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BEAVER STUDIES

by  
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Final Report  
Federal Aid in Wildlife Restoration  
Projects W-17-4 through W-17-7, Jobs 7.2R, 7.8R and 7.9R

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(Printed August 1975)

FINAL REPORT (RESEARCH)

State: Alaska

Cooperators: Richard H. Bishop and Peter E. K. Shepherd

Project Nos: W-17-4 through W-17-7      Project Title: Small Game and Furbearer Investigations

Job No: 7.2R      Job Title: Beaver Ecology in Takotna and Holitna River Drainages

Job No: 7.8R      Job Title: Beaver Population Dynamics

Job No: 7.9R      Job Title: Effects of Trapping on Beaver Populations

Period Covered: July 1, 1971 through June 30, 1975

SUMMARY

The number of beaver colonies on the Holitna and Hoholitna Rivers and Titnuk Creek increased dramatically between 1970 and 1973 and there was a continued increase in beaver numbers along the Takotna and Nixon Fork Rivers from 1969 to present. Based on annual harvest data it appears that these increases resulted from decreased trapping pressure (particularly along the Holitna River upstream from Titnuk Creek where the trapping season has been closed since 1971).

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## BACKGROUND

Regulation of beaver (*Castor canadensis*) harvests has taken many forms during the history of Alaska as a Territory and as a State. The intent of these regulations has generally been to improve conservation and management of the beaver and to improve the estimates of harvests.

Sealing beaver pelts with individual tags or seals began in 1923 (Burris 1966) and is still required. Beaver sealing assures a reasonably accurate estimate of the annual harvest and discourages traffic in illegally taken beaver skins.

Considerable work on the life history, population ecology and management of beaver was done by personnel of the Alaska Cooperative Wildlife Research Unit in the early 1950's. It was found that a fairly consistent relationship existed between the stretched pelt size and the age of the beaver (Buckley and Libby 1955). As a result, from 1955 on, all beaver skins were measured when they were sealed. It was felt that if the proportion of kits (beavers 1 yr. old or less) in the harvest from a drainage or management area exceeded 20 percent, exploitation was too great to allow a sustained annual yield (Libby 1955, 1957). These conclusions remain an integral part of current beaver management policy. In Game Management Units 17, 18, 19 and 21 reductions in bag limits and seasons have been made or proposed in response to finding that kits comprised more than 20 percent of the harvest. Because of changing social and economic conditions and trapping patterns, the results of these restrictions are not always clear. While the beaver harvest and the number of trappers have continued to decline in most game management units, in some units the proportion of kits remains higher than is considered desirable. Apparently a direct relationship between harvest size and age composition of the catch does not necessarily exist on a unitwide or even drainage basis (Rausch 1965, Burris 1966, 1968, 1969). It became clear that more information was needed to fully utilize the beaver affidavit information and to develop a plan that could deal with the dynamic beaver management situation. Burris (1968) commenced beaver surveys in problem drainages in Units 19 and 21, where surveys had been done in the mid-1950's, and also on the Chena River where beaver trapping was increasing. He also analyzed the present fur dealer and fur export reports to determine their value and initiated several other avenues of investigation and action to find solutions to the whole complex of the beaver management situation.

With the assignment of a game biologist to McGrath, a more comprehensive study of beaver ecology and exploitation was begun in the Holitna River drainage, one of the problem areas, and in the Takotna River drainage as a control. Data from this study were expected to clarify some of the problems which have crippled management efforts to date.

#### OBJECTIVES

To determine and compare characteristics of productivity and population composition in the Takotna and Holitna River drainages.

To determine relative densities of beaver populations in the Takotna and Holitna River drainages, and to determine the effects of ecological factors and trapping pressure on beaver densities.

To determine the relationships between harvest levels and population composition of beavers in the Takotna and Holitna River drainages.

#### PROCEDURES

Specimens were collected from beavers trapped in the Takotna and Holitna River drainages in 1970 and 1971 to allow investigation of productivity and population composition. In the Takotna area, whole carcasses were purchased (\$3.00 each) if possible, and standard body measurements were recorded. In the Holitna drainage skulls and reproductive tracts were purchased at the price of \$1.00 for each, or \$3.00 for both from the same animal. Carcasses were prized for home consumption and were not available in the Holitna area.

Female reproductive tracts were preserved in AFA or in 10 percent formalin, and later examined macroscopically for placental scars, embryos, corpora lutea and corpora albicantia. Uterine horns were opened for examination. Ovaries were hand-sectioned longitudinally in 1 mm to 2 mm sections with a razor blade and examined with the naked eye and with a binocular dissecting microscope following descriptive criteria for ovarian structures presented by Provost (1962).

Molariform teeth were extracted from one mandible of skulls collected. Age determination criteria based on lumen closure and cementum deposition described by Van Nostrand and Stephenson (1964) were used to assign ages to beavers.

Relative densities of beaver populations were determined by aerial counts of occupied and unoccupied beaver houses on selected portions of the Takotna, Holitna, Innoko and other drainages. Counts were made from a Super Cub aircraft in September or October, when food caches were conspicuous. The location and status of each beaver house were plotted on 1:63,360 maps. Comparisons with past data were made to determine the direction and magnitude of trends.

Description and analysis of beaver habitat were initiated by obtaining aerial photographs of the study areas, devising a means of assessing physiography of the streams, and selecting and characterizing selected areas of beaver habitat.

The procedure, briefly, is to divide the streams into sectors based on physiographic characteristics, select areas with stands of vegetation characteristic of the sectors, and describe species composition and other characteristics of the stands on a reconnaissance basis. A description of the physiographic characteristics will also be included.

Reports and observations of disease, unusual mortality, etc., were recorded and investigated as they occurred.

Harvest levels were monitored through beaver sealing certificate data and personal contact with trappers. Gross data on age composition were obtained from hide measurements recorded on the same records. Data on sex and age composition of the harvest were also obtained from specimens collected from trappers. Historical information on trapping patterns, harvest and related factors was recorded.

## FINDINGS

### Beaver House Surveys

Holitna drainage: Surveys were not made in 1971 and 1972 in the Holitna drainage.

Surveys were made by Shepherd in 1973. Counting conditions were only fair. Turbulence and intermittent heavy rain and snow occurred during surveys of the Holitna and Hoholitna Rivers and Titnuk Creek.

Results of the surveys are given in Table 1. The number of beaver colonies on the Holitna River increased dramatically between 1970 and 1973. The major known change in circumstances that could have contributed to this increase was the closure on trapping from 1971 to the present. In addition, better than average overwintering conditions and possibly expansion of beaver populations from side streams into the main river may also have contributed to the increase. However, it seems most likely that prohibition of trapping was the major factor, because both winter conditions and adjacent beaver populations were roughly comparable for several years preceding the closure, at least since 1968-69.

Both Titnuk Creek and the Hoholitna River showed substantial increases in the number of occupied beaver houses between 1970 and 1973 (Table 1). Titnuk Creek receives comparatively steady trapping pressure in two areas: its lower reaches and a portion of its extreme upper reaches, but it is not trapped intensively, considering the total stream area involved. Hoholitna River trapping pressure has fluctuated a great deal, but beavers there seem able to rapidly recoup their losses despite periodic high harvests. In fact, numbers of occupied beaver houses have steadily increased (Table 1).

Takotna drainage: Counts on the Takotna and Nixon Fork Rivers indicated a continued increase in beaver numbers (Table 2). The Takotna River data, as arranged in Table 3, provide some insight into beaver

Table 1. Beaver house counts, Holitna drainage, 1967-1973. Areas comparable in all years. Presence of cache indicates house is occupied.

Area	Year	No. of Houses	Cache			
			Present		Absent	
			No.	%	No.	%
Holitna River 115 river miles	1967	35	30	86	5	14
	1968	48	23	48	25	52
	1969	58	27	47	31	53
	1970	52	37	71	14	29
	1971	No counts made				
	1972	No counts made				
	1973	114	88	76	26	24
Hoholitna River 119 river miles	1967	64	55	86	9	14
	1968	110	76	69	34	31
	1969	165	115	70	50	30
	1970	147	119	81	28	19
	1971	No counts made				
	1972	No counts made				
	1973	211	163	78	48	22
Titnuk Creek 95 river miles	1967	38	28	74	10	16
	1968	60	41	68	19	22
	1969	79	45	57	34	43
	1970	42	37	88	5	12
	1971	No counts made				
	1972	No counts made				
	1973	79	53	67	26	33

Table 2. Beaver house counts, Takotna River and Nixon Fork, 1967-1973. Presence of cache indicates house is occupied.

Area	Year	No. of Houses	Cache				
			Present		Absent		
			No.	%	No.	%	
Takotna River	1967	60	48	80	22	20	
116 river miles	1968	No counts were made					
	1969	168	101	60	61	40	
	1970	160*	97	61	63	39	
	1971	106	82	77	24	23	
	1972	148	113	77	34	23	
	1973	155	126	81	29	19	
Nixon Fork	1967	31	15	48	16	52	
Forks to 155° 30'	1968	No counts were made					
35 river miles	1969	44*	25	57	18	43	
	1970	44*	25	57	19	43	
	1971	40	22	55	18	45	
	1972	52	35	67	17	33	
	1973	54	42	78	12	22	
Nixon Fork	1967	No counts were made					
Mouth to 155° 00'	1968	No counts were made					
(total count area)	1969	No counts were made					
	1970	69	47	68	22	32	
	1971	No counts were made					
	1972	No counts were made					
	1973	No counts were made					

\* Takotna River 1969 - 6 additional houses probably occupied; 1970 - 7 additional houses probably occupied.

Table 3. Summary of beaver house counts, Takotna River, 1969-1973. Data arranged by physiographic sectors of the valley.

SECTOR	YEAR	HOUSES				Total Occ.	Percent Occ.
		Occ.	Unocc.	Poss. Occ.	Total		
I	1969	29	27	4	60	33	55
	1970	37	19	3	59	40	68
	1971	28	10	0	38	28	74
	1972	37	17	0	54	37	69
	1973	49	10	0	59	49	83
II	1969	16	13	1	30	17	57
	1970	18	12	3	33	21	64
	1971	18	6	0	24	18	75
	1972	28	8	0	36	28	78
	1973	31	5	0	36	31	86
III	1969	34	13	1	48	35	73
	1970	20	17	0	37	20	54
	1971	19	6	0	25	19	76
	1972	28	5	0	33	28	85
	1973	24	11	0	35	24	69
IV	1969	22	8	0	30	22	74
	1970	22	8	1	31	23	74
	1971	17	2	0	19	17	89
	1972	20	4	0	24	20	83
	1973	28	3	0	31	28	90
TOTAL	1969	101	61	6	168	107	64
	1970	97	56	7	160	104	65
	1971	82	24	0	106	82	77
	1972	113	34	0	147	113	77
	1973	126	29	0	155	126	81



population trends in different portions of the river valley. The "sectors" were designated on the basis of general physiography of the river valley as it related to beaver habitat. They coincidentally represent broad areas of trapping effort, i.e. if a trapper is trapping beaver in one sector, he is very unlikely to be trapping in another as well. Because trapping effort has been negligible in sector IV, while it has varied in sectors I, II, and III, the trend in changes from sector to sector is of interest. Thus in sector I, with a relatively large number of occupied houses and only light harvests since 1969, the number of occupied houses has increased. Sector III, with substantial numbers of houses, has been trapped regularly in the last three years, and it appears beaver numbers there have declined since 1969, and may be somewhat stable as a result. Sector II has had little trapping pressure since 1969, and seems to have an increasing population. Sector IV, has largely been untrapped and beaver there seem to be increasing slowly. As noted in a progress report (Bishop 1973) the 1971 counts may have been low because they were done early and perhaps because a different flying technique was used, therefore the increase since that year is probably exaggerated. Beaver harvests from these various sectors are discussed in a later section.

In the Nixon Fork area, a gradual increase also seems to be the trend (Table 2). Again, trapping pressure has fluctuated but in general has not been high since 1969.

Innokko and Dishna Rivers: Count data from the Innoko and Dishna Rivers show substantial increases in both of these count areas (Table 4). Some trapping occurred in both areas, but with no apparent effect. In the upper part of the Innoko count area (from Beaver Creek to 25-30 miles downstream), unusually heavy overflow (icing) occurred in late January, February and March 1972. Fewer occupied houses were found in that area, possibly because of the overflow conditions.

#### Trapping Pressure and Harvest

Holitna River: The Holitna River remained closed to beaver trapping above Titnuk Creek. Below Titnuk Creek beaver habitat is poor, beaver numbers are low and trappers seldom attempted to trap there. Few beavers were known to have been taken on the Holitna River in 1972 or 1973 (Table 6).

Hoholitna River: Few beavers were taken by trappers on the Hoholitna River in 1971 and 1972 (Table 5). In 1973, however, interest in beaver trapping and the Hoholitna beaver harvest both rose dramatically. Reasons for the renewed effort probably included improved prices for furs, a moderate winter and the fact that most trappers had not been out for two seasons.

Titnuk Creek: Titnuk Creek also received some additional pressure. In spite of the substantial catch, occupied beaver houses showed an increase (Table 1).

Takotna River drainage: Essentially no trapping was done in the Takotna drainage in 1971. Extremely deep snow discouraged most trappers, and reduced the catch of the lone trapper on the Nixon Fork.

Table 4. Beaver house counts, Innoko and Dishna Rivers, 1966-1973.

Area	Year	No. of Houses	Cache			
			Present		Absent	
			No.	%	No.	%
Innoko River (Beaver Creek to Dishna River)	1966*	160	51	32	109	68
	1967	186	83	45	103	55
	1968	241	99	41	142	59
	1969	283	110	39	173	61
	1970	Count data unusable**				
	1971	124	87	70	37	30
Dishna River (mouth to 63° 15' N. Lat.)	1966*	60	34	57	26	43
	1967	76	39	51	37	49
	1968	109	66	61	43	39
	1969	143	82	57	61	43
	1970	Count data unusable**				
	1971	66	52	79	14	21
	1972	75	64	85	11	15
1973	95	81	85	14	15	

\* Count data for 1966-69 from Burris (1971) and unpublished reports.

\*\* Counts were attempted in October. Results were unsatisfactory due to ice and snow.

Table 5. Distribution of beaver harvest and trappers, Holitna drainage, 1971-73, from beaver sealing documents.

Year	Location	No. Trappers	No. Beavers
1971	Holitna River*	1	10
	Hoholitna River	2	15
	Titnuk Creek	0	0
1972	Holitna River*	2	17
	Hoholitna River	1	10
	Titnuk Creek	2	20
1973	Holitna River*	0	0
	Hoholitna River	20	166
	Titnuk Creek	5	49

\* Holitna River closed above Titnuk Creek

Table 6. Distribution of beaver harvest and trappers, Takotna Drainage, 1971-73, from beaver sealing documents.

Year	Location	No. Trappers	No. Beavers	Remarks
1971	Takotna River	0	0	None reported
	Nixon Fork (from west fork upstream)	1	8	
1972	Takotna River (mouth to forks)	1	10	
	Forks to Takotna	4	19	14 taken near forks
	Fourth of July Creek	2	37	Trappers flown in from Sleetmute
1973	Takotna River (mouth to forks)	1	5	
	Forks to Takotna	1	16	Taken mainly near the forks
	Vicinity of Big Waldren	1	14	Trapper flew in from Red Devil
	Nixon Fork	1	25	Vicinity of west fork

Trapping effort increased on the Takotna River drainage in 1972. The trapper who traditionally has trapped from McGrath to the Forks was active, several young trappers were active near the Forks, and two men from Sleetmute trapped Fourth of July Creek, a major tributary to the Takotna River in sector III. Fourth of July Creek has not been trapped for many years. The trapper on the Nixon Fork doubled his 1971 catch. Nevertheless, the catch for the two streams was relatively low.

Harvests were similar in distribution and number in 1972 and 1973. The chief differences were 1) a shift in trapping location and decline in catch in sector III on the Takotna River, and 2) a slight increase in harvest (by a different trapper than in previous years) on the Nixon Fork.

Trapping pressure and harvest were still quite low in 1973 (Table 6), but most of the limited trapping was in sectors I and III, which are the sectors receiving heaviest pressure when trapping interest is high. As noted earlier, these are the sectors with slowly increasing (sector I) or stable (sector III) beaver populations as reflected by numbers of occupied houses.

Catch data for 1974 were not final, but it appears 75 to 100 beavers were taken in the Takotna and Nixon Fork Rivers in 1974, of which 55 to 75 were taken in sector I of the Takotna. A harvest of this magnitude has not been taken on the Takotna since 1969.

On the Takotna River in 1974, three trappers trapped in sector I, two in sector II, one in sector III, and two in sector IV. One trapper trapped on the Nixon Fork in 1974.

Although numbers and distribution of beaver trappers are known for the Innoko, Dishna and Iditarod Rivers, catch data are not yet available. Data for these areas will be reported elsewhere. In general there was a slight increase in number of trappers.

#### Habitat Evaluation

Reconnaissance of study plots on the Takotna River was done in August 1973 by Shepherd and Bishop, and selection and reconnaissance of study plots on the Holitna River were done by Shepherd in fall 1973 and summer 1974.

We decided to utilize the procedure of Ohman and Ream (1971) to analyze the vegetation on these plots, because that system seemed adequate in detail, straightforward, and was being used in other taiga habitat by Coady (1973) and the Institute of Northern Forest Research, Fairbanks. Vegetation analysis was tentatively planned to begin in summer 1974 but was dropped in favor of other emphases.

#### Population Composition and Reproduction

Work on population composition and reproduction did not proceed apace with aspects of the study reviewed above. Originally, a comparison

of age composition and reproduction between populations in the Holitna and Hoholitna River drainages was to be made, based on specimens collected from trappers. Several factors interfered: 1) trapping effort varied dramatically in both areas--in some years large catches were made, in other years the catch was essentially zero, 2) the trapping preceded the beaver breeding season in the Holitna drainage, which eliminated the possibility of estimates of pregnancy rates, 3) by the time reproductive tracts were collected from the Holitna drainage they were badly decomposed, and for the most part unreadable and 4) following Bishop's transfer to Fairbanks, he did not follow through on age determination work. Although age determination was done by Bill Gasaway, Ed Kootuk and Dick Bishop, it was essentially exploratory in nature, and was not sufficiently developed to be reliable for routine use. None of these personnel developed the expertise needed to work out the "bugs" in the technique. It can be done with persistent effort, as Boyce (1974) has demonstrated.

The net result of this phase of the study was some experience in age determination and ovarian analysis (done by Ernest and Bishop), and some data on in utero litter size and on numbers of corpora lutea and corpora albicantia in the 1969 collection from the Takotna River. These data follow.

In 1969, nine beavers in early pregnancy averaged 3.2 embryos each (range: 2 to 5); however, of 29 embryos or implantations counted, 2 (6.9%) were being resorbed. In the same nine beavers, corpora lutea and embryos corresponded both in number and in location (left vs. right horn of uterus, ovary) with only one exception--one beaver contained two embryos and three corpora lutea. Among 28 beavers containing corpora lutea and/or corpora albicantia, means of 2.5 corpora albicantia and 2.4 corpora lutea were found. Of the 42 female beavers collected, 8 (19%) were immature.

Tentative ages determined for beavers collected suggest that age distribution of Holitna drainage beaver was younger than that of Takotna drainage beavers; a possible explanation lies in the rather more consistent trapping effort in the Holitna drainage (at least through 1970).

#### DISCUSSION

Three objectives were given for this study. Of them, only parts of the second and third objectives related to relative numbers of beavers, and the influence of trapping on relative numbers of beaver have been regularly addressed. For various reasons the more intensive aspects of the study involving population composition and habitat have not been pursued.

As a result, this study evolved into essentially a survey and inventory activity. Definitive data illustrating ecological relationships between beavers, habitat and other factors are lacking, and conclusions cannot be drawn. However, Boyce (1974) did obtain sufficient quantitative data of similar nature to develop conclusions about the relationship between beavers, habitat and trapping which should be taken into account in future beaver management considerations.

Measurements of beavers obtained in this work are recorded in accession lists located at the McGrath office.

#### RECOMMENDATIONS

Annual or biannual assessment of beaver numbers (as represented by occupied beaver houses in fall) and of trapping effort and harvest should be continued and expanded if possible in Units 18, 19 and 21. A scheme of identifying beaver habitat quality in general terms on those streams surveyed would prove useful in future considerations involving land use planning and beaver management.

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