# Seasonal changes in food habits of river otters in southwestern Arkansas beaver swamps

by Renn TUMLISON [1] and Mark KARNES [2]

[1] *Department of Zoology, Oklahoma State University, Stillwater, OK 74078*
[2] *The Ross Foundation, P.O. Box 335, Arkadelphia, AR 71923, U.S.A.*

*Summary.* — The seasonal food habits of river otter *(Lutra canadensis)* in beaver swamps in southwest Arkansas were investigated through analysis of 240 scats. Crayfish occurred more frequently in otter scats during winter and spring, and fish occurred more frequently during summer and fall. Silvicultural practices required drainage of beaver swamps during spring, which resulted in rapid changes in water level and loss of otter foraging habitat. An abrupt shift in resource availability is believed to have caused the observed shift in otter food habits.

*Résumé.* — Le régime alimentaire saisonnier de la loutre de rivière, *Lutra canadensis,* dans les marais à castors du sud de l'Arkansas a été mis en évidence par l'analyse de 240 déjections. Il y a plus de restes d'écrevisses dans celles-ci en hiver et au printemps, et plus de poisson en été et en automne. La sylviculture exige le drainage des marais à castors au cours du printemps, ce qui détermine des modifications rapides du niveau de l'eau et une réduction du milieu dans lequel la loutre peut se nourrir. Un changement brutal de disponibilité des ressources alimentaires est probablement responsable des modifications observées dans les habitudes alimentaires de la loutre.

## INTRODUCTION

Many published studies of river otter *(Lutra canadensis)* food habits are based on analysis of stomach contents or scats collected during late fall to early spring. Of the studies based on samples taken throughout the year, most are from northern or western regions (Greer 1955 ; Sheldon and Toll 1964 ; Knudsen and Hale 1968 ; Grenfell 1978 ; Melquist and Hornocker 1983). In addition, most studies are based on samples from a large area covering several habitat types (Lagler and Ostenson 1942 ; Ryder 1955 ; Wilson 1959 ; Hamilton 1961 ; Toweill 1974 ; Lauhachinda and Hill 1977) or are from lake and reservoir habitats (Greer 1955 ; Sheldon and Toll 1964). Tumlison *et al.* (1982) suggested that damming activities of beaver *(Castor canadensis)* may create suitable habitat for otter. The present study of food habits was initiated in an effort to understand

*Mammalia, t. 51, n° 2, 1987.*

more fully the relationship between river otter and beaver activity, and to provide information on seasonal food habits of otters from a region not previously documented in the literature.

## STUDY AREA

The study was conducted in the Little Missouri River bottoms of southwest Arkansas. Topography ranged from flat to an approximate 3 % gradient. Beavers and otters used three kinds of habitats : 1) bottomland hardwood consisting primarily of oaks (*Quercus* sp.), 2) old stream-channel brakes dominated by cypress *(Taxodium distichum)* and water tupelo *(Nyssa aquatica),* and 3) more upland areas consisting of oaks and pines (*Pinus* sp.) on streams dammed by beavers.

## METHODS

Scats were collected from otter latrines located around beaver impoundments on lands managed by the Ross Foundation, Arkadelphia, Arkansas, in Clark, Nevada, and Ouachita counties. Collections began on 22 April 1983 and continued through March 1984. Latrine sites were sought and revisited at least monthly throughout the year because otters often reuse them (Greer 1955). Fresh scats were removed from latrines and stored in plastic bags. Individual scats were dissected with the aid of a binocular microscope and examined for diagnostic remains. The minimum number of individuals of each taxon in each scat was estimated by counts of diagnostic features. Fish remains were identified to species where possible, using scale characteristics (Sheldon and Toll 1964) or other diagnostic features.

Traditionally, scat analyses have been conducted by recording only the presence or absence of a food item in a scat. Statistical computations on such data are difficult because proportions derived in this manner often sum to greater than 100 %. Bowyer *et al.* (1983) noted this phenomenon in an analysis of coyote *(Canis latrans)* scats and used proportions derived from total food items to allow statistical analyses. In the present study, frequency of occurrence (%) was calculated by dividing the total number of individuals of each taxon found during a specified season by the total number of individuals in all prey taxa recorded for that season. When calculated in this manner, percent frequency reflects the relative importance of each taxon more accurately than when it is calculated as one occurrence per scat, and it allows statistical comparisons. Food habits were distinguished by prey class and season. Between-season comparisons were made using an R $\times$ C contingency table and the G-statistic (Sokal and Rohlf 1969).

Seasonal food habits were examined using calendar and climatic seasons. Climatic (wet-dry) seasons were defined according to the surface area encompassed by beaver swamps used in this study. Aerial photographs were used to estimate the surface area of larger beaver swamps (Table 1). The area of smaller swamps was estimated using topographic maps and tape measure in the field. Seasonal differences in water levels in beaver impoundments were noticeable due to the flat topography of most of the study area. Local silvicultural management requires

TABLE 1. — Maximum and minimum sizes of eight beaver swamps from which otter scats were collected.

| Swamp | High water area (ha) | Low water area (ha) | % decrease |
|---|---|---|---|
| 1 | 1.5 | 0.0 | 100 |
| 2 | 8.0 | 4.0 | 50 |
| 3 | 32.0 | 8.0 | 75 |
| 4 | 4.8 | 2.4 | 50 |
| 5 | 6.0 | 0.0 | 100 |
| 6 | 5.6 | 0.0 | 100 |
| 7 | 17.4 | 0.4 | 98 |
| 8 | 3.6 | 2.0 | 44 |
| TOTAL | 78.9 | 16.8 | $\bar{X}$=79 |

that beaver swamps be drained in the spring. This results in rapid reduction in water level, and swamps remained in low water condition until the onset of fall rains. During the study, the maximum extent of water occurred in June and the minimum in mid-September. We defined the wet season as 15 November to 14 July, and the dry season as 15 July to 14 November. The lengthy wet season is due, in part, to the retention of water because of beaver activity. All of the study swamps were used by otter, thus it is noteworthy that three were « dry » in the dry season. In our usage, « dry » could mean that some small pools of water remain, but the continuity of the pond was lost. In one instance, a shallow 17.4 ha swamp was reduced to 0.4 ha in the dry season. The quantity of water available had a marked effect on the seasonal distribution of otter scats (Karnes and Tumlison 1984).

## RESULTS

Analysis of 240 otter scats indicated that crayfish and fish constituted the majority of the diet (Fig. 1). Approximately 39 % of the items identified in scats during summer and fall were crayfish. The relative occurrence of crayfish increased during winter to 65 % and peaked in spring at 83 %. Re-grouping of the data by climatic period indicated that crayfish constituted 73 % of the prey consumed during the eight month wet season. During the four month dry season, the relative occurrence of crayfish declined to 28 % of the prey consumed.

The seasonal occurrence of fishes in otter diets varied as an inverse proportion of the seasonal occurrence of crayfish. Fishes occurred in 56 % to 61 % of the summer and fall diets. The relative occurrence of fishes declined during winter to 34 % and dropped to 14 % through spring. During the wet season, fishes were identified in 25 % of the diet but increased to 69 % during the dry season.

Because fish and crayfish constituted 98 % of the total food items found, statistical comparisons were made to examine for seasonal differences in their use. Comparisons between calendar seasons and wet-dry seasons indicated that there were seasonal differences in prey use (calendar : $G = 46.6$, $P < 0.005$ ; wet-dry : $G = 41.08$, $P < 0.005$).

Centrarchids were the most commonly taken fish taxon (63 % of total) ;

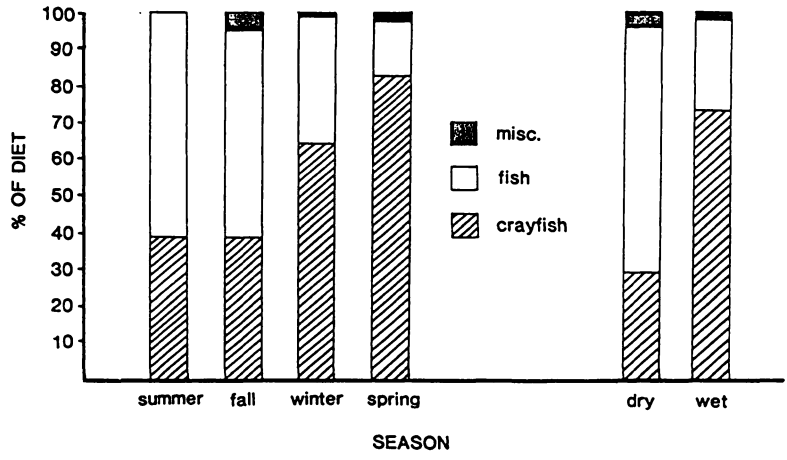


Fig. 1. — Major foods of otters as indicated by analysis of 240 scats from beaver swamps. Number of scats examined per season were : Summer, 49 ; Fall, 61 ; Winter, 60 ; Spring, 70 ; Dry, 79 ; Wet, 161. The miscellaneous category includes reptiles, amphibians, mice, and water beetles.

Catostomids (17 %) and Amiids (16 %) were also important prey (Table 2). Sizes of scales and bony remains indicated that most Centrarchids were ≤ 130 mm in total length while bowfins, gars, and suckers were 200-300 mm total length. Centrarchids occurred most frequently in summer (i.e., dry season) scats, and were least frequent in winter. Suckers were most frequently found in winter and least frequently occurred during summer and fall. Bowfins were taken most

TABLE 2. — Seasonal predation by otters on fish taxa in beaver swamps in southwest Arkansas, 1983-1984.

| Fish taxon | No. of occurrences by season | | | | | | |
|---|---|---|---|---|---|---|---|
| | Summer (%) | Fall (%) | Winter (%) | Spring (%) | Dry (%) | Wet (%) | Total (%) |
| Centrarchidae | 16(80) | 22(65) | 12(48) | 10(59) | 29(73) | 31(55) | 60(63) |
| Catostomidae | 2(10) | 2(6) | 8(32) | 4(24) | 2(5) | 14(25) | 16(17) |
| Amiidae (Amia calva) | 2(10) | 8(24) | 5(20) | 0 | 8(20) | 7(13) | 15(16) |
| Cyprinodontidae (Fundulus sp.) | 0 | 0 | 0 | 3(18) | 0 | 3(5) | 3(3) |
| Ictaluridae (Ictalurus sp.) | 0 | 1(3) | 0 | 0 | 0 | 1(2) | 1(1) |
| Lepisosteidae (Lepisosteus sp.) | 0 | 1(3) | 0 | 0 | 1(3) | 0 | 1(1) |
| | 20 | 34 | 25 | 17 | 40 | 56 | 96 |

commonly in fall and winter. Centrarchids, Catostomids, and Amiids were most equally represented during the wet season, but Centrarchids constituted 73 % of dry season fish prey. Statistical comparisons of the seasonal consumption of the three major fish taxa taken by otters indicated significant seasonal variation

($G = 15.7$, $P < 0.05$). Pairwise comparisons among these taxa suggested that use of Centrarchids versus Amiids was not seasonally variable ($G = 7.1$, $P > 0.05$) but use of Centrarchids versus Catostomids ($G = 8.2$, $P < 0.05$) and Catostomids versus Amiids ($G = 10.1$, $P < 0.05$) was seasonally variable.

Miscellaneous food items accounted for less than 5 % of the diet in any season. The highest occurrence was in the fall (5 %) and no miscellaneous items were identified during summer. Amphibians and reptiles were encountered during spring (1 frog, Ranidae ; and 1 mud snake, *Farancia abacura*). Two rodents, probably Cricetidae, were identified, one each from the fall and winter. One aquatic beetle, probably *Cybister* sp. (Dytiscidae) or *Hydrophilus* sp. (Hydrophilidae), was found during spring.

## DISCUSSION

The importance of crustaceans in river otter diets is well documented (Lagler and Ostenson 1942 ; Ryder 1955 ; Hamilton 1961 ; Sheldon and Toll 1964 ; Knudsen and Hale 1968 ; Grenfell 1978 ; Toweill 1974 ; Lauhachinda and Hill 1977). Crayfishes rank second in importance to fishes in these studies except that of Grenfell (1978), in which crayfish strongly dominated the diet. The reason for the latter result is likely due to the fact that Grenfell's study was conducted on a marsh system, while the other studies were conducted in reservoirs, rivers, or a mixture of habitats. However, in contrast to the present study, Grenfell's marsh study showed crayfish to be the predominant otter food throughout the year. The present study is the first report of river otter diets showing seasonal reversals in occurrence of crayfish and fish. This finding supports the view that otters are opportunistic foragers. Melquist *et al.* (1981) found otters to be opportunistic in relation to spawning runs of kokanee salmon *(Oncorhynchus nerka)*.

Sheldon and Toll (1964) noted that the availability of fishes to otters was affected by the abundance and agility of fish, the habitat of the fish species, time of day otters fish, fish spawning periods, effects of ice in winter, and fishing methods of otter. Ryder (1955) believed that the fishes preyed on by otters were taken in proportion to their abundance but in inverse proportion to their swimming ability. Therefore, fishes like suckers and bowfins are expected to be the more common fish prey when forage and game fishes are equally abundant. Most studies have shown that such fishes are primary fish prey.

Other studies have shown Centrarchids to be important (Lagler and Ostenson 1942 ; Wilson 1959 ; Hamilton 1961) or dominant (Sheldon and Toll 1964 ; Lauhachinda and Hill 1977) prey taxa in otter diets, presumably because Centrarchids occupy relatively shallow and often muddy water or weedy areas that provide predator advantage to otter. The relative decline of Centrarchids and increase of Catostomids during winter is presumably a function of water level, spawning movements of prey fishes, or temperature variables that make one taxon more susceptible to predation during one season. Greer (1955) obtained results in seasonal trends with sunfishes and suckers very similar to those reported here, although the habitat was very different.

Most of the food items placed in the « miscellaneous » category have been reported in other studies. The occurrence of amphibians and reptiles in the spring

and fall may correlate with availability due to breeding activity, suitable temperatures, or water availability, but the sample is too small to be conclusive.

Seasonal variation of water levels reduced the amount of habitat available to otter inhabiting beaver swamps. Crayfish are seldom found deeper than one meter (Pennak 1978), thus the shallowness of most of the high-water swamps greatly increased crayfish habitat. Crayfish are undoubtedly more accessible to otters during periods of inundation, and otters respond to their seasonal abundance in an opportunistic manner. High water also allows fishes to disperse, which decreases their density and the chance of encounter by otters. Probably as a result of these factors, wet season (especially spring) diets suggest greater predation on crayfish. As swamps dry, crayfish seek refuge in their burrows and post-reproductive fish populations are compacted into remaining pools as the waters recede during the dry season. The low-water level in the study ponds represented a 79 % decline from the observed high-water level. We speculate that this caused crayfish to become less important in the otter's diet while fish assumed the dominant role, by occurrence, during summer (i.e., the dry season).

Judging from the decrease in the number of otter scats found during late summer, we believe that some otters were forced to move to the river draining the streams of the area. Melquist *et al.* (1981) and Melquist and Hornocker (1983) also noted that otters travel throughout their home area to visit preferred foraging sites or as prey density changed. Most importantly, however, a significant seasonal shift was observed in otter food habits when samples were taken from a seasonally variable environment created by beaver activity and altered by timber management practices. Crayfish did not necessarily become the most important item in the diet of otters during one season and fishes at another, but their *relative* importance shifted significantly.

## BIBLIOGRAPHY

BOWYER, R.T., S.A. MCKENNA, and M.E. SHEA, 1983. — Seasonal changes in coyote food habits as determined by fecal analysis. *Am. Midl. Nat.,* 109 : 266-273.

GREER, K.R., 1955. — Yearly food habits of the river otter in the Thompson Lakes region, northwestern Montana, as indicated by scat analyses. *Am. Midl. Nat.,* 54 : 299-313.

GRENFELL, W.E., Jr., 1978. — Food habits of the river otter in Suisin Marsh, central California. *Cal-Neva Wildl.,* 1978 : 65-73.

HAMILTON, W.J., Jr., 1961. — Late fall, winter and early spring foods of 141 otters from New York. *N.Y. Fish and Game J.,* 8 : 106-109.

KARNES, M.R., and R. TUMLISON, 1984. — The river otter in Arkansas. III. Characteristics of otter latrines and their distribution along beaver-inhabited watercourses in southwest Arkansas. *Proc. Arkansas Acad. Sci.,* 38 : 56-59.

KNUDSEN, G.J., and J.B. HALE, 1968. — Food habits of otters in the Great Lakes region. *J. Wildl. Manage.,* 32 : 89-93.

LAGLER, K.F., and B.T. OSTENSON, 1942. — Early spring food of the otter in Michigan. *J. Wildl. Manage.,* 6 : 244-254.

LAUHACHINDA, V., and E.P. HILL, 1977. — Winter food habits of river otters from Alabama and Georgia. *Proc. Southeast. Assoc. Fish Wildl. Agencies,* 31 : 246-253.

MELQUIST, W.E., and M.G. HORNOCKER, 1983. — Ecology of river otters in west central Idaho. *Wildl. Monogr.*, 83 : 1-60.

MELQUIST, W.E., J.S. WHITMAN, and M.G. HORNOCKER, 1981. — Resource partitioning and coexistence of sympatric mink and river otter populations. *Proc. Worldwide Furbearer Conf.*, 1 : 187-220.

PENNAK, R.W., 1978. — *Freshwater invertebrates of the United States,* 2nd. ed. John Wiley and Sons, New York. 803 pp.

RYDER, R.A., 1955. — Fish predation by the otter in Michigan. *J. Wildl. Manage.*, 19 : 497-498.

SHELDON, W.G., and W.G. TOLL, 1964. — Feeding habits of the river otter in a reservoir in central Massachusetts. *J. Mammal.*, 45 : 449-454.

SOKAL, R.R., and F.J. ROHLF, 1969. — *Biometry.* W.H. Freeman and Co., San Francisco. 776 pp.

TOWEILL, D.E., 1974. — Winter food habits of river otters in western Oregon. *J. Wildl. Manage.*, 38 : 107-111.

TUMLISON, R., M. KARNES, and A.W. KING, 1982. — The river otter in Arkansas. II. Indications of a beaver-facilitated commensal relationship. *Proc. Arkansas Acad. Sci.*, 36 : 73-75.

WILSON, K., 1959. — The otter in North Carolina. *Proc. Southeast. Assoc. Game Fish Comm.*, 13 : 267-277.