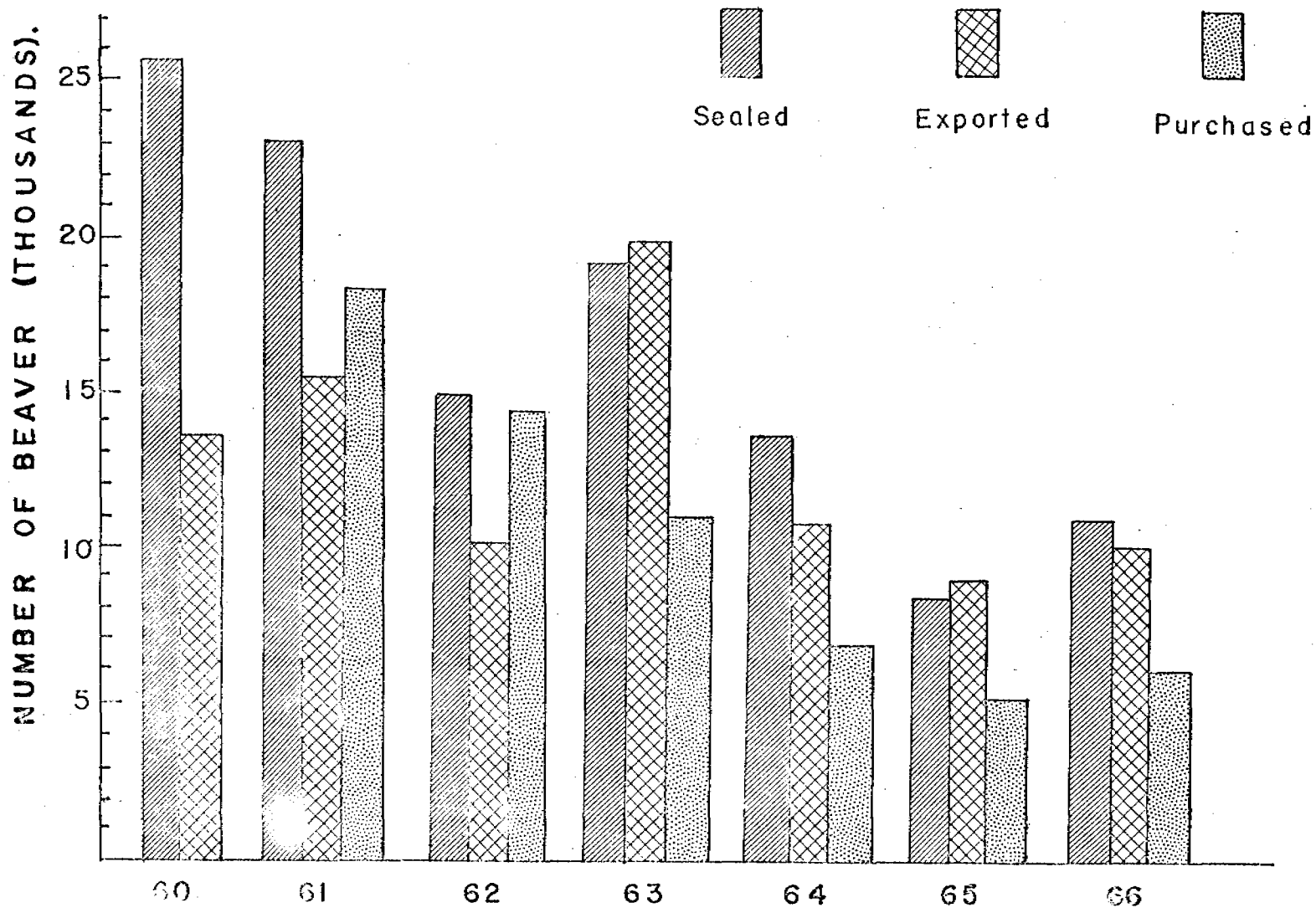

Fig. 1. Comparison of beaver sealed, beaver exported, and beaver purchased.

Table 2. Estimated harvest of furbearers by Game Management Unit. The trappers residence is used as the location where the furbearers were harvested.

Game Mgmt. Unit	Beaver**	Mink	Muskrat	Marten	White Fox	Other Fox	Otter	Weasel	Lynx	Squirrel
1	180	940	90	870	0	<10	380	40	130	0
2	55	470	0	370	0	0	70	30	0	0
3	4	2,120	<10	240	0	0	830	<10	0	0
4	0	1,900	10	880	0	0	600	10	<10	0
5	0	30	0	<10	0	<10	<10	40	0	0
6	169	500	40	40	0	0	250	<10	30	0
7	25	240	0	40	0	<10	30	<10	50	<10
8	199	<10	<10	30	110*	220	220	<10	0	0
9	554	410	90	20	40*	280	210	<10	60	0
10	0	160	220	0	60	<10	20	<10	0	0
11	4	0	0	0	0	0	0	0	0	0
12	55	20	5,200	20	0	130	10	<10	370	0
13	257	150	10	60	10*	110	20	50	1,580	0
14	665	180	530	580	40*	100	20	60	390	20
15	25	80	40	40	20*	<10	20	40	50	0

Table 2. continued

Game Mgmt. Unit	Beaver**	Mink	Muskrat	Marten	White Fox	Other Fox	Otter	Weasel	Lynx	Squirrel
16	510	30	<10	250	0	0	0	30	10	0
17	1,424	110	190	<10	0	100	50	0	20	0
18	411	5,400	6,990	80	120	250	830	210	380	30
19	1,510	180	290	1,380	<10*	30	50	120	80	0
20	1,415	480	4,900	810	100*	270	30	110	1,100	<10
21	2,760	860	300	680	10*	60	120	40	180	0
22	69	10	220	90	570	210	30	50	90	0
23	0	560	900	0	<10	40	<10	<10	220	0
24	577	250	2,360	180	0	20	100	20	70	0
25	478	670	4,040	780	30*	200	<10	340	1,120	110
26	0	20	390	0	250	0	0	0	10	120
Unknown	80	60	170	100	130	20	70	10	200	<10

* White fox only occur in GMU 18, 22, 23, and 26, the harvest reported in other units is indicative of the possible inaccuracies of the estimates.

**Actual number of furs harvested from the unit (not an estimate).

< Indicates less than.

Table 3. Comparison of the actual harvest of beaver in 1966 with the estimated harvest derived from fur export reports and fur dealer reports.

Game Management Unit	Actual Number of Beaver Harvested From the Unit	Estimated Number Harvested
1	180	240
2	55	0
3	4	<10
4	0	0
6	169	<10
7	25	230
8	199	20
9	554	790
11	4	0
12	55	50
13	257	100
14	665	720
15	25	50
16	510	160
17	1,424	1,940
18	411	720
19	1,510	1,050
20	1,415	1,030
21	2,760	2,330
22	69	120
23	0	0
24	577	860
25	478	970
Unknown	80	820

Value of Furbearer Harvest

The value of most species of furbearers varies greatly throughout the state. Variations are primarily due to the large size of the state and extremely variable climate and habitat. In the previous annual project segment report (Volume 7), an attempt was made to compensate for this extreme variation in pelt value by determining the percentage of pelts which were shipped from the various areas in Alaska that are known for a particular quality of pelt. The accuracy of this method is questionable because of two unaccountable variables. Accurate information on the percentage of pelts marketed of a particular size class, and accurate information on when Alaskan furs are sold on the auction are not available. Pelt values listed in Table 4 are derived by establishing the average value for all sizes of pelts and the average value from all qualities of pelts from all areas for a given auction date or price listing. This average is once again averaged for the auctions when most Alaskan furs for a particular species are sold.

Some data are available to provide a more precise estimate of the value of Alaskan furs. Fur export permits provide dates when Alaskan furs leave the state. An estimation of the time when the furs were sold or auctioned could be used to minimize the variations in prices found throughout the season. Fur dealers and auction houses are also listed on the fur export permits and from this information reports of fur sales at the various auctions would provide more specific information.

This method would still be indirect and would not provide information of primary interest. Prices paid directly to trappers provide the incentive and reward for trapping. The price the trapper receives is much more valuable for interpreting variations in the harvest.

The decline in the harvest of over 12,000 pelts was partially offset by improved prices for five species of furbearer with beaver, a major furbearer, remaining constant. Species showing substantial increases were fox, white fox, lynx, marten, and otter. The average estimated pelt values are listed in Table 4. The estimated harvests and their approximate value since 1961 are listed in Table 1.

Harvest Data

The three systems now used to gather harvest data are adequate to determine the statewide harvest of furbearers, with fur export reports providing the most reliable information. Records for 6 years indicate that the number of beaver skins reported on export reports equals 83 percent of the number reported by the beaver sealing system for the same areas. Exports of other furbearers are also assumed to be 83 percent of the harvest.

The export report system does not provide a satisfactory means of establishing where furbearers were harvested. Only 17 percent of all exports are made by trappers whose residence indicates where the fur was harvested (Table 5). The remaining 83 percent were made by fur

Table 4. Average pelt values, value of exported pelts, and value of the estimated harvest.

Species	Average Value All Sizes and Areas	Number Exported	Value of Exported Pelts	Estimated Harvest	Value of Estimated Harvest
Beaver	$20.00	10,314	$206,280	11,426*	$228,500
Mink	22.00	13,087	287,914	15,800	347,600
Muskrat	1.00	22,533	22,533	27,100	27,100
Marten	15.00	6,238	93,570	7,510	112,600
Otter	28.00	3,333	93,324	4,010	112,300
White Fox	22.00	1,249	27,478	1,500	33,000
Other Fox	14.00	1,725	24,150	2,080	29,100
Weasel	.85	1,033	878	1,240	1,000
Lynx	35.00	5,158	180,530	6,210	217,400
Squirrel	.25	237	59	290	100
TOTALS			$936,716		$1,108,600

*Number of beaver sealed.

Table 5. Comparison of percentage of furs exported by trappers and fur dealers.

	Beaver		Mink		Muskrats		Marten		Otter	
	64-65	65-66	64-65	65-66	64-65	65-66	64-65	65-66	64-65	65-66
% Exported by Trapper	14.7	13.9	23.2	14.3	6.4	14.8	17.6	17.5	27.3	24.3
% Exported by Fur Dealer	85.3	86.1	76.8	85.7	93.6	85.2	82.4	82.5	72.7	75.7

	White Fox		Other Fox		Weasel		Lynx		Squirrel	
	64-65	65-66	64-65	65-66	64-65	65-66	64-65	65-66	64-65	65-66
% Exported by Trapper	45.8	22.9	32.2	28.3	28.9	26.7	37.1	23.1	54.5	30.0
% Exported by Fur Dealer	54.2	77.1	67.8	71.7	71.1	73.3	62.9	76.9	45.5	70.0

	64-65	65-66
% Exported by Trapper	16	17
% Exported by Fur Dealer	84	83

dealers, whose reports cannot be used to establish the location where the pelts were harvested.

Fur dealer reports itemizing the purchase of pelts from each trapper and recording the trapper's address should provide information on the location of the harvest for the 83 percent of the furs exported. Fur dealers exported many more furs than they reported buying from trappers (Table 6). This is a considerable loss of information, greatly affecting the reliability of the harvest estimates for Game Management Units. To estimate the harvest for each Game Management Unit it is assumed that the loss of information is proportional for all Game Management Units. The assumption is obviously fallacious. One or two conscientious fur dealers might purchase and correctly report almost all of a species of furbearer from a Game Management Unit. Accurate reporting in one area would have the effect of causing an over-estimation of the harvest in that area.

Questionnaires may have value in providing a check on the harvest of furbearers from some areas; however, lack of compliance would also be a problem and it would probably be compounded by varying degrees of illiteracy.

In areas where there is a high compliance with licensing regulations, licenses may provide a suitable sampling frame to contact trappers either by mail or in person to obtain a sample needed to check the validity of fur export reports and fur dealers reports.

Table 6. 1965-66 fur dealer export and fur dealer purchase comparison

	Beaver	Mink	Muskrat	Marten	Otter	White Fox	Other Fox	Weasel	Lynx	Total
Pelts purchased from all trappers	5,047	6,542	14,845	2,244	1,301	73	430	383	2,051	32,916
Pelts purchased from other fur dealers	1,392	950	1,166	346	108	91	83	--	40	4,176
Pelts exported by fur dealers	8,871	11,210	19,200	5,152	2,526	963	1,236	756	3,970	53,884

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-13-R-2 TITLE: Small Game and Furbearer Investigations

WORK PLAN: A TITLE: Furbearers

JOB NO.: 3 TITLE: Beaver

PERIOD COVERED: July 1, 1966 to June 30, 1967

ABSTRACT

The 1966 beaver harvest increased about 3,000 from the 10-year low of 8,556 in 1965. Recurring reports necessitated the breakdown of the harvest by drainages in Game Management Units 19 and 21. Both units had a great disparity between the up-river portion and lower portions in the percentage of kits reported in the harvest. A subdivision of Unit 21 was made and the subdivision made in Unit 19 was redrawn.

Beaver house and cache counts were conducted on the Innoko and Chena Rivers. The aerial count on the Innoko River indicated a decline in beaver colonies from previous counts made in 1956 and 1957. Comparability of the counts is questionable.

Forty-nine beaver caches counted on the Chena River by canoe indicated approximately one beaver cache or live colony per 1.5 miles of stream. The average water depth at caches was 6.9 feet and variation was 4 to 12.5 feet.

Betula, Populus, Salix and Alnus were identified in the caches. Salix occurred in 44 of 45 caches where plant composition was noted.

Tom Schuck, employed by the University of Oklahoma, contributed a supplemental bibliography of beaver diseases and parasites while cooperating with the Alaska Department of Fish and Game.

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-13-R-2 TITLE: Small Game and Furbearer Investigations

WORK PLAN: A TITLE: Furbearer

JOB NO.: 3 TITLE: Beaver

PERIOD COVERED: July 1, 1966 to June 30, 1967

OBJECTIVES

1. To compile, analyze, and summarize available data on utilization of beaver populations.

2. To gather more detailed data in the field on beaver in areas of low abundance and poor trapping success.

TECHNIQUES

Since 1957 the stretched pelts of beaver have been sealed and measured in order to separate the entire catch into age classes. Beaver hides are traditionally stretched round and measured to separate them into age classes. The measurement is the sum of a longitudinal diameter and medial diameter. The young of the year or kits are those beaver where the measurement measures less than 54 inches. Beaver between 55 and 59 inches are considered yearling, and pelts over 59 inches are adults. Table 1 lists the age breakdown and total harvest for each Game Management Unit. The number of beaver trappers and the average number of beaver taken per trapper are also listed in Table 1. The total number of beaver harvested in 1966 was 11,426. There were 1,316 trappers and the average catch was 8.6 beaver per trapper.

Since 1964 several Game Management Units have been subdivided with different seasons and bag limits in the various subdivisions. Prior to 1966 no analysis was made of the harvest within the sub-units. To provide a better factual background in which to assess the effects of the regulation changes and to provide better information on which to make future subdivisions, the harvest was broken down by drainages in Game Management Units 19 and 21.

An aerial survey was conducted on the Innoko River. An area was selected where surveys had been made from 1953 to 1957 with the exception of 1955. The intent of the original surveys was to locate and count the houses and food caches in order to compare the number of these food caches from year to year as an indication of the beaver populations.

Two basic techniques were used to conduct aerial surveys. In some areas beaver caches found within a given distance of the stream course were tallied. The other type of survey was to establish a point-to-point transect and record live and dead houses within a specified distance from the transect. Wide variations in the counts from year to year indicate that the techniques were not altogether satisfactory.

Counts were made in late September or early October after the food caches had been constructed.

A beaver cache and house or burrow complex was termed a "live house." Early counts tallied only live houses. Later counts also included "dead" houses or beaver lodges that did not have caches. The number of aerial surveys decreased after 1957 until they ceased entirely in 1962.

The 1966 aerial survey on the Innoko River followed much the same pattern as the previous surveys with the exception that whenever possible beaver houses and caches were marked on 1:63,360 scale maps. By identifying specific houses and caches and rechecking them each year, future population changes which may be reflected in the number of caches in the count areas can be determined, and the unexplained variations found in earlier counts can be reduced so that observed variations can be attributed to the beaver population.

Another survey was conducted on the Chena River. The Chena was traversed by canoe and beaver caches were plotted on 1:63,360 scale maps. Observations were made of the species of plants in the cache, water depth and bottom composition.

Both of these surveys will be repeated in 1967 and in addition it is planned to independently conduct an aerial survey on the Chena River so the accuracy of aerial surveys can be checked.

FINDINGS

Harvest Analysis

The standard beaver affidavit analysis made since 1957 is presented in Table 1. The 1966 harvest increased about 3,000 animals from a low of 8,556 recorded in 1965. The average number of beaver per trapper dropped slightly from 9.0 to 8.6. A significant increase

Table 1. Beaver Affidavit Analysis, 1957-66.

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
1	1957	No open season						
	1958	15	24.8	35.7	64.3	330	38	8.7
	1959	15	24.6	37.7	62.3	69	8	8.6
	1960	15	6.9	31.0	69.0	115	14	8.2
	1961	15	28.5	45.9	54.0	99	12	8.2
	1962	15	21.9	34.2	65.8	42	5	8.4
	1963	15	12.4	31.3	68.6	180	20	9.0
	1964	50	16.1	32.7	67.1	204	17	12.0
	1965	50	17.7	43.5	56.5	62	5	12.4
	1966	50	18.9	44.5	55.0	180	19	9.6
2	1957	No open season						
	1958	15	22.7	36.4	63.7	22	10	2.2
	1959	15	22.2	37.0	63.0	27	2	13.5
	1960	15				75	13	5.8
	1961	15	25.0	39.2	58.9	56	8	7.0
	1962	Season Open - No animals taken						
	1963	15	21.1	53.7	46.1	52	5	10.4
	1964	50	21.6	49.7	50.3	157	12	13.1
	1965	50	24.7	54.8	45.2	73	8	9.1
	1966	50	33.3	45.8	54.2	55	9	6.1
3	1957	No open season						
	1958	15			100.0	115	13	8.35
	1959	15	6.3	6.2	93.8	16	3	5.3
	1960	15				57	17	2.8
	1961	15						
	1962	Season Open - No animals taken						
	1963	15	31.6	57.9	42.1	21	5	4.2
	1964	50	22.5	42.5	57.5	40	3	13.3
	1965	50		33.3	66.6	6	1	6.0
	1966	50			100.0	4	3	1.3

Table 1. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
4[1/]	1962	15	30.5	56.8	33.2	36	3	12.0
	1963					16	1	16.0
	1964	50						
	1965	50			100.0	1	1	1.0
	1966	50	No harvest reported					
6	1957	20	24.1	40.0	60.0	245	16	15.3
	1958	20	12.9	28.0	72.0	264	15	17.6
	1959	20	14.3	20.2	79.8	168	11	15.3
	1960	40	14.3	35.7	64.3	304	15	20.3
	1961	40	13.2	31.0	68.9	264	15	17.6
	1962	40	13.5	27.1	72.9	155	10	15.5
	1963	50	13.7	24.4	75.6	305	11	27.7
	1964	50	12.3	29.0	71.0	155	8	19.4
	1965	50	20.7	41.5	57.8	135	13	10.4
	1966	50	15.0	38.9	61.1	169	9	18.8
7	1957	20	22.7	48.0	52.0	75	14	5.4
	1958	20	15.7	34.8	65.2	89	18	5.0
	1959	20	34.0	52.3	47.7	44	8	5.5
	1960	15	17.2	35.4	64.6	393	67	5.0
	1961	15	15.8	22.4	66.0	236	39	6.0
	1962	15	17.3	36.0	64.+	259	57	4.5
	1963	20	24.5	45.2	54.7	106	15	7.1
	1964	20	30.8	61.5	38.5	13	4	3.3
	1965	20	31.7	51.2	48.8	41	9	4.5
	1966	20	12.0	44.0	56.0	25	10	2.5
8	1957	15	23.6	32.9	67.1	140	15	9.3
	1958	20	21.3	35.7	64.3	235	24	9.8
	1959	20	22.7	40.9	59.1	154	12	12.9
	1960	40	28.4	47.7	52.3	369	25	14.8

Table 1. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
8	1961	No limit	20.1	34.4	64.9	154	10	15.4
	1962	No limit	18.3	33.3	56.7	185	13	14.2
	1963	No limit	22.7	42.4	55.6	268	22	12.2
	1964	No limit	23.3	48.6	51.4	210	18	11.7
	1965	No limit	33.3	51.0	49.0	102	11	9.3
	1966	No limit	25.6	43.2	56.8	199	16	12.4
9	1957	15	17.0	25.9	74.1	1,469	138	10.6
	1958	15	22.4	34.2	65.8	1,515	141	11.0
	1959	15	23.9	34.7	65.3	1,975	170	11.6
	1960	20	21.9	32.3	67.8	1,768	115	15.4
	1961	20	19.8	32.0	67.3	2,319	161	14.4
	1962	15	28.3	38.0	62.0	933	82	11.3
	1963	15	19.9	34.9	65.1	2,080	161	12.9
	1964	15	26.3	37.9	62.0	951	91	10.5
	1965	15	17.6	13.8	68.6	494	47	10.6
	1966	40 + 15	22.6	39.2	60.8	554	49	11.3
11	1957	20	12.8	15.4	84.6	39	5	7.8
	1958	20			100.0	20	4	5.0
	1959	20	8.5	16.9	83.1	59	5	11.8
	1960	20	35.0	50.0	50.0	20	2	10.0
	1961	20	5.0	30.0	70.0	20	2	10.0
	1962	20				2	1	2.0
	1963	20				16	3	5.3
	1964	20	5.1	30.8	69.2	39	6	6.5
	1965	20	16.7	25.0	75.0	12	2	6.0
	1966	20	0.0	50.0	50.0	4	2	2.0
12	1957	5	2.8	13.2	86.8	106	40	2.6
	1958	15	10.5	13.9	86.1	409	85	4.8
	1959	15	11.6	15.1	84.9	423	80	5.3
	1960	15	17.2	35.4	64.6	393	67	5.9

Table 1. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
12	1961	15	15.8	22.4	66.0	236	39	6.0
	1962	15	17.3	36.0	64.+	259	57	4.5
	1963	15	22.7	32.5	67.5	255	67	3.8
	1964	15	16.0	33.2	66.3	205	63	3.2
	1965	15	6.1	28.3	70.7	99	45	2.2
	1966	15	14.5	32.7	67.3	55	23	2.4
13	1957	20	20.0	23.5	71.5	165	24	6.9
	1958	20	12.9	22.5	71.5	473	59	8.0
	1959	20	16.4	28.3	71.7	385	37	10.4
	1960	20	23.2	36.9	63.1	507	59	8.6
	1961	20	23.9	44.3	55.0	206	21	9.8
	1962	20	27.5	34.0	66.0	98	13	7.5
	1963	20	19.1	40.6	59.4	335	51	6.6
	1964	20	20.7	34.8	64.1	376	43	8.7
	1965	20	14.6	36.5	63.5	137	28	4.9
	1966	20	19.1	32.8	67.2	257	41	6.3
14	1957	20	17.7	36.2	63.8	923	84	11.0
	1958	40	16.4	30.6	69.4	1,204	96	12.6
	1959	40	27.2	50.7	49.3	647	49	13.2
	1960	40	24.1	43.4	56.7	844	68	12.4
	1961	40	23.9	44.3	55.0	877	69	9.8
	1962	40	22.3	45.9	54.1	493	38	12.9
	1963	40	24.9	48.1	51.9	789	83	9.5
	1964	40	21.2	46.0	54.0	655	60	10.9
	1965	40	22.2	43.3	56.7	365	41	8.9
	1966	40	16.7	41.6	58.4	665	99	6.7
15	1957	20	17.2	37.9	62.1	303	26	11.7
	1958	40	16.4	27.5	72.5	360	30	12.0
	1959	40	29.8	46.4	53.6	168	15	11.2
	1960	40	17.5	35.3	64.7	379	20	18.9

Table 1.. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
15	1961	40	15.1	33.9	66.1	438	20	21.9
	1962	40	17.7	33.9	66.1	180	14	12.8
	1963	40	18.1	33.2	66.8	254	25	10.1
	1964	40	19.4	36.3	63.7	237	24	9.9
	1965	40	23.8	52.4	42.8	21	4	5.2
	1966	40	20.0	44.0	56.0	25	7	3.6
16	1957	20	19.4	41.9	58.1	62	5	12.4
	1958	40	13.7	25.7	74.3	1,148	45	25.5
	1959	40	22.1	39.7	60.3	1,715	72	23.8
	1960	40	15.1	35.3	64.7	2,200	95	23.2
	1961	40	20.9	37.9	62.3	1,309	63	20.7
	1962	40	34.3	43.3	56.7	524	34	15.4
	1963	40	18.1	38.3	61.7	1,305	66	19.7
	1964	40	19.5	38.7	62.3	798	39	20.5
	1965	40	15.7	42.5	57.5	381	17	22.4
	1966	40	15.9	39.6	60.4	510	28	18.2
17[2/]	1957	10	22.9	36.8	63.2	367	46	8.0
	1958	15	19.1	33.0	67.0	3,165	263	12.0
	1959	10	19.6	29.4	70.6	3,245	369	8.8
	1960	15	24.3	34.2	65.8	3,721	279	13.3
	1961	15	23.1	24.7	65.2	2,849	230	12.3
	1962	15	29.5	41.5	58.5	1,903	175	10.8
	1963	15	23.3	36.8	63.2	2,172	189	11.5
	1964	15	28.4	38.4	61.6	1,766	180	9.8
	1965	15	22.1	34.9	65.1	957	97	9.9
	1966	15	25.2	37.9	62.1	1,424	143	10.0

Table 1. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
18	1957	No open season						
	1958	No open season						
	1959	10	31.2	45.1	54.9	2,766	357	7.7
	1960	10	25.7	38.7	61.3	2,013	260	7.7
	1961	10	28.9	44.6	55.3	1,428	187	7.6
	1962	10	34.9	45.1	54.8	817	116	7.0
	1963	10	33.3	50.1	49.9	1,503	202	7.4
	1964	10	30.3	44.7	54.9	666	116	5.7
	1965	10	18.6	36.4	63.6	264	41	6.4
	1966	10	30.6	46.0	54.0	411	66	6.2
19	1957	15	12.5	24.8	75.2	2,200	200	11.1
	1958	20	15.5	24.0	76.0	3,852	256	15.1
	1959	20	16.3	29.3	70.7	4,034	284	14.2
	1960	20	16.7	30.0	70.0	3,128	210	14.9
	1961	20	17.5	30.8	69.1	4,576	307	14.9
	1962	20	19.7	35.2	65.8	3,035	219	13.9
	1963	15	20.0	34.9	65.1	2,250	196	11.4
	1964	15*	20.0	32.6	67.3	2,148	176	12.2
	1965	15*	30.7	42.5	57.5	1,290	128	10.1
	1966	15*	27.6	39.5	60.5	1,510	137	11.0
20	1957	15	8.9	16.6	83.4	641	74	8.8
	1958	20	8.7	19.7	80.3	1,869	152	12.3
	1959	20	4.1	17.7	82.3	1,242	119	10.4
	1960	20	9.1	23.3	76.7	1,540	145	10.6
	1961	20	11.4	24.5	75.5	1,435	129	11.1
	1962	20	15.8	25.7	74.1	1,139	96	10.2
	1963	20	9.6	21.7	78.3	1,514	133	13.3
	1964	25	12.2	23.0	76.0	2,176	194	11.2
	1965	25	9.6	24.4	76.7	1,671	163	10.2
	1966	25	14.5	30.5	69.5	1,415	231	6.1

* Portion of Unit 19 (above Medfra) had limit of 25 in 1964 through 1966.

Table 1. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
21	1957	15	12.3	23.4	76.6	5,460	490	11.1
	1958	20	11.0	22.6	77.4	6,871	499	13.8
	1959	20	12.7	26.2	73.8	5,771	425	13.6
	1960	20	12.0	25,8	74.2	5,945	381	15.6
	1961	20	12.8	28.7	71.1	5,488	356	15.4
	1962	20	13.6	32.4	67.6	3,833	288	13.3
	1963	20	14.5	29.1	70.9	4,638	343	13.5
	1964	20	16.0	31.3	68.6	2,067	212	9.7
	1965	15	13.7	30.4	69.6	1,478	182	8.7
	1966	15	13.8	29.3	70.7	2,760	261	10.6
22	1957	No open season						
	1958	10	45.2	54.8	45.2	42	10	4.2
	1959	10	18.8	35.4	64.6	48	14	3.4
	1960	10	25.8	41.9	58.1	62	12	5,2
	1961	10	4.7	14.2	85.7	21	3	7.0
	1962	10	26.1	38.2	61.8	42	7	6.0
	1963	20						
	1964	50	19.4	27.6	72.4	98	14	7.0
	1965	50	2.3	13.6	86.4	44	4	11.0
	1966	50	23.2	37.7	62.3	69	6	11.5
23	1957	15			100.0	5	1	5.0
	1958	No open season						
	1959	15				0	0	
	1960	15				0	0	
	1961	15	12.5	50.0	50.0	8	1	8.0
	1962	15		30.0	70.0	7	2	3.5
	1963	15				3	1	3.0
	1964	15						
	1965	15			100.0	5	1	5.0
	1966	15				0	0	

Table 1. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
24	1957	20	8.2	22.0	78.0	1,486	96	15.5
	1958	25	6.2	23.2	76.8	1,841	105	17.5
	1959	25	6.8	17.6	82.4	1,434	97	14.8
	1960	25	13.0	30.2	69.8	1,375	79	17.4
	1961	25	11.1	30.9	68.5	1,333	88	15.1
	1962	25	8.2	27.8	72.2	1,066	71	15.0
	1963	25	9.5	27.9	72.1	965	70	13.7
	1964	15	6.9	19.0	80.6	578	64	9.0
	1965	15	3.9	22.2	77.7	436	55	7.9
	1966	15	6.9	17.9	82.1	577	69	7.5
25	1957	15	21.7	31.6	68.4	630	77	8.2
	1958	15	25.9	37.1	62.9	625	77	8.1
	1959	15	21.1	38.3	61.7	725	86	8.4
	1960	15	17.3	33.3	66.7	788	61	12.9
	1961	15	13.4	30.2	69.9	644	70	9.2
	1962	15	15.8	29.1	70.9	430	44	9.8
	1963	20	14.6	27.9	72.1	464	63	7.4
	1964	20	18.4	30.9	69.1	488	63	7.7
	1965	20	21.5	35.9	64.1	382	47	8.1
	1966	20	22.1	33.6	66.4	478	88	5.4
Miscellaneous Areas	1966		22.5	43.8	56.2	80	10	8.0

Table 1. Beaver Affidavit Analysis, 1957-66 (Continued).

Game Mgmt. Unit	Year	Limit	Percent Kits (Under 54")	Percent Kits and Yearlings (Under 59")	Percent Adults (Over 59")	Total No. of Beaver	No. of Trappers	Avg. No. Beaver/ Trapper
TOTAL	1957		13.8	25.8	74.2	14,344	1,351	10.6
	1958		14.1	26.2	73.8	24,484	1,940	12.6
	1959		17.9	31.0	69.0	25,115	2,223	11.3
	1960		16.4	29.4	70.6	26,504	2,028	13.1
	1961		17.6	32.2	67.4	23,859	1,800	13.2
	1962		19.1	33.4	66.6	15,187	1,289	11.7
	1963		18.5	34.0	66.0	19,619	1,739	11.3
	1964		19.5	33.6	66.3	14,046	1,589	8.8
	1965		17.4	33.4	66.6	8,556	949	9.0
	1966		----	----	----	11,426	1,316	8.6

1/ Either no open season or no beaver taken during 1957-1961 in Units 4, 5, 10 and 26.
2/ Part of Unit 17 closed in 1957 and 1958.

10 year average (1957-66) - 18,304
10 year range (1957-66) - 8,556-26,504
10 year average (1957-66) no. of trappers - 1,622

in the harvest occurred in Game Management Units 21 and 17. The harvest in Unit 19 increased slightly despite a limit reduction in part of the Unit. Unit 20 decreased.

Numerous reports from Unit 19 and 21 over the past few years have necessitated analysis of the harvest on a drainage basis. In 1964 Unit 19 was separated into two parts with different seasons and bag limits. No provisions were made at that time to analyze the harvest from the two different sub-units to attempt to detect differences in the age composition of the harvest.

An analysis of the 1966 harvest in Unit 19 on a drainage basis, using the stretched hide measurements as an indication of kits in the harvest, indicated that a readjustment of the Unit 19 sub-units was in order. The area being over-harvested was smaller than originally indicated and the degree of over harvest was greater. The major portion of Unit 19 is being harvested conservatively. When the information for the entire unit is lumped, the conservative harvest in the portion of the unit far outweighs the harvest in the over-harvested portion. Looking at the unit as a whole, the information would not indicate that there were any problems. The apparent over-harvest has been in the lower river portions of Unit 19.

The harvest from Unit 21 was also analyzed by drainage. Unit 21 followed much the same pattern as that which existed in Unit 19; however, the degree of over-utilization did not appear to be as great in Unit 21. Unit 21 was divided into two portions and the season was shortened 15 days in the lower portion of Unit 21.

Evidence is not available to determine if conditions which exist in both Units 19 and 21 are due entirely to excessive trapping. Significant differences in the productivity of beaver in different areas could possibly explain the variations in the percentage of kits represented in the harvest.

Beaver Aerial Surveys

A beaver house and cache count was conducted on the Innoko River. A total of 250 houses with and without caches was observed. One hundred and eighty-six of the houses and caches were plotted on 1:63,360 scale maps. Ninety-four or 38 percent of the houses had caches. In 1956 111 houses or 76.5 percent had caches, and in 1957 154 or 61 percent had caches (Table 2). If the counts are comparable, it would indicate the population on the Innoko count area has decreased since 1957.

At present it is not known what effect the ability of the observer or varying counting conditions may have on the results of the count. Ice and snow conditions may affect the accuracy of the counts. Proper timing and recording all houses and caches on maps may overcome many counting errors previously encountered. Further refinements of techniques may necessitate the re-analysis of past information.

Table 2. Innoko River Aerial Beaver Cache Counts

Year	Houses W/Caches	Houses W/O Caches	Total
1953	177		177
1954	187		187
1956	111 (76.5%)	34	145
1957	154 (61%)	73	227
1966	94 (38%)	156	250

Chena River Beaver Cache Survey

A canoe was launched on the Chena River approximately 74.0 to 79.5 river miles above Fairbanks. The canoe was paddled and motored down the Chena River to Fairbanks. Forty-nine beaver caches and six beaver houses without beaver caches were observed. There was an average of one cache per 1.5 to 1.6 miles of stream depending on the distance used.

The composition of the bottom, water depth at the cache, and plant species comprising each cache was also noted.

The bottom composition was recorded at 39 of the 49 caches observed. The composition was divided into three categories: silt, sandy silt, and sandy gravel. No critical measurements were used; the bottom was categorized by observation. A greater variation of bottom types was originally expected considering the various types comprising the bottom of the entire stream; however, placement of the beaver caches in locations where the water velocity was not as fast as many stretches of the river was the probable reason. The substrate around 5 (13 per cent) of the caches was silt; 24 (61 percent) were on sandy silt, and 10 (26 percent) were on sandy ground. The purpose of sampling bottom types was to determine if the loss of water around the beaver cache and house were contributing to winter mortality and specifically to determine if the loss of water was associated with bottom types.

Water depths were recorded at 44 caches; the average depth was 6.9 feet, the mode was 7 feet, and the extreme variation was 4 to 12.5 feet.

The depth of the entrance to the house below the surface of the water was measured on 25 beaver houses. The average depth was 4.5 feet. The variation was from 3.0 to 7.0 feet and the mode was 4.0 feet. Only one entrance was measured on each house. If multiple entrances are common on beaver houses and considering that entrances could not be found to some houses, these measurements may not be representative.

The kind of plants comprising the caches were also recorded as to genus. Four genera of plants were observed: Betula, Populus, Salix,

and Alnus. Observations were made of 45 caches and frequency of occurrence by genus is listed below.

	Betula	Populus	Salix	Alnus
No. of caches	9	2	44	9

Thirty caches contained only Salix and only one cache did not contain Salix. Betula and Salix combinations were common, but Betula and Alnus occurred together in only three caches. It is not known whether the observed composition is related to availability or preference.

Trapping Mortality

Efforts to measure the trapping mortality of each colony failed. Trappers, were uncooperative and did not report or maintain records of the number or sex of beaver taken from individual colonies. Each colony had been identified by a distinctive tag placed near the beaver house or cache.

Miscellaneous Studies

Tom Schuck, employed by the University of Oklahoma and cooperating with the Alaska Department of Fish and Game, examined 10 beaver carcasses for incidence of parasitism. As a result of Mr. Schuck's interest, he prepared a bibliography of beaver diseases and parasites to supplement an earlier bibliography by William H. Lawrence and S.A. Graham (1955). Both bibliographies are included in the Appendix.

APPENDIX

PARASITES AND DISEASES OF BEAVER

A supplementary bibiography by

Tom Schuck

This paper supplements the bibliography "Parasites and Diseases of the Beaver (Kuhl)" by W. H. Lawrence and S. A. Graham. The references examined to compile this bibliography are listed on page 2.

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Lawrence, W. H., L. D. Fay, and S. A. Graham. 1956. A report on the beaver die-off in Michigan. Jour. Wildl. Mgmt. 20(2):184-187. (Abstract in Biol. Abst. 31:27174)

Olsen, O. W. 1949. Incidence of helminth parasites in beavers from the Platte River in Weld County, Colorado. Jour. Colorado-Wyoming Acad. Sci. 4(1):64

Parker, R. R., E. A. Steinhaus, and G. M. Kohls. (U.S. Public Health Serv., Hamilton, Mont.) 1943. Tularemia in beavers and muskrats and the contamination of natural waters and mud by Pasteurella tularensis in the northwestern United States. Jour. Bact. 45(1):56-57

Parks, J. J. and J. W. Barnes. 1955. Notes on the family leptinidae including a new record of Leptinillus validus (Horn) in North America (Coleoptera). Ann. Ent. Soc. Amer. 48(5):417-421 (Abstract in Biol. Abst. 30:27386)

Rausch, Robert, B. B. Babero, R. V. Rausch, and E. L. Schiller. 1956 Studies on the helminth fauna of Alaska XXVII. The occurence of larvae of Trichinella spiralis in Alaskan mammals. Jour. Parasitol. 42(3):259-271 (Abstract in Biol. Abst. 31:9287)

Tenner, J. S. 1954. Beaver mortality. Can. Dept. N. Affairs and Natl. Resources, Wild. Mgmt. Pap. delivered at 18th Fed. Prov. Wildl. Conf. p. 35-38. (Abstract in Wildl. Rev. 86:44)

Vasenius, Helvi. 1963. A case of septicaemia in Canadian beaver (Castor canadesis Kuhl), caused by Aeromonas hydrophila. Nord. Vet. Med. 15(1):18-20 (German and Swedish summery)

Yeager, L. E. and K. G. Hay 1955. A contribution toward a bibliography on the beaver. Col. Dept. Game and Fish, Tech. Bul. no. liii + 103 p. Mimeo. Paper bound (abst. in Wildl. Rev. 85:29)

References searched

1. Amer. Midland Nat. Vol. 13, 19, 24, 26-27
2. Arctic Bibliographies Vol. 1-11
3. Biological Abstracts Vol. 1-33, 35-45
4. Canadian Field Naturalist Vol. 45-71, 73-76
5. Canadian Journal of Zoology Vol. 29-37, 39-42
6. Helminthological Abstracts Vol. 1-29, 30(1), 31-33

7. Journal of Mammalogy Vol. 1-42, 43(1, 3, 4), 44
8. Journal of Parasitology Vol. 1-43, 45-48
9. Journal of Wildlife Management Vol. 1-6, 8, 9, 11-21, 23, 26
10. Parasitology Vol. 1-25, 40-45, 46(3, 4), 49-54
11. U. of California Publications in Zoology Vol. 50, 52-61, 66-73
12. Wildlife Abstracts, 1935-51, 1952-55, 1956-60
13. Zoological Record Vol. 75, 77, 84-98

michigan

NUMBER 2

NOVEMBER, 1955

PARASITES AND DISEASES OF THE BEAVER (Castor canadensis Kuhl)[1]

AN ANNOTATED BIBLIOGRAPHY

WILLIAM H. LAWRENCE AND S. A. GRAHAM[2]

The bibliography here presented was prepared as a preliminary step in an ecological investigation of potential vectors and reservoirs of tularemia: a disease involved in a current epizootic among beavers in the Lake States and Canada. This is a selected bibliography in that it excludes some papers that deal primarily with taxonomy, morphology, and general parasitological surveys. The inclusion of unpublished data, special project reports and collection records, was thought desirable for completeness. Special acknowledgment is due the investigators permitting our mention of their unpublished findings. A list of parasitic organisms attacking beavers is appended.

1669. Perrault, Claude. Description anatomique d'un Cameleon, d'un Castor, d'un Dromadaire, d'un Ours, et d'une Gazelle. Académie des Sciences de l'Institute France. pp. 120.

The following quotation pertains to a beaver collected in Canada in the vicinity of the St. Lawrence River.

> ....we found in the inside 8 worms long and round like to earth-worms, three whereof were between seven and eight inches long, and the rest about four.

This is perhaps the first reference to parasites of North American beavers. See Rudolphi, 1819. (Translation of the original French by Alexander Pitfield in "Memoirs for a Natural History." London: Joseph Streater, 1688.)

1809. Rudolphi, C. A. Entozoorum sive vermium intestinalium historia naturalis. Vol. 2, Amstelaedami.

Lists as *"species dubiae"* the nematode, *Trichocephalus castoris*, reported from the large intestine of *Castor fiber*. Locality not given, and prior to 1820 the name *Castor fiber* was applied to both New and Old World beavers. A female of this worm is reported to be in the Vienna Museum. See Hall, 1916.

1819. Rudolphi, C. A. Entozoorum synopsis cui accedunt mantissa duplex et indices locupletissimi. Berolini.

Describes the fluke, *Amphistoma subtriquetrum* n. sp. (=*Stichorchis subtriquetrus*) from caecum and colon of *Castor fiber*. The round worms Perrault described in 1669 are named *Ascaris castoris* n. sp. by Rudolphi.

1830. Tanner, John. The narrative of the captivity and adventures of John Tanner during thirty years of residence among the Indians in the interior of North America. New York: G. & C. & H. Carvill.

Gives an account of a beaver epizootic.

1868. Morgan, L. H. The American beaver and his works. Philadelphia: Lippincotte Co.

Morgan was one of the first to record and describe endoparasites of North American beavers. His brief descriptions appear in a footnote on page 73 where he writes,

> In the stomach of the beaver I have found a very fine filamentous worm, 40''' in length, species unknown. Large numbers of a long, slender white worm 3" to 5" in length were found in the peritoneal cavity (Filaria species not known), also in the colon, and especially in the caecum, sclerostema, male and female, species not known and the amphistoma subtriquetrum.

[1]PAPER NO. 2 TULAREMIA PROJECT, SCHOOL OF NATURAL RESOURCES, SUPPORTED BY RESEARCH GRANT E-668, NATIONAL INSTITUTES OF HEALTH AND FACULTY RESEARCH GRANT 914, HORACE H. RACKHAM SCHOOL OF GRADUATE STUDIES, UNIVERSITY OF MICHIGAN.

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For further treatment of the unnamed worms found by Morgan see Hall, 1916 and Chapin, 1925.

1869. Ritsema, J. Petites Nouvelles Entomologiques for Sept. 15, 1869. (Publication not seen.)

Describes the beetle ectoparasite *Platypsyllus castoris* n. sp., from European and American beavers on exhibit in the Rotterdam Zoological Garden. Because of an early misunderstanding, many authors have subsequently spelled the genus name *Platypsylla*. This is an error and the original spelling is valid.

1889. Riley, C. V. Systematic relations of Platypsyllus as determined by the larva. Insect life, *1:* 300-307.

Drawings of the adult and larval forms of the beaver beetle, *Platypsyllus castoris*.

1892. Riley, C. V. Systematic relations of *Platypsyllus* as determined by the larva. Appendix C, p. 237 in the book "Castorologia" by H. T. Martin.

Figures an adult platypsyllid and mentions an associated beaver ectoparasite the nest beetle, *Leptinillus validus* (= *Leptinus validus* n. sp. Horn, G. H. 1872. Descriptions of some new North American coleoptera. Trans. Amer. Ento. Soc., *4:* 145-146. Beetle from the Hudson Bay region, no host given.)

1896. Osborn, Herbert. Insects affecting domestic animals. U. S. Dept. Agric. Division Ent. Bul., 5NS.

Describes and figures the louse, *Trichodectes castoris* n. sp. from the beaver. No locality given.

1896. Trouessat, E. Sur un type nouveau de Sarcoptides Pilicoles (*Schizocarpus mingaudi*) vivant sur le castor. Bull. Mus. Hist. Nat. Paris, *2:* 62-63.

Describes the hair mite, *Schizocarpus mingaudi* n. sp., from both Old and New World beavers.

1897. Coues, Elliott, ed. The manuscript journals of Alexander Henry and David Thompson, 1799-1814. New York: Harper.

Gives an account of a beaver epizootic.

1905. MacFarlane, R. Notes on mammals collected and observed in the northern Mackenzie River District, North-west Territories of Canada, with remarks on explorers and explorations of the far north. Proc. U. S. Nat'l. Mus., *28:* 673-764.

Reports it is not uncommon to find dead beavers in lodges and "washes." Low water is believed to be the cause of death of some beavers during winter.

1910. Stiles, C. W. The taxonomic value of the microscopic structure of the stigmal plates in the tick genus *Dermacentor*. Hygienic Lab. Bul., 62.

Lists the beaver as a host of *Dermacentor albipictus*. Locality not given; however, the specimen was collected by Lawrence Brunner, who lived in the vicinity of West Point, Neb.

1916. Hall, Maurice. Nematode parasites of mammals of the orders Rodentia, Lagomorpha, and Hyracoidae. Proc. U. S. Nat'l. Mus., *50:* 1-252.

States the name *Trichocephalus castoris* Rudolphi, 1809, is probably a *nomen nudum*. Lists *Ascaris castoris* Rudolphi, 1819 and the *Filaria* sp. Morgan, 1868. Relying wholly on Morgan's descriptions, Hall assigns the fine filamentous stomach worms, 3-1/3" long, to the genus *Gongylonema* sp. and the *Sclerostema* sp. to the genus *Strongylus*. See Chapin, 1925, regarding *Strongylus* sp.

1916. Tyrrell, J. B., ed. David Thompson's narrative of his explorations in Western America, 1784-1812. Toronto: The Champlain Society.

Gives an account of a beaver epizootic.

1923. Bailey, Vernon. The combing claws of the beaver. Jour. Mammal., *4:* 77-79.

Records the occurrence of *Leptinillus validus* from Wisconsin beavers.

1925. Chapin, E. A. New nematodes from North American Mammals. Jour. Agric. Research, *30:* 677-681.

Describes the stomach worm, *Travassosius americanus* n. sp., (= *T. rufus* of Khalil, 1922) and the intestinal strongyle *Castorstrongylus castoris* n. sp.. The latter is believed by Chapin to be the *Strongylus* sp. of Hall, 1916, and the *Sclerostema* sp. of Morgan, 1868.

1927. Rush, William. Notes on disease in wild game mammals. Jour. Mammal., *8:* 163-165.

Reports *Travassosius americanus* (= *T. rufus*) from Montana beavers.

1927. Warren, E. R. The beaver: its work and ways. Baltimore: Waverly Press.

Records the occurrence *Platypsyllus castoris* and *Leptinillus validus* by localities. Includes an account of an early beaver die-off.

1929. Canavan, W. P. Nematode parasites of vertebrates in the Philadelphia Zoological Garden and vicinity I. Parasitol., *21:* 63-102.

Reports the occurrence of *Oxyuris* sp. in 4 of 17 beavers which died at the zoo. No further mention is made of this worm.

1931. Canavan, W. P. Nematode parasites of vertebrates in the Philadelphia Zoological Garden and vicinity II. Parasitol., *23:* 196-229.

Reports the occurrence of *Castorstrongylus castoris* in beavers at the zoo.

1932. Law, R. G. and H. K. Arnold. Parasites of fur-bearing animals. Ontario Dept. Game and Fish Bul. 4.

Record the fluke, *Cladorchis subtriquetrus (=Stichorchis subtriquetrus),* from Ontario beavers.

1934. Canavan, W. P. On a trematode *Allopyge indulatus* n. sp. parasitic in Lilfords crane *(Megalornis grus lilfordi).* Parasitol., *26:* 117-120.

Reports trematode, *Renifer ellipticus.* from a beaver that died at Philadelphia Zoological Garden. This is an unusual record as this species is normally parasitic in the mouths of snakes.

1934. Chitwood, B. C. *Capillaria hepatica* from the liver of *Castor canadensis canadensis.* Helminth Soc. Wash. Proc., *1:* 10.

Host died at the National Zoological Garden.

1934. Morley, L. C. Report on internal parasites of the beaver. Penn. Game News, *5* (7):16.

Reports the occurrence of the nematodes, *Castorstrongylus castoris* and *Travassosius americanus (T. = rufus),* and the amphistome, *Stichorchis subtriquetrus* in beavers from the state. Coccidia oocysts were found on the large intestine in one specimen.

1934. Price, E. W. A new trematode from a beaver. Helminth. Soc. Wash. Proc., *1:* 1.

Describes the intestinal fluke, *Stephanoproraoides lawi* n. sp. from Ontario beavers.

1937. Kofoid, C. A. and J. T. Park. A new trematode *Paramphistomum castori* sp. nov. from *Castor canadensis baileyi* Nelson from Mary's River, Nevada. Univ. Calif. Pub. Zool., *41:* 419-422.

A synonym of *Stichorchis subtriquetrus.* See Erickson, 1944.

1940. Cook, A. H. Screwworms infest beavers in Texas. Jour. Mammal., *21:* 93.

Reports of 3 out of 40 beavers trapped infested with larvae of the screwworm fly, *Cochliomyia americana.*

1940. Ferris, W. A. Life in the Rocky Mountains. Denver: Old West Publishing Co.

Contains an account from an early traveler's journal of a beaver die-off.

1940. Hammersland, H. L. and E. M. Joneschild. Tularemia in beaver. Jour. Amer. Vet. Med. Assoc., *96:* 96-97.

See Scott, 1940a following.

1940a. Scott, J. W. Natural occurrence of tularemia in beaver and its transmission to man. Science, *91:* 263-264.

Scott, and Hammersland and Joneschild, 1940, report on the first isolation of *Pasteurella tularensis* from the beaver. The organism was recovered from several carcasses found during a die-off of these animals in Wyoming in 1939.

1940b. Scott, J. W. Winter kill in beaver. Jour. Mammal., *21:* 462.

Reports on the death of a colony of six beavers in Wyoming. No bacterological evidence that tularemia was the cause of death. Animals appeared to have died during the winter of "suffocation" as the shallow pond, 3'-4' in depth, is believed to have frozen solid.

1942. Jellison, W. L. *et. al.* Epizootic tularemia in the beaver, *Castor canadensis,* and the contamination of stream water with *Pasteurella tularensis.* Am. Jour. Hygiene, *36:* 168-182

Report on an epizootic among beavers in Montana during 1939-1940. Discusses the epidemiology of spontaneous tularemia in beavers. Jellison believes the occurrence of the disease in these animals results from a concurrent tularemia epizootic in terrestrial mammals and in the absence of a suitable anthropod vector for beavers proposes the hypothesis of water contamination by terrestrial animals.

1944. Erickson, A. B. Parasites of beavers, with a note on Paramphistomum castori Kofoid and Park, 1937 a synonym of Stichordis subtriquetrus. Am. Mid. Nat., *31:* 625-630.

Reviews the literature on beaver parasites. Records the occurrence of the helminths *Stichorchis subtriquetrus, Stephanoproraoides lawi, Travassosius americanus,* and *Castorstrongylus castoris,* and the beetle *Platyspyllus castoris* from Minnesota beavers.

1948. Lawrence, R. F. Studies on some parasitic mites from Canada and South Africa. Jour. Parasitol., *34:* 364-379.

Describes the hair mite, *Prolabidocarpus canadensis* n. sp. from a Canadian beaver.

1949. Erickson, A. B. The fungus *(Haplosporangium parvum)* in the lungs of the beaver *(Castor canadensis).* Jour. Wildlife Mgt., *13:* 419-420.

Reports the disease from a Minnesota beaver.

1951. Parker, R. R. *et al.* Contamination of natural waters and mud with *Pasteurella tularensis* and tularemia in beavers and muskrats in the Northwestern United States. Nat'l. Institutes of Health Bull., 1993.

Report the results of experiments in isolating tularemia from mud and water, and the survival of the organism in these media. Review the literature and state reports pertaining to tularemia in beavers and muskrats.

1952. Brakhage, G. K. Rabies in beaver. Jour. Wildlife Mgt., *16:* 226.

Reports the disease from Missouri where a rabid beaver was found attacking a farm dog. Determination of the disease was made at the University of Missouri School of Veterinary Medicine.

1952. Labzoffsky, N. A. and J. A. F. Sprent. Tularemia among beaver and muskrat in Ontario. Cand. Jour. Med. Sci., *30:* 250-255.

Report the isolation of *P. tularensis* from beaver and muskrat carcasses collected during an epizootic in Northern Ontario, 1949-1951.

1953. Anderson, R. C. Dipetalonema sprenti n. sp., from Castor canadensis Kuhl. Parasitol., *34:* 215-221.

Reports this filariid from the peritoneal cavity of Canadian beavers. Possibly the filaria species of Morgan, 1886.

1953 Flakas, K. G. Beaver disease investigations. Job completion report Pittman-Robertson Project 24-R. P-R Quarterly Progress Reports, Wis. Wildlife Res., *12*(3):75-85.

This unpublished report summarizes the bacteriological findings made in connection with Knudsen's studies (see below). *Pasturella tularensis* was isolated from one beaver carcass. Suggests that *Psuedomonas hydrophila* might have been responsible for some beaver mortality and includes findings suggestive of this possibility.

1953a. Knudsen, G. J. Beaver die-off. Wisconsin Conservation Bull., *18:* 20-23.

Die-off occurred during two years 1952-53. Two hundred ninety dead beavers reported for 1953. Tularemia organism was recovered from only one carcass though gross pathology in a number of carcasses was suggestive of this disease. No human cases of tularemia among trappers was reported.

1953b. Knudsen, G. J. Beaver disease studies - Job completion report Pittman-Robertson Project 15-R. P-R Quarterly Progress Reports, Wis. Wildlife Res., *12*(3):59-74.

This unpublished report summarizes the findings on the cause and extent of beaver mortality in Wisconsin during the winter, 1952-53. Two hundred and ninety two dead beavers were found. It is estimated 1000 to 1500 beavers were killed during the epizootic. *Pasturella tularensis* was isolated. The possible correlation between areas of beaver mortality and areas of extreme fluctuations in vole populations is suggested.

1953. Stenlund, M. H. Report of Minnesota beaver die-off, 1951-52. Jour. Wildlife Mgt., *17:* 376-377.

Four hundred seven dead beavers reported. Although gross pathological examinations disclosed in many carcasses lesions typical of tularemia the organism could not be isolated. No human cases reported among beaver trappers.

1954. Banfield, A. W. F. Tularemia in beavers and muskrats, Waterton Lakes National Park, Alberta, 1952-53. Can. Jour. Zoo., *32:* 139-143.

Twenty-six beavers and four muskrats found dead. *Pasteurella tularensis* was isolated from carcasses of several beavers and a muskrat. The organism was also recovered from water of the affected ponds and streams. No human cases reported.

1954. Judd, W. W. Some records of ectoparasitic Acarina and Insecta from mammals in Ontario. Jour. Parasitol., *40:* 483-484.

Records the occurrence of the tick, *Ixodes cookei*, from an Ontario beaver. This record is in error as the tick was misidentified. Upon re-examination by us, the tick was found to be actually *Ixodes banksi*.

1954. Langford, E. V. An out-break of tularemia in beaver and muskrats in Waterton Lakes National Park, Alberta. Can. Jour. of Comparative Med. and Vet. Sco., *18:* 28-30.

See Banfield, 1954.

1954. Lawrence, W. H. and L. D. Fay. The recent epizootic among Michigan beavers. Paper presented at the Sixteenth Midwest Wildlife Conference, St. Louis, Mo. Dec. 1-3, 1954. (unpublished ms).

Die-off occurred during two years 1953-54 and may still be in progress. One hundred thirty-three beavers reported (more recent records have now increased the number to 188, WHL). Tularemia organism was first isolated during 1954 from two beaver carcasses; however, three serological confirmed cases of this disease occurred among trappers who had handled sick or dead beavers in 1953. Report the occurrence of the tick *Ixodes banksi* from both beavers and muskrats in five counties in the Upper Peninsula, within the general area of the die-off.

Parks, J. J. and J. W. Barnes. Notes on the family Leptinidae including a new record of *Leptinillus validus* (Horn) in North America (Coleoptera). Annals Am. Ent. Soc., in press.

Gives distribution records for *L. validus*.

Davies, D. M. Unpublished data. Collection records of the tick, *Ixodes banksi*, from Ontario beavers, Sudbury District, April 14, 1949, and Algonquin Park, August 10, 1950.

1953. Connell, Robert. An unpublished report on beaver specimens examined at the Veterinary Research Station, Letbridge, Alta., since January 1953.

Reports the beetle ectoparasite, *Platypsyllus castoris* and the nematodes, *Castorstrongylus castoris* and *Travassosius americanis (T. = rufus)* from specimens examined. Also reports the isolation of the following pathogens from beaver carcasses: *Pasturella tularensis; Pasturella pseudotuberculosis; Salmonella bareilly;* and rabies virus. The tularemia organism was recovered from two carcasses found in the Waterton Lakes National Park. See Bandfield, 1954 and Langford, 1954 for discussion on beaver mortality in this area.

Lawrence, W. H. and S. A. Graham. Unpublished data 1953-54. Collection records of the tick, *Ixodes banksi*, the hair mite, *Prolabidocarpus canadensis;* two beetle ectoparasites, *Leptinillus validus* and *Platypsyllus castoris;* and single records each of the occurrence of the mite, *Haemolaelaps glasgowi*, and the fleas, *Megabothris quirini* and *Corrodopsylla curvata* from Michigan beavers.

SPECIES LIST

Protozoa

Coccidia sp.
Morely, 1934

Roundworms

Ascris castoris n. sp. Rudolphi, 1819
Perrault, 1669 (first observed this worm)
Hall, 1916

Capillaria hepatica
Chitwood, 1934

Castorstrongylus castoris n. sp. Chapin, 1925
(= *Sclerostema* sp. Morgan, 1868)
(= *Strongylus* sp. Hall, 1916)
Canavan, 1931
Morley, 1934
Erickson, 1944
Connell (unpublished)

Dipetalonema sprenti n. sp. Anderson, 1953

Filaria sp. Morgan, 1868
Hall, 1916

Gonglylonema sp. Hall, 1916
Morgan, 1868 (Fine filamentous stomach worms 3-1/3" long)

Oxyuris sp.
Canavan, 1929

Travassosius americanus n. sp. Chapin, 1925
(= T. rufus)
Rush, 1927
Morely, 1934
Erickson, 1944
Connell (unpublished data)

Trichocephalus castoris "species dubiae" Rudolphi, 1809
Hall, 1916 (lists as a *nomen nudum*)

Flukes

Renifer ellipticus
Canavan, 1934

Stephanoproraoides lawi n. sp. Price, 1934
Erickson, 1944

Stichorchis subtriquetrus (Rudolphi, 1819)
(= *Amphistoma subtriquetrum* n. sp. Rudolphi, 1819)
(= *Cladorchis subtriquetrus* of Law and Arnold, 1932)
(=*Paramphistumum castoris* n. sp. Kofoid and
Morgan, 1886
Morely, 1934
Park, 1937
Erickson, 1944

Ticks

Dermacentor albipictus
Stiles, 1910

Ixodes cookei
Judd, 1954. This is an error. The specimen was misidentified and is actually *Ixodes banksi.*

Ixodes banksi
Lawrence, W. H. and Fay, 1954
Davies, D. M. Unpublished data
Lawrence, W. H. and Graham. Unpublished data

Mites

Haemolaelaps glasgowi
Lawrence, W. H. and Graham (unpublished data)

Prolabidocarpus canadensis n. sp. Lawrence, R. F., 1948
Lawrence, W. H. and Graham (unpublished data)

Schizocarpus mingaudi n. sp. Trouessat, 1896.

Biting Lice

Trichodectes castoris n. sp. Osborn, 1896

Beetles

Leptinillus validus
(= *Leptinus validus* n. sp. Horn, 1872. See Riley, 1892)
Bailey, 1923
Warren, 1927
Parks and Barnes (in press)
Lawrence, W. H. and Graham (Unpublished data)

Platypsyllus castoris n. sp. Ritsema, 1869
Riley, 1889 and 1892
Warren, 1927
Erickson, 1944
Connell (unpublished data)
Lawrence, W. H. and Graham (unpublished data)

Fleas

Corrodopsylla curvata
Lawrence, W. H. and Graham (Unpublished data)

Megabothris quirini
Lawrence, W. H. and Graham (Unpublished data)

Flies

Cochliomyia americana
Cook, 1940

Diseases

Beaver die-offs (non-specific)
Tanner, 1830
Coues, 1897
MacFarlane, 1905
Tyrrell, 1916
Warren, 1927
Ferris, 1940
Scott, 1940b
Stenlund, 1953
Connell (unpublished data)

Tularemia Epizootics
Hammersland and Joneschild, 1940
Scott, 1940a
Jellison *et. al.*, 1942
Parker *et. al.*, 1951
Labzoffsky and Sprent, 1952
Flakas, 1953
Knudsen, 1953a and 1953b
Banfield, 1954
Langford, 1954
Lawrence, W. H. and Fay, 1954
Connell (unpublished data)

Pasturella pseudotuberculosis
Connell (unpublished data)

Salmonella barielly
Connell (unpublished data)

Rabies
Brakhage, 1952
Connell (unpublished data)

Pathogenic Fungus

Haplosporangium parvum
Erickson, 1949

WORK PLAN SEGMENT REPORT
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-13-R-2 TITLE: Small Game and Furbearer Investigations

WORK PLAN: A TITLE: Furbearer Studies

JOB NO.: 4 TITLE: Lynx: Productivity and Breeding

PERIOD COVERED: July 1, 1966 to June 30, 1967

ABSTRACT

Analysis of lynx reproductive information is still largely incomplete. Preliminary information indicates a gross decrease in reproduction as evidenced by placental scars.

Trapping success for lynx declined greatly from the 1965-66 season to the 1966-67 season. Trappers reported medium to low lynx populations in 1965-66. Low and decreased lynx populations were reported in 1966-67.

Hare populations were considered to be very low in both seasons. Hare populations had increased slightly in the 1966-67 season.

Low and decreased grouse populations were reported in the 1965-66 season. Somewhat higher and increased grouse populations were reported for the 1966-67 season.

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PROJECT NO.: W-13-R-2 TITLE: Small Game and Furbearer Investigations

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JOB NO.: 4 TITLE: Lynx: Productivity and Breeding

PERIOD COVERED: July 1, 1966 to June 30, 1967

OBJECTIVES

To obtain data on the breeding and physical condition of lynx in Alaska from carcass examinations.

To determine annual productivity and to relate production of young to population trends of lynx.

To study relationships between lynx numbers and abundance of their prey.

TECHNIQUES

Skinned lynx carcasses are purchased from trappers. Collection dates range from November 1, 1966 to March 31, 1967. This collection was primarily limited to females. The carcasses are weighed and measured. The stomach contents are noted. The skull, ulna, radius, and reproductive tract are removed and processed for other observations. Skull characteristics and epiphyseal closure of the ulna and radius are used to determine the approximate age of the specimens, to be checked against data from tooth sectioning.

The reproductive tracts are placed in water and frozen immediately after they are removed from the carcass. Later they are thawed and examined for placental scars. Both cornu are slit open. The locations of the placental scars are recorded on a diagramatic sketch of the uterus. The color and intensity of the pigment are also noted. The uterus and ovaries are then preserved in 10 percent formalin.

After the ovaries have hardened in formalin, they are macroscopically sectioned to reveal the number of corpora albicantia.

At the time the skulls, ulni and radii are cleaned, the canine

teeth are removed and preserved in 1 percent formalin. The teeth are then decalcified in a formic acid solution, sectioned, stained, mounted, and examined under low-power magnification to determine the number of cementum layers on the tooth root.

Questionnaires are mailed to trappers to obtain information on trapping success and game populations. The questionnaire provides for observations of density and trends in lynx, hare, and grouse. Small maps were included with the questionnaires sent to trappers not participating the previous season. Copies of the questionnaire and letter sent requesting cooperation and letter with information derived from the survey may be found in the appendix.

An index has been established to evaluate the answers to the questionnaire. The index is derived by giving each answer a numerical value: high or more equals nine, medium or the same equals five, and low or fewer equals one. An index value of 9.00 would indicate that all responses indicated either a high population or the animals were more abundant. An index value of 1.00 would indicate that all responses indicated either a low population or that there were fewer animals than the previous year.

Breeding and Physical Condition of Lynx

Much of the material from this collection and past collections dating back to 1961 remains to be analyzed. The reproductive information from the 1964-65 collection (a large collection of females partly reported in the last segment report) has been machine-compiled and analyzed. Correlations have been run and statistically checked. The report will be prepared in fulfillment of a Master of Science Thesis by Joseph Nava II and presented in the next segment report.

Age Classes

The 1966-67 specimens were separated into two age classes based on long bone epiphyseal fusion and skull characteristics: subadults (45 females, 5 males), and adults (155 females, 9 males). There were no kits.

Three male and six female subadults had characteristics which were more advanced than typical subadults. Two females were even more advanced than the latter group of nine; however, they still had some subadult characteristics.

Aging by cementum layers of the canine teeth may provide additional information necessary to place the questionable specimens in the correct age group. No known-age lynx are available to provide information on aging; therefore, a tagging program will commence as soon as possible.

Reproduction

Female reproductive material has not been completely analyzed.

Counts of corpora albicantia and placental scars have been made; however, only the placental scar counts have been related to age as estimated from long bones.

Mean placental scar counts in 1963 and 1964 were 2.50 to 5.05 for subadult females, depending on geographic area. In 1966-67, the mean of subadult lynx from all areas was 0.57. Only five subadults out of 52 had placental scars, and adult females also had a much reduced rate of placentation. Mean placental scar counts from the 1963-64 season varied from 5.20 to 7.11 per female depending upon the area. From the 1966-67 season, the over-all mean was 2.31 placental scars per female.

Forty-seven percent of the adult females collected in the 1966-67 season had no placental scars from the previous season. We suspect that many more females did not have placental scars from the preceding season; however, because of difficulty of interpreting pigmentation many were considered to be from the previous season. These are only preliminary figures; they will change when checked more thoroughly with other variables and when our ability to interpret placental scars improves.

Lynx Numbers and Prey Abundance

Questionnaires were mailed out to trappers around the close of the lynx trapping season in 1966 and 1967. One hundred and nine out of 235 returned the forms in 1966 and only 63 returned the forms in 1967. The probable causes of the low return are that trappers did not trap or they did not catch any lynx as a result of the low lynx population.

The results are placed on Unisort Analysis Cards (Form Y9) and separated into eight areas. With only 63 persons answering the questionnaire in 1967, few answers were received from some areas. If there were differences of opinion between the few persons answering, the results of the questionnaire are doubtful.

It would appear that during the years when hare, grouse, and lynx populations are at their lowest there is more disagreement between trappers than when the populations have made an obvious increase or decrease. From these observations I postulate that questionnaires will be useful only to establish obvious increases or decreases in populations. If there are two or more years with small percentage population changes at the high and low of the cycles, other techniques will need to be applied to determine population changes.

Area Description

The area covered by the survey includes the Yukon Valley from the village of Tanana to the Canadian border, the Tanana Valley from the mouth of the Tanana River to the Canadian border, and the Copper River Valley from the headwaters to Chitina. The area is subdivided

into seven sections corresponding with trappers residences and patterns of lynx utilization: Fairbanks, Delta Junction, Tok, Glennallen, Fort Yukon, Rampart, and Minchumina.

Lynx Populations

The average lynx harvest dropped from 13.75 lynx per trapper in 1966 to 3.95 lynx per trapper in 1967. In 1966 trappers reported low and declining lynx population in most areas. The exception was the Glennallen area where a medium population at about the same level as the previous year was reported.

Table 1. Summary of replies to questionnaire on Lynx Harvest.

	1966		1967	
	No. of Responses*	Average Catch per Trapper	No. of Responses*	Average Catch per Trapper
Fairbanks	42	5.3	21	1.5
Delta Junction	13	6.9	7	3.9
Tok	14	10.5	5	1.6
Glennallen	21	32.2	12	9.4
Fort Yukon	7	29.6	5	8.2
Rampart	4	10.0	4	3.2
Minchumina	2	3.0	2	.5
Other Areas	1	1.0	8	1.8
TOTAL	104	13.75	64	3.9
Largest Catch		231		31

*Trappers not answering the question, "How many lynx did you take?" were considered to have trapped and not caught lynx.

In 1967 trappers reported lynx numbers to be down except in the Tok area where a slightly larger population was reported. Tok trappers inconsistently reported the population to have declined from the previous year. Fort Yukon trappers demonstrated a similar inconsistancy, but in both cases the very small sample would account for the differences.

Table 2. Summary of Replies to Questionnaires on Lynx Populations.

1966 Survey

	Abundance in 1965-66 Season				Comparison with 1964-65 Season			
	High	Medium	Low	Index*	More	Same	Fewer	Index*
Fairbanks	2	21	19	3.38	5	9	25	2.95
Delta Junction	2	6	7	2.72	2	3	5	3.80
Tok	0	5	9	2.43	3	2	9	3.29
Glennallen	8	6	4	5.89	6	9	4	5.42
Fort Yukon	0	4	3	3.29	0	1	5	1.67
Rampart	0	2	2	3.00	1	2	1	5.00
Minchumina	1	0	1	5.00	1	0	1	5.00

* See section on techniques for explanation of index.

Table 2. Summary of Replies to Questionnaires on Lynx Populations (Cont.)

	1966 Survey							
	Abundance in 1965-66 Season				Comparison with 1964-65 Season			
	High	Medium	Low	Index*	More	Same	Fewer	Index*
Other Areas	0	0	1	1.00	0	1	0	5.00
Combined	13	44	46	3.72	18	27	50	3.75

	1967 Survey							
	Abundance in 1966-67 Season				Comparison with 1965-66 Season			
	High	Medium	Low	Index*	More	Same	Fewer	Index*
Fairbanks	0	1	21	1.18	1	1	19	1.57
Delta Junction	0	1	6	1.57	1	0	6	2.14
Tok	1	0	2	3.67	0	0	3	1.00
Glennallen	0	0	12	1.00	0	0	11	1.00
Fort Yukon	0	2	3	2.60	0	1	4	1.80
Rampart	0	0	0	0	0	0	3	1.00
Minchumina	0	0	2	1.00	0	0	2	1.00
Other Areas	0	2	5	2.14	1	0	4	2.60
Combined	1	6	51	1.55	3	2	52	1.56

* See section on techniques for explanation of index.

Hare

Very low hare populations were reported in both 1966 and 1967. Little change was reported in most areas. Glennallen trappers reported a decline from 1966 to 1967 and Fort Yukon trappers indicated an increase in 1967. Even though low populations were generally reported in 1967, many areas indicated the population was increasing.

Table 3. Summary of Replies to Questionnaires on Hare Populations.

	1966 Survey							
	Abundance in 1965-66 Season				Comparison with 1964-65 Season			
	High	Medium	Low	Index	More	Same	Fewer	Index
Fairbanks	0	4	38	1.38	3	5	32	2.10
Delta Junction	0	2	13	1.53	1	2	6	2.78
Tok	0	0	14	1.00	1	0	14	1.53
Glennallen	1	6	12	2.68	1	4	12	2.41
Fort Yukon	0	1	6	1.57	0	3	3	3.00
Rampart	0	0	4	1.00	1	0	3	3.00
Minchumina	0	0	2	1.00	0	0	2	1.00
Other Areas	0	1	0	5.00	0	1	0	5.00
Combined	1	14	89	1.62	7	15	72	2.24

Table 3. Summary of Replies to Questionnaire on Hare Populations (Cont.)

1967 Survey

	Abundance in 1966-67 Season				Comparison with 1965-66 Season			
	High	Medium	Low	Index	More	Same	Fewer	Index
Fairbanks	1	2	19	1.73	4	5	11	3.60
Delta Junction	0	1	6	1.57	2	2	3	4.43
Tok	0	0	1	1.00	0	1	2	2.33
Glennallen	0	0	11	1.00	0	0	11	1.00
Fort Yukon	1	2	2	4.20	3	1	1	6.60
Rampart	0	0	4	1.00	0	0	3	1.00
Minchumina	0	0	2	1.00	0	1	1	3.00
Other Areas	0	0	6	1.00	1	0	4	2.60
Combined	2	5	51	1.62	10	10	36	3.14

Grouse

The changes in the grouse population from 1966 to 1967 are reflected by fewer trappers holding the opinions that there are fewer grouse. Very few trappers in either year felt that grouse populations were high. In 1967 a higher percentage felt the grouse population was increasing.

Table 4. Summary of Replies to Questionnaire on Grouse Populations.

1966 Survey

	Abundance in 1965-66 Season				Comparison with 1964-65 Season			
	High	Medium	Low	Index	More	Same	Fewer	Index
Fairbanks	1	6	34	1.78	8	13	18	3.98
Delta Junction	2	1	10	2.54	3	2	2	5.58
Tok	0	0	14	1.00	0	5	9	2.43
Glennallen	1	0	17	1.44	3	4	10	3.35
Fort Yukon	0	5	2	3.86	3	2	1	6.34
Rampart	0	1	3	2.00	0	0	3	1.00
Minchumina	0	1	1	3.00	1	1	0	7.00
Other Areas	0	1	0	5.00	1	0	0	9.00
Combined	4	15	81	1.92	19	27	43	3.92

1967 Survey

	Abundance in 1966-67 Season				Comparison with 1965-66 Season			
	High	Medium	Low	Index	More	Same	Fewer	Index
Fairbanks	0	11	11	2.50	6	12	2	5.80
Delta Junction	0	1	5	1.68	1	4	2	4.43
Tok	0	0	3	1.00	2	0	1	6.33
Glennallen	0	0	11	1.00	1	6	4	3.91
Fort Yukon	1	3	1	5.00	4	0	1	7.40
Rampart	0	0	4	1.00	0	0	3	1.00
Minchumina	0	2	0	5.00	1	1	0	7.00
Other Areas	0	2	4	2.34	2	2	0	7.00
Combined	1	19	39	2.42	17	25	13	5.29

APPENDIX

NAME: _____ ADDRESS: _____

Where did you trap? _____ _____
(Please also mark area on map if enclosed)

How many lynx did you take in the 1966-67 trapping season?

From your observations during the 1966-67 trapping season, please place an "X" in the best boxes for the following:

Numbers of lynx were: high ☐ / medium ☐ / low ☐ — There were: more lynx than ☐ / the same number of lunx as ☐ / fewer lynx than ☐ — in the 1965-1966 trapping season.

Numbers of rabbits were: high ☐ / medium ☐ / low ☐ — There were: more rabbits than ☐ / the same number of rabbits as ☐ / fewer rabbits than ☐ — in the 1965-1966 trapping season.

Numbers of grouse were: high ☐ / medium ☐ / low ☐ — There were: more grouse than ☐ / the same number of grouse as ☐ / fewer grouse than ☐ — in the 1965-1966 trapping season.

Comments:

ALASKA DEPARTMENT OF FISH AND GAME
604 Barnette St., Room 116
Fairbanks, Alaska

April 11, 1967

Dear Trapper:

Last spring the Department of Fish and Game conducted a survey of trappers to learn more about lynx. I was extremely pleased with the results and hope to do as well this year.

Trappers spend more time outdoors and are more observant than most people who only hunt and fish. Therefore, you can be of great help to us by filling out the enclosed form and return it in the self-addressed envelope.

The comments and letters returned with the forms last year were very valuable and interesting and I hope you will continue to make comments. Please return the questionnaire promptly so I can send the results back to you as soon as possible.

If you are a new cooperator, I have enclosed a map so you can show us the area you trap. You needn't be exact, all we need to know is the general area you are talking about. If the map is not of the right area, then tell us as best you can where you trap.

Sincerely,

ALASKA DEPARTMENT OF FISH AND GAME

Oliver E. Burris

Oliver E. Burris
Game Biologist

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
504 Barnette Street, Room 116, Fairbanks, Alaska

December 26, 1967

Dear Trapper:

The wheels of progress came to a complete stop at Fairbanks this summer. One of the results was I failed to pass on the information you generously supplied me by filling out the lynx trappers questionaire. This was the third season the survey has been conducted. A very small number of trappers sent back the forms this year, only 63. Ten of the 63 trappers did not trap in the 1966-67 season. The average number of lynx caught was 5 per trapper.

	1964-65	1965-66	1966-67
Average number of lynx caught per trapper.	19	17	5
Highest catch reported	170	231	31

Trappers have reported on lynx, snowshoe hare, and grouse populations in several areas.

UPPER YUKON VALLEY

Fort Yukon

Lynx: Low population Lower than last year

Hare: Medium population.Slightly more than last year.

Grouse: Medium population.More than last year.

Rampart-Tanana

Lynx: Lower than last year.

Rampart-Tanana continued

Hare:	Low population	Lower than last year.
Grouse:	Low population	Lower than last year.

TANANA VALLEY

Tok

Lynx:	Low population.	Lower than last year.
Hare:	Low population.	Slightly fewer than last year.
Grouse:	Low population.	Slightly more than last year.

Delta Junction

Lynx:	Low population.	Definitely lower than last year.
Hare:	Low population.	Slightly lower than last year.
Grouse:	Low population.	About the same as last year.

Fairbanks

Lynx:	Low population.	Definitely lower than last year.
Hare:	Low population.	Definitely lower than last year.
Grouse:	Medium population.	About the same as last year.

Minchumina

Lynx:	Low population	Lower than last year.
Hare:	Low population.	Slightly lower than last year.
Grouse:	Medium population.	Slightly higher than last year.

Copper River Valley

Lynx:	Low population.	Definitely lower than last year.
Hare:	Low population.	Definitely lower than last year.
Grouse:	Low population.	About the same as last year.

In all areas lynx were down and lower than in the winter of 1965-66. Snowshoe hare were also low in most areas but increasing in the Fort Yukon Area. Grouse were generally low but increasing in several areas (Fort Yukon, Tok, and Minchumina). I would predict that most areas will show increases in hares and grouse this winter but it will probably take a few more seasons for most areas to show a real increase in lynx.

It may be of interest to some of you who have been selling lynx carcasses to the Fish & Game Department that we are learning some interesting facts about lynx. In the spring of 1964 adult female lynx were very productive. In one area females averaged more than 7 kits for each female. The average for all areas in the spring of 1966 was only one kit for every 2 adult females.

Almost all females have their first litter of kits when they are about one year old when the lynx cycle is near the peak. After the peak only a few females have litters when they are one year old.

Many predators change to other animals for food when their main prey becomes scarce. After looking at thousands of lynx stomachs it looks like lynx do not shift to other animals for food but they rely mostly on snowshoe hare during the highs and lows.

Stomach contents show that other food is used in the fall (mice and other small animals) but later in the season lynx take mostly hare. I suspect that mice go under the snow and lynx can't get at them later in winter. In the future we hope to learn what they eat in Spring and Summer.

We are still purchasing male and female lynx carcasses taken in Game Management Units 11, 12, 13, 20 and 25. Carcasses are coming in slowly so please send what you have.

Good luck and good trapping,

Oliver E. Burris

Oliver E. Burris
Leader, Furbearer Studies

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