Winter Foods of River Otters from Saline and Fresh Environments in Louisiana

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Abstract: Winter foods of the river otter (*Lutra canadensis*) in southern Louisiana were determined to gain an understanding of prey eaten by otters. Otters were taken by trappers in the salt marsh in southeastern Louisiana and freshwater swamp in the Atchafalaya Basin in southcentral Louisiana. Fishes were found in 83.3% of the digestive tracts from salt marsh and 83.0% of the tracts from the swamp area. Blue crabs (*Callinectes sapidus*) occurred in 19.8% of the digestive tracts from salt marsh and 3.8% of the tracts from the swamp area. Crayfishes (*Procambarus* sp.) were found in 34.% of the swamp area digestive tracts and 1.6% of the tracts from the salt marsh. Remains of mammals were found in 7.9% of the digestive tracts from salt marsh and 7.5% of the tracts from the swamp. Other foods of otters from salt marsh and their frequencies of occurrence were birds (2.4%), mollusks (1.6%) and shrimp (1.6%). Snake remains were found in 5.7% and mollusks in 3.8% of the otter digestive tracts from the freshwater swamp.

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River otters are common inhabitants of wetlands in Louisiana and one of the major fur animals in the state. The annual harvest has exceeded 4,000 since the 1970–71 season and during the 1976–77 season was 11,900 animals

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for which trappers received $535,000. River otters occur in all 64 parishes in the state, but approximately 80% of the harvest is from the coastal parishes (Ensminger and Linscombe 1980).

The Louisiana Department of Wildlife and Fisheries funded research to provide information necessary for statewide management of otters. This paper includes a segment of that research and reports on winter foods of otters in 2 major coastal habitat types, salt marsh and freshwater swamp.

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Methods

River otters trapped in saline environments came from sites in St. Bernard and Plaquemines Parishes near the Gulf of Mexico and east of the Mississippi River. The Louisiana coast is bordered by marshes of variable width which can be grouped into 4 general marsh types: saline, brackish, intermediate, and fresh (Chabreck and Linscombe 1978). Otters were taken from the saline and brackish types and water salinities ranged from 15 to 25 ppt. Shallow lakes and lagoons ranging from 0.6 to 1.2 m deep at mean normal tide level are scattered throughout these areas (Fontenot and Rogillio 1970). These open water areas are interconnected by a system of bayous and canals containing deeper water. In many areas, lakes, bayous, and canals are so abundant that the marsh appears as a vast region of small islands. The opposite is true in other regions with fewer bodies of water and marsh vegetation growing in vast unbroken stands covering large areas (Chabreck 1972).

In general, the coastal marshes are without distinct relief features. Most marsh areas are only slightly above mean sea level. Low natural levees along tidal channels and larger streams are the most noticeable relief features. Artificial levees and spoil deposits constructed in recent years have greatly altered coastal marshes (Chabreck 1972).

River otters examined from freshwater swamp were trapped in the Atchafalaya Basin, a vast wetland area in south central Louisiana. The Atchafalaya Basin extends from the junction of the Atchafalaya, Old, and Mississippi Rivers near Simmesport to the mouth of the Atchafalaya River. The Basin is bounded on the east and west by the levees of the Atchafalaya Basin Floodway. The portion of the Atchafalaya Basin selected as a study area was located approximately 30 km inland from the mouth of the Atchafalaya River and situated between Interstate Highway 10 on the north and U.S. Highway 90 on the south.

The annual hydrologic cycle of the Basin is characterized by low water

stages from September to November and high water from February until June (Nichols 1973). Annual overbank flooding by the Atchafalaya River results in water depths of 1 – 2 m over the study area. The area consists primarily of baldcypress (*Taxodium distichum*) and water tupelo (*Nyssa aquatica*) swamp with black willow (*Salix nigra*) and eastern cottonwood (*Populus deltoides*) common at slightly higher sites.

The Louisiana Department of Wildlife and Fisheries purchased otter carcasses from trappers during December through February, of 1976–77, 1978–79, and 1979–80. Sheldon and Toll (1964) compared otter foods during all seasons in Massachusetts and found little seasonal difference in predation. The authors therefore felt that taking otters during other seasons was not justifiable for the purposes of this investigation. Wilson (1954) noted that otter scats were composed only of indigestible foods; therefore, scat examination was not attempted.

Digestive tracts from 399 otters were removed and frozen for later examination of stomach and intestine contents to determine food habits. All material was removed, washed, and placed on filter paper in a Buchner funnel in an aspiration flask. An attached vacuum pump was used to remove most of the excess moisture. Stomach contents were then placed in Petri dishes and frozen for later food item identification. Intestinal contents were surrounded by a thick mucous that hampered the removal of food items and required drying at about 30 C for 3 days. Digestive tract contents were examined under a 10× binocular dissecting microscope. Hair identification was done with a 400× compound microscope.

Fishes, except catfish, were identified by scales and bones. The scales were compared to those in a reference collection and to photographs. Catfish were identified to family by skin and spines.

In this study emphasis was placed on frequency of occurrence of food items. Volume measurements were initially taken, but differences in the stage of digestion caused wide variation in the amount of material remaining in the stomach or intestine; therefore, volume measurements were abandoned. Toweill (1974) reported similar findings and explained that differenital rates of digestion of food items could bias volume measurements.

Availability data for prey species were obtained from other studies conducted in the areas (Perret et al. 1971, Ruebsamen 1972, Bryan et al. 1975). All species found in the otter digestive tracts were not represented by data in the literature. Areas where fish availability data were obtained did not always coincide with specific areas where otters were trapped but were in similar habitat in the general vicinity. Many factors are involved in determining fish availability (Sheldon and Toll 1964). It was not practical to observe otters feeding and collect fish samples in those areas during the study.

Results and Discussion

Only 179 otter digestive tracts (44.9%) of the 399 examined contained identifiable food items. The remaining 220 tracts (55.1%) were empty or contained only nonfood items. The relatively large proportion of empty digestive tracts may be related to the length of time the animals remained alive after being trapped (Knudsen and Hale 1968).

Otter hairs were found in 110 digestive tracts (27.6%). We assumed that these hairs were ingested during grooming.

Many stomachs contained vegetative debris such as grass, leaves, and bits of wood. Knudsen and Hale (1968) stated that otters apparently ingested vegetation out of frustration or hunger while in the trap. Others have reported that otters pick up vegetable matter incidently while foraging for food (Lagler and Ostenson 1942, Ryder 1955, and Toweill 1974).

Mud and sand were found in several tracts. Such material could be ingested while the otter was alive in a trap (Wilson 1954). Some of the mud and sand could have been picked up while capturing and ingesting bottom-dwelling organisms.

Of the 179 digestive tracts containing food items, 79 had food in both the stomach and intestines, 40 had food in the stomach only, and 60 had food items only in the intestines. Because of size and stage of digestion, stomach contents were examined and identified with the use of a binocular microscope (10×). Occasionally prey items from the digestive tracts were large and fresh enough to facilitate identification. Intestinal contents contained indigestible hard parts such as scales, bones, teeth, spines, and exoskeletons of crayfishes and crabs.

Salt Marsh

Of 308 otter diegstive tracts collected from salt marsh habitat, 126 (40.9%) contained identifiable food items. Fifty of the 126 tracts had food items in both stomach and intestines, 26 had food in the stomachs only, and 50 contained food only in the intestines.

Fishes.—Fishes were present in 83.3% of the digestive tracts (Table 1) from salt marsh. Members of the family Cyprinodontidae appeared in 76.2% of the tracts making it the most frequently occurring family in the otter's diet. Ruebsamen (1972) sampled fish populations in salt marsh intertidal ponds and streams in Southeastern Louisiana and reported that Cyprinodontidae comprised 96.1% of the fish in winter samples.

Two members of this family, sheepshead minnow (*Cyprinodon variegatus*) and diamond killifish (*Adinia xenica*), were the most frequently used food items by otters and appeared in 57.9% and 37.3% of the digestive

Table 1. Food Items in Digestive Tracts of River Otter from Salt Marsh (N = 126) and Freshwater Swamp (N = 53) in Louisiana

Species	Salt Marsh		Swamp	
	No. of Tracts	% Occurrence	No. of Tracts	% Occurrence
FISHES	105	83.3	44	83.0
Sheepshead minnow	73	57.9	0	0
Diamond killifish	47	37.3	4	7.5
Gulf killifish	20	15.9	1	1.9
Bayou killifish	20	15.9	2	3.8
Blackspotted topminnow (*Fundulus olivaceous*)	8	6.3	1	1.9
Killifishes (*Fundulus spp.*)	0	0	8	15.1
Largemouth bass	4	3.2	6	11.3
Longear sunfish	0	0	5	9.4
Warmouth (*Lepomis gulosus*)	0	0	4	7.5
Bluegill	0	0	3	5.7
Spotted bass (*Micropterus punctulatus*)	0	0	3	5.7
Unidentified sunfishes	0	0	3	5.6
Southern flounder	17	13.5	2	3.8
Striped mullet	15	11.9	6	11.3
Sailfin molly	13	10.3	4	7.5
Bowfin	2	1.6	10	18.9
Smallmouth buffalo (*Ictiobus bubalus*)	0	0	4	7.5
Gizzard shad (*Dorosoma cepedianum*)	0	0	4	7.5
Unidentified fishes	3	2.4	4	7.5
CRUSTACEANS	21	24.6	22	41.5
Crayfishes	2	1.6	18	34.0
Blue crab	25	19.8	2	3.8
MAMMALS	10	7.9	4	7.5
BIRDS	3	2.4	0	0
SNAKES	0	0	3	5.7
MOLLUSKS	2	1.6	2	3.8

tracts, respectively. Ruebsamen (1972) also reported that the sheepshead minnow and diamond killifish were the most abundant species (59.1% and 26.2%, respectively). Two other cyprinids, gulf killifish (*Fundulus grandis*) and bayou killifish (*F. pulvereus*), were each found in 20 (15.9%) digestive tracts. Ruebsamen (1972) reported that these species comprised 9.6% and 0.9% of his samples, respectively.

Species from other families appeared with lower frequencies in otter digestive tracts. Previous work has also shown that families other than Cyprinodontidae are poorly represented in intertidal areas (Ruebsamen 1972).

Only 3 non-Cyprinodont species appeared in a relatively high number of tracts. The southern flounder (*Paralichthys lethostigma*) occurred in 13.5% of the otter tracts but was absent in the samples taken by Ruebsamen (1972). Tarbox (1974) also noted that southern flounder are uncommon in winter elsewhere along the Louisiana coast. Nocturnal foraging by otters (Ryder 1955) and the southern flounder's nocturnal behavior (Perret et al. 1971) could account for the observed frequency of occurrence in the otters' diets. Wilson (1954) reported that flounders were the principal prey of otters examined from Pamlico Sound, North Carolina.

Sailfin molly (*Poecilia latipinna*) and striped mullet (*Mugil cephalus*) appeared in 10.3% and 11.9% of the otter digestive tracts but comprised only 2.3% and 0.4%, respectively, of the fishes captured by Ruebsamen (1972).

Remains of freshwater fishes, largemouth bass (*Micropterus salmoides*), bowfin (*Amia calva*), and mosquitofish (*Gambusia affinis*), were found in <4% of the otter captured in salt marsh. Of these, only the mosquitofish was taken in samples by Ruebsamen (1972). The presence of freshwater fishes suggests that otters may have ranged over a large area and came in contact with freshwater in the vicinity.

Although Ruebsamen (1972) sampled fish populations in a salt marsh environment about 60 km from our study area, we believe that fish populations in the 2 areas are similar and that otters in salt marsh feed primarily in small intertidal ponds and streams. Perret et al. (1971) sampled fish and invertebrate populations on larger bodies of water (lakes and bays) in the vicinity of our study area, but species commonly found in otter digestive tracts were not present in their samples or occurred only at minor rates (<0.4%). Dominant species in samples from large water bodies, bay anchovy (*Anchoa mitchilli*) and gulf menhaden (*Brevoortia patronus*), were not found in digestive tracts of otter taken in salt marsh. Sheldon and Toll (1964) compared data on fish distribution in large reservoirs in Massachusetts with species eaten by otters and concluded that otters feed in coves or near shore. Species confined to deep water comprised a negligible part of the otters' diet.

Crustaceans.—Crabs ranked second to fishes in abundance in the otter digestive tracts and occurred in 23.8% of the tracts (Table 1). Blue crabs comprised 0.09% of the aquatic organisms in samples taken by Perret et al. (1971) in water bodies near the study area but the high frequency of occurrence in otters (19.8%) gives the impression that the otters may prefer these crustaceans. Mud crabs (*Rhithropanopeus harrisii*) were present in 1.6% of the digestive tracts from salt marsh and fragments from a fiddler crab (*Uca pugnax*) were found in 1 digestive tract.

Crayfishes (*Procambarus* sp.) were found in 1.6% of the tracts. The otters collected in the marshes with crayfish in their digestive tracts apparently obtained the crayfish from freshwater in the area.

Mammals.—Mammals ranked third among food groups taken by otters in salt marsh and were found in 7.9% of the otter diegstive tracts. *Rattus* spp. were found to have the highest frequency of occurrence (4.0%) among mammals. Nutrias (*Myocastor coypus*) were second with a frequency of 2.4%.

The eastern wood rat (*Neotoma floridana*) and mink (*Mustela vison*) were each found in single tracts. Eastern wood rats are not normally found in coastal marsh regions and the presence of this species in an otter's digestive tract may be the result of the otter feeding in a wooded area around freshwater. Muskrats (*Ondatra zibethicus*) are common inhabitants of salt marsh in Louisiana (O'Neal 1949, Palmisano 1973); however, we found no evidence of otter feeding on muskrats. Wilson (1954) examined digestive tracts and scats of otter feeding in salt marsh in North Carolina and found that <1% contained remains of muskrats.

Birds.—Bird species were noted in 2.4% of the otter digestive tracts from salt marsh (Table 1). American coot (*Fulica americana*) remains were found in 2 tracts and Lesser scaup (*Aythya affinis*) feathers were found in a single tract. We were unable to determine if the birds were captured by otters or eaten as carrion. Both species are important game birds in Louisiana and may have been shot by hunters and not retrieved.

Mollusks.—Mollusk shell fragments occurred in 1.6% of the tracts, and we were unable to ascertain whether the mollusks were taken as food or ingested while capturing or consuming other prey.

Freshwater Swamp

Of the 91 otter digestive tracts collected in the Atchafalaya Basin, only 53 tracts (58.2%) contained food items. Twenty-nine of the 53 tracts contained food in both the stomach and intestines; 14 had food in the stomach only and 10 had food items in the intestines only.

Fishes.—Fishes were found in 83.0% of the digestive tracts of otters collected from the Atchafalaya Basin (Table 1). The most common family was Centrarchidae (sunfishes) which occurred in 49.1% of the tracts. Although largemouth bass comprised only 1.3% of seine samples in the Atchafalaya Basin (Bryan et al. 1975), they occurred frequently in otter digestive tracts (11.3%).

Longear sunfish (*Lepomis megalotis*) were also found in a large percentage (9.4%) of the otter digestive tracts but occurred at a low rate (1.0%) in seine samples. Bluegills (*Lepomis macrochirus*) were present in 5.7% of the otter tracts but constituted 32.5% of the fishes caught in seine samples (Bryan et al. 1975).

Ranked second after Centrarchidae was the family Cyprinodontidae which occurred in 32.1% of the digestive tracts (Table 1). All species in this family found in otter digestive tracts from the Atchafalaya Basin were also found in otter taken in salt marsh and are generally described as saltwater fishes (Ruebsamen 1972). However, Douglas (1974) stated that it is not uncommon to find saltwater species in freshwater environments near the coast. None of the saltwater species of Cyprinodontidae that occurred in otter digestive tracts in the Atchafalaya Basin were found in seine samples by Bryan et al. (1976). Since the study area was over 20 km from saline environments, the fishes were probably present in low numbers or in areas not sampled.

Bowfins occurred in 18.9% of the otter tracts but were not found in seine samples. Douglas (1974) noted that bowfins are frequently found in small sluggish streams and ponds that are often choked with aquatic plants. Such habitats may not have been included in seine samples.

Fish of the family Poeciliidae occurred in 11.3% of digestive tracts from the Atchafalaya Basin (Table 1). Sailfin mollies were found with a frequency of 7.5%. Mosquitofish was the dominant species (39.7%) in seine samples in the Atchafalaya Basin (Bryan et al. 1975) but occurred in only 3.8% of the digestive tracts. Douglas (1974) stated that mosquitofish were commonly found among shoreline vegetation and the vegetation may have effectively concealed the small fish from otters. Both species in this family were also used as food by otters in salt marsh.

Striped mullets, another species commonly eaten by otter in salt marsh, were found in 11.3% of the tracts in the Atchafalaya Basin. In both environments, this species is described as uncommon during winter months (Ruebsamen 1972, Bryan et al. 1975).

Brook silversides (*Labidesthes sicculus*) comprised 8.40% of the seine catch by Bryan et al. (1976) in the Atchafalaya Basin but were not found in otter tracts from the freshwater swamp. These fish are commonly found near the water surface (Douglas 1974) and may not be captured by otters that frequently feed near bottom.

Crustaceans.—Crayfishes ranked second (frequency: 34.0%) in importance as otter food items in the Atchafalaya Basin (Table 1). No data were found in the literature on the availability of crayfishes compared with fish species in the Atchafalaya Basin. O'Brien (1977) and Bryan et al. (1976)

found 7 species of crayfishes in samples in the basin, red swamp crayfish (*Procambarus clarkii*) dominated each sample and white river crayfish (*P. acutus*) was second in abundance. Crayfish are normally abundant in the Atchafalaya Basin during the winter and spring and the harvest by commercial fisherman is approximately 10 million kg annually (Montegut 1982).

Blue crabs were found in 3.8% of the digestive tracts. Bryan et al. (1976) reported that blue crabs are generally less abundant during winter in the Atchafalaya Basin.

Mammals.—Mammals were found in 7.5% of the otter digestive tracts (Table 1). Nutria remains were found in 5.7% of the tracts and hair from *Rattus* sp., was found in a single tract. Nichols (1973) stated that nutrias were the most important furbearer to Atchafalaya Basin trappers during the 1971–72 season and probably the most abundant.

Reptiles.—Snakes were found in 5.7% of the tracts. Banded water snake (*Nerodia fasciata*) remains were found in 2 tracts (3.8%), and skin and scales of a green water snake (*N. cyclopion*) were found in 1 tract (Table 1). Nichols (1973) stated that green water snakes were among the most common snakes in the Atchafalaya Basin, and Hebert (1977) reported that banded water snakes were present in the swamp but gave no estimate of abundance.

Conclusions

Fishes were the major food item of river otter in both habitat types and occurred at almost identical frequencies (salt marsh: 83.3%; freshwater swamp: 83.0%). Members of the family Cyprinodontidae were major foods of otters in both saline and fresh environments. Species of this family were common in salt marsh and possibly were taken by otters in proportion to their abundance. Lauhachinda and Hill (1977) found fish remains in 83.2% of the otter digestive tracts examined from Alabama and Georgia. Greer (1955) reported fish remains in 100% of the otter tracts collected in winter in Montana, and Toweill (1974) noted that fish occurred at a frequency of 80% in otter tracts in Oregon.

Crustaceans are apparently important foods, especially blue crabs and crayfishes. These groups were generally taken in relation to their abundance. In salt marsh, blue crabs were abundant and were a major food source; likewise, crayfishes were dominant crustaceans in the freshwater swamp and were a major food source in that habitat.

Mammal remains also occurred in otter digestive tracts at similar frequencies in the different habitat types. In salt marsh, mammal remains were

found in 7.9% of the tracts and in the swamp they were present in 7.5% of the tracts. Members of the Rodentia were major mammalian prey of otters in both habitat types.

River otters inhabiting salt marshes along the Louisiana coast are frequently found over 20 km from freshwater. This raises the question of whether otters require freshwater for normal body metabolism and, if so, how the freshwater is obtained. Tarasoff (1972) reported that harbor seals (*Phoca vitulina*) were unable to drink seawater to meet their water needs. He stated that the seals' freshwater demands were met by the water in the fish they eat. River otters in salt marsh may obtain freshwater from the same source.

Otters in salt marsh apparently feed in small intertidal ponds and streams. Fish species commonly found in digestive tracts from salt marsh were similar to those of seine samples in intertidal ponds and streams (Ruebsamen 1972) but were absent or uncommon in samples taken in larger lakes and bays nearby (Perret et al. 1971).

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