2592

SUSITNA HYDROELECTRIC PROJECT

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114

FURBEARER STUDIES FALL 1984: BEAVER

LGL Ecological Research Associates
AND
UNIVERSITY OF ALASKA
ALASKA COOPERATIVE
WILDLIFE RESEARCH UNIT

UNDER CONTRACT TO

ARZA-EBASCO
SUSITNA JOINT VENTURE

FINAL REPORT

NOVEMBER 1984
DOCUMENT No. 2592

ALASKA POWER AUTHORITY

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FURBEARER STUDIES
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Report by

LGL ALASKA RESEARCH ASSOCIATES
James D. Woolington

AND

ALASKA COOPERATIVE WILDLIFE RESEARCH UNIT
UNIVERSITY OF ALASKA, FAIRBANKS
Philip S. Gipson
David Volsen

Under Contract to
Harza-Ebasco Susitna Joint Venture

Prepared for
Alaska Power Authority

Final Report
November 1984

NOTICE

ANY QUESTIONS OR COMMENTS CONCERNING THIS REPORT SHOULD BE DIRECTED TO THE ALASKA POWER AUTHORITY SUSITNA PROJECT OFFICE

INTRODUCTION

Beaver (Castor canadensis) have been selected as the key furbearer species for study to predict impacts of the Susitna Hydroelectric Project downstream from the proposed impoundments. There were several reasons for selecting beaver:

1. Beavers are tied directly to the aquatic system and changes in water depths, flow rates, water temperatures, and icing conditions will be reflected in changes in beaver distribution and abundance.

2. Beavers are economically and ecologically important.

3. Reliable and practical techniques exist for censusing beaver populations and monitoring their use of habitats.

This study has focused on determining numbers of beavers occurring naturally along the Susitna River and tributaries; determining how beavers use both aquatic and adjacent terrestrial habitats; and modeling probable responses of beavers to various management scenarios for the hydroelectric project. Monitoring numbers and distribution of beavers and other furbearers on a long-term basis is important to help understand the population dynamics and life requisites of these species. Data obtained could be used for predicting responses of furbearers to impacts caused by the project. This report summarizes the beaver field studies conducted during fall 1984 for the Susitna Hydroelectric Project. It builds upon two previous reports which present the results of earlier furbearer studies (Gipson et al. 1982, Gipson et al. 1984).

STUDY AREA

The study area is the floodplain of the Susitna River, between Devil Canyon and Talkeetna in southcentral Alaska (Fig. 1). The biotic communities, weather and physiography are discussed in Alaska Power Authority (1983). Surveys for signs of beaver activity were restricted to within 0.5 km of either side of the Susitna River.

METHODS

Four surveys on the Susitna River were conducted between Devil Canyon and Talkeetna during September and October 1984. Sites of active beaver colonies were identified by freshly cut trees, recent cache construction, beaver tracks on the shore, and peeled branches near the lodge. Caches were examined and beavers counted at five colonies.

One preliminary trip was conducted September 1-4 to determine if cache building activity had commenced along the Susitna River. This survey began with a helicopter overflight of the area to locate beaver colonies and food caches. Study personnel were dropped off at cache locations and beaver activity observed. Each day, at mid-day, study personnel were transferred by helicopter to a different cache location. A proposed method of estimating the number of beaver in a colony by observing beavers while they were active and involved in cache construction was evaluated.

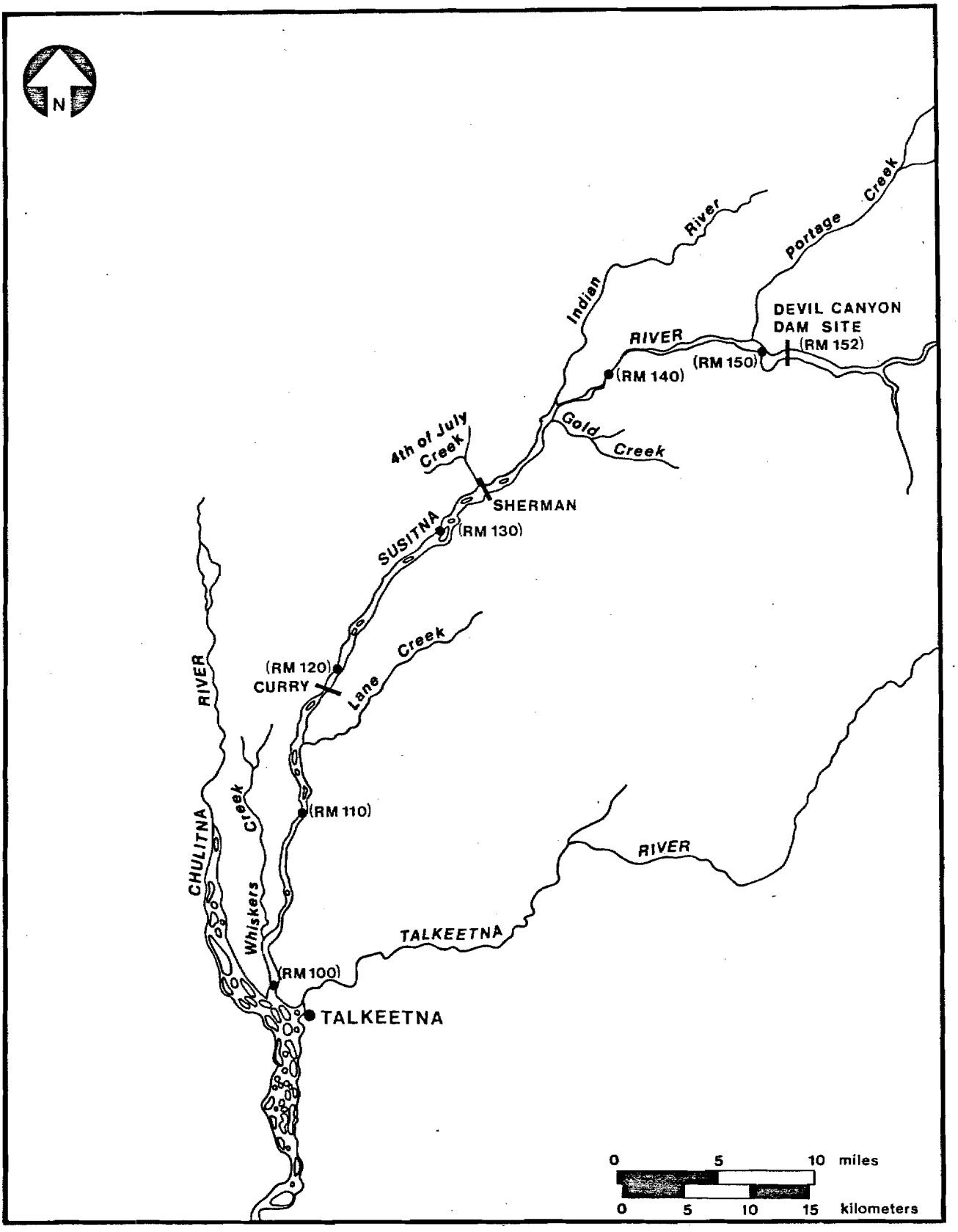

Figure 1. Susitna River between Devil Caynon and Talkeetna.

On September 16, a helicopter survey was conducted to determine the location of caches and stage of cache construction. The route of the earlier survey was flown to determine where new food caches had been started by the beaver.

From September 27 to October 2, study personnel traveled by boat to beaver colonies where caches had been observed during the September 16 survey. When beavers at each site became active in the evenings, they were observed to determine types of activity and to estimate colony size. After observing and counting the beaver at a colony, the food cache was examined and characterized (length, width, circumference and depth), and the surrounding area examined for food availability.

The number and age classes of beaver observed were recorded for each colony visited during the September 1-4 and September 27 - October 2 surveys. Every effort was made to get accurate counts, but most cases represent a minimum number of beaver at a colony. The relative sizes of the larger beaver (i.e. adults and yearlings) were difficult to determine unless they were close together. Kits (young-of-the-year) could usually be identified at a distance because of their small size and behavior.

The final fall cache survey took place on October 4 and was flown in a Bell 206 helicopter at an altitude of 75-100 feet above ground, and a ground speed of 20-60 miles per hour. The survey team included a pilot, navigator/recorder, and 2 observers. The location and number of beaver caches, lodges, and dams were recorded on aerial photos. The area surveyed consisted of the active floodplain

of the Susitna River (channels susceptible to hydrologic changes associated with the project) and selected tributaries.

The population of beaver in an area during autumn was estimated by counting the number of food caches and multiplying by 5 (Gipson et al. 1982). The preferred survey method is by aircraft after the deciduous leaves have fallen, for increased visibility, and before the winter ice forms.

Individual beaver colonies were identified as follows: the prefix 84 (indicating the count was conducted in 1984) followed by a number indicating the numerical sequence in which the site was examined during the October 4 cache count. The location of each colony is listed in Appendix A.

Beaver habitats were classified according to the seven categories developed by the Alaska Department of Fish and Game Aquatic Study Team (ADF&G 1983). Although described in terms of water type, habitat also included bank characteristics, water sources, and tree and shrub vegetation. Seasonal changes in water level in the river may alter the habitat classifications. All habitats were classified at the time of beaver surveys. The seven categories were:

1) Mainstem Habitat consists of those portions of the Susitna River that normally convey streamflow throughout the year. Both single and multiple channel reaches are included in this habitat category. Groundwater and tributary inflow appear to be inconsequential contributors to the overall characteristics of mainstem habitat. Mainstem habitat is typically

characterized by high water velocities and well armored streambeds. Substrates generally consist of boulder and cobble size materials with interstitial spaces filled with a grout-like mixture of small gravels and glacial sands. Suspended sediment concentrations and turbidity are high during summer due to the influence of glacial melt-water. Streamflows recede in early fall and the mainstem clears appreciably in October. An ice cover forms on the river in late November or December.

2) Side Channel Habitat consists of those portions of the Susitna River that normally convey streamflow during the open water season but become appreciably dewatered during periods of low flow. Side channel habitat may exist either in well defined overflow channels, or in poorly defined water courses flowing through partially submerged gravel bars and island along the margins of the mainstem river. Side channel streambed elevations are typically lower than the mean monthly water surface elevations of the mainstem Susitna River observed during June, July and August. Side channel habitats are characterized by shallower depths, lower velocities and smaller streambed materials than the adjacent habitat of the mainstem river.

3) Side Slough Habitat is located in spring fed overflow channels between the edge of the floodplain and the mainstem and side channels of the Susitna River, and is usually separated from the mainstem and side channels by well vegetated bars. An exposed alluvial berm often separates the head of the slough from mainstem or side channel flows. The controlling streambed/

streambank elevations at the upstream end of the side sloughs are slightly less than the water surface elevations of the mean monthly flows of the mainstem Susitna River observed for June, July and August. At intermediate and low-flow periods, the side sloughs convey clear water from small tributaries and/or upwelling groundwater. These clear water inflows are essential contributors to the existence of this habitat type. The water surface elevation of the Susitna River generally causes a backwater to extend well up into the slough from its lower end. Even though this substantial backwater exists, the sloughs function hydraulically very much like small stream systems and several hundred feet of the slough channel often conveys water independent of mainstem backwater effects. At high flows the water surface elevation of the mainstem river is sufficient to overtop the upper end of the slough. Surface water temperatures in the side sloughs during summer months are principally a function of air temperature, solar radiation, and the temperature of the local runoff.

4) Upland Slough Habitat differs from the side slough habitat in that the upstream end of the slough is not interconnected with the surface waters of the mainstem Susitna River or its side channels. These sloughs are characterized by the presence of beaver dams and an accumulation of silt covering the substrate resulting from the absence of mainstem scouring flows.

5) Tributary Habitat consists of the full complement of hydraulic and morphologic conditions that occur in the tributaries. Their seasonal streamflow, sediment and thermal regimes reflect the integration of the hydrology,

geology and climate of the tributary drainage. The physical attributes of tributary habitat are not dependent on mainstem conditions.

6) Tributary Mouth Habitat extends from the uppermost point in the tributary influenced by mainstem Susitna River or slough backwater effects to the downstream extent of the tributary plume which extends into the mainstem Susitna River or slough.

7) Lake Habitat consists of various lentic environments that occur within the Susitna River drainage. These habitats range from small, shallow, isolated lakes perched on the tundra to larger, deeper lakes which connect to the mainstem Susitna River through well defined tributary systems. The lakes receive their water from springs, surface runnoff and/or tributaries.

RESULTS

September 1-4 Survey

Many of the sites contained active beaver colonies at this time, but very little cache building was in progress. In the week prior to this field trip, the Susitna River was in high water condition, and caches on the main stem could have washed away. Even so, most of the beaver colonies in the backwaters and sloughs adjacent to the mainstem of the river (and not affected by the high water) did not have caches under construction. Only two sites with partially constructed food caches were observed. Three sites were examined from the ground:

Site 84-35. One active beaver lodge with evidence of new food cache construction was found in this 0.5 km long upland slough. The beavers at this site were observed on September 1 and 2. Four beavers (two adult-sized, one probable yearling and one kit) were observed. Several of the beavers were observed carrying mud and sticks onto the lodge. Very limited cache construction activity was observed. On only three occasions were beaver observed placing material in the cache. Approximately 1 m x 1 m of cache material, mostly birch (Betula papyrifera) and alder (Alnus spp.) protruded from the water. Birch trees up to 45 cm diameter breast height (dbh) were cut by beaver in some of the feeding areas surrounding the slough. Very little willow (Salix spp.) was found in the area around the slough.

Site 84-38. This beaver colony was in an upland slough that was part of an extensive system of old and recent beaver ponds. One partially constructed cache was located adjacent to a new lodge. An older and larger lodge was approximately 0.3 km southwest of the new lodge, but no recent activity was noticed. Two adult-sized and one unknown-sized beaver were observed on September 2, but the beavers were not observed adding to the cache. The cache appeared to be approximately 2 m x 1.5 m and was constructed of birch and alders. Evidence of beavers felling birch (up to 45 cm dbh) and alders was noted in the forest near the lodge and cache.

Site 84-15. This beaver lodge was on the downstream end of a large island. No actual cache was observed at this lodge on September 3 and 4, but several 30 to 40 cm DBH balsam poplar (Populus balsamifera) had been cut down by the beaver

and had fallen into the water immediately upstream of the lodge. Several leafed branches (alder or birch), were on the side of the lodge. Only one beaver (probably a small adult or large yearling) was briefly observed near this lodge, but numerous beaver tracks were in the mud near the lodge. Trees or shrubs on the island included balsam poplar, alders, birch and some willow. Evidence of beavers cutting trees on a small nearby island was noticed.

In general, cache construction by beaver along the Susitna River had not begun by early September. Almost all the leaves on the trees in the river valley (150 to 350 m elevation) were still green. During the flight on September 4, from the Susitna River area to Cantwell, numerous fresh food caches were noticed in beaver ponds in the Chulitna Pass area (400-600 m). Leaves in this area had turned yellow, but most had not fallen from the trees.

Numerous salmon were observed in the sloughs and backwaters along the river. Many of the areas where salmon were observed were sites of past beaver activity.

One trapper from the Talkeetna area was interviewed. He indicated that numerous beaver (actual number not given) were trapped along the river between Talkeetna and Curry. Most of the trapping activity occurred on the east side of the river, as the river ice was usually not considered safe until mid-winter.

September 16 Survey

This survey of the river located 22 active beaver colonies. One cache was observed at each of 19 colony sites, two sites had two caches and one site had

four caches. Five sites of beaver cache construction occurred on mainstem river habitat, four occurred in side channels, four in side sloughs and nine occurred in upland slough habitat. Most of the caches observed during this survey appeared to be less than 3 m diameter and were probably in the early stages of construction.

Similar to the first survey (September 1-4), cache construction in the Chulitna Pass area between Chulitna and Hurricane appeared to be more advanced than along the Susitna river.

September 27 - October 2 Survey

Beaver colonies at five sites along the Susitna River were observed in order to estimate the number of beaver per colony and characterize food caches. Low water conditions hindered boat travel by the survey personnel and restricted this survey to the area along the Susitna River between Chase and Talkeetna. Cache measurements are listed in Appendix B, and are described below.

Site 84-35. A minimum of 3 adult or yearling-sized beaver and one kit was observed at this upland slough site on October 28. The cache had been enlarged since it was first examined in early September, and the areas where beaver were cutting trees showed a substantial increase in the number of down trees. The beaver did not become active until late evening. Even then, very little cache building activity was observed.

Site 84-29. On September 29, one large, adult-sized beaver and one kit were observed at this cache and lodge located on the mainstem side of an island. Willows, alders and large balsam poplar trees had been cut behind the lodge. The beaver were not active until late evening, and were not observed adding any material to the cache.

Site 84-30. A minimum of four adult or yearling-sized beaver and one kit were observed on September 30. The cache and lodge were located on the mainstem side of an island. Numerous balsam poplar had been cut down behind the lodge. Beavers at this colony became active during the late evening at the time this site was observed. The beaver fed or carried mud onto the lodge until just before nightfall. At nightfall, most of the beaver swam to foraging areas downstream of the lodge and were observed bringing material back to the cache.

Site 84-22. Four adult or yearling-sized beaver and at least one kit were observed at this upland slough site on October 1. Beavers were observed feeding and adding material to the dam, but did not add material to the cache until very late in the evening. Birch, alder and balsam poplar were the main components of the cache.

Site 84-24. Observed at this side slough site on October 1 were three adult or yearling-sized beaver and one kit. The beaver were active in late evening and several swam to the nearby mainstem Susitna River. Numerous large (50 cm DBH) balsam poplars had been cut down by beaver in the area around the slough and the cache consisted of balsam poplar, alder and birch.

Beaver activity related to cache construction was observed at each of the five sites, but not at the intensity expected. Cache building activity occurred in late evening and all beavers observed at a colony appeared to add material to the cache.

Cache composition appeared to be similar to what was available on the area surrounding each site. Air temperatures during this period ranged between 3 and 10°C, and water temperature remained at 5°C in the Susitna River.

October 4 Survey

The fall cache counts determined that beaver colonies were preparing to overwinter at a minimum of 45 sites along the Susitna River between Devil Canyon and Talkeetna (Appendix A). Thirteen caches were found in mainstem habitat, four in side channels, 14 in side sloughs and 14 in upland sloughs (Table 1). During this survey, only three beaver were observed.

DISCUSSION

Observations from the earliest survey (September 1-4) revealed that it was feasible to count beaver at active colonies, but cache construction had not yet begun at most colonies. Beaver had initiated construction of caches by the second survey (September 16), and caches were present at sites where none had occurred on the earlier survey.

TABLE 1. Aerial counts of beaver caches in the floodplain of the Susitna River between Devil Canyon and Talkeetna.

Habitat	1982[a] September 15	1983[a] October 18-19	1984 October 4
Mainstem	2	11	13
Side Channels	2	2	4
Side Sloughs	7	11	14
Upland Sloughs	3	3	14
TOTAL	14	27	45

[a] From Gipson et al. (1984)

Several techniques have been employed to estimate beaver populations, including direct counts of beavers and indices of beaver abundance such as counts of dams, lodges, and food caches. Many researchers now agree that counts of food caches are the most reliable and practical method of estimating beaver populations over a large area (Hay 1958, Murray 1961, Koontz 1968, Machida 1982). Each active overwintering lodge and/or overwintering bank den is associated with a food cache accessible from the lodge or den under the winter ice. Between one and 14 beaver may occupy a lodge with an average of five generally used for population surveys in Alaska (Koontz 1968, Boyce 1974). Results from the counts at colonies along the Susitna River during fall 1984 and the Kanuti River of interior Alaska during summer and fall 1984 (D. Kafka 1984, pers. com.) supports the use of the above approximation to estimate beaver numbers.

There was a marked difference among the number of caches counted in 1982, 1983 and 1984 (Table 1). The 1982 survey was flown on September 15, similar to the date of the 1984 preliminary survey when 22 caches were observed. The 1983 survey (October 18-19) was flown at a time when the sloughs were beginning to freeze over. Several caches of active colonies were not found during the 1983 survey; an investigation in Spring 1984 to assess overwinter and breakup survival revealed five caches that had not been included in the fall survey (Gipson et al. 1984).

There are a number of possible explanations for the differences in numbers of caches observed between the 1982, 1983 and 1984 surveys. Gipson et al. (1984) described the Susitna River as rapidly rising during the 1982 survey, and some

caches on the mainstem could have been covered by water or washed away in the current. In 1983 and 1984, the water level of the Susitna River dropped throughout September and October.

An increase in the number of beavers, or a difference in the number of dispersing beaver (those which would start new colonies), might also explain differences in cache counts between years (Gipson et al. 1984). Increased experience of personnel in searching for beaver caches may also have accounted for increased cache counts.

The possibility exists that beaver utilizing mainstem habitat may habitually start cache construction later in the fall than beaver in upland and side sloughs. These areas of slow water movement generally freeze earlier than the mainstem river, where beaver can remain active later into the fall. The 1982 survey (September 15) may have occurred before many beaver colonies in mainstem habitat had begun cache construction. Only 2 of 14 caches in 1982 were in mainstem habitat, as compared with 11 of 27 caches and 13 of 45 caches respectively in the 1983 (October 18-19) and 1984 (October 4) surveys.

The factors involved in the onset of beaver cache construction are not well understood. It could be suspected that weather plays an important role in the onset of cache construction activities. Warm weather (or a late fall) might delay onset of cache construction, while cool weather (or an early fall) might initiate earlier cache construction activities. Beaver cache construction along the Susitna River during the warm fall of 1984 appeared delayed, relative to

previous years. This also seemed to be true of beaver in the Kanuti River in Interior Alaska (D. Kafka 1984, pers. com.).

It seems probable that the onset of cache construction varies from year to year, depending on weather conditions. It is important that surveys to locate beaver caches are flown as late in the fall as possible, but still prior to freeze-up and snow fall.

In light of the year-to-year variations in dates of surveys and weather, we do not feel that the beaver population fluctuated as dramatically as implied by the results of the cache counts. It is possible that in 1982, the lowest cache count, the survey was conducted too early; before most of the colonies along the river had initiated cache construction. The discrepancy in annual cache counts would be compounded if beaver colonies on the mainstem initiate caches later than colonies occupying sloughs. Moreover, by 1984, the study personnel were familiar with the Susitna River, and the higher counts may reflect an increased ability to locate beaver colonies.

During the 1984 observations, most cache construction activity apparently began very late in the evening and probably continued through the night. Beaver activity was usually not observed during the daylight hours. This is contrary to the 1983 cache survey, where beaver were observed working throughout the day, even shortly after study personnel landed at the sites with a helicopter.

One objective of the beaver field studies was to relate the size of a food cache to the number of beavers at a colony. Shape of the caches varied widely,

causing where lengths and widths were measured to be fairly arbitrary. Points where depths were measured were also arbitrary because of differences in cache shape. The circumference of the cache appeared to be a measurement that might allow comparisons between colonies.

The size of a food cache is obviously very dependent upon the stage of construction. The results of cache measurements would be a reflection of when the measurements were taken in relation to the onset of cache construction. If cache construction at a colony proceeds until freeze-up, then comparisons between years (with different weather resulting in different freeze-up dates) may not give accurate results. In addition, comparison of cache size between different types of river habitat (such as mainstem and upland sloughs), which freeze at different times, may also give inaccurate results.

Similarity of the material with which a cache is constructed might also be an important consideration when comparing cache size. A loosely constructed cache containing large branches might contain a similar volume of wood as a small, densely packed cache containing small branches and twigs.

The degree to which beaver were active and the accuracy of determining the number of beaver per colony is also important if the number of beaver per colony is to be related to cache size. If beaver are most active at night, inaccurate counts could result. Delayed onset of cache construction may also contribute to inaccurate counts because of the decreased amount of daylight available for counting beaver.

SUMMARY

Very limited cache construction was observed in early September 1984, but it appeared feasible to obtain minimum counts of beaver at colonies. By mid-September, about half of the food caches eventually located in early October were under construction. Most beaver activity occurred in late evening or during the night.

Minimum counts of beaver at colonies suggests that five beaver per colony, as used in the past, is probably an adequate figure to determine a rough estimate of the beaver population along that portion of the Susitna River. Correlations between cache characteristics and the number of beaver per colony may be feasible, but the data collected to date is insufficient to allow accurate comparisons.

Fall cache counts for 1984 were the highest of the three years of data collection. Thirteen caches were found in mainstem habitat, four in side channels, 14 in side sloughs and 14 in upland sloughs. It is doubtful whether the differences in the counts from 1982, 1983 and 1984 represents such a dramatic change in the number of beaver, but rather these differences may be the results of; 1) variations in data collection between years, 2) actual changes in beaver numbers, and/or 3) variations in river flow regime.

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PERSONAL COMMUNICATIONS

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Appendix A. Locations and habitat designation of beaver food caches along the Susitna River, between Devil Canyon and Talkeetna. October 4, 1984.

Site No.	Characteristics	
84-1	Location	- T31N, R2W, Sec. 10, NW¼ of SW¼ north side of river
	River mile	- 139.5
	Habitat	- mainstem
84-2	Location	- T31N, R2W, Sec. 9, NE¼ of SE¼ north side of river
	River mile	- 139.4, Slough 18
	Habitat	- side slough
84-3	Location	- T31N, R2W, Sec. 9, NE¼ of SE¼ north side of river
	River mile	- 139.4, Slough 18
	Habitat	- side slough
84-4	Location	- T31N, R2W, Sec. 8, SE¼ of SE¼ north side of river
	River mile	- 139.0
	Habitat	- upland slough
84-5	Location	- T31N, R2W, Sec. 17, NW¼ of NE¼ northwest side of river
	River mile	- 137.4, Slough 15
	Habitat	- side slough
84-6	Location	- T31N, R2W, Sec. 17, SE¼ of NW¼ northwest side of river
	River mile	- 137.2, Slough 15
	Habitat	- upland slough
84-7	Location	- T31N, R2W, Sec. 19, NW¼ of NE¼ northwest side of river
	River mile	- 136.4, Slough 14
	Habitat	- upland slough
84-8	Location	- T31N, R2W, Sec. 19, SE¼ of SE¼ east side of river
	River mile	- 135.7, Slough 11
	Habitat	- side slough
84-9	Location	- T31N, R2W, Sec. 19, SW¼ of SE¼ west side of river
	River mile	- 135.5
	Habitat	- mainstem

Site No.	Characteristics	
84-10	Location	- T31N, R2W, Sec. 25, SE¼ of NE¼ west side of river
	River mile	- 134.0, Slough 10
	Habitat	- upland slough
84-11	Location	- T31N, R3W, Sec. 36, NW¼ of NE¼ southeast of river
	River mile	- 133.3, Slough 9A
	Habitat	- side slough
84-12	Location	- T31N, R3W, Sec. 36, NW¼ of SE¼ east side of river
	River mile	- 133.4, Slough 9A
	Habitat	- side slough
84-13	Location	- T31N, R3W, Sec. 36, SW¼ of SW¼ northwest side of river
	River mile	- 132.8
	Habitat	- mainstem
84-14	Location	- T30N, R3W, Sec. 2, SW¼ of NE¼ northwest side of island, on northwest side of river
	River mile	- 132.0
	Habitat	- side channel
84-15	Location	- T30N, R3W, Sec. 9, SW¼ of NE¼ downstream end of island
	River mile	- 129.8
	Habitat	- mainstem
84-16	Location	- T30N, R3W, Sec. 9, NW¼ of SW¼ east side of river
	River mile	- 129.3, Slough 9B
	Habitat	- side slough
84-17	Location	- T30N, R3W, Sec. 20, NW¼ of NE¼ mainstem side of island, on west side of river
	River mile	- 127.4
	Habitat	- mainstem
84-18	Location	- T30N, R3W, Sec. 30, NE¼ of NE¼ southeast of river
	River mile	- 126.0, Slough 8A
	Habitat	- side slough
84-19	Location	- T30N, R3W, Sec. 30, SE¼ of NW¼ southeast of river
	River mile	- 125.7
	Habitat	- side slough

Site No.	Characteristics		
84-20	Location	-	T30N, R3W, Sec. 25, SE¼ of NE¼ downstream end of island
	River mile	-	125.0
	Habitat	-	side channel
84-21	Location	-	T30N, R3W, Sec. 30, NW¼ of NW¼ island on east side of river
	River mile	-	125.8
	Habitat	-	side slough
84-22	Location	-	T26N, R5W, Sec. 13, SW¼ of SW¼ west of river
	River mile	-	98.0, Billion slough
	Habitat	-	side slough
84-23	Location	-	T26N, R5W, Sec. 24, NE¼ of SW¼ east side of river
	River mile	-	98.0
	Habitat	-	mainstem
84-24	Location	-	T26N, R5W, Sec. 23, NE¼ of NE¼ east of river
	River mile	-	98.0
	Habitat	-	upland slough
84-25	Location	-	T26N, R5W, Sec. 13, SW¼ of SW¼ east of river
	River mile	-	98.0
	Habitat	-	upland slough
84-26	Location	-	T26N, R5W, Sec. 14, SE¼ of NE¼ east side of river
	River mile	-	99.4
	Habitat	-	upland slough
84-27	Location	-	T26N, R5W, Sec. 14, SW¼ of SE¼ east side of river
	River mile	-	98.5
	Habitat	-	mainstem
84-28	Location	-	T26N, R5W, Sec. 14, NE¼ of NW¼ west side of river
	River mile	-	99.0
	Habitat	-	side slough
84-29	Location	-	T26N, R5W, Sec. 11, NE¼ of NW¼ mainstem side of island on east side of river
	River mile	-	100.4
	Habitat	-	mainstem

Site No.	Characteristics		
84-30	Location	-	T26N, R5W, Sec. 11, SE¼ of SE¼ island on east side of river
	River mile	-	99.8
	Habitat	-	mainstem
84-31	Location	-	T26N, R5W, Sec. 11, SE¼ of SE¼ island on east side of river
	River mile	-	99.8
	Habitat	-	mainstem
84-32	Location	-	T26N, R5W, Sec. 2, SE¼ of SW¼ east side of river
	River mile	-	100.6, Slough 2
	Habitat	-	side channel
84-33	Location	-	T27N, R5W, Sec. 35, NW¼ of SW¼ west of river
	River mile	-	102, Slough 3A
	Habitat	-	upland slough
84-34	Location	-	T26N, R5W, Sec. 25, SE¼ of SE¼ east of river
	River mile	-	102.9
	Habitat	-	upland slough
84-35	Location	-	T27N, R5W, Sec. 25, SE¼ of SE¼ east of river
	River mile	-	102.9
	Habitat	-	upland slough
84-36	Location	-	T27N, R5W, Sec. 13, SW¼ of NW¼ east of river
	River mile	-	105.6
	Habitat	-	upland slough
84-37	Location	-	T27N, R5W, Sec. 12, SE¼ of SW¼ east of river
	River mile	-	106.2
	Habitat	-	upland slough
84-38	Location	-	T28N, R5W, Sec. 36, SW¼ of NE¼ west of river
	River mile	-	109.3
	Habitat	-	upland slough
84-39	Location	-	T28N, R4W Sec. 30, NW¼ of NW¼ east of river
	River mile	-	110.5
	Habitat	-	mainstem

Site No.	Characteristics		
84-40	Location	-	T28N, R4W, Sec. 6, SE¼ of SW¼ east of river
	River mile	-	114.2, Slough 8
	Habitat	-	upland slough
84-41	Location	-	T28N, R4W, Sec. 6, NW¼ of SW¼ downstream and of island in mid-channel
	River mile	-	114.7
	Habitat	-	mainstem
84-42	Location	-	T29N, R4W, Sec. 21, NW¼ of NE¼ east side of island
	River mile	-	119.0
	Habitat	-	side channel
84-43	Location	-	T29N, R4W, Sec. 16, NE¼ of NE¼ main channel side of large island on west side of river
	River mile	-	120.1
	Habitat	-	mainstem
84-44	Location	-	T30N, R4W, Sec. 35, SW¼ of SE¼ east of river
	River mile	-	122.6
	Habitat	-	side slough
84-45	Location	-	T30N, R4W, Sec. 35, NE¼ of SE¼ east of river
	River mile	-	123.2
	Habitat	-	side slough

Appendix B. Characteristics of beaver colonies examined along the Susitna River, September 27 - October 2, 1984.

Site No.	Characteristics	
84-35	Date examined	- September 28-29
	Location	- T27N, R5W, Sec. 25, SE¼ of SE¼
	River mile	- 102.9
	Cache size	- length[a] - 8 m
		- width[b] - 6.5 m
		- circumference[c] - 30 m
		- distance from lodge - 1 m
		- water depth[d] - 1.4 m, 1.8 m, 1.5 m, 1.2 m
	Number of beaver observed	- 3 adult or yearling-sized 1 kit
	River habitat	- upland slough
84-29	Date examined	- September 29-30
	Location	- T26N, R5W, Sec. 11, NE¼ of NW¼
	River mile	- 100.4
	Cache size	- length[a] - 1.4 m
		- width[b] - 4.4 m
		- circumference[c] - 15 m
		- distance from lodge - adjacent to lodge
		- water depth[d] - 0.55 m, 0.85 m, 0.8 m, 0.55 m
	Number of beaver observed	- 1 adult-sized 1 kit
	River habitat	- mainstem
84-30	Date examined	- September 30 - October 1
	Location	- T26N, R5W, Sec. 11, SE¼ of SE¼
	River mile	- 99.8
	Cache size	- length[a] - 6 m
		- width[b] - 5 m
		- circumference[c] - 21 m
		- distance from lodge - 3 m
		- water depth[d] - 0.95 m, 1.25 m, 2.2 m, 1.7 m
	Number of beaver observed	- 4 adult or yearling-sized 1 kit
	River habitat	- mainstem

Site No.	Characteristics		
84-22	Date examined	-	October 1-2
	Location	-	T26N, R5W, Sec. 13, SW¼ of SW¼
	River mile	-	98.0, Billion slough
	Cache size	-	length[a] - 13 m
		-	width[b] - 6 m
		-	circumference[c] - 30 m
		-	distance from lodge - 2 m
		-	water depth[d] - 1.6 m, 1.5 m, 1.3 m, 1.7 m
	Number of beaver observed	-	4 adult or yearling-sized 1 kit
	River habitat	-	side slough
84-24	Date examined	-	October 1-2
	Location	-	T26N, R5W, Sec. 23, NE¼ of NE¼
	River mile	-	
	Cache size	-	length[a] - 6.9 m
		-	width[b] - 5.2 m
		-	circumference[c] - 15 m
		-	distance from lodge - adjacent to lodge
		-	water depth[e] - 1.4 m, 1.3 m, 1.1 m
	Number of beaver observed	-	3 adult or yearling-sized 1 kit
	River habitat	-	upland slough

[a] Greatest distance across cache, measured parallel to shore.
[b] Greatest distance across cache, measured perpendicular to shore.
[c] Measured at water level.
[d] Order of measurements: left-hand corner nearest to lodge, left corner farthest from lodge, right corner farthest from lodge and right corner nearest to lodge.
[e] Only 3 depth measurements for site 84-24, two corners nearest to lodge and point farthest from lodge.