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THE RIVER OTTER IN ARKANSAS. II. INDICATIONS OF A BEAVER-FACILITATED COMMENSAL RELATIONSHIP

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ABSTRACT

Dam building activities of beaver (*Castor canadensis*) create ponds that apparently augment habitat available to otter (*Lutra canadensis*). This paper considers possible effects of beaver activity and pond formation on distribution and populations of otter in Arkansas. Literature synthesis and analysis of harvest records were used to investigate the suspected relationship.

INTRODUCTION

Analyzing Arkansas harvest records for the last 20 years, Tumlison et al. (1981) described an expanded range for the river otter *(Lutra canadensis)* in Arkansas. Although their use of mink *(Mustela vison)* as an "indicator organism" to reduce the bias inherent in harvest records did not conclusively demonstrate an otter population increase, the authors intuitively felt that a population increase had occurred and that dispersal of an expanding population had led to the expanded distribution.

The dramatic increase in Arkansas' otter harvest since 1975 is partly explained by a general fur market upswing. However, factors potentially responsible for the increase are many. It is hypothesized that beaver, through their damming activities on smaller streams, augment suitable habitat for otter providing dispersal routes and increased habitat.

Effects of beaver ponds on biota have been intensively studied. The primary emphasis has been on beaver-trout relationships (Rasmussen, 1941; Reid, 1952; Rupp, 1955; Huey and Wolfrum, 1956; Gard, 1961), although effects on fish populations in general have been researched as well (Bailey and Stephens, 1951; Hanson and Campbell, 1963). Effects of beaver pond formation on other forms of wildlife have also been considered (Beard, 1953; Rutherford, 1955; Speake, 1956; Knudsen, 1959; Arner, 1963; Reese and Hair, 1976; Allred, 1980). Practically all reports have found beaver ponds to be beneficial to the forms of life studied. However, only Knudsen (1959) included otter in his discussion. Green (1932) described observations of otter in a Canadian beaver pond, and believed their interaction was negative because otter apparently killed at least one beaver.

METHODS AND MATERIALS

Literature examinations were made for general requirements of otter and the nature of habitat alteration brought about by beaver ponds, in a determination of the extent that beaver ponds might meet those requirements.

To test the hypothesis that increased beaver activity enhances otter populations, data strongly suggesting a definite beaver population increase were required as a base for comparison with otter harvest. Beaver harvests in Arkansas have increased dramatically since the restocking program of the 1940's reported by Holder (1951), and the Arkansas Game and Fish Commission presently considers the beaver population to be at nuisance levels. The sharp upswing in beaver harvest has occurred within the last nine years (1971-72 through 1979-80). Because harvests are often functions of pelt price, a correlation coefficient for beaver price versus harvest was calculated based on data for the last nine years. Arkansas is divided into four major physiographic regions (Foti, 1974), and otter harvest from one region, the Ozark Mountains, is small and erratic. Therefore, harvests from this region were excluded from the analysis to allow comparisons based on sympatric populations. Otter harvests over the same nine year period were also tested to determine the effect of price on harvest.

RESULTS AND DISCUSSION

Preferred Habitat of Otter: The otter occurs in good-sized, clear streams that abound with fish and have pools, rapids, and log jams (Seton, 1909). Yeager (1938) ranked aquatic habitats for otter in the Mississippi delta into nine categories. The four most favorable types contained relatively clear, deep water in swamps, lakes, and small rivers or creeks. Additionally, log-filled and heavily timbered and shaded areas were preferred. Beaver ponds inhibit stream flow, allowing sedimentation which clears stream waters (Gard, 1961; Allred, 1980). Because otter are sight feeders, this characteristic of beaver ponds may make them preferable to otherwise muddy streams. Arner et al. (1969) found that, in Mississippi, beaver impoundments larger than one acre comprised a total of 23,673 acres, and that 71% of these were constructed on intermittent streams. A decade later, beaver impounded areas had increased almost 300% (Arner and Dubose, 1978). Because many such streams flow through heavily forested lands and beaver fell logs that can be utilized by otter as refuges, beaver ponds could provide suitable otter habitat, particularly in areas of limited deep water habitat. In addition, abandoned beaver dens are occasionally utilized by otter (Schwartz and Schwartz, 1959), and Knudsen (1959) indicated that otter frequent beaver ponds where they can forage and play — in contrast to feeder streams where water depth is minimal.

Otter Foraging Strategy: Beaver impoundments would be of little value to otter if pond characteristics were not compatible with the foraging strategy of otter. Liers (1951) observed otter foraging in a beaver pond, and found that otter often rooted in debris and mud on the bottom where they located frogs and other prey. Sheldon and Toll (1964) described cooperative foraging by fishing otter. They observed otter swimming on the surface about ten feet apart, then diving and swimming rapidly toward a shallow cove in an apparent attempt to herd fish into the shallows. The tactic was usually successful for capturing fish. Otter in their study also visited stumps along the shore, presumably

in search of crayfish. When fishing solitarily, otter swam along the surface, rapidly diving upon location of prey. Seton (1909) discussed the agility of otters and their ability to capture even the fastest fish.

It is evident then, that the foraging strategy of otter requires sufficiently deep water for chase manueverability, and that shallows, debris and mud bottoms, and a log and stump edge are beneficial. Over one-half of the acreage of beaver impounded water in Mississippi contained shallows 2.5 feet or less in depth (Arner et al., 1969). Beaver pools in headwater regions of a north Missouri stream attained depths of up to four feet (Hanson and Campbell, 1963). Beaver dams are constructed of felled trees and bushes, which requires location in wooded areas that provide a log or stump bank. Pool formation results in sedimentation and therefore mud and debris bottoms (Gard, 1961; Allred, 1980). Obviously beaver impoundments provide suitable habitat for otter foraging.

The Trophic Requirements of Otter: Studies of otter food habits throughout the United States consistently indicate fish, crayfish, and amphibians to be dietary staples (Lagler and Ostenson, 1942; Wilson, 1954, 1959; Greer, 1955; Ryder, 1955; Hamilton, 1961; McDaniel, 1963; Sheldon and Toll, 1964; Knudsen and Hale, 1968; Toweill, 1974). Fishes of many types, but primarily forage species, occur most frequently (70-90% of specimens examined). Crayfish or invertebrates rank second in importance, usually occurring in 30-40% of specimens examined. Mammals, birds, vegetation, and various aquatic insects occur infrequently.

Intermittent streams support the food items mentioned above, but not in sufficient biomass to support otter populations. However, the activity of a beaver colony may alter the environment, provide prey habitat requirements, and promote a dramatic increase in prey biomass. Benthic organisms supply the food base for many of the otter's prey. Gard (1961) found that biomass of benthic organisms in beaver ponds increased 5X that of normal stream sections. Arner et al. (1969) also found significant increases in invertebrate biomass, as well as more fish species. Increases in diversity and biomass of fishes in beaver ponds is corroborated by Hanson and Campbell (1963). Beaver ponds supported a standing crop of up to 256 pounds per acre, while natural pools contained few fish larger than fingerlings and a standing crop of about 60 pounds per acre.

These data indicate that trophic requirements of otter are supplied by beaver ponds on smaller streams through enhancement of all levels of the food chain. Increased production of food items, especially forage and rough fishes and crayfish, invite otter into an otherwise marginal habitat.

Harvest Data: It appears that the increase in beaver harvest (from 296 in the 1971-72 season to 6807 in the 1980-81 season) can be attributed to a population increase, since price has had little effect on harvest levels ($r = 0.18$). However, otter harvests were correlated with price ($r = 0.76$). To reduce the harvest bias of price, mean otter pelt price over the nine year period was divided by the actual yearly price, and this ratio was multiplied by the yearly reported harvest. This treatment adjusts the estimated harvest toward a more standardized price, so that harvest from years with high prices are reduced and those from years with lower prices are elevated. Adjusted harvest values were assumed to more accurately represent a harvest not biased by price. It should be noted that some otter are harvested by becoming entangled in the nets of commercial fishermen, and therefore a non-trapping, year-long source of bias may exist. The commercial fish hatchery in Arkansas has grown in the past few years and its effect on otter harvest is not known.

The correlation between beaver and adjusted otter harvest is strong ($r = 0.97$). Clearly, some of this correlation can be attributed to trapping in aquatic habitats. However, most beaver are trapped on their lodges or dams on smaller streams, and many otter are taken from those locations as well. A correlation of this magnitude could indicate: 1) that both populations are simultaneously, but independently, experiencing proportional populational increases, or 2) that there is a relationship between beaver population increases and otter population increases (most likely, caused by inadvertant habitat improvement for otter by beaver).

Bottorff et al. (1976), by corresponding with officials of state wildlife agencies, obtained data supporting our belief in a beaver-otter relationship. Respondents from Massachusetts, New Hampshire, and Tennessee stated that the majority of otter were caught in traps set specifically for beaver, and 25 to 50 percent of the otters harvested in Michigan and Wisconsin were taken in beaver sets. Further, a direct correlation between the annual beaver harvest and otter harvest had been observed for many years in Michigan, Wisconsin, and New Hampshire. Tabor (1974) found that 28% of the otter taken in Oregon came from small tributary streams and creeks, and that 15.8% of the otter taken were caught in traps intended for beaver.

Several knowledgable trappers and furbuyers ($N = 12$) throughout Arkansas were asked whether or not otter could be found on smaller streams. Invariably, the response was affirmative. When questioned as to where one might look on a small stream to find otter, the response always included a beaver dam and pond. Finally, approximately 500 acres of beaver impounded waters occur on lands managed by the Ross Foundation of Arkadelphia, Arkansas, and otter sign is quite common in these areas (Danny Adams, pers. comm.).

CONCLUSION

A possible commensal relationship by river otter with beaver would be facilitated through the development of suitable otter habitat in beaver ponds. This possibility was investigated through a literature synthesis and analysis of harvest records. It appears that beaver dams form ponds whose characteristics provide preferred otter habitat, allow expression of otter foraging strategy, and provide the trophic requirements of otter. Otter in Arkansas' delta region are loosing valuable habitat to channelization, swamp drainage, and clearing of bottomland hardwood forests (Holder, 1969). Beaver may partially mitigate the loss. Tumlison et al. (1981) found the Arkansas River to be a dispersal corridor for otter, because counties near the river reported higher takes than counties not bordering the river. However, otter are expanding their range into smaller streams in those areas, and it is known that they utilize many beaver ponds. We feel that an increased beaver population positively influenced otter pouplations in Arkansas. We further suggest that in regions of marginal otter habitat or where otter habitat destruction is occurring, beaver and their activities may play a major role in preventing extirpation of the otter.

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