

BEAVER SURVEY

YELLOWSTONE NATIONAL PARK

1996

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SUMMARY

The number of active beaver (*Castor canadensis*) colonies in Yellowstone National Park was determined by aerial survey in late October and early November 1996. This was the first near-complete autumn aerial count of beavers in park history. Flying time for the survey was 14.9 hours, plus 4 hours ferry time from Bozeman, Montana, for a total of 18.9 hours. Total number of beaver colonies with food caches was 49; three other sites had beaver sign (beaver dam or cutting) indicating that beavers were probably present, but no lodge or food cache was sighted. Ninety percent of the park's beavers were located in three areas: 1) the Yellowstone River southeast of Yellowstone Lake, 2) the Bechler area, and 3) creeks and rivers in the northwest corner of the park which included the Madison and Gallatin rivers, and Cougar, Campanula, and Gneiss creeks. There was only one beaver colony on Yellowstone's Northern Range. All colonies were associated with willow (*Salix* spp.).

INTRODUCTION

The history of beavers (*Castor canadensis*) in Yellowstone National Park (YNP) is sketchy (Schullery and Whittlesey 1992, Consolo Murphy and Tatum 1995). Information from the late 1800s is the least clear, but most information generally agrees with region-wide patterns that beavers were at all-time population lows, a result of fur trade over-exploitation (Warren 1926, Schullery and Whittlesey 1992).

In 1926, Warren (1926) described in detail the beaver colonies living in the Yancey's Hole region. Numerous colonies in this region indicate that beavers were abundant and this likely reflected a parkwide trend. Warren (1926) also reported extensive use of aspen, which was showing signs of depletion. In 1955, Jonas (1955) did a follow up study to Warren's in the Yancey's Hole region, but also looked parkwide for beaver activity. He found numerous active lodges throughout the park. At Yancey's Hole, Jonas (1955) reported that the aspen that the beavers were using in the

early 1920s (Warren 1926) was mostly gone.

In 1989 and 1994, Consolo Murphy and Hanson (1993) and Consolo Murphy and Tatum (1995) conducted parkwide ground surveys for beaver activity, complemented by a limited aerial search in August or September. Their findings indicated that beavers were still distributed throughout Yellowstone, but they reported reduced presence of beavers in some areas of the park compared to earlier surveys (Warren 1926, Jonas 1955).

The purpose of our survey was to continue monitoring beaver population distribution and abundance, as earlier studies had done, but in a more rigorous, parkwide fashion at the most ecologically appropriate time of year. Aerial census in autumn, after leaf-fall (no leaves on deciduous vegetation) and before freeze-up (ice formation on ponds, rivers, and creeks), has become an accepted method of censusing beavers inexpensively over large areas (Hay 1958, Novak 1987), yet no complete aerial census has ever been done in Yellowstone. Much of the speculation and guess work about beaver abundance and distribution could be curtailed if systematic, regular aerial surveys were instituted. We report the results of the first such survey, and discuss the potential and feasibility for future aerial surveys for beavers in Yellowstone National Park.

METHODS

We spotted active beaver colonies from a small fixed-wing aircraft (Supercub) from an altitude of 100–175 feet and an air speed of 55–65 mph. The park was surveyed by flying rivers and creeks looking for beaver sign. We did not fly in a systematic pattern, as is done in flatter country (midwest United States), because large areas of Yellowstone are not beaver habitat (lodgepole pine expanses in the park

interior; Fig. 1). We also did not fly every creek in the park because streams with gradients >15% are uninhabitable to beavers. We did fly every river in the park (Fig. 1). In areas of high beaver density, repeated overflights with much circling were often necessary to locate every colony.

Our censusing unit was the beaver colony. Each colony of beavers in autumn cuts woody vegetation for storage near their lodge or bank burrow for use through winter. To store woody vegetation, beavers weave their wood sticks together forming large (~1–4 m²) mats called food caches that fan out from their dwellings (Slough 1978). There is only one cache per colony, and they are highly visible from the air (Novak 1987), hence the development of the aerial survey technique (Hay 1958, Payne 1981). To aid aerial searches for food caches, we also looked for cut trees, beaver lodges, dams (which cause easily seen ponds to form), and freshly peeled sticks, which shine brightly white when viewed from above in an airplane. Once any one of these signs were sighted, it clued us in to circle back and look for a food cache. Once a food cache was located, in the airplane we marked the location directly onto a 1:125,000 scale topographic map.

RESULTS

We did not begin the survey until after October 15 because it was not until then that the willows lost their leaves allowing us to see the beaver food caches. The first survey day was October 17 followed by flights on October 21, 31, and November 5. We did not fly on consecutive days because of inclement flying weather. For each flight we had clear skies. The first three survey flights we had complete snow cover and some ice in the streams and rivers. For the last flight we had significant

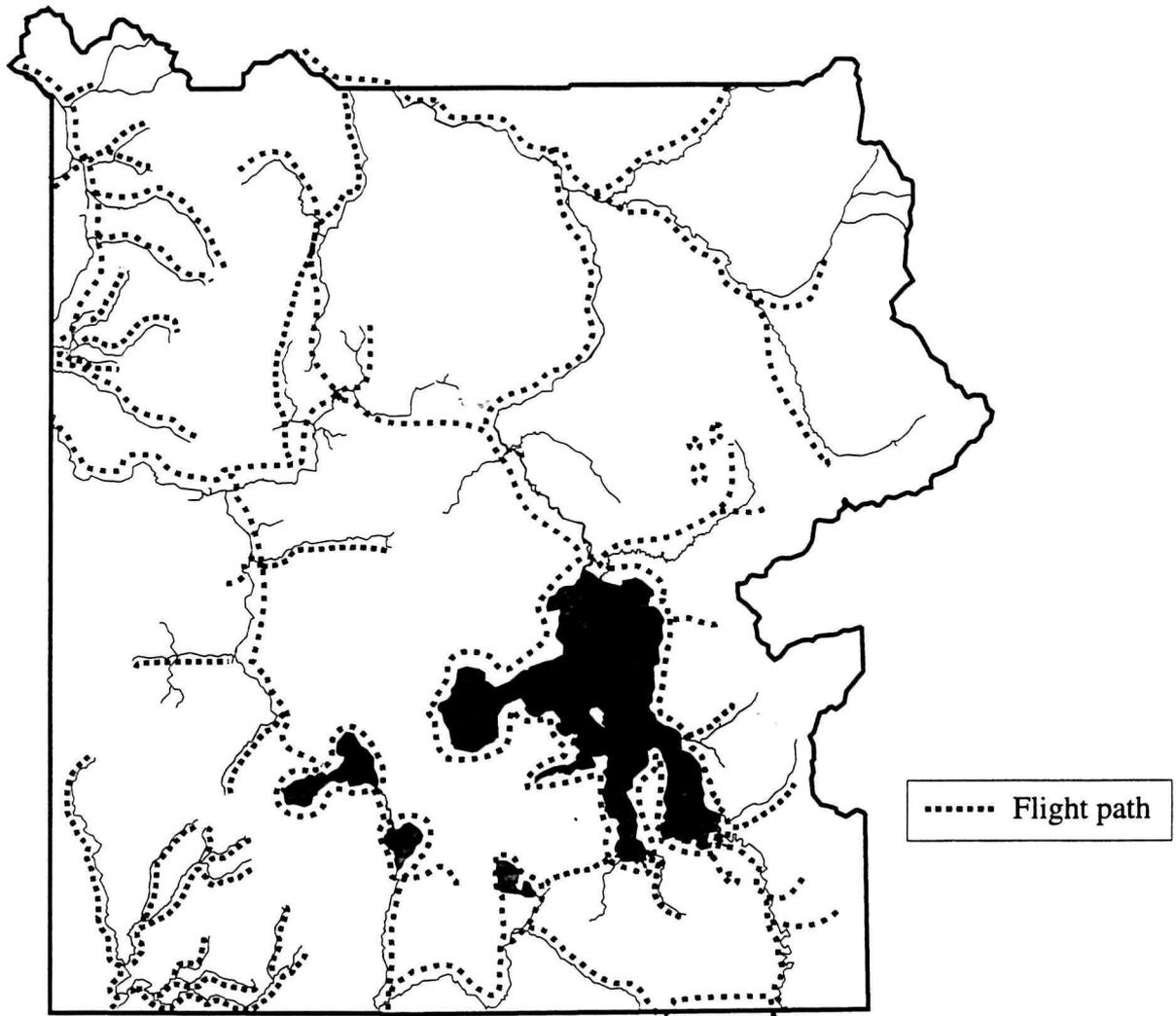


Figure 1. Area covered for 1996 aerial beaver survey. Dotted lines indicate approximate flight path of airplane.

ice in streams and rivers that made viewing conditions difficult.

On October 17, we surveyed the central portion of the park, Yellowstone Lake, and a large portion of the Yellowstone River, including that section of the river south of the lake (delta area) and all its tributaries, as well as the portion of the Thorofare River inside YNP (Fig. 1). On October 21, we surveyed the area south of Yellowstone Lake, including the Snake and Lewis rivers and Heart, Lewis, and Shoshone lakes. On October 31, we surveyed the Bechler area and the creeks and rivers in

the southwestern portion of the park as well as the Gibbon River and its tributaries. On November 5, we surveyed the Madison River and the rivers and creeks in the northwestern corner of the park as well as the entire Northern Range, which included the Yellowstone and Lamar rivers and their tributaries (Hellroaring), Yancey's Hole, and Soda Butte Creek.

The total number of active colonies with a food cache in Yellowstone National Park was 49 (Fig. 2). Forty-four (90%) of these colonies were in three regions of the park: 1) the

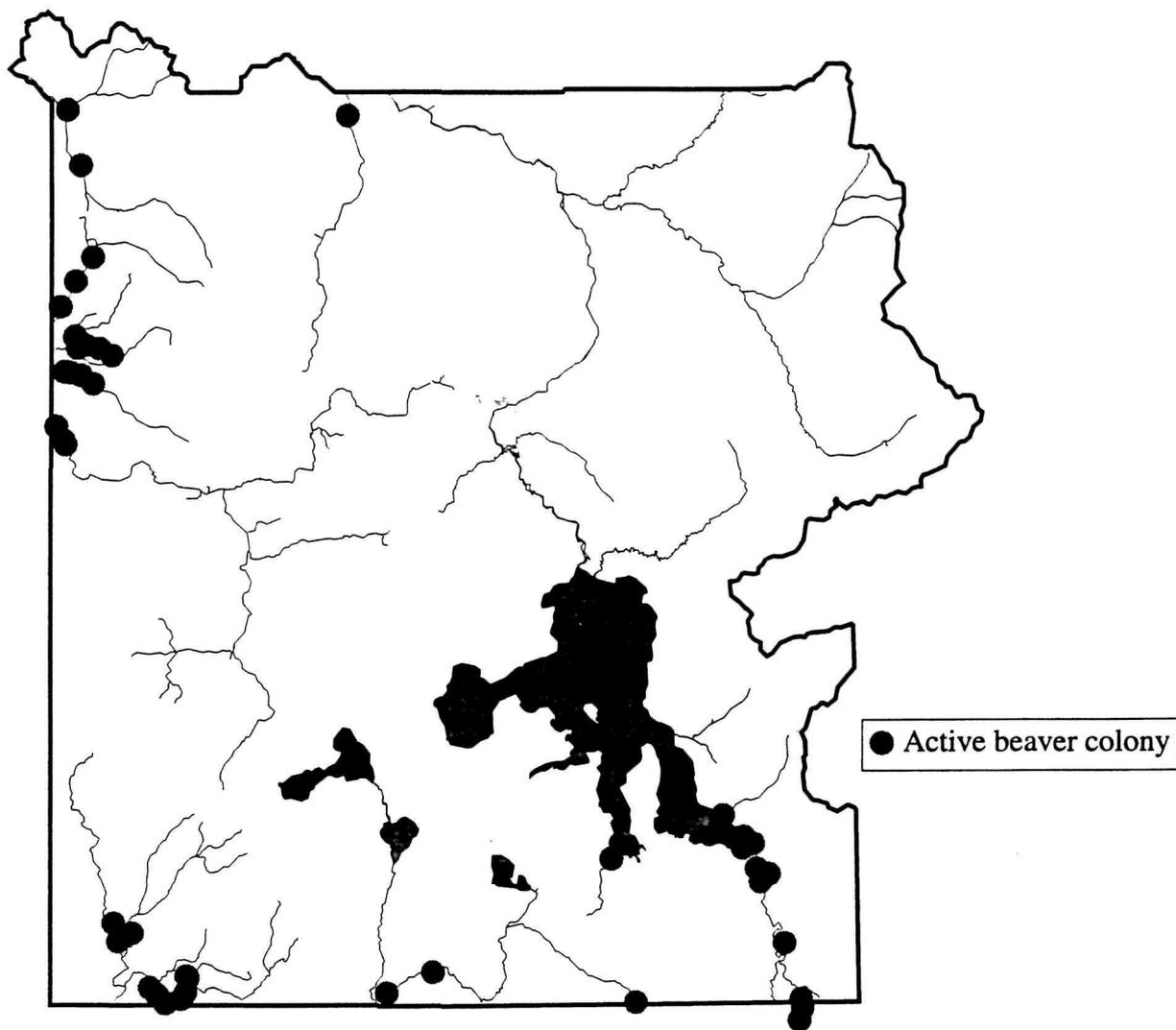


Figure 2. Location of active beaver colonies in Yellowstone National Park, 1996.

Yellowstone River south of Yellowstone Lake, 2) the southwest portion of the park (Bechler area), and 3) the northwest portion of the Park including the Madison and Gallatin rivers (Fig. 2; Table 1). A colony was on Slide Lake north of Mammoth, the only Northern Range beaver colony. Three other colonies were along the Snake River, and another was on Grouse Creek near the South Arm of Yellowstone Lake. The areas of highest beaver density were the Yellowstone River delta area south of the southeast arm of Yellowstone Lake, and Campanula and Gneiss creeks in the northwest

corner of the park (Table 1).

We observed cut trees at sites along the Madison and Gardner rivers, but did not locate food caches or lodges (Table 1). At four other sites we saw beaver dams without food caches: one was at lower Slough Creek and appeared old, two other old dams were spotted on the Gallatin River and Lynx Creek (Thorofare), and a dam with sign, but no cache, was seen on Fan Creek. If we count active beaver lodges with a cache and add sites with fresh sign, then there are 52 active beaver sites in Yellowstone National Park.

Table 1. Number of active beaver colonies by area in Yellowstone National Park, 1996.

Location	Number of Active Colonies	Kilometers of River/Stream Surveyed	Colonies/km
Northwest			
Campanula/ Gneiss/Duck Creek	7	25.6	0.27
Cougar Creek	4	27.2	0.15
Gallatin River	2	32.0	0.06
Grayling Creek	3	27.2	0.11
Madison River	3	8.6	0.35
Southwest			
Bechler River	1	19.7	0.05
Boundary Creek	2	10.2	0.20
Mountain Ash/Proposition Creek	7	31.8	0.22
Southeast/Southcentral			
Snake River	3	49.3	0.06
Yellowstone River	15	40.0	0.38
Other			
Grouse Creek	1	-	-
Slide Lake	1	-	-

In addition to colonies with active sign, we counted six other sites where we spotted a beaver lodge, but saw no indication that the lodge was being used by beavers. Two of these unoccupied lodges were located in a bog at the east end of Heart Lake. Although we called these lodges inactive, one of them could have beavers living there because beavers often stuff the sticks for their food cache underneath a bog mat, rather than construct the normal surface food cache (D. Smith, personal observation). Knowing this, we looked hard for fresh mud on the lodge or freshly peeled sticks but saw none. The other lodges without fresh sign were in Bechler Meadows, Beaverdam Creek, and two along the Madison River.

All fresh beaver sign and colonies, except the cutting along the Gardner River, were associated with willow (Fig. 3). The cutting along the Gardner River was young cotton-

wood trees. We saw no colony located near aspen.

Stream gradients where colonies were located were gentle. On the Gallatin River where stream gradients were greater, beavers located themselves off the main river channel on tributary streams. Colonies along main river channels, like on the Bechler and Yellowstone rivers, were located in slack water, or on a meander where the current was reduced.

DISCUSSION

Since this is the first beaver survey of its kind in Yellowstone National Park, it is difficult to make comparisons to earlier surveys or make statements about beaver population trend. This said, and despite methodological differences, the only comparison possible is to the two surveys conducted in 1989 and 1994

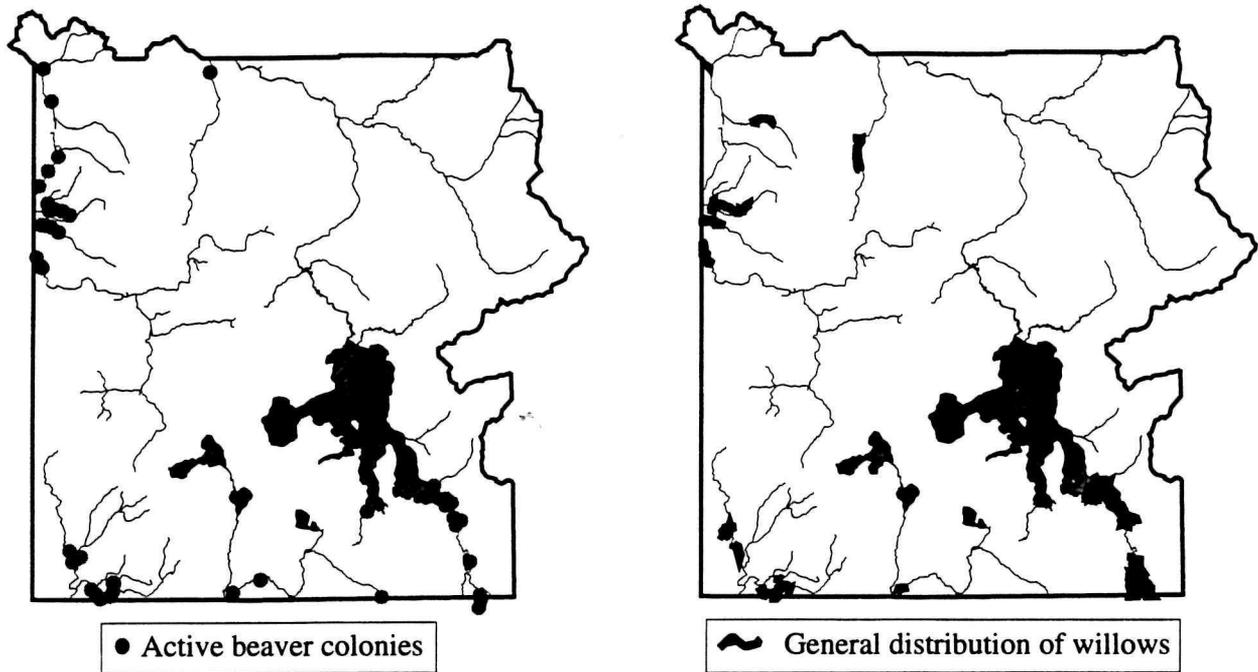


Figure 3. Location of active beaver colonies (left map) and general distribution of willow (right map) in Yellowstone National Park, 1996.

(Consolo Murphy and Hanson 1993, Consolo Murphy and Tatum 1995). Making this comparison, from 1994 to the 1996 the beaver population is stable at approximately 50 colonies. Our results, however, are a 31% decline from their 71 colonies in 1989 (Consolo Murphy and Hanson 1993).

No study of beaver demographics has been conducted in Yellowstone, but if we use a mean colony size of six beavers, a number derived by averaging beaver colony sizes across North America (Jenkins and Busher 1979, Novak 1987), then there are approximately 300 beavers in Yellowstone National Park.

From this survey, we can conclude that beavers are not widely distributed in Yellowstone, but they are not rare. In appropriate habitats they are common. Beaver densities on the Yellowstone River delta south of Yellowstone Lake and along Campanula and Gneiss creeks are as dense as beaver colonies subsisting on willow anywhere in North

America (Novak 1987). Parkwide beavers are probably not common because there are too many high gradient streams, which they have difficulty damming and storing food, and because so much of Yellowstone is dominated by conifers (Despain 1990), a very poor beaver food.

We did not find beavers living on any of the large lakes of Yellowstone, a place they have been reported before (Jonas 1955). Riverine beavers were most common, but we also found beavers that had constructed dams to flood water and create ponds (Campanula and Gneiss creeks).

Beavers in Yellowstone appear to be subsisting on willows. We saw no colony that was not located amidst willows, and beaver distribution closely corresponds to willow distribution (Fig. 3). The population ecology of beavers living on willows tends to be more stable than beaver populations that depend on trees for winter food. Beavers can more easily deplete trees because they do not grow back

quickly, whereas willows are hardy resprouters often stimulated by browsing, and typically occur at such densities that beavers have difficulty reducing their abundance anyway (Boyce 1974). We do not, then, predict large beaver population fluctuations in the near future, unless some other population regulator like drought, flood, or disease was to effect the beavers of Yellowstone.

Beavers in Yellowstone have not always been dependent on willow. Warren (1926) described colonies harvesting large amounts of aspen in the early 1920s, the beavers' prime food (Jenkins and Busher 1979, Novak 1987), and Jonas (1955) found some cutting of aspen in isolated patches as did Consolo Murphy and Hanson (1993). Beaver population size now compared with then, although no complete survey was conducted by Warren (1926) or Jonas, is lower and probably due to less aspen.

Another possible population factor affecting beavers in Yellowstone is the status of beavers outside the park. Many, but not all, of Yellowstone's creeks and rivers are headwaters that are typically characterized by steep gradients. The kinds of habitats beavers settle are usually further downstream. Hence, beavers downstream and outside the park may be the colonizers that are available to settle the few habitats that beavers can settle inside the park. A reverse scenario, however, may exist on Yellowstone's Northern Range. The creeks of Hellroaring, Buffalo Fork, and Slough had no beavers living on them inside the park, but there are or were colonies along these streams, further upstream, outside the park on land managed by Gallatin National Forest (D. Tyers, personal communication). Since we found no colonies downstream on these three drainages, the beaver colonies upstream may be the colonizers that settle any areas inside the park on the Northern Range.

CONCLUSIONS AND RECOMMENDATIONS

The first aerial survey of Yellowstone National Park located 49 active colonies (a lodge or burrow with a food cache), and three other sites that had fresh sign but no food cache. We estimate the park's beaver population to be around 300 animals. In some areas beaver colonies were found at high density. Beavers typically live in three settings: 1) on large lakes, 2) on rivers, and 3) on ponds that they create. Yellowstone had no beavers living on any of the large lakes, but there were beavers living on rivers and in ponds that they had created. The beavers of Yellowstone subsist on willows.

This beaver survey will be more valuable, and a greater amount learned about Yellowstone's beaver population, if more surveys are completed. So far, no beaver population survey in Yellowstone has been conducted in a similar fashion, so little can be concluded about beaver population trend or changes in distribution. If more surveys are done using similar methodologies, more accurate data will become available on the beaver population.

We recommend that aerial census be adopted as the primary technique to monitor the beaver population. Aerial census is widely used and an accepted methodology to monitor beaver populations (Novak 1987). It is also cost effective over large areas such as Yellowstone. Our survey, for example, took 15 hours, whereas the survey in 1989 was from May through October, and the survey in 1994 was from August through November, and neither covered as much area as did the aerial survey. Such time intensiveness was by necessity because there was so much area to survey. Because there was so much country to

examine, workers were not able to census at the most ecologically appropriate time of year, autumn, when beaver activity is at its highest and most obvious. Surveys should be conducted every other year.

Aerial census can only be used as a method to examine beaver population size, trend, and distribution. If more information about beavers in Yellowstone is desired, then a more intensive study is necessary. Questions pertaining to average colony size, reproduction, movements, or effects on riparian areas can only be answered by more involved studies that would include handling and possibly radio instrumentation.

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