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YFNWR Project Report Number 86-4
Key Words: Beaver, food cache, Interior Alaska, Yukon Flats National Wildlife Refuge

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Lori H. Nordstrom
U.S. Fish and Wildlife Service

On Reserve

Management Study
Yukon Flats National Wildlife Refuge
U.S. Fish and Wildlife Service
101 12th Avenue, Box 20
Fairbanks, Alaska

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INTRODUCTION

A survey was conducted for the Yukon Flats National Wildlife Refuge (YFNWR) in summer 1985 to assess the feasibility of a proposed study to estimate beaver colony size through observations of active lodges in autumn. The objective of this proposed study is to determine if the number of beavers in a colony is positively related to the size of the food cache associated with the lodge. Such a relationship is believed by trappers to exist, and it has been proposed for study in the past in the Lower Yukon-Kuskokwim Region in southwestern Alaska (Machida and Dinneford 1983: unpubl. Alaska Department of Fish and Game (ADF&G) proposal, S. Patton ADF&G-Bethel: pers. comm.). The information would be used in YFNWR to 1) supplement the current trend counts of caches in order to give estimates of actual beaver abundance, and 2) better evaluate harvests and the status of populations within selected areas and the refuge as a whole (McLean 1985).

In this report, we will discuss the results of a field reconnaissance of active beaver lodges and review the literature on beaver ecology and census methods. We conclude with a statement of feasibility and our procedural recommendations.

L. Scott McLean outlined the scope of this survey as part of his continuing effort to monitor beaver populations on YFNWR. He provided logistic support and a forum for discussion of problems and possible solutions.

METHODS

The beaver-cache census areas (McLean 1985) of Old Lost Creek (OLC) and Beaver Creek (BC) were chosen for the reconnaissance. The former was surveyed during 23-25 August 1985 and the latter surveyed from 18-20 September 1985. Each site was typical of the Yukon River basin habitat, consisting of taiga forest interspersed with wet meadows and numerous shallow waterbodies of lakes and ponds and meandering creeks and rivers. White spruce (Picea glauca), black spruce (P. mariana), birch (Betula papyrifera), aspen (Populus tremuloides), and balsam poplar (P. balsamifera) comprise the major tree species of the taiga. Willow (Salix spp.) and alder (Alnus spp.) commonly line the shores of most waterbodies. The average elevation is about 120m in both census areas.

The areas were surveyed via canoe for active lodges, defined as having new food caches, fresh-packed mud, recent cuttings, and tracks. Food caches were measured and their contents documented, as were other signs of beaver activity and nearby vegetation. Attempts were made on a few occasions to observe beaver activity outside the lodge, however, this effort was discontinued because it was so unproductive.

Literature on various aspects of beaver ecology and census techniques were examined. Information from other studies will be discussed and used in a determination of the feasibility of the study proposed here.

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RESULTS AND DISCUSSION

Reconnaissance

We observed a total of 7 beaver lodges between the 2 areas surveyed (Figure 1). The 3 in OLC provided little useable information; 2 lodges were inactive and 1 appeared to be a new bank den with no food cache. Four active lodges with food caches were observed in BC (Table 1).

There was no obvious relationship between cache size and composition in BC. With the notable exception of aspen in the cache of lodge no. 3 (Table 1), caches were comprised of species found in adjacent vegetation. Willow was the primary component of caches, and it was usually the most abundant shoreline genera as well. Vegetation adjacent to lodges was usually grass or sedge close to shore, shrub and small tree next, and tall deciduous/conifer forest beyond. Shrub and tree canopy cover was 60% either adjacent to or within a short distance of each lodge we observed..

Table 1. Observations on 4 active beaver lodges within the Beaver Creek (BC) cache-census area during 18-20 September 1985 in YFNWR.

Lodge No.	Food Cache		Nearby Vegetation 2/	Waterbody Type
	Size (M) 1/	Composition 2/		
1	7 x 4 x 2.5	AL, B, PL, S, W	AL, B, PL, S, W	Lake
2	7 x 5 x 2.5	W	GR, S, SG, W	Creek
3	15 x 7 x 2.5	AS, W	B, S, W	Creek
4	15 x 7 x ? 3/	P, W	AL, P, S. W	Lake

1/ Length x width x depth.
2/ AL = alder, AS = aspen, B = birch, GR = grass, P = poplar, PL = pond lily (*Nuphar variegatum*), S = spruce, SG = sedge (*Carex* spp.), and W = willow.
3/ Depth of cache not measured.

Proximity of lodges to protective cover in BC probably made most nearby waterbodies accessible to beavers, enabling them to travel within territories in search of food and construction materials. Boyce (1974) found beaver colonies along Birch Creek and Chena River in interior Alaska to be 0.35 - 0.48 km apart, and that beavers foraged within those limits and up to 60m from water. He also found that beaver density was positively related to the abundance of preferred plant types (Boyce 1974). Aspen, willow, poplar, and especially green vegetation like pond lily appear to be used most for food by beavers (Slough 1978, Jenkins 1979, 1981, Slough and Jessup 1984).

Sizes and nutritional quality of food items and temporal changes in supply dictate how far beavers will forage from their lodges (Jenkins 1979, 1980). Generally, beavers cut smaller trees the farther they are from their lodge, but they may still cut large trees further away if they have high nutritional value (e.g., aspen)(Jenkins 1981). The seasonal or yearly abundance or scarcity of preferred foods may force beavers to eat less-preferred plants or

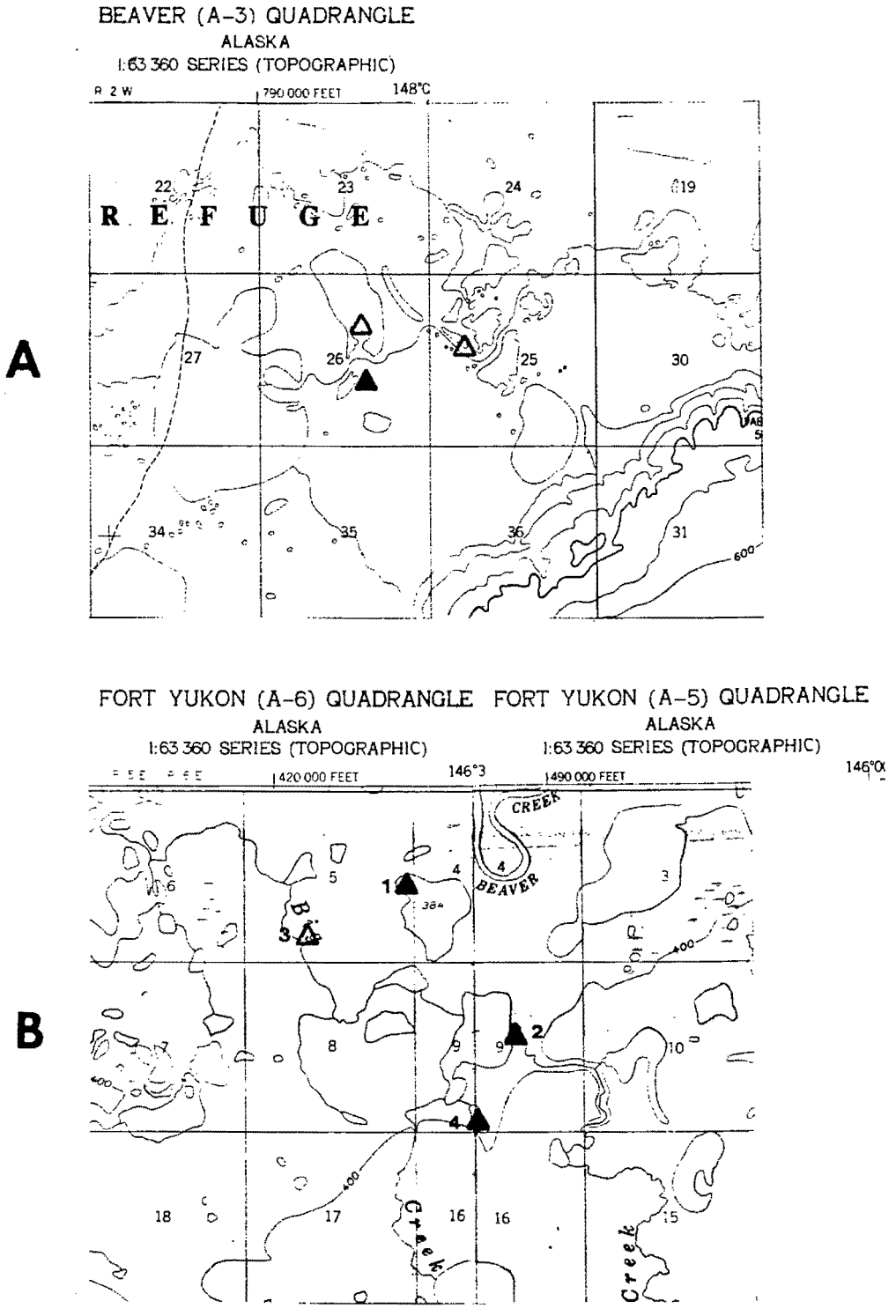

Figure 1. Beaver lodges (▲=house, △=bank den) on A: Old Lost Creek (OLC) and B: Beaver Creek (BC) beaver-cache census areas, YFNWR.

possibly forage farther from the lodge in search of high-quality food. These strategies provide beaver the most nutrition while minimizing energy demands and the risks from predation because less time is spent gathering food (Jenkins 1981).

The ability of beavers to find food outside their immediate surroundings may explain why a cache in BC (i.e., lodge no. 3, Table 1) or in another area would sometimes contain food items not present or common in adjacent vegetation. Cache contents may also be affected by the beaver's choice of materials for the raft within a cache. Caches in Canada each contain a raft of low-preference species of vegetation, such as alder, spruce, and the previous year's contents of peeled logs (Slough 1978). These materials act as a cap above the main body of preferred food items, which allows them to remain below the ice in winter. Preferred food cuttings may also be interspersed throughout the entire cache including the raft.

Two of the lodges we observed in BC were located on creeks and 2 were on lakes (Table 1). The 2 lake lodges were houses as was one of the creek lodges. Lodge no. 3 on Big Creek (Figure 1) was a bank den located at the mouth of a small lake (not shown) on the creek. There was evidence of an old dam across the creek, indicating the beavers tried, at one time, to stabilize the flow and increase water depth. Water in this area has been reported to fluctuate markedly (P. Heglund: pers. comm.). The dam may also have been destroyed with breakup and required too much labor for the beavers to rebuild during the short summer. Lodge no. 2, a house, was on Big Creek, too, near the mouth of a lake, but it was below a small dam or log jam. Last year's food cache had been pushed against the opposite bank by ice flow, but, apparently, neither the creek's current nor moving ice prevented the construction of a house. It is possible this house began as a small bank den and expanded once conditions were favorable (Hill 1982).

Estimation of Colony Size

A colony has been defined as "a group of beavers occupying a pond or stretch of stream in common, utilizing a common food supply, and maintaining a common dam or dams" (Hill 1982:262). Hodgdon and Lancia (1983) consider a colony to be a family unit of related individuals. A breeding pair of adults and offspring, including newborn kits, yearlings, and sometimes 2-year-old subadults, comprise a colony or family (Boyce 1974, Busher et al. 1983).

Because beaver colony sizes can and do change from year to year, it is difficult to determine beaver population levels. Aerial censuses of caches alone do not provide enough information to estimate numbers of beavers (Swenson et al. 1983). Applying an average value for a typical colony, e.g., 5 (Slough and Jessup 1984), to food caches counted is also inadequate because it assumes a stable colony size. Hay (1958) tested several census methods and concluded that aerial cache counts combined with yearly estimates of colony size, through observation or dead trapping, was the most reliable and economical method to estimate population sizes.

During our reconnaissance, we attempted to observe beaver activity and count individual animals. We were unsuccessful in OLC due to the lack of beavers in the area, and in BC because the beavers were only active after dark during the time we were there.

Several things must be considered before attempting to observe beavers in order to count individuals. Behavior, specifically activity, is probably the most important. Beaver activity tends to be crepuscular or nocturnal, and lasts 11-13 hours/night (Hodgdon and Lancia 1983). In general, adults are outside the rest site most often with the adult males spending the most time patrolling (Hodgdon and Lancia 1983, Busher and Jenkins 1985). During fall, all family members participate in cache construction and lodge maintenance but kits and 1 and 2 year-old offspring spend less time in this activity than adults (Busher and Jenkins 1985).

Live trapping (Hay 1958, Boyce 1974) and ear marking (Miller 1964) beavers would provide data on family sex and age composition and allow identification of individual animals (Busher and Jenkins 1985). Observations could then be made to see how many beavers were marked or unmarked in order to determine or closely estimate colony size. After our limited reconnaissance, we believe it is only practical to trap and mark in mid to late summer and then observe beaver in early fall before daylight wanes and temperature drops. Kits are more active in those periods (Busher and Jenkins 1985) so it may be easier to capture and observe them (Busher et al. 1983).

An alternative to observation is to dead trap all beavers in a colony (Hay 1958), preferrably in the spring after caches have been counted and estimated for size the previous fall. Refuge personnel or a local trapper could set traps at selected lodges to capture entire colonies and obtain carcasses. This method would provide the most accurate information on the number, age and sex ratios, physical condition, and reproductive performance of beavers in a colony (Hay 1958, Hill 1982). It would, therefore, facilitate an understanding of beaver population status and dynamics on the YFNWR.

Estimation of Cache Size

Precise estimates of cache sizes from the air will need to be made to meet the objective of the proposed study. Potential observer bias in determining cache sizes may be a major problem, however. Criteria must be established as to 1) the categories of sizes to be used, e.g., small, medium, or large, and 2) what constitutes size, e.g., long and narrow vs. short and wide. Golden conducted a portion of the cache census in BC on 8 October 1985, and felt his ability to estimate sizes of about 50 caches was fair to poor using small, medium, and large categories. It is apparent to us that extensive practice sessions will be necessary to train observers. Practice by the same observer at estimating cache sizes in other areas just prior to the test area would be beneficial.

Surveys to estimate cache size should be conducted during aerial censuses of beaver caches on YFNWR. Golden found the visibility of caches was good in early October, and it would likely have been just as good anytime in September after leaffall. Because cache construction activity by beavers is accelerated in fall (Busher and Jenkins 1985), it is best not to begin surveys too early. However, Golden and others (S. Harrington and L.S. McLean, YFNWR-Fairbanks: pers. comm.) have observed that the poor and sometimes erratic weather typical of October, which can hinder or halt aerial work, is incentive to begin surveys shortly after leaffall.

Analytical Considerations

It is important that the variabilities in food cache sizes and numbers of beavers per colony are recognized, and that the sampling efforts attempt to minimize the potential detrimental effects these variabilities may have on data interpretations. Sampling design should, at first, only be concerned with estimating food cache sizes and counting beavers in selected colonies. Other sources of variability, e.g., habitat characteristics, can be examined in future studies once sampling procedures for the proposed study are established. We think it is essential to randomly select and have large samples (N 30) of caches and colonies so that analyses are statistically sound. We see a high potential for bias where sample sizes are inadequate.

Recommendations

The feasibility of any study depends upon an ability to gather adequate data for proper analysis of a problem and, ultimately, on the costs involved in gathering those data. Given those constraints, we feel the proposed study would be feasible and worthwhile, and we make the following recommendations on procedure:

1. Review the short and long-term furbearer management needs for the YFNWR to determine if estimates of actual beaver abundance and data on population dynamics are desirable information additions considering current cache censuses and other available information.

2. Research the information the Alaska Department of Fish and Game (ADF&G) have gathered and updated from beaver pelt-sealing records. Their current effort is to compile harvest data on beavers by drainage and subdrainage area within a particular game management unit (H. Melchior, ADF&G-Fairbanks: pers. comm.).

3. Determine colony size using one of the following methods: A) dead trap all colony members in spring and collect the carcasses for study, or B) live trap, eartag, and observe all colony members in mid to late summer. We believe option A would be the most practical method to census colonies in terms of time, money, and data acquisition. Each colony trapped should have had its cache size estimated the previous fall during the cache censuses. Colony trapping should accompany cache size estimates every 3 years to update the colony-size values applied to cache sizes. Caches and colonies should be randomly selected from the same study areas as specified earlier.

4. This study should be expanded if the results of the proposed study prove promising in estimating beaver populations. Further efforts should concentrate on the importance of available vegetation and other habitat components in YFNWR on beaver abundance (see Boyce 1981). Specifically, we feel it would be useful to investigate the function of food quality and quantity on cache contents and sizes.

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