POPULATION STATUS OF BEAVER ON THE FREE-RUNNING MISSOURI RIVER IN SOUTHEASTERN SOUTH DAKOTA [1]

Robert J. Vanden Berge[2] and Paul A. Vohs, Jr.[3]
Department of Wildlife and Fisheries Sciences
South Dakota State University, Brookings, S. D.

ABSTRACT

One hundred sixty-two beaver (*Castor canadensis*) harvested by trappers from the free-running Missouri River in southeastern South Dakota were examined from fall 1974 to spring 1976. The sample was composed of 92 males and 70 females (131:100 sex ratio). The age structure was 69:26:45: 15:4:3 for the six age classes represented in the sample.

Minimum breeding age for female beaver was 2.5 years. Seventy-eight percent of sexually mature females had corpora lutea and viable fetuses. The mean number of corpora lutea was 4.91 per breeding female; the mean number of viable fetuses was 4.62 per breeding female. An overall resorption rate of embryos was 5.8%.

A colony count index estimated a 15.3% decline in the beaver population between the 1974-75 and 1975-76 sampling periods. Estimates of population size were 185-272 beaver. Colony density in the stabilized portion of the study area was 0.16 colonies per km in 1974-75 and 0.06 colonies per km in the 1975-76 sample period. The unstabilized section contained 0.75 colonies per km in 1974-75 and 0.50 colonies per km in 1975-76. The mean difference between the stabilized and unstabilized sections was significant ($P<0.01$) during both sample periods.

INTRODUCTION

Radical changes have been made in the Missouri River in southeastern South Dakota in the last 50 years under the auspices of the U.S. Army Corps of Engineers. The most significant changes were Kensler's Bend Project providing 32 km of bank stabilization upstream from Sioux City, Iowa to Ponca State Park, Nebraska and the closure of Gavins Point Dam near Yankton, South Dakota in 1955.

The beaver (*Castor canadensis*) is an important furbearer on the Missouri River. Information concerning the beaver population is essential for development of adequate management recommendations and for evaluating the impact of additional river development by the U.S. Army Corps of Engineers. Our study was designed to evaluate the current status of the beaver population on the free-running Missouri River between Yankton, South Dakota and the South Dakota-Iowa state line.

R. L. Linder provided helpful critique of the manuscript.

[1]Approved for publication by the Director, Agricultural Experimental Station, South Dakota State University, Brookings, as Journal Series No. 1498.
[2]Present address: U. S. Fish and Wildlife Service, Cibola Natl. Wildlife Refuge. P. O. Box AP, Blythe, Calif. 92225.
[3]Present address: Oklahoma Cooperative Wildlife Research Unit, Oklahoma State University, Stillwater, Oklahoma 74074.

STUDY AREA

The study area included 116 km of Missouri River between the U.S. Highway 81 bridge at Yankton, South Dakota and the South Dakota-Iowa border at Sioux City, Iowa. The shorelines of the lower 32 km had been stabilized with granite revetments and wing dams. The upper river remained in near native, unstabilized condition. Width of the Missouri River within the study area varied from 0.4 km to 2.4 km. Depth of the river was highly variable (0-10 m). The current (0.9 m to 2.5 m per second) carried a moderate silt load.

The downstream discharge rate from Gavins Point Dam varied according to seasonal runoff from the upper Missouri River watershed and to seasonal navigation requirements. Summer (navigational) season discharge rate is normally around 990 m^3 per second. Winter (non-navigational) season discharge rates vary between 425-710 m^3 per second. The seasonal variations in discharge rate cause a fluctuation in river stage of 0.5 m to 2.0 m depending upon the extremes of summer and winter discharge and the width of the river.

Winter freeze-up on the study area usually occurs during the first part of December and spring break-up takes place in February or March. During mild winters the Missouri River does not completely freeze over.

METHODS AND PROCEDURES

Carcasses of 162 beaver harvested on the study area were solicited from trappers during the 1974-75 and 1975-76 South Dakota trapping seasons. Age class for each specimen was determined by counting adhesion lines in the periosteal region of mandible cross sections (Klevezal and Kleinenberg 1969) and counting cementum annuli in molariform teeth (Van Nostrand and Stephenson 1964).

Corpora lutea occurring in both ovaries of female reproductive tracts were counted. Uteri with noticeable convolution or swellings were opened and fetuses removed. The sex of each fetus was determined where possible. Resorptions (any implantation failure or intrauterine death which caused a difference between the num-

ber of corpora lutea and the number of implanted embryos) were recorded.

Three counts of active beaver colonies were made during each winter season (1974-75 and 1975-76). An active beaver colony was defined as a group of beaver possessing at least one den or hut and one food cache.

Intensive trapping of a randomly chosen 5% sample of beaver colonies in the study area was planned for both trapping seasons. An estimate of population density was calculated by multiplying the mean number of beaver per colony (from intensive trapping) times total number of beaver colonies in the study area (from the colony count census).

RESULTS

Thirty-four beaver carcasses were collected during the 1974-75 trapping season and 128 were obtained in the 1975-76 season. The age structure of the sample was 69:26:45:15:4:3 for age classes 0 through 5, respectively. The large proportion of individuals in younger age classes (Table 1) is typical of an exploited population.

TABLE 1

Age Composition of 162 Beaver Harvested by Trappers on the Missouri River in Southeastern South Dakota, 1974-76

Age Class	Age (months)	No. of Individuals in Age Class	Percentage of Total Sample
0	6-12	69	42.6
1	18-24	26	16.0
2	30-36	45	27.8
3	42-48	15	9.3
4	54-60	4	2.5
5	66-72	3	1.8
Total		162	100.0

Beaver have a physiological longevity of 15 years (Bradt 1947). The harvested sample in this study had only six age classes represented and suggests a rapid turnover rate within the population. The mortality associated with a high rate of turnover probably resulted from fur harvest since beaver have practically no natural enemies in southeastern South Dakota, and no disease or heavy parasite infestations were noted.

The sex ratio (131 male:100 female) observed was not signficantly different from a 1:1 ratio ($\chi^2 = 2.99$, $P>0.05$, 1 d.f.). Other investigators observed similar sex ratios: 113:100 (Leege and Williams 1967), 108:100 (Bradt 1947), and 108:100 (Bond 1956). The fetal sex ratio (130:100) of four litters containing 23 fetuses corresponded closely to the overall sex ratio and was not significantly different from a 1:1 ratio ($\chi^2 = 0.39$, $P>0.05$, 1 d.f.).

Evidence of reproduction was not found in female beaver less than 2.5 years old. The first evidence of reproduction occurred in 3 year old beaver with 63% pregnant. Of the 70 female beaver collected, 41% were found to be sexually mature. Henry and Bookhout (1969) found no evidence of reproduction in females less than 2.5 years old from a sample of 105 beaver harvested in northeastern Ohio.

The mean number of corpora lutea was 4.91 for all breeding females (Table 2). The overall mean of implanted embryos per breeding female was 4.62 (Table 2). In age classes 2, 3, 4, and 5 the mean number of embryos per breeding female was 4.0, 5.5, 4.0, and 6.0, respectively (Table 2). There was no statistical difference between age classes in mean number of embryos per breeding female ($F = 1.65$; $P>0.05$; 3.19 d.f.). The overall resorption rate was 5.8% (Table 2).

Recruitment rate was defined as the number of pups per breeding female at the beginning of the spring trapping period. Individual age specific recruitment rates were not calculated because there was no significant difference ($F = 1.63$-3.09; $P>0.05$; 3.19 d.f.) in the numbers of corpora lutea or implanted embryos per breeding female between age classes. The recruitment rate was calculated by dividing the number of individuals in age class 0 (Table 1) by the total number of breeding females (Table 2). The recruitment rate was estimated to be 3.3 pups per breeding female.

The colony count index provides an estimate of population change between two or more successive counts. Fifty-two beaver colonies in the unstabilized section and five colonies in the stabilized portion of the study area were located during the winter 1974-75. The colony count in winter 1975-76 yielded 48 colonies in the unstabilized section and only two colonies in the stabilized portion of the study area. Assuming the number of beaver per colony remains nearly constant from year to year, the colony count may be used as a rough index of population trend.

Colony density per river km is highly variable, especially in the unstabilized river. To test the hypothesis that there was no difference in colony density between the stabilized and unstabilized sections, the number of colonies per km in the stabilized section (31.6 km) was compared to the number of colonies in 31.6 km of unstabilized river immediately upstream from the stabilized area.

TABLE 2

Number of Corpora Lutea Per Female Having Corpora Lutea Present, Number of Implanted Embryos Per Female Having Implanted Embryos, and the Percentage of Resorptions in the Combined Samples of Beaver Taken From the Missouri River in Southeastern South Dakota, 1974-1976

Age Class	No. in Class	No. with Corpora Lutea	Mean No. per Breeding Female	Range	No. with Embryos	Mean No. per Breeding Female	Range	Percentage of Resorption
0	28	0	0.0	0-0	0	0.0	0-0	....
1	13[a]	0	0.0	0-0	0	0.0	0-0	....
2	19[b]	12	4.3	1-7	12	4.0	1-6	5.9
3	7[c]	6	5.5	4-7	6	5.5	4-7	0.0
4	1	1	4.0	4-4	1	4.0	4-4	0.0
5	2	2	7.5	6-9	2	6.0	4-8	20.0
Total	70	21	4.91	1-9	21	4.62	1-8	5.8

[a]Contains two females collected prior to the onset of the breeding season.

[b]Contains one female collected prior to the onset of the breeding season.

[c]Percentage of females breeding excludes one female collected prior to the onset of the breeding season.

The mean number of beaver colonies in the stabilized section (1974-75) was 0.16 colonies per km compared to 0.75 colonies per km in the unstabilized sample area. The mean difference was highly significant ($t = 3.73$, $P<0.01$, 19 d.f.). During the winter of 1975-76, the mean number of colonies dropped to 0.06 colonies per km in the stabilized section and 0.50 colonies per km in the unstabilized sample area. This difference was also highly significant ($t = 2.99$, $P<0.01$, 19 d.f.).

Thirty-one beaver colonies trapped during the 1974-75 and 1975-76 seasons produced a mean of 3.4 beaver per colony. This figure was considered minimum as an estimate of colony size because colonies were not exterminated in most instances. Longley and Moyle (1963) in Minnesota found 5 to 6 beaver per colony in trapped areas. This agreed closely with 5.1 beaver per colony in Michigan (Bradt 1938) and 5.3 beaver per colony in Virginia (Swank 1949).

The mean number of colonies per year through both sampling periods was 51 in the unstabilized section. The beaver population calculated using 3.4 beaver per colony (from intensive trapping) and 5.0 beaver per colony, a conservative mean estimate (Bradt 1938, Swank 1949, and Longley and Moyle 1963), was 173 and 255 beaver, respectively, in the unstabilized portion of the study area. The mean number of beaver colonies in the stabilized section over the two sample seasons was 3.5 colonies. Applying estimates of colony size, the beaver population in the stabilized section was estimated at 12-17 beaver. The overall estimates of population size combining the stabilized and unstabilized sections were 185 and 272 beaver.

DISCUSSION

Most beaver management consists of limiting the harvest by manipulation of season length. Bradt (1947:43) stated the maximum allowable annual loss in a beaver population, while still maintaining the ability of the population to replenish itself at the same density, is 50% provided mortality is evenly distributed through all age and sex groups. In the 1975-76 trapping season, 128 beaver were recorded as harvested in the study area. Based on population estimates in this study, 128 beaver represents a removal of 47-69% of the beaver in the study area during the 1975-76 trapping period.

The large proportion of beaver in younger age classes suggests rapid population turnover if trapping provided an unbiased estimate of age structure. Fur trapping is believed to be the dominant mortality factor on beaver in southeastern South Dakota.

A 15.3% decline in the colony count index occurred between the sample seasons. We found no evidence that the number of

beaver per colony changed during the study. Thus, we conclude that the population declined from 1974 to 1976. Individuals experienced at trapping beaver on the study area agreed with this conclusion.

The stabilized section of the river had a greatly reduced beaver population when compared to the unstabilized portion of the river. It is our conclusion that the process of stabilization as currently practiced alters the habitat in a manner which exceeds the range of adaptability of the beaver to adjust and to survive. The few colonies that are present in the stabilized section appear vulnerable because of their isolation and their uniqueness. The pioneering ability of the beaver may allow recolonization of suitable sites where they exist in the stabilized portion if the unstabilized section is allowed to remain a natural river. Continued expansion of the stabilization will reduce the beaver population. As stabilization proceeds, it may be necessary to restrict the consumptive use of the remaining beaver population. The aesthetic value of the beaver on the Missouri River in southeastern South Dakota is difficult to measure and should be protected for future generations.

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