WINTER FOOD HABITS OF RIVER OTTERS FROM ALABAMA AND GEORGIA*

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Abstract: Food habits of river otters (*Lutra canadensis*) in Alabama and Georgia were studied using 315 digestive tracts from otters taken by trappers during the 1973-74 through 1976-77 trapping seasons. Additionally, 12 scats were collected during and immediately following the 1975-76 trapping season. Fish occurred in 83.2% of the digestive tracts and in 91.7% of the scats. Fishes of the following families were found in the frequency percentages indicated; Centrarchidae, 53.6%; Castomidae, 12.1%; Ictaluridae, 10.5%; Amiidae and Aphredoderidae, 8.2%; Cyprinidae, 6.3%; Esocidae, 5.1%; Clupeidae, 1.6%; Cyprinodontidae, Poeciliidae, and Percidae, 0.6%; Hiodontidae, 0.3%; and unclassified fish 3.2%. Crayfish were recovered from 62.5% of the digestive tracts and from 7 of 12 (58.3%) scats. Frogs and a salamander together made up 5.1% of the food remains.

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Several studies of the food habits of river otters have been conducted in North America. Lagler and Ostenson (1942) reported the early spring food of river otters in Michigan based on 95 stomachs and 133 intestines. Forage fish (mudminnows, sculpins, minnows, sticklebacks, suckers, and darters) constituted the majority of the food. Game and pan fish, crayfish, amphibians, and insects made up the remainder.

Ryder (1954, 1955) continued the studies in Michigan based on the contents of 75 stomachs. H econcluded that fish, crayfish, and amphibians were the 3 primary spring foods of otters in both numbers and volume.

In Montana, Greer (1955) collected a total of 2,209 otter scats from the Thompson Lakes Region. He reported food remains in scats by percentage-frequency as follows: fish 98.2 percent; invertebrates, 41.2; amphibians, 18.4; mammals, 6.1; birds, 5.2; and reptiles, 0.4

Hamilton (1961) studied the contents of the stomachs and intestines of 141 otters from the Adirondack region of New York. Reported percentage-frequencies were: fish, 70 percent; crayfish, 34.7; frogs and their tadpoles, 25.8; and aquatic insects, 13.5.

Sheldon and Toll (1964) analyzed 517 otter scats from a reservoir in central Massachusetts and found that fish remains were present more frequently in the winter than at any other season. In order of frequency, Centrarchids were found in 54 percent of the scats, followed by yellow perch (*Perca flavescens*), white sucker (*Catostomus commersonii*), and golden shiner (*Notemigonus crysoleucas*).

Knudsen and Hale (1968) studied the food habits of the otter over a period of 6 yrs in Wisconsin, Michigan, and Minnesota. Fish made up the main items of the otter's food. Crayfish ranked second to fish, and frogs and large aquatic insects were eaten often.

Wilson (1954 and 1959) examined the contents of 54 otter digestive tracts and 61 scats in coastal North Carolina. He reported the fall-winter food of otters to consist mainly of fish, principally carp, catfish, suckers, and sunfish. At other seasons, the food consisted primarily of fish, blue crab, and crayfish. Other foods taken in small quantities included shrimp, clams, water beetles, and decapods.

McDaniel (1963), based on an examination of the contents of 18 stomachs, classified the foods of otters in Florida into 4 broad categories (rough fish, game fish, crayfish, and frogs). Rough fish, suckers, bowfin, and catfish made up 54.3 percent of the diet, and crayfish were found more often than game fish. Other than this work in Florida, no reports of food habit studies from the Upper or Lower Gulf Coastal Plains of the Southeastern United States were found.

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METHODS

Information on the food habits of otters was obtained from examination of the contents of 339 digestive tracts, 261 tracts from the Lower Coastal Plain of Southeastern Alabama and 78 tracts, mostly from the Piedmont of Northeastern Georgia (Fig. 1). Digestive tracks came from carcasses purchased from trappers who had caught the otters from 1973 through spring 1977 primarily in 330 conibear traps.

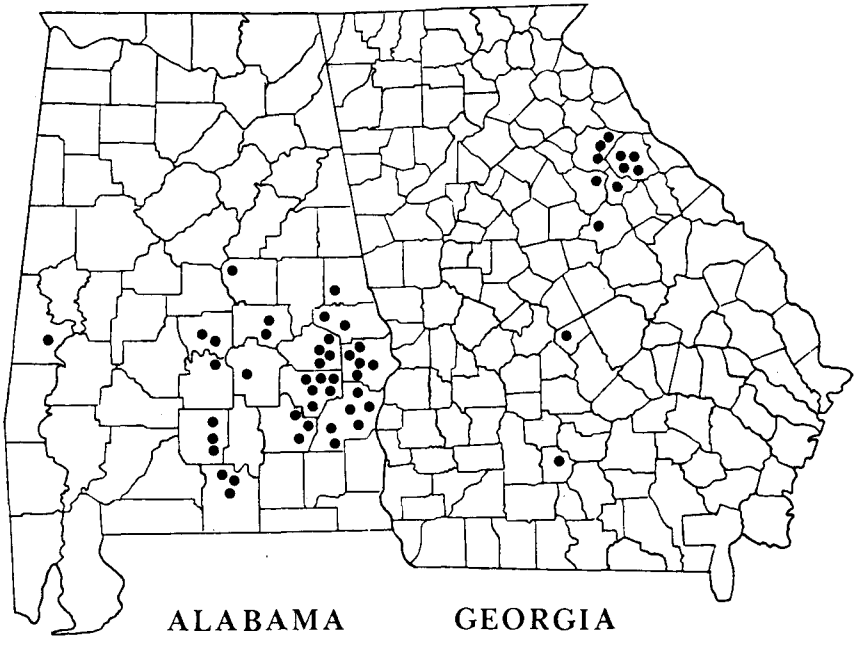

Fig. 1. Source locations of river oters, 261 from Alabama and 78 from Georgia, used in determining food habits during 1973-1977.

The stomachs and intestines were analyzed seperately, but when the same food appeared in both, it was counted only once. The contents of each part were washed with tap water through a fine-screened sieve of 0.15 mm mesh. Washed portions of this material were examined under a 10X binocular dissecting microscope. A compound miscroscope with 400X magnification also was used occasionally to check hair identification and other small items.

During the 1975-76 trapping season 7 scats were collected by trappers and 5 were collected by the senior author after the trapping season. All of the fecal samples were examined closely to insure they were from otters, and the material from any scats of doubtful origin was discarded. Typical otter scats are easily identified. They average approximately 20 mm in diameter and occur characteristically in 2, 3, or 4 curved segments each about 40-80 mm long making a total length of 100-175 mm (Greer 1955). Park (1971) noted that large numbers of scats may be found in 1 location. Dry scats were crumbled and searched for recognizable remains utilizing the microscopes described above.

Fish remains except centrarchids, catfish, and cyprinids, were identified to species from the scales, vertebrae, teeth, and spines by methods similar to those employed by Sheldon and Toll (1964). Fish scale remains were compared to those in a prepared

reference file of scales consisting of slides and enlarged photographs prepared from known species of fish in the collection in the Department of Fisheries and Allied Aquaculture, Auburn University.

Mammals were identified by using small bones, bone fragments and hairs. The banding patterns and general appearance of hairs along with keys and descriptions published by Hausman (1920), Mathiak (1938), Mayer (1952), and Stains (1958) aided in identification.

Feathers were identified to avian order using keys by Chandler (1916) and Day (1966). Tabulation of foods was made on the basis of frequency of occurrence.

RESULTS AND DISCUSSION

Of the 339 digestive tracts examined during the study, 315 contained at least a trace of foods, and 24 (7.1%) were empty, or contained only debris and nonfood items. Knudsen and Hale (1968) stated that the number of empty digestive tracts was influenced to some extent by trapping techniques. They mentioned that otters trapped in dry sets frequently did not drown, but remained alive for several hours before being dispatched, thus allowing time for digestion of whatever food was in their stomachs at the time of capture.

Of the 315 digestive tracts containing nutrients, 208 had food remains in both the stomachs and intestines and 107 had food remains in only the intestines. The stomach contents consisted of pieces of partially digested food of various sizes. Some of the large pieces were still in their natural form and colors which facilitated identification. The intestinal contents consisted of indigestible hard parts, such as fish scales, bones, and pieces of exoskeleton of crayfish. These food remains and mucus occurred throughout the entire length of the intestinal tracts posterior to the stomach.

Vertebrae, scales, and for catfish, pectoral and dorsal spines, were the easiest parts of fish to recognize. Occasionally identification was made from only a few scales, or vertebrae from the intestines or, for frogs, fragments of long bones or vertebrae.

The contents of digestive tracts and scats (Tables 1 and 2) are most representative of the winter foods, since comparatively few samples were obtained from the other seasons. A higher percentage of occurrence of food items was found in scats than was found in the digestive tracts. This was probably due to the meager number of scat samples compared with digestive tracts, and the fact that scats represent the indigestible materials that may accumulate over several hrs whereas the contents of a digestive tract may have accumulated from one feeding.

Fish were the most important food items in both digestive tracts (83.2%) and scats (91.7%). These results were similar to those reported by Lagler and Ostenson (1942) and Ryder (1955) in Michigan, Greer (1955) in Montaina, Wilson (1954) in North Carolina, Hamilton (1961) in New York, Sheldon and Toll (1964) in Massachusetts, and Knudsen and Hale (1968) in the Great Lakes Regions.

The Centrarchidae were the most abundant fishes taken by otters and occurred in 53.6 percent of the digestive tracts and 75 percent of the scats. These Centrarchids, except green sunfish (*Lepomis cyanellus*), pygmy sunfish (*Elassoma zonatum*), and largemouth bass (*Micropterus salmoides*), were difficult to identify to species because of similarity in scale characteristics. The largemouth bass was believed to occur in only 5 (1.5%) of 315 digestive tracts. Characteristics of the scales show that most of the centrarchid fishes belonged to the genus *Lepomis*.

Centrarchid fish, mainly green sunfish, bluegill (*L. macrochirus*), longear sunfish (*L. megalotus*), spotted sunfish (*L. punctatus*), and largemouth bass are common in the streams where the otter were taken (Smith-Vaniz 1968 and Pullen 1971). These fishes as mentioned by Sheldon and Toll (1964), occupy relatively shallow and often muddy water which might be of logistic advantage to the otter.

Suckers ranked second in importance occurring in 12.1 percent of the digestive tracts and 33.3 percent of the scats. In digestive tracts creek chubsuckers (*Erimyzon oblongus*) were found most frequently (7%) followed by greater jumprock (*Moxostoma lachneri*) and lake chubsucker (*E. sucetta*). From the sizes of the scales, many of the suckers preyed upon by otters were quite large, up to an estimated 60-80 cm (23 to 31 in.).

Catfish ranked third in importance occurring in 10.5 percent of the digestive tracts and bowfin (*Amia calva*) and pirate perch (*Aphredoderus sayanus*) ranked fourth and fifth, each occurring in 8.2 percent of the digestive tracts. Catfish, such as channel

Table 1. Food of otters based on contents of its digestive tracts taken by trappers in southeastern Alabama and northeastern Georgia from 1973 to 1977.

Food	*No. of Occurrences*		*Frequency (%)*	
Fish	262		83.2	
Family Centrarchidae		169		53.7
Family Catostomidae		38		12.1
Creek chubsucker		22		7.0
Greater jumprock		8		2.5
Lake chubscker		7		2.2
Blacktail redhorse (*Moxostoma poecilurum*)		1		0.3
Family Ictaluridae		33		10.5
Family Amiidae				
Bowfin		26		8.2
Family Aphredoderidae				
Pirate perch		26		8.2
Family Cyprinidae		20		6.3
Shiner		16		5.1
Creek chub		4		1.3
Family Esocidae				
Redfin pickerel		16		5.1
Family Clupeidae				
Gizzard shad		5		1.6
Family Cyprinodontidae				
Blackspotted topminnow		2		0.0
Family Poeciliidae				
Mosquitofish		2		0.6
Family Percidae		2		0.6
Logperch		1		0.3
Yellow perch		1		0.3
Family Hidontidae				
Mooneye		1		0.3
Unclassified		10		3.2
Crayfish	197		62.6	
Other arthropods	34		10.8	
Insects		31		9.8
Sialis spp.		14		4.4
Dragonfly nymphs		5		1.5
Ants		3		1.0
Grasshoppers		2		0.6
Paper wasp		1		0.3
Unclassified (Insect wings)		6		1.9
Cyclops		2		0.6
Spider		1		0.3
Amphibians	17		5.4	
Frogs		16		5.1
Salamander		1		0.3
Mollusks (Snails)	8		2.5	
Mammals	3		1.0	
Muskrats		2		0.6
Unclassified		1		0.3
Bird	1		0.3	
Plant Materials	12		3.8	

Table 2. Food of otters based on contents of 12 scats collected from southeastern Alabama.

Food	*No. of Occurrences*		*Frequency (%)*	
Fish	11		91.7	
Family Centrarchidae	9		75.0	
Family Catostomidae	4		33.3	
Creek chubsucker		3		25.0
Greater jumprock		1		8.3
Family Ictaluridae	2		16.6	
Family Amiidae				
Bowfin	1		8.3	
Crayfish	7		58.3	
Bird	1		8.3	

catfish (*Ictalurus punctatus*), could frequently be identified from the pectoral spines recovered from otter stomachs. Several species of catfish were believed to have been eaten because many are common throughout both states.

Interestingly, bowfin were found only in river otters obtained from Alabama; none was found in specimens taken from Georgia. Although bowfin is widely distributed throughout the eastern half of the United States (Douglas 1974 and Clay 1975), it was not recovered in samples of fish from 17 beaver areas in the Piedmont of Georgia and South Carolina (Pullen 1971). Most of the river otters obtained from Georgia came from the northeastern Piedmont section that contains more swift running streams and fewer bowfin than are typically found in Coastal Plain of south Alabama. This may explain the absence of bowfin from the Georgia sample. If pirate perch were recovered from a digestive tract, 2 or more individuals were present. They all were small in size averaging 5 to 8 cm in length.

Other fishes represented occurred in less than 16 percent of the digestive tracts. In order of ccurrence, they were cyprinids, redfin pickerel (*Esox americanus*), gizzard shad (*Doroosma cepedianum*), blackspotted topminnow (*Fundulus olivaceous*), mosquitofish (*Gambusia affinis*), yellow perch (*Perca flavescens*), logperch (*Percina caprodes*), and mooneye (*Hiodon tergisus*). Among the cyprinids, creekchub (*Semotilus atromaculatus*) and shiner (*Notropis* spp.) were found as food.

Crayfish were second to fish and were recovered from 62.5 percent of the 315 digestive tracts that contain food remains and from 58.3 percent of the scats. They were reduced to numerous small fragments of chitin and broken appendages, and were found more frequently in the intestines than in the stomachs. Sealander (1943) noted that hard indigestible materials apparently are passed rather quickly from the stomach. More than one species of crayfish were eaten by otters. One species identified from the characteristics of the great chela, was believed to be *Cambarus latimanus*.

Insects occurred in 9.8 percent of the digestive tracts. The aquatic insect larvae appeared to be mostly fragments of alderfly (*Sialis* spp.) The others were ants, grasshoppers, and a wasp. Other groups of arthropods (cyclops and a spider) also appeared in the food remains, but were very few in number (less than 1%). Because of their fragmented conditions, it is believed that most, possibly all, of the arthropods were obtained from the digestive tracts of fish eaten by the otters. Lagler and Ostenson (1942) believed that these food items were engulfed in the search for other food or were the remains of food items eaten by fish. However, Greer (1955), Hamilton (1961), and Knudsen and Hale (1968) believed that insects were taken directly and they were at least a moderately important food.

Amphibians as a group occurred in 5.4 percent of the digestive tracts. Frogs, largely unclassified as to species, were found most frequently. It is believed that most of these frogs, based on the fragments left in the stomachs and the distribution of the frogs in Alabama (Mount 1975), were the bronze frog (*Rana clamitans*). One was positively identified as bullfrog (*R. catesbeiana*) by the extremely large hind foot. A single mole salamander (*Ambystoma talpoideum*) was taken from one otter stomach.

Freshwater snails, the only mollusks found, occurred in 2.5 percent of the digestive tracts. They were usually found in small numbers (fewer than 5), and were not more than 4 mm in length. They may have been ingested accidentaly, or taken secondarily with some other food as mentioned by Lagler and Ostenson (1942). However, Toweill (1974) reported use of freshwater snails and mussels and that the freshwater periwinkles may be fed on extensively in western Oregon. Morejohn (1969) reported evidence of river otter feeding on freshwater mussels (*Anodonta californiensis*) that occurred in extremely high densities in San Bonito County, California.

Mammals occurred in only 3 (1%) of the digestive tracts. Two of them were identified as muskrat (*Ondatra zibethicus*) which are not abundant in the Coastal Plain beaver pond habitat. The third one was not positively identified but was believed to be another mustelid based on characteristics of a piece of kidney.

Birds were found only twice, one from a stomach and the other from a scat collected from Eufaula National Wildlife Refuge. The feathers in the scat were from an American coot (*Fulica americana*), whereas those recovered from the stomach appeared to be down feathers from a waterfowl.

Plant materials, including duckweed (*Lemna minor*), water shield (*Brasenia schreberi*), grass leaves, and pieces of wood, were found in 12 digestive tracts. It is assumed that plant materials were taken inadvertently with animal matter. Ryder (1955) believed that plant materials were taken by otters after they were trapped, or that they were taken accidentally while the otter foraged along the stream bottom in search of animal foods.

Predation on Fish

Otter have been blamed by many fishermen or sportsmen for a reduction in the number of game fishes. The present study reveals no detrimental predation by otter on local sport fish. Their foods include many species of rough fish, principally suckers, bowfin, cyprinids, pirate perch, and shad, not of particular interest to sport fishermen. Sunfish constituted the highest percentage of occurrence in this study, but this group of fish is found abundantly throughout Alabama and Georgia. Largemouth bass, which is an important game fish, represented a very small proportion of the food items. Sheldon and Toll (1964) investigating the feeding habits of the otter in a reservoir in central Massachusetts found a similar relationship between sport fish that were available and those utilized. In spite of high populations of Salmonids in their study, there was no evidence of predation on lake, brown, or rainbow trout.

Fish are probably captured by the otter in inverse relationship to their swimming ability, that is, their speed and agility. Bailey (1924) stated that the otter captures its prey with great skill and ease, taking fish in a fair race but probably getting more of the slower swimming species, such as suckers, than swift game fish. Pickerel (*Esox spp.*), a game fish that occurred in 5.1 percent of the digestive tracts, is classified as one of the fish of high speed (Norman 1975). However, the scales of the pickerel in the present study were all less than 4 mm long, suggesting that they came from small fish. This may reflect an ability of larger pickerel to avoid predation by an otter but is believed to indicate a paucity in larger sizes of pickerel. Smith (1939) and Ryder (1955) concluded that otter probably take fish somewhat in proportion to their abundance. The great variety of scale sizes and shapes recovered in this study would indicate no positive preference for size or kind of fish.

River otter may cause some serious predation problems in commercial fish ponds. They may take large numbers of channel catfish broodstock from commercial fish farming operations, or they may reduce populations of adult fish in farm ponds.

Predation on Mammals

Otter predation on mammals in Alabama and Georgia as determined in this study was negligible particularly when compared to that of the mink (*Mustela vison*) (Hamilton 1936 and 1940, and Sealander 1943). The percentage-frequency (1.0%) is lower than that indicated by Greer (1955) where mammals constituted 6.1 percent of otter food items, and muskrat made up 72.6 percent (61 in 84) of all mammal items recorded. This difference is perhaps related to distribution and relative scarcity of the muskrat in Alabama and Georgia. Howell (1921) and Arant (1939) noted and the junior author has observed that muskrats occur in most of the streams and ponds in the northern part of Alabama but are rare in the section of the state where most of the otters were obtained for this study.

Predation on Other Vertebrates

Otters have been reported only infrequently to prey upon reptiles and birds, and each report indicated an abundance of such animals in that area. Stophlet (1947) observed a group of otters feeding on a large turtle (*Pseudemys* sp.) at least 360 mm in length. He mentioned the local abundance of this species counting the heads of 90 terrapins protruding above the surface of water in a small area. Meyerriecks (1963) reported that otters preyed on common gallinule (*Gallinule chloropus*) in Florida. He mentioned that such areas were inhabited by numerous birds, such as gallinules, grebes, coots, and herons. Data from the present study indicate that predation on verterbrates, other than fish, is infrequent. No reptiles, and remains of only 2 birds were found.

The results of this study are similar to those reported in other studies, and reiterate the dependence of the river otter on fish as its major food. This becomes relevant regionally and worldwide as one considers the many human activities that reduce water quality below fish tolerances, thus reducing the distribution of the river otter and other members of the genus *Lutra*. The needs to upgrade water quality to support a year-round supply of fish will have to be met if the river otter is to be reestablished and maintained in its original range in North America.

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