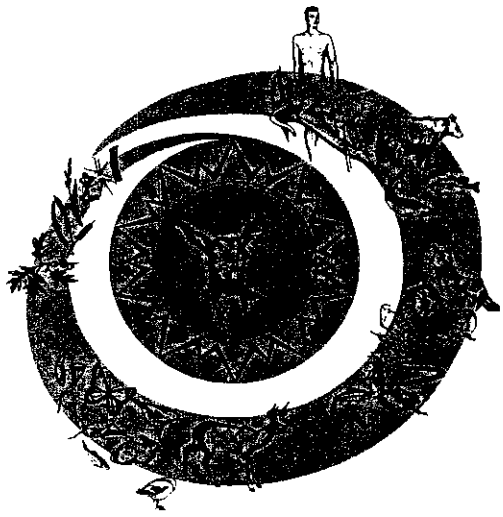

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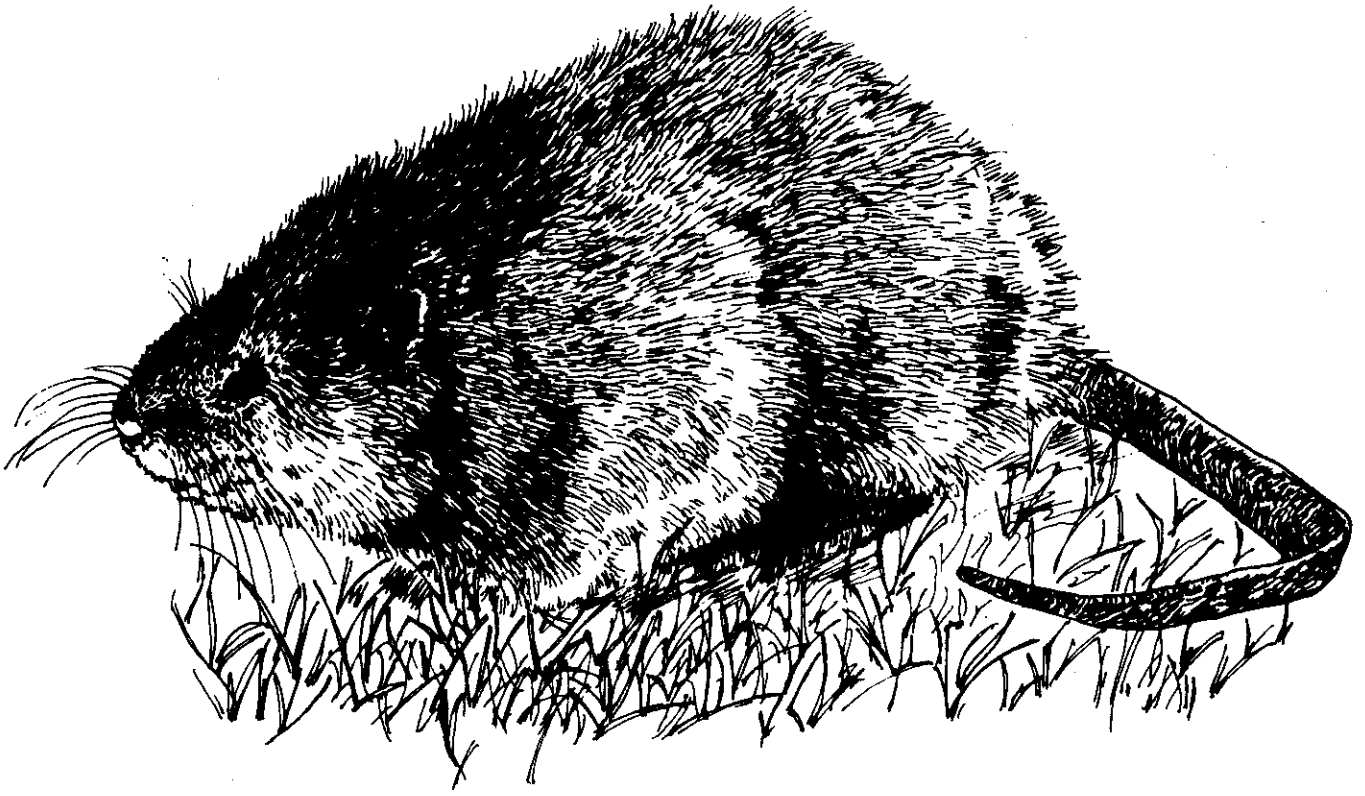
Muskrat *(Ondatra zibethicus)*

Description

The muskrat is a semiaquatic rodent (Order Rodentia). With its chunky body, short legs, short rounded ears, small black eyes, and broad, short head, the muskrat resembles its close relatives, the voles and lemmings. Fur color ranges from white and silver, to tan, chestnut, or black, but usually muskrats are a rich brown. Dense, fine gray underfur helps repel water and traps air, insulating the muskrat's body from cold. The volume of air trapped in the underfur may be as much as one-fifth of the animal's total volume. Long, dark, glossy guard hairs on the muskrat's back and sides function to protect underfur from matting and give the animal its rich, dark coloring. Underparts are paler, and may be pale gray, tawny, or cinnamon. Male and female adults are similarly colored.

Like the beaver, the muskrat's mouth is equipped with valvelike flaps that close behind the incisors (front teeth). This adaptation allows it to gnaw on vegetation underwater, without taking in water through its mouth. The muskrat's long tail is black or dark brown, nearly hairless, and covered with small scales. In contrast to the beaver's paddlelike tail, that of the muskrat is laterally flattened and is used as a rudder while swimming.

The muskrat's feet are dark brown or black. Hind feet are fringed at their outer edges with short stiff hairs. These large, broad hind feet are



partially webbed, an important aid in swimming. The front feet are smaller and are held against the muskrat's body when swimming. Four sharp claws and a "thumb" nail are present on each front foot, making them particularly efficient for digging. Front feet are also used for manipulating food and handling house-building materials.

The muskrat is approximately the size of a small housecat. On small ponds in Central New York State average total length is 563 mm (22.5 in) for males and 558 mm (22.3 in) for females. Average tail length is 262 mm (10.4 in) for males and 269 mm (10.8 in) for females. Male muskrats weigh an average of 1362 g (2.98 lbs) and the average weight of females is 1328 g (2.91 lbs). One large individual, a female, measured 616 mm (24.6 in) long and weighed 1899 g (4.15 lbs). In general, male and female muskrats are similar in size and weight. Size differences may be marked between populations of different genetic stock and between individuals living in different habitat types (e.g., streams, marshes, small ponds).

Distribution and Abundance

Muskrats are widely distributed throughout North America; they are found from near the Arctic Circle, south to the Gulf of Mexico. They inhabit the East Coast as far south as South Carolina. These furbearers have been

introduced (deliberately or accidentally) in California, Oregon, Louisiana, Europe and Asia. In New York State, the muskrat is one of the most numerous and most widely distributed furbearers, occurring statewide except in the higher elevations of the Adirondack Region. It is found even in marshes close to urban centers.

The muskrat population in an area may be estimated by counting the number of active muskrat houses during early winter. In New York State, an average of 3-4 muskrats occupy each house or den at that time. Populations within an area may fluctuate greatly from year to year due to changing local conditions. Fall populations may reach a high level of 20-30 muskrats per 0.4 ha (1 A) in marshes with high-quality habitat, and up to 100-150 muskrats per 1.6 km (1 mi) along watercourses. On the other hand, a population within a particular area may be almost entirely extirpated by a disease, such as tularemia. Differences in trapping harvests of muskrats reflect such population fluctuations; for example, in Central and Western New York (where about 50% of the state harvest occurs) the number of muskrats trapped decreased by 22% from the 1980-81 to the 1981-82 season. Still, the muskrat is the most abundant furbearer in New York State. In 1980-81, trappers harvested between 700,000 and 1,000,000 muskrats statewide.

Life History

The muskrat acquired part of its common name because of its musky scent. This odor is especially apparent during the breeding season. Both males and females possess musk glands near the anus at the base of the tail. Scent from these glands is deposited near houses and dens, along trails, and sites where they defecate. The musky scent probably functions as a means of communication (for sexual attraction).

The muskrat breeding season typically begins in March in New York State. Muskrats are territorial prior to and during the breeding season. Males, especially, may fight with one another during this time. In a local muskrat population, dominant individuals may drive away low-ranking individuals from prime habitats.

The breeding association between male and female muskrats appears to be promiscuous or loosely monogamous for a breeding season. The pair may live together, sharing in house building and maintenance, or adults may live apart throughout the year. The first litter of muskrat "kits" is born in April or

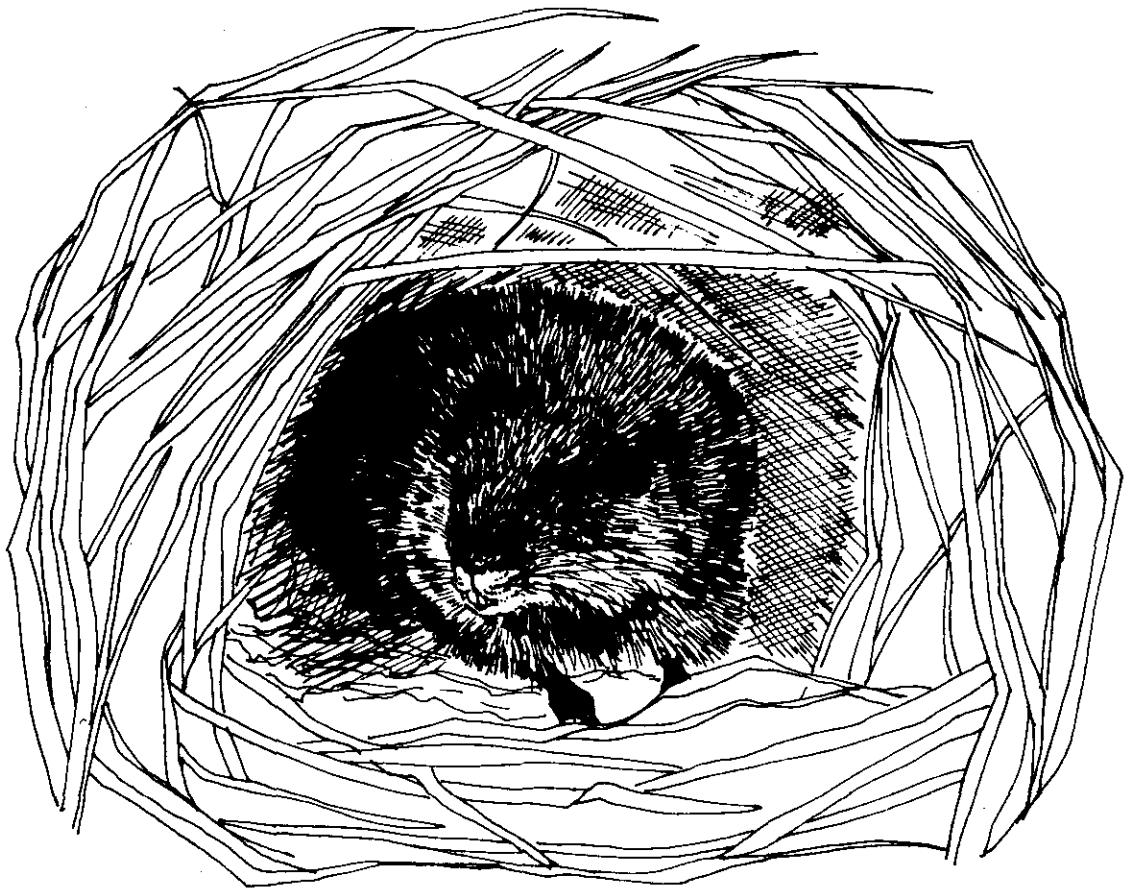
May, after a gestation period of 25-30 days. The females may mate again only 10 days after giving birth to the first litter. In New York State, about 50% of the female muskrats living in small bodies of water will give birth to a second litter in June or July. The number of litters per female per year varies according to the subspecies, habitat type, habitat condition, and population density. In general, muskrats living under stress presented by low quality habitats have fewer litters per year and fewer young per litter. In New York State, a few female muskrats may bear a third litter in August.

The female muskrat may give birth to 1-11 kits. In New York State, the average litter size is about 6 young. The female cares for the young in a nest chamber lined with grass or other fresh vegetation. Nests are located either in an underground burrow or in a muskrat house.

Muskrats are born blind and nearly hairless. When one day old they weigh an average of 23 g (0.81 oz) and average about 102 mm (4.08 in) in total length. The kits grow rapidly. When one week old they weigh about 46 g (1.61 oz) and are about 150 mm (6.0 in) long. When 14-16 days old, young muskrats have open eyes, are covered with a fine gray fur, are able to swim and dive, and begin to eat small amounts of vegetation. They weigh about 74 g (2.59 oz) and are about 191 mm (7.64 in) long. The kits are weaned when 4 weeks old and become independent at that time. By then, the muskrats are about half-grown. They are full-grown within 6-7 months. Most muskrats breed during their first spring. However, very infrequently in New York State, young will breed during the same year in which they were born.

Adults (males and females) and young all participate in house or den building and maintenance. Muskrats build several different types of structures. The most well-known structure is the muskrat "house", within which the kits are born and reared. Here, also, several 'rats may huddle to keep warm during the winter. Muskrats do not live in colonies, like beavers. This winter aggregation of muskrats is temporary; as the breeding season approaches they become aggressive toward each other.

Rotted debris (logs, vegetation) on the pond or marsh bottom usually forms the base for the house, usually in about 0.6 m (2 ft) of water. Upon this the muskrat piles debris of a variety of nonwoody aquatic vegetation; it gathers nearby mud and root masses, stems and other parts of plants, such as cattails, to add to this mound. In this process the marsh bottom is excavated slightly, as mud is scooped up to form the mound. Then, from



underwater, the muskrat excavates one or more "plunge holes" in its pile of debris. It hollows out dens above the water level in the center of the pile. Material taken from the inside is used to strengthen the outer wall of the house. When completed the house is an elliptical mound usually 90-180 cm (3-6 ft) in diameter, and rising about 30-120 cm (1-4 ft) above the water surface. The walls of a house are at least 30 cm (1 ft) thick. Each nesting chamber is about 30 cm (1 ft) in diameter. Muskrat houses vary in size; larger houses may have more nesting chambers, tunnels and plunge holes. Occupied houses may be identified by food wastes floating nearby or beneath the ice in winter.

Muskrats build "feeding shelters" which look much like the houses. In fact, houses and shelters are built in the same manner. Feeding shelters are circular, however, and only about 30-45 cm (1-1.5 ft) tall. This structure provides a short-term refuge for one muskrat while it feeds.

In fast-moving water the muskrat excavates a burrow in the streambank or riverbank instead of building a house. This animal may also burrow into banks of ponds or marshes. Tunnels have their entrances under water and are

12.5-15 cm (5-6 in) in diameter and 3-15 m (10-50 ft) long. They lead to one or more nest chambers above the water level. The chambers, or dens, may be ventilated by small vertical tunnels, with the air holes hidden under tree roots, shrubs, or among other vegetation.

Although muskrats are mainly nocturnal, they may occasionally be active during the day when building structures, swimming, or sunning themselves. They remain active throughout the year. Building activity peaks from late May to early June and again in early October. In winter, these industrious rodents construct a third type of shelter called a "push-up". The muskrat creates these by cutting a 10-12.5 cm (4-5 in) hole in the ice, into which it pushes uneaten food or other vegetation (e.g., certain fibrous roots and submergent vegetation). Eventually, about one bushel of material may accumulate in a mass 30-45 cm (12-18 in) in diameter. A cavity is formed in the middle at ice level. Muskrats use the push-ups as feeding shelters or as "breathers". The push-ups collapse when the ice thaws in the spring. Muskrats also create channels or runways through aquatic vegetation and mud. Under-ice tunnels provide access to favorite winter feeding areas.

Muskrats typically retire to the safety of their shelters or to a partially submerged stump or log to feed, nest, or preen. These herbivores eat the roots, stems and shoots of aquatic plants. In fact, when food is scarce, they may eat some of the vegetation from their houses. Cattail is a preferred food. Muskrats eat the tender inner parts of cattail stalks during the summer, the shoots during the winter, and the rootstocks throughout the year. Muskrats tend to be larger and healthier in marshes where cattail is abundant. Other foods preferred by muskrats include bulrushes, burreed, rice cutgrass, and arrowhead. They also eat sedges, pondweeds, duckweed, smartweed, water lily, sweet flag, and panic grass. Occasionally they will eat the leaves and bark of willow or other succulent shrubs. Along streams and rivers, muskrats may eat grasses, grains, clover, alfalfa, soybeans, dandelion roots, corn, apples, and garden vegetables such as carrots. On rare occasions, a muskrat may take animal food including crayfish, insects, freshwater clams, snails, frogs, young turtles or birds, carrion, or fish.

The muskrat is a proficient swimmer. It swims using its hind feet and holding its nose out of water. A muskrat is able to swim forward, backwards and underwater. It can remain submerged up to 20 minutes.

Most feeding activity occurs within a 5- to 10-m (16.5- to 33-ft) radius of a house or push-up. During most of its life, the muskrat remains within a few hundred meters of its house. A muskrat living along a stream or river rarely moves more than 0.4 km (0.25 mi) up or downstream. Muskrats require larger home ranges in poor-quality habitats. These rodents demonstrate a limited homing ability, but if they are taken about 3.2 km (2 mi) from their home areas they probably will not return.

Many muskrats emigrate over long distances during the spring or fall. Spring movements usually begin in late February and continue through early March. As much as 40% of a muskrat population may disperse distances over 1 km from the original habitat.

There are several reasons for such extensive movements. In the spring, young may disperse primarily in search of mates. In the fall, subadults expand their territories away from the parental territories. Movements may occur when the habitat becomes unsuitable; for example, when water levels become too low or too high. A major reason for the muskrat's long-distance movements is a population density too high for the habitat to support. In such instances, especially, a phenomenon called "intraspecific strife" occurs. This "strife" is competition for superiority within a given population. When muskrats compete for breeding sites, larger or older individuals nearly always occupy the best sites. Both males and females defend their territories by driving off other individuals, especially the weak and the young. Female muskrats are often more aggressive than males, sometimes killing intruders or their own young in the attempt to drive them away.

As a result of these large-scale dispersal movements, population pressure within an area is reduced, and the emigrants populate new habitats. During their journeys overland, or in outlying marginal habitats, the low-ranking muskrats are much more vulnerable to cannibalism, predation, and disease. This further serves to reduce the muskrat population. Muskrats provide an example of how dispersal serves as a built-in, natural mechanism of population regulation.

Cars, droughts, and floods kill a small proportion of muskrats each year. Widely fluctuating water levels increase muskrats' exposure to predators. In good habitats, predators (including humans) seldom drastically affect muskrat numbers. Humans are a major cause of muskrat mortality. In

New York State, mink are significant predators on muskrats. Other predators include hawks (especially the marsh hawk), owls (especially the great horned owl), bobcats, house cats, foxes, dogs, coyotes, raccoons, skunks, river otters, weasels, snapping turtles, large snakes, northern pike, pickerel, and largemouth bass.

Muskrat diseases include: hemorrhagic disease (Errington's disease), yellow fat disease, tularemia, adiaspiromycosis, epizootic chlamydiosis, leptospirosis, pseudotuberculosis, salmonellosis, Tyzzer's disease, and ringworm diease. Endoparasites (internal parasites) of muskrats include: trematodes, nematodes, and cestodes. Ectoparasites (external parasites) include a variety of ticks, mites, and fleas. New York State muskrats may at times be heavily infested with the tick Ixodes muris during summer.

Muskrats are sensitive to severe cold and may die if exposed to subzero or suddenly changing temperatures. Mortality due to combinations of predation, disease, and intraspecific strife may be very high. Up to 50-65% of the summer population of muskrats in a particular area may die before January of any year. Muskrat longevity is about 3-4 years.

Besides the variety of muskrat-made structures, these semiaquatic rodents leave many other signs of their presence. Each of the muskrat's feet has 5 toes, although the "thumb" on the forefoot rarely makes an imprint. The hindfoot imprint (about 7.5 cm [3 in] long) may appear in front of, behind, or on top of the forefoot's imprint (about 5 cm [2 in] long). Footprints are handlike in shape. The walking stride is about 20 cm (8 in) long, and the trail's width is about 8.8 cm (3.5 in). Often, the muskrat's tail leaves a central, wavy line.

Muskrat fecal droppings, or scats, are elongate, about 1.6 cm (0.6 in) long, and are found in clusters. Scats may be found on the bank, on rocks, or on logs in the water. Other muskrat "sign" includes food remnants (e.g., plant stalks, roots, clamshell heaps) floating on the water or scattered on the bank near preferred feeding sites. Scent posts are located along banks, and function in communication. These are small mats of cut vegetation, sometimes mixed with mud, and marked with the odor from the animal's musk glands. Muskrat scent posts are not as obvious as those left by beavers.

Habitat

Muskrats are found in a variety of habitats adjacent to or in water. They require a sufficient supply of fresh or slightly salty water for

swimming and sanitation. Another habitat requirement is an abundance of aquatic vegetation for food, cover, and use in building shelters. If this feature is not present, the muskrat will feed on other succulent, green vegetation near the waterway, and it will burrow into the pond or streambank to establish its den. Finally, a third essential for muskrat habitat is suitable soil in which to dig burrows and channels.

Muskrats prefer habitats with still or slow-moving water because these habitats typically have the vegetation muskrats feed upon. They are especially abundant in extensive shallow marshes. Muskrats may be present, but are least abundant in small, fast-moving streams. Optimum muskrat habitat consists of a marsh with about 20% open water and 80% emergent vegetation. These furbearers are present in sluggish streams, canals, and rivers, especially if aquatic vegetation is plentiful. They also commonly inhabit ponds and lakes which experience only slight seasonal fluctuations in water level. In the spring, a sudden rise in water level will drown young muskrats in the dens. Extremely low water level for long periods in the summer may halt breeding activity and decrease the survival rate. If too shallow in winter, the water will freeze completely and food will be inaccessible. In suitable habitat, water depth is 15-50 cm (6-20 in) during the summer and at least 0.9 m (3 ft) during winter.

Ecological Role

A muskrat population plays an important role in controlling the growth of emergent aquatic vegetation. Muskrats feeding on this vegetation produce more and larger areas of open water, making the habitat more suitable for waterfowl and other aquatic life. In the extreme, however, a muskrat population too high for the habitat to support may decimate the aquatic vegetation. This is called "eat-out".

Structures built by muskrats from aquatic vegetation are used as nesting platforms by Canada geese and other birds and mammals.

As herbivores, muskrats play on important ecological role in converting plant material into animal tissue. In turn, muskrats provide food for a variety of predators. For example, an increase in the muskrat population of an area may be followed by an increase in the mink (which prey upon muskrats) population the following year. Then, the increase in mink numbers may be followed in the the next year by a decrease in the muskrat population. These

predator-prey relationships offer evidence of the interdependency of members of the wildlife community. Most researchers report that muskrats usually follow approximately a 10-year cycle in population fluctuations.

Another important ecological role is that muskrats may act as indicators of environmental quality. For example, these aquatic rodents accumulate heavy metals in certain body tissues. These tissues can be analyzed to monitor heavy metal contamination of the environment. Exposure to even moderate amounts of crude oil may kill muskrats. By examining muskrats, humans may be able to discover pollutants in certain aquatic environments.

Management

In New York State, the muskrat is managed primarily as a furbearing species. Trappers here harvest several hundred thousand muskrats each year to supply the fur market. This animal's extremely high reproductive rate makes such a harvest possible each year. Humans may kill more muskrats than any other mortality factor, but regulated trapping as it is now practiced will never extirpate muskrats in New York State. Furbearers are a renewable resource that can be managed on a sustained yield basis.

Wildlife managers have long known the value of muskrat management in marshes. By controlling the number of muskrats (through regulated harvest), wildlife managers can achieve a density of emergent vegetation which is optimum for nesting waterfowl.

Private landowners, too, can manage muskrats. Those wishing to improve muskrat habitat may choose from some widely-used techniques. Controlled burning or well-timed, temporary water draw-down in the marsh will encourage growth of food plants. Ditching provides more open water and more potential burrow sites for muskrats. Once a muskrat population is well-established, it may be managed on a sustained yield basis. Trapping will keep the population fairly stable. Landowners should seek professional advice before attempting muskrat management practices.

Economic and Social Values

The muskrat is North America's most abundant furbearer; trappers harvest between 15 and 20 million annually. This harvest rate is six to seven times higher than the harvest rate of any other furbearer.

American Indians taught the European settlers that muskrats are edible. (The Iroquois word for muskrat, ondatra, is still used today as the scientific name for the genus to which this animal belongs.) The muskrat became important in the New World economy, as a source of food and fur and as a valuable trade commodity. The muskrat's meat is still eaten; today it is sold under the misnomer "marsh rabbit". But this animal's greatest value is its fur. In New York, one of the most productive of the muskrat-inhabited states, income to trappers for muskrat pelts usually exceeds $1 million per year. In 1981-82, New York State trappers received a total of $1.9 million for muskrat pelts. The cash value of one muskrat pelt may be relatively low, but the total income is high due to the large number harvested. In New York State it is typical for more muskrats to be trapped than all other furbearers combined. Trappers are not the only individuals who benefit economically; fur dressers and garment makers in the garment industries are employed to handle muskrat pelts. This renewable resource, with its extremely high reproductive rate, will continue to provide people with a "cash crop" and with a recreational activity. Muskrats may transmit tularemia to humans. For this reason, humans should avoid handling dead or dying muskrats if the cause of death is unknown. While skinning 'rats, rubber or plastic gloves should be worn.

These rodents may be detrimental in some situations. Muskrats occasionally damage agricultural or ornamental crops growing near water, but they are most noted for their damage to water-retaining structures due to burrowing. During the era of transportation by canal in the mid-1800's, canal companies paid bounties on this burrowing rodent. Muskrats burrow into earthen dams, dikes, levees, and railway embankments, thereby weakening these structures. Their activities also damage the banks of canals, farm ponds, and irrigation and drainage ditches. Small farm ponds can suffer the heaviest muskrat damage; muskrat tunnels may even drain a pond.

Control Methods

The most effective solution to muskrat damage problems seems to be annual trapping. Muskrats are not trap shy and may be taken with No. 1 or No. 1 1/2 steel traps or body-gripping traps. During the regular muskrat-trapping season this method assures taking prime pelts of considerable value.

Other control methods focus on making the habitat less attractive to muskrats. Frequent mowing of grassy areas around the pond discourages muskrats by reduction of their food and shelter. Earthen dikes may be protected by rip-rapping in the shoreline with flat, closely fitted stones or a layer of very coarse gravel or crushed stone. Loose material should be 0.2 meters (8 in) or more thick, and any such surface protection must extend 0.9 m (3 ft) below and at least 0.3 m (1 ft) above the normal water level. Other materials such as poultry wire and asbestos board have been used to protect dikes, but these deteriorate quickly. Concrete cores at the center of dikes are sometimes used to prevent muskrat damage.

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(Illustrations drawn by Donna Curtin.)