THE ROLE OF MINK AND OTTER AS MUSKRAT PREDATORS IN NORTHEASTERN NORTH CAROLINA

KENNETH A. WILSON

Proc. Annu. Conf. Southeast. Assoc. Game & Fish Comm. 6:606-618

The mink *(Mustela vison mink)* today is first in fur value among fur animals in North Carolina and the otter *(Lutra canadensis lataxina)* is trapped in quantities second only to those harvested from Louisiana. Fur dealers' reports for the past five years reveal that between 12,000 and 21,000 mink and from 801 to 1,341 otters have been annually harvested by trappers.

On the other hand, despite fur value, minks and otters in northeastern North Carolina are believed by some trappers to be serious muskrat predators. In recent years, the muskrat crop in Currituck County has dropped from nearly 40,000 in 1944 to about 20,000 in 1952 and to the trapper this fact proves his point.

An investigation to determine the extent that minks and otters prey upon muskrats *(Ondatra zibethicus macrodon)* in northeastern North Carolina was intiated in the fall and winter of 1947 - 48 and continued each year during the legal trapping season (December 15 - February 15) through the winter of 1950 - 51. The work was conducted as part of a study in the ecology and management of the muskrat on the Northwest River Marsh in Currituck County.

Most material for the study was obtained at the fur shed in Moyock, North Carolina, where trappers brought fur to sell in the carcass. Digestive tracts (stomachs and intestines) were removed from carcasses and stored in vats containing a 10 per cent solution of formaldehyde. Except for a few minks and otters from nearby Dare and Camden Counties all digestive tract material came from Currituck County. Because colored help engaged to collect the tracts could not write, the location of only seven is known. Except for 11 otter scats from Pamlico County, all droppings came from the Northeast River Marsh.

During the study, the contents of 568 mink digestive tracts and 54 otter digestive tracts were examined. Of these, 335 (59%) minks and 24 (44%) otters contained food. The 233 (41%) minks and 30 (56%) otters without food were largely filled with mud, chewed leaves and twigs, toe nails, foot pads and other detritus. Sixty-one otter scats and 53 mink scats represent the dropping material.

The contents of each tract were thoroughly washed in a fine screened container, the residue being placed in an electrically operated chamber to dry. Material in stomachs and entrails was studied separately, but when the same food appeared in both, it was counted only once. Tabulation of foods found was made on the basis of frequency of occurrence — not volume. Food in the stomachs, whether mammal, bird or fish, was usually chewed into bits about one-half inch long though when the diet was rabbit or similar size prey, minks often bolted food in inch size or larger hunks. Food in the otter stomachs was chewed up finer than food eaten by mink. Intestines in general contained hair, teeth, skeletal parts, fish scales, chiten and other undigested hard food remains. Otter intestines lined with about one-fourth inch of mucus for protection from fish spines and other sharp edged foods appeared to function as repositories for undigested food, i.e., they held food accumulations extending over several days. No attempt was made to identify the

species of fish in each tract, though the residue of what appeared to be typical samples was analyzed to obtain data on the principal kinds and species being consumed. Identification in general was limited by the quality and kind of material (feather, tooth, hair, skeletal part, etc.) in the study sample. Study procedure for the scats was similar to that employed to identify digestive tract foods.

The writer wishes to thank Mr. Arnold L. Nelson, Director, Patuxent Research Refuge, U. S. Fish and Wildlife Service, Laurel, Maryland for the use of laboratory facilities in food identification. I am also indebted to Mr. Francis Uhler for help in fish identification, to Mr. William Stickle who identified the reptiles and many of the mammals, and to Mr. Robert Stewart for aid received in bird identification. To Mrs. Lucille Stickle and Mr. Leonard Llewellyn for help with certain mammals and Mr. Robert Mitchell for assistance in identifying the arthropods, thanks are given.

CURRITUCK COUNTY

Currituck County is located in the northeastern corner of North Carolina. It is bounded on the north by Virginia, on the east by the Atlantic Ocean, on the south by Dare County and the Albemarle Sound and on the west by Camden County. Physiographically, the county is low, almost level, with elevations ranging from sea level to 20 feet. Of the 186,880 land acres in the county, approximately 60,000 acres are swamp and about 33,000 acres, marsh.

Swamp Habitat: Swamp, which includes portions of the Great Dismal Swamp, is largely vegetated with sour gums *(Nyssa-aquatica biflora-sylvatica),* red maple *(Acer rubrum),* cypress *(Taxodium distichum),* magnolia *(Magnolia virginiana),* and swamp rose *(Rosa carolina).* Sluggishly flowing creeks and ditches drain the land. Water depths in most swamps range from a few inches to a foot.

Fish, crayfish, frogs, mice, cottontail rabbits, grey squirrels and birds are common. Raccoons are abundant in all swamps and the larger ones carry deer and bear. In recently cutover sites where there are cattails *(Typha latifolia),* muskrats are plentiful. In this study, it is believed that at least 70 per cent of all the digestive tracts came from swamps.

According to Mr. John J. Flora, fur dealer, Moyock, North Carolina, trappers in Currituck County annually harvest about 200 minks, most of which come from swamps, and between 30 and 40 otters. About half of the latter also come from swamps. The majority of trappers seldom exceed twenty mink and one or two otter a season although two brothers trapped the North River section of the Great Swamp in 1949 to catch 72 mink and 17 otters.

Marsh Habitat: Most marsh acreage in Currituck County lies along the shoreline and on islands in Currituck Sound (a shallow 35 mile long by 3 to 6 mile wide body of water between the mainland and the outer banks). Cover types consist principally of needlerush *(Juncus roemerianus),* cordgrass *(Spartina cynosuroides),* sawgrass *(Cladium jamaicense),* cattails *(Typha angustifolia, T. latifolia, T. domingensis,* and *T. glauca)* and Olney's threesquare *(Scirpus olneyi),* the last two plants being important muskrat foods. Peat depths ranging from one foot to twenty feet and more cover the marsh. Water ranges from slightly brackish to almost fresh.

Muskrats and otters are the important fur animals. Practically no minks inhabit outer banks marsh but on the mainland where swamp borders marsh, minks are

relatively common. Raccoons are numerous in all swamps-marsh cover types where they lie adjacent. Fish, rice rats, mice, muskrats, rabbits and birds are the principal winter foods. An estimated 60 digestive tracts (10 otter and 50 mink) came from this habitat.

Normally between 30 and 40 thousand muskrats are annually harvested in Currituck County approximately 75 per cent of which come from marsh. In recent years, harvests from marsh habitat have dropped sharply. Muskrat trapping records for a five-year period on Tice Marsh (approximately 1,000 acres) in northern Currituck Sound reveal a drop from 958 in 1948 to 98 in 1952 — a crop shrinkage of 90 per cent. Absurd as it may seem, the writer has substantial proof that this drop in marsh production — largely county wide — has not been caused by muskrat-eating mink and otter but by muskrat-litter-eating raccoons.

Northwest River Marsh, a 1,263 acre state holding, is a management study center for increased production of the muskrat. About half the property is woodland, much of it swamp and the remainder is marsh. Cover types in the approximately 650 acres of marsh are largely cattails (4 species), Olney's three square, needlerush, sawgrass and cordgrass. Wooden diking that floods a 100-acre area is benefitting muskrats and waterfowl. Minks are common and it is estimated that at least a half dozen otters live on and travel over the area. Raccoons until recently have been abundant. All the otter-mink scat material (except 11 otter scats from Pamlico County) came from this area.

FOOD OF MINKS

The amazing energy, durability and physical qualities of the mink combine to make it one of the most efficient hunters in the animal kingdom. Whether on land or in water it always seems to know exactly what to do. In hilly or mountain country it may hunt for food along waterways week after week, then quite suddenly depart for the boulder strewn side of a mountain in quest for new foods. I have followed its serpentine trail on snow along trout streams in New England, seen where trout were caught and consumed and yet, instead of holing up, the mink continued its course along the stream for miles, hunting. Unlike the bobcat which is content to tarry, crouched waiting for appearance of prey, the mink always appears to be on the move and in a hurry. In the course of a night, it has been trailed on snow more than ten miles. In February, 1951, three inches of snow on the Northwest River Marsh lasted until noon following the night it fell. In the short period tracks of four mink, one pair and two singles, were seen and from the trails on logs in an adjacent swamp it appeared that these animals were finding sufficient food in a twenty acre swamp. Because of the abundance of food in Currituck County, it is believed more mink are present per square mile of habitat and that minks are disinclined to cover the long distances their cousins in rolling country travel.

Of the 233 mink digestive tracts without food, approximately 175 contained mud, shredded grass, stems and twigs of herbaceous and woody vegetation. Although mink may occasionally eat green leaf vegetation, none of these items were considered food. The large quantities of mud-debris in tracts (of the 335 tracts with food about 100 contained mud and vegetal debris) suggests that more than half the mink remained alive in traps after capture. Obviously the stomachs and intestines of these animals were purged of food when the trapper arrived.

Of the 335 stomachs or intestines with dietary material, 181 (54%) stomachs and 305 (91%) intestines contained food or food remains. Intestines of 148 (44%) minks held only a few hairs, fish scales or other fragmentary food remains and in these instances the stomach was nearly always empty. Stomachs and intestines often contained the same food remains. Mammal prey was found in large volumes in stomachs more often than cold blooded animals. About half the stomachs and half the intestines contained one kind of food but between 30 and 40 per cent of the digestive tracts (stomachs and intestines) contained two food items and occasionally stomachs or intestines held four and five kinds of food. These findings differ from those of Sealander's (1943) work with mink in Michigan who said "Usually only a single item of food was represented in the stomach and intestines of an animal." Stomachs filled to capacity ordinarily contained only one food item.

It was noted that passage rates of certain foods through digestive tracts were different. Stomachs filled with mammal and bird material apparently pass hair and feathers into the intestines first retaining fleshy pieces. Sloughed fish scales went into intestines first, skeletal parts last. More crayfish and other arthropod remains were found in the intestines than the stomachs. Colon parts nearly always contained the bulk of intestinal food remains. These findings tend to confirm those of Dearborn (1932) and Sealander (1943).

Scats were largely composed of hair, bones, feathers, chiten and the small cycloid scales of minnow size fishes.

Results of the dropping and digestive tract studies disclose wide differences in prey items. In the digestive tract study, the principal diet was fish with mammals of secondary importance (Fig. 1). The diet largely represented foods from swamp habitat. On the other hand droppings from the Northwest River Marsh show mammals, especially rice rats and deer mice, the popular foods, while only a few

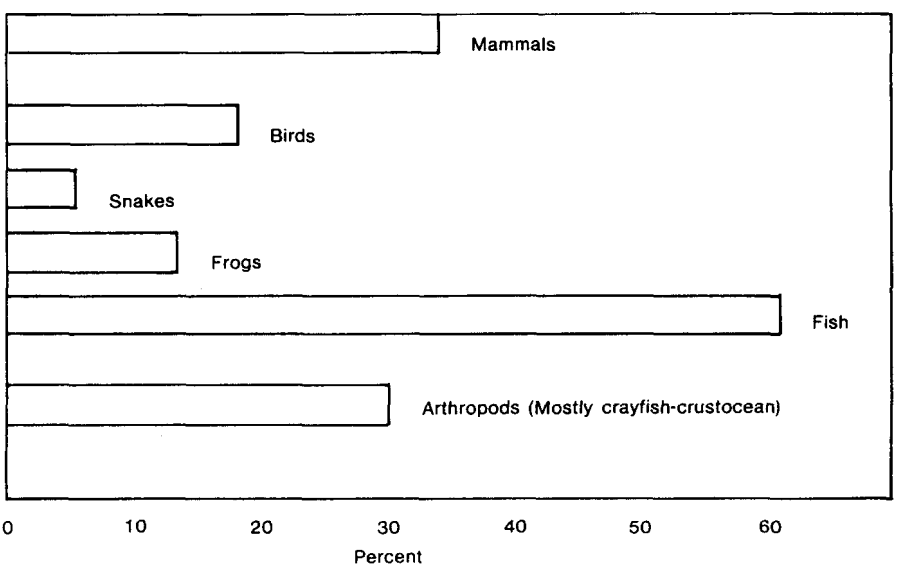

Fig. 1. Class and phylum frequency indices in the fall and winter diet of minks based on contents of 335 digestive tracts.

samples contained fish (Fig. 2). Muskrat, both in tracts and droppings, represented a minor food item.

Hamilton (1940) in New York and Sealander (1943) and Dearborn (1932) in Michigan found muskrat an important food of minks. Sealander's work revealed that male minks consumed more muskrats than the smaller female and suggests "the size of a mink may determine the size of its prey." Coastal minks are known for their small size while muskrats are relatively large. Adult male and female minks average 1 lb. 8 oz. and 1 lb. 1 oz., respectively, while the average weight of adult muskrats approaches 3 lbs. At least three of the seventeen muskrats consumed were kit size (a pound or less) and it is possible, with the numerous sources of easily obtained foods, that minks would prefer these to strenous conflict with the muskrat.

The study failed to disclose the amount of food in terms of volume and grams that wild mink consume during a 24 hour period. About 15 of every 100 stomachs contained an "abundance" (from 30 to 120 grams) of food but in most instances some or considerable digestion had started. Ranch mink are fed about a half-pound (227 grams) of food once a day. Wild mink, though on the average smaller than ranch mink, could be expected to consume almost as much.

Digestive Tract Foods

Of the 335 tracts, fish were found in 204 (61%). Killifish and mosquito fish, both small non-game varieties, made up the bulk of this food. Possibly 10 per cent of the samples contained remains of the following fish: sunfish, catfish, eel, yellow perch and pickerel. Large quantities of small fish species inhabit shallow coastal waters. The consistent consumption of this food suggests that it is eaten in quantity, at least in the fall-winter months and possibly the year round.

Approximately one-third (34%) of the study material contained mammals. Mice occurred in 50 tracts, deer mice in 28, meadow mice in 21 and one held a house mouse (Fig. 3). During the severe winter of 1948 - 49, in which more than twenty inches of snow fell, it is noteworthy that only 5 of 103 mink had eaten mice. Intermittent cold weather with snow probably made hunting them more difficult or possibly populations were down. The same winter, however, fish (74 times) and crayfish (24 times) were eaten more frequently than at any time during the study. That no lemming voles *(Synaptomys cooperi helaletes)* were found indicates small or no populations. Specimens from the Great Dismal Swamp have been examined by Handley and Patton (1947) and their range is believed to extend into northeastern North Carolina. The fact that no pine mice *(Pitymys)* were found cannot be explained although their range might be outside that hunted generally by mink. The scarcity of rice rats, only 5 were recorded, is puzzling since scats from the Northwest River Marsh and live trapping the author has done there, indicate heavy populations of this rodent in the marsh. Of 538 items in the study identified as food, mammal prey larger than small rodent sizes appeared only 35 (7%) times, namely: muskrat 16, rabbit 11, gray squirrel 7, and opossum 1 (Fig. 3). Except for opossum, all these animals are common in swamp and marsh habitat. Again it would appear that when food is abundant, minks choose the easier-to-obtain prey species. The remainder of mammalian food consisted of shrews, Norway rats, and one mole.

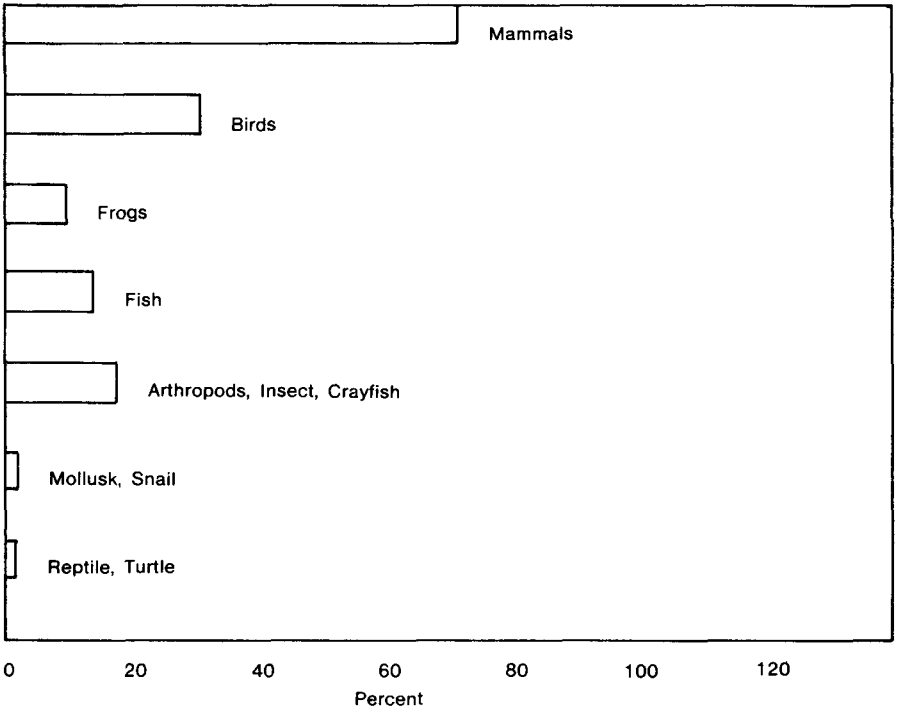

Fig. 2. Frequency of occurence of foods bound in 53 mink scats from the Northwest River Marsh.

Crayfish comprised the bulk of this food which was represented in 44 (13%) tracts. Intestines usually contained the largest volume, and 25 per cent greater frequency than stomachs, presumably because of accumulations of indigestible parts. In Michigan, Dearborn (1932) found crayfish a minor food of minks in the winter, but an important summer food. A study of mink foods during the summer when large crayfish populations are active would doubtlessly show greater consumption of this crustacean. Other arthropods (all minor foods) represented were decapods, shrimp, beetles, katydids and spiders.

Birds are not an important food in the mink's diet. Although 59 (18%) animals contained bird, only a few appeared in volume. Of the six species of birds identified, king rails (8), by volume and frequency, formed the largest percentage. Virginia rails, not so common, were found in two mink. Sora rails *(Porzana carolina)* and a few clapper rails *(Rallus longirostris)* also frequent Currituck marshes. Ducks (ruddy and black) and flickers (the latter often feeds on the gound where it would be vulnerable to mink) were eaten twice. One Florida gallinule and whippoorwill were the other identified birds. Of the small birds (mostly passerines) that could not be identified, many probably were warblers and sparrows. Only large species appeared in volume, mostly in the stomach. Most bird remains (60%) were located in the intestines. Often the evidence was only part of a foot, bill and bone fragments, or a feather.

By volume and frequency (11%), frogs comprised a small part of the diet. Except during the winter of 1950 - 51 when they were found — twice in volume — in 28 of 103 mink, few were consumed. Hibernation would reduce the predation rate on this animal though occasional winter warm spells bring them (mostly Hylidae) out. Why a relatively large number of frogs were taken only in the 1950 - 51 winter, which was colder than average, cannot be explained. As with crayfish an birds, most (70%) frog remains — largely bones — were found in the intestines. The general absence of skin precluded identification beyond *Hyla* and *Rana*.

Sixteen (5%) tracts contained snakes, mostly watersnakes. The others: two garter snakes, two rat snakes and one unknown species. During the severe winter of 1948 - 49, snakes were eaten by 12 of 103 mink but in two mild winters in which the weather was warm enough for muskrats to mate in January, no reptiles were eaten. Why it happened this way cannot be explained. Despite numerous cottonmouth mocassins *(Agkistrodon pisciverus)* in the county, none were found and it is doubtful that minks eat them at any time except possibly as carrion. Non-poisonous snakes, however, are doubtlessly consumed more frequently during warmer seasons of the year.

Prey items in the droppings largely represent fall foods. Analyses of the 53 scats disclosed mammals (72%) the principal foods (Fig. 2). Of these, rice rats appeared in 22 (42%) droppings and deer mice in 13 (25%). Though common in parts of the Northwest River Marsh, only one of the 53 droppings contained muskrat — bones and hair of young animal (Fig. 4). Of 16 (30%) droppings that contained birds, king rail appeared in 6, black duck in 1. King rails are relatively plentiful in the area and black ducks — each year about 100 spend the winter on the 1,300 acre refuge — are common. Most of the unidentified birds were small passerines. Fish, plentiful in the digestive tract material, were found in only 7 (13%) scats. Minnows and other small forage fish made up the bulk of this food. Other foods found in small quantities were frogs, insects (katydid and beetles), crayfish, meadow mice, turtle, snail and spider.

FOOD OF OTTERS

In 1947, when the author came to North Carolina, trappers complained of the destruction of muskrat populations and other deeds committed by the otter. The principal complaints were: 1) otters tear open houses and devour muskrats in their beds; 2) consume muskrats in traps, and 3) create panic among muskrats, causing them to leave their homes. Scats at two large otter toilets on the outer banks were shown to me by a bitter trapper in 1949, but examination revealed that what looked like muskrat hair was actually the shredded feathered remains of waterfowl. At the time (January), the waterfowl season had just closed and marshes contained the remains of dead coots *(Fulica americana)* other dead waterfowl, and some crippled ducks unable to fly. Of the many hundred droppings the author has observed at toilets or pulverized for quick examination in the hand, almost everything excepting occasional feathers, has appeared to be either fish or crustaceans. Trappers (many are apprehensive of another closed season on otters) also observe similar droppings but despite the evidence, some still complain about muskrat-eating otters.

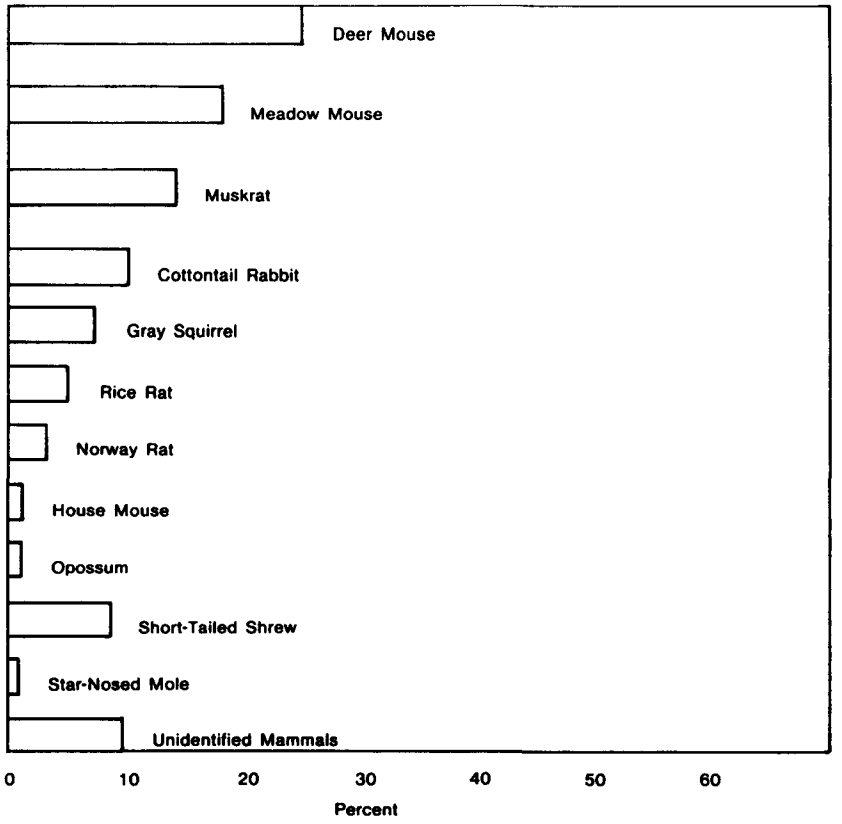

Fig. 3. Frequency indices of different mammals eaten in fall and winter by minks based on contents in 335 digestive tracts.

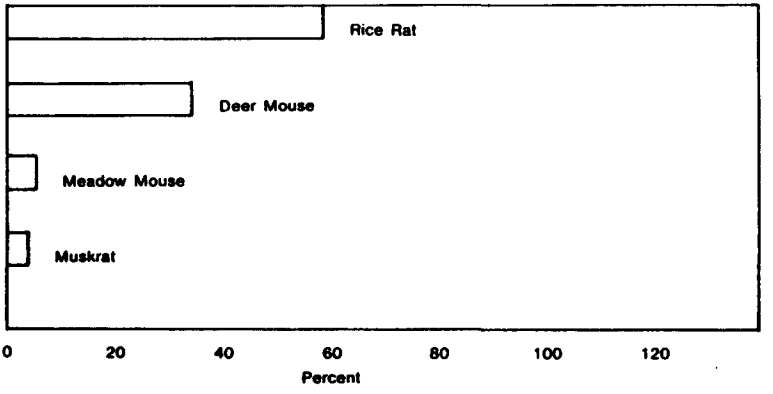

Fig. 4. Frequency indices of different rodents eaten by minks in fall based on contents of 53 scats from Northwest River Marsh.

The digestive tracts of 30 (56%) otters contained small quantities of masticated grass and woody vegetation, mud and sand. These materials, apparently ingested while the animal was in the trap, were not considered food.

Of 24 (44%) digestive tracts with food most of it was in the intestines. These data, coupled with the fact that a majority of the 54 tracts were empty, indicate most otters were found alive in traps.

The author does not know the rates of food passage through the alimentary canal. It was noted, however, that the intestinal content of fleshly food (fish and birds) remains was smaller by the proportion of food ingested than the intestinal content from consumption of hard foods (crayfish and crabs). In other words the exoskeletal remains of a couple of one-ounce crayfish would approach or exceed the residue from a one-pound bass. Awareness of this fact is important in evaluating foods consumed by otters and minks.

Droppings were composed of indigestible food remains, largely fish scales, pectoral fins, skeletal parts and chiten.

Fish occurred in 91 per cent of the tracts and scats and curstaceans — crayfish, blue crab, decapod, shrimp, in 39 per cent (Fig. 5). Of all the foods consumed, the volume of fish was estimated at 80 per cent and crustaceans 15 per cent. Traces of water beetle, (possibly eaten by fish) were located in five droppings. Birds (one king rail and two unidentified) were found in two scats and one tract. Scats (3) and

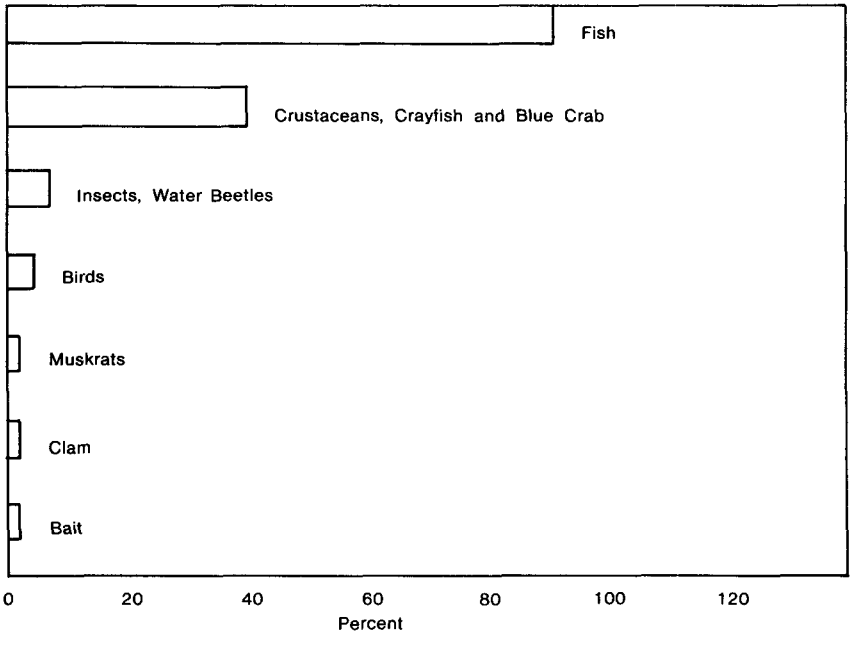

Fig. 5. Frequency of occurrence of fall and winter foods of otters based on contents of 24 digestive tracts and 61 scats.

tracts (2) contained the bones of five frogs, *Rana.* One stomach contained clam *(Pelecypoda)* and another stomach liver (bait). Intestines of one otter revealed the hair of an adult muskrat.

Since the objective of the study was to determine the role of otters as muskrat predators, no effort was made to identify all the fish species. However, an attempt was made to obtain approximate data on the frequency of their consumption by family (genera and species where possible). To do this the food in 10 stomachs and 20 droppings was analyzed.

Scales and skeletal remains of eleven families were represented in the material, six families of forage fish (57%) and five families of game and pan fishes (43%) (Table 1).

Forage Fishes

The bones and scales of carp *(Carpiodes cyprinus)* and chub sucker *(Erimyzon a. sucetta)* were found in ten study samples (Table 2). Carp occurs in greatest abundance in Currituck Sound and in rivers, where they are seined and trucked alive to large northern cities for human consumption. Most of the suckers are found in rivers and creeks.

Most remains were not identifiable beyond family, however, the skeletal parts and scales of shiners (probably *Luxilus cornutus)* and minnows *(Hybopsis)* were found in one tract and four scats. Small streams in the locality contain large quantities of these fishes.

Specimens *(Fundulus heteroclitus* and *Cyprinodon variegatus)* from two to three inches long were identified in three tracts and four scats. Very abundant in coastal waters, they are probably eaten more frequently than the samples show.

Bowfins *(Amia calva),* 2, and mosquito fishes, 2, were the other forage fishes represented. The first two are probably eaten in larger quantities than the study shows but mosquito fish are too small to be considered a principal food, especially when so many larger fish are available. Despite its abundance in many parts of the county, gars (Belonidae) were not among the foods recorded.

Game and Pan Fishes

Sunfishes and bass are abundant throughout the area, the latter being especially plentiful in Currituck Sound. Of eight occurrences, only three were identified to genus and/or species: red bellied sunfish *(Lepomis),* 2; common sunfish *(Eupomotis gibbosus),* 1; and large-mouthed bass *(Huro salmoides),* 1. Other fishes present that the otter doubtlessly eats are: blue gill *(Helioperca),* goggle-eye bass *(Ambloplites supestris)* and flier *(Centrarchus macropterus).*

The bones and spines of catfish were found in 5 study samples. Channel cats *(Ictalurus punctatus),* bullheads *(Ameiurus spp.),* and white cats *(Villarius catus)* that occur in the area are undoubtedly prey items.

White perch *(Morone americana),* 3, pickerel, 3, and yellow perch, 1, were other fishes identified. The principal specimens of marine fish were also recorded.

Table 1. Fall and winter foods of mink based on contents in 335 digestive tracts and 53 scats, 1947 - 48 and 1950 - 51.

Food	Frequency of Occurrence			
	Digestive tract	Per cent	Scat	Per cent
FISH				
Killifish *(Cyprinodontidae)*	204	61	7	13
Mosquito fish *(Gambusia)*				
Yellow perch *(Perca flavescens)*				
Sunfish *(Centrarchidae)*				
Catfish *(Ameiuridae)*				
Eel *(Anguilla bostoniensis)*				
Pickerel *(Esox)*				
Unidentified fish				
MAMMALS	115	34	38	71
Deer mouse *(Peromyscus sp.)*	28		13	
Meadow mouse *(Microtus sp.)*	21		2	
House mouse *(Mus musculus)*	1			
Rice rat *(Osyzomys p. palustris)*	5		22	
Norway rat *(Rattus norvegicus)*	3			
Muskrat *(Ondatra z. macrodon)*	16		1	
Rabbit *(Sylvilagus)*	11			
Gray Squirrel *(Sciurus carolinensis)*	7			
Opossum *(Dedelphis v. virginiana)*	1			
Short-tailed shrew *(Blarina telmalestes)*	10			
Star-nosed mole *(Condylura c. cristata)*	1			
Unidentified mammals	11			
BIRDS	59	18	16	30
King rail *(Rallus e. elegans)*	8		6	
Virginia rail *(Rallus limicola limicola)*	2			
Blackduck *(Anas rubripes)*	1		1	
Ruddy duck *(Exis matura jamaicensis)*	1			
Florida gallinule *(Gallinula chloropus sachinnans)*	1			
Flicker *(Colaptes auratus)*	2			
Whip-poor-will *(Setochalcis vocifera)*	1			
Unidentified birds	43	13	9	
ARTHROPODS	102	30	9	17
Crayfish *(Cambarus)*	44		3	
Insect	31		4	
Beetle *(Coleoptera)*				
Water beetle *(Dyteccidae)*				

Table 1. Continued.

Katydid *(Tettigonidae)*				
Spider *(Arenidae)*	13		1	
Wolf spider *(Lycosidae)*				
Decapod	12			
Shrimp *(Phyllopoda)*	2		1	
AMPHIBIANS				
Frogs *(Rana and Hyla)*	42	13	5	9
REPTILES	16			
Water snake *(Natrix sp.)*	11			
Garter snake *(Thamnophis)*	2			
Rat snake *(Elaphe)*	2			
Unknown snake	1			
Turtle *(Testudinata)*			1	
MOLLUSK				
Snail *(Planorbis)*	538		77	

SUMMARY

A 4-year (fall and winter) collection, 1947 - 48 and 1950 - 51, of mink and otter digestive tracts and a 2 year (fall of 1950 and 1951) collection of mink and otter scats included material most of which was from Currituck County.

An analysis of 568 digestive tracts, 335 of which contained food, and 53 scats disclosed that muskrat is a minor fall-winter food or mink.

Digestive tract food by frequency (61%) and volume was largely fish. Mammals (34%) and arthropods (30%), next in importance, were largely comprised of mice and crayfish, respectively. Of the birds (18%), most were small passerines. Among seven species identified, king rail was prominent. Other foods were frog and snake. Sixteen of the 335 tracts contained muskrat.

Mammal prey in mink scats from the Northwest River Marsh constituted more than 70 per cent of the food by frequency. The remainder consisted of birds, frogs, insects, crayfish, spiders, turtle, and snail.

Rice rats and deer mice were the most important prey items. Small birds ranked next, followed by fish and frogs. One scat contained remains of a young muskrat.

Otter foods, both in tracts and droppings, were largely fish. Of 24 tracts and 61 droppings, largely representing winter diet, fish by frequency was in more than 90 per cent. Other foods were crayfish, blue crab, water beetles, bird (mostly king rail), shrimp, clam, bait, and one muskrat.

Forage fish and game fish constituted 54 per cent and 46 per cent by frequency, respectively. Of the former, carps and suckers were favorites, while among the latter the choice was sunfish and catfish.

Food contents of 11 droppings collected in June 1951 from Pamlico County were principally fish (flounder) and crustaceans (blue crab, crayfish) but not muskrat.

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