

Muskrats

James E. Miller
Professor Emeritus
Mississippi State University
Starkville, Mississippi



Figure 1. Muskrat (*Ondatra zibethicus*)

Human-Wildlife Conflicts

The muskrat (*Ondatra zibethicus*) is a common, semi-aquatic rodent native to the United States (Figure 1). It spends its life in aquatic habitats and is well adapted for swimming.

Although muskrats are an important part of native ecosystems, their burrowing and foraging activities can damage agricultural crops, native marshes and water control systems, such as aquaculture and farm ponds and levees. Such damage can significantly impact agricultural crops like rice that rely on consistent water levels for growth.

Muskrats also cause damage by eating agricultural crops, other vegetation, and crayfish, mussels and other aquaculture products. Loss of vegetation from muskrat foraging can impact marsh viability and habitats for other species, including waterfowl. Habitat restoration often takes years, negatively impacting fish and wildlife.

Economic losses due to muskrat damage in Arkansas, California, Louisiana and Mississippi likely exceed most other states combined, primarily because of the vast amounts of productive marshlands and types of crops (i.e., rice, fish, crayfish and vegetable crops) grown in those states.

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Figure 2. Typical marshland habitat where muskrat may be found.

Landscapes

Muskrat damage to agricultural crops and aquaculture can significantly impact crop yields and economic investments. In states where damage occurs, regulations regarding the lethal removal of muskrats is often relaxed to allow for damage control.

Marshland habitats (Figure 2) and their associated wildlife communities can be substantially changed when muskrat populations erupt leading to “eat-outs.” “Eat-outs” are areas where vegetation is completely removed due to foraging by muskrats. These areas may take several years to recover.

Structures

Muskrat burrowing can cause structural damage to dams, dikes, railroad/road beds and levees. Erosion due to muskrat burrows and dens may cause cave-ins and the collapse of some structures. The economic impact can be substantial to aquaculture facilities, if levees or water sources are impacted.

Human Health and Safety

Muskrats can carry and transmit several infectious diseases to people. Of most concern is tularemia, a bacterial disease that is transmitted through contaminated water, infected meat or an open cut. Signs

of tularemia infection include lethargy, fever, flu-like symptoms and infected sores. Tularemia can be life-threatening to people and proper protective gear (i.e., rubber gloves) should be worn when handling muskrats.

Muskrats also serve as reservoirs for numerous other diseases including hemorrhagic disease, leptospirosis, ringworm disease and pseudotuberculosis. In addition, muskrats can carry parasites, such as tapeworms, roundworms, flukes, ticks and mites.

Rarely do muskrats attack people unless captured. Use caution when handling live muskrats as they will bite and scratch with their clawed feet.

Damage Identification

Muskrat damage includes chew marks or stripped bark on trees, and partially eaten stalks on agricultural crops or wetland vegetation, such as cattails, sedges and water lilies. Where freshwater mussels are eaten by muskrats, caches of mussel shells can be found on vegetation rafts or near resting and feeding sites used by muskrats.

Depending upon site conditions, muskrats either dig dens in steep banks or build dome-shaped lodges in open water using vegetation and mud (Figure 3). Burrowing may not be evident until serious damage has occurred. Signs of muskrat damage to banks from their burrowing activities include burrow entrances, erosion and cave-ins. One way to observe early burrowing is to walk along the edge of the dam or shoreline when the water is clear and look for “runs” or trails from just below the surface of the water to as deep as 3 feet.

Several other aquatic mammal species (e.g., American beaver (*Castor canadensis*), nutria (*Myocaster coypus*) and river otter (*Lutra canadensis*)) may inhabit the same rivers, streams, lakes, ponds and marshes as muskrats. Muskrat damage can be distinguished from these other species’ damage by the type of vegetation and animal matter consumed. Also look for differences in the size of the animals’ tracks or droppings, the size and locations of

burrows, the type of lodges/houses built, and other behavioral and physiological characteristics (See section on Physical Description for more information).

Most muskrat damage is caused by their burrowing into pond dams, levees, aquaculture structures and other sites. Other damage includes foraging on grain crops, particularly rice, occasional vegetation “eat-outs,” and gnawing into floatation materials or structures around boat docks or platforms. Unlike other species, such as beaver, muskrats do not build dams, cut down trees, stop up culverts and pipes or create lodges from gnawed down trees and limbs. Muskrat do not cut down small trees, sugar cane or corn stalks like nutria and beaver do in some areas. River otter damage is most often associated with predation on fish and other aquatic species in farm ponds and aquaculture facilities.

Muskrat burrow entrances are typically no larger than 5 to 6 inches (12 to 15 cm) in diameter, whereas beaver and nutria burrow entrances can be 14 to 20 inches (35 to 50 cm) in diameter.

Management Methods

No single management method to prevent muskrat damage works all the time or in all settings. Generally, management methods should be combined so that one method enhances the effects of another.

Timing of control efforts is important. For instance, prime fur trapping season for muskrats is in the fall and winter when the muskrats’ coats are thick. This coincides with a decrease in open water habitats that muskrats depend upon. Thus, the trapping of muskrats during winter is not only economically worthwhile, but also easier since overwintering habitats are limited. Winter trapping also helps reduce the number of muskrats likely to cause damage the following spring.

Habitat Modification

The best way to modify the habitat to prevent muskrat



Figure 3. Muskrat lodge made of vegetation and mud.

damage is to eliminate aquatic vegetation or other suitable foods eaten by muskrats. This can be done using prescribed burns to reduce marsh vegetation.

Modifying the habitat by depleting water storage canals used for irrigation when no longer needed and removing water from rice fields after harvest can reduce muskrat overwintering habitat and make trapping more effective.

If farm ponds or levees are impacted by muskrats, draw down the pond’s water level at least 2 feet below normal, then fill dens, burrows and runs, and rip-rap the dam with stone.

Exclusion

Excluding muskrats from areas is difficult given the varied habitats they use. Fencing or other barriers may be worthwhile to prevent damage to specialty crops or urban and suburban lawns that are adjacent to aquatic habitats.

Fertility Control

None available.

Frightening Devices

Although some commercial frightening devices are available, they typically are not effective at preventing muskrat damage.

Repellents

No repellents are currently registered for use with muskrats and none are known to be effective, practical or environmentally safe.

Shooting

In some states, it is legal to shoot muskrats. Before attempting to shoot muskrats, check regulations and, if applicable, secure the appropriate permits.

In areas where small populations of muskrats exist, shooting can be an effective method for reducing damage. Shoot in the early morning or late afternoon. The best firearm to use is a shotgun with small shot (e.g., number 4 or smaller pellets), if range is 30 yards or less. Other firearms such as .17 or .22 rimfire rifles can be effective when targeting the animal's head or chest. Make sure to avoid ricochets, if shooting toward water.

Toxicants

The only toxicant currently registered by the U.S. Environmental Protection Agency for use on aquatic rodents is Zinc Phosphide Concentrate (EPA Reg. No. 56228-6). It must also be registered in the state of intended use. This toxicant can be used with bait materials, such as apples, carrots, pears and sweet potatoes, and made accessible to muskrats by placing near burrows or on floating feeding stations. Before using, carefully read and follow label instructions and use restrictions.

Trapping

Trapping is commonly used for reducing muskrat damage. A variety of traps exist including foothold traps, colony traps and body-gripping traps. Effectiveness is dependent upon the trapper's skill, knowledge of muskrat behavior, trap type used and persistence. There are many commercially available baits and lures for attracting muskrats to trap sets, such as feed bed sets.

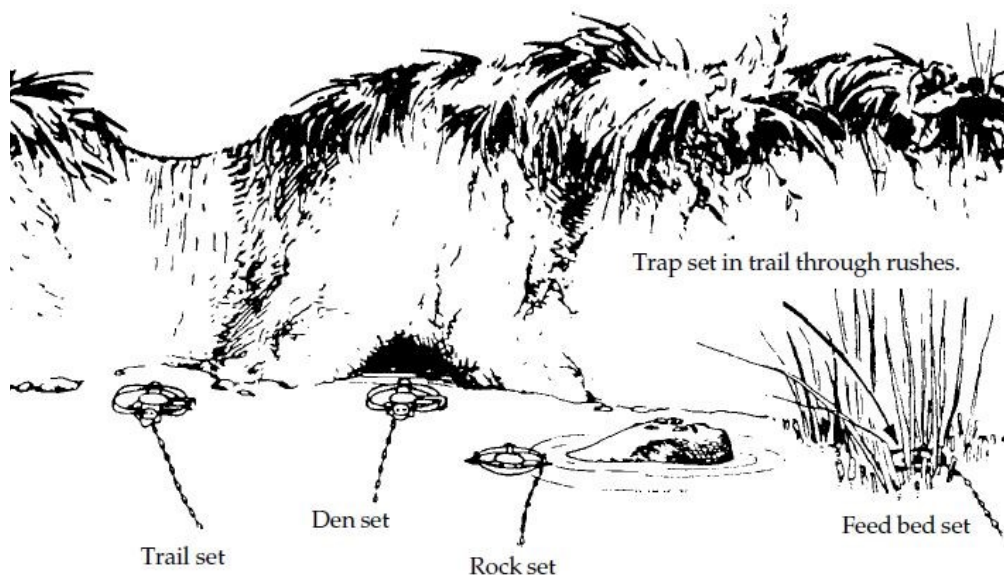


Figure 4. Four foothold trap sets for muskrats. Note: All traps are placed underwater. Chains are wired to anchors in deep water.

Before utilizing traps, the user should check current regulations regarding the status and take of muskrats in the state where they intend to trap. Some states have regulations applicable to the transfer or relocation of animals, euthanasia and disposal. Traps used for muskrat control include the following:

- **Body-gripping type traps** (#110, #120, #160 size): extremely effective when used in underwater sets and properly placed in burrow entrances and runs.
- **Foothold traps** (sizes 1, 1 ½, or 2): effective in underwater sets near burrow entrances or other commonly used locations (Figure 4).
- **Species-specific traps** (i.e., stovepipe or colony trap): effective if properly placed in runs or burrow entrances; can take multiple animals per night when completely submerged.
- **Live-cage type traps:** not commonly used because of the animal's aquatic habits; translocation of live muskrats is not allowed in most states.
- **Cable devices:** not commonly used because of the animal's shape and difficulty in snaring.

For more information, please see the Association of Fish and Wildlife Agencies' publication "Best Management Practices for Trapping Muskrat in the United States."

Euthanasia

If traps are properly placed in deep enough water, euthanasia is not necessary as the muskrat will drown in the trap.

For live-trapped muskrats, a gunshot to the head (targeted to destroy the brain) is an approved method of euthanasia by the American Veterinary Medical Association. Where guns are prohibited, manually applied blunt force trauma to the head may be used to euthanize muskrats.



Figure 5. Muskrat is a stocky rodent with a vertically flattened tail.

Disposal

Check local and state regulations regarding carcass disposal. In some areas, trappers process and sell the fur from muskrats and retain the meat for personal use or sale for human or domestic pet consumption.

If using the toxicant Zinc Phosphide Concentrate, follow label directions for appropriate carcass disposal.

Economics

Economic losses due to muskrat damage can be very high in some areas, particularly in agriculture and aquaculture producing areas. In some states, damage may be as high as \$1 million per year. Totals in four states (Arkansas, California, Louisiana and Mississippi) exceed losses throughout the rest of the United States.

Elsewhere, economic losses because of muskrat damage may be rather limited and confined primarily to burrowing in road beds, railroad beds, farm ponds, lake lots or golf course ponds. In some cases, the value of the muskrat population may outweigh the cost of the damage.

Muskrats also provide economic benefits. Muskrat pelts processed annually are valued in the millions of dollars, even with low prices. The species also provides ecological

benefits, influencing wetland structure and function and serving as a prey species for other wildlife. Muskrat lodges create nesting habitat for many different waterfowl.

Species Overview

Identification

The muskrat belongs to the Family Cricetidae in the Order Rodentia. It is found primarily in marshes, wetlands and other aquatic habitats throughout North America. A similar species, the round-tailed muskrat (*Neofiber alleni*), is found only in the southeastern United States.

The name “muskrat” is derived from a musky yellowish secretion males use to mark territories and attract mates during the breeding season.

Physical Description

Although sometimes confused with beavers or nutria, muskrats are much smaller. A muskrat’s tail is narrow and vertically flattened versus wide and horizontally flattened (beaver) or round (nutria). They are stocky rodents with small eyes, very short rounded ears, and a vertically-flattened, slightly scaled tail that is almost as long as their body. A muskrat’s front feet are considerably shorter than



Figure 6. Range of muskrat (*Ondatra zibethicus*) in North America .

its hind feet and are adapted for digging and feeding. The large hind feet are partially webbed, with stiff hairs on the toes that aid in swimming (Figure 5).

The average weight of muskrats varies geographically with larger animals usually found at more northern latitudes. Most male muskrats weigh around 2.5 lbs. (1.1 kg) with rare specimens weighing as much as 4 lbs. (1.8 kg). Male muskrats can reach overall lengths of 30 inches (76 cm) although most range from 18 to 24 inches (46 to 61 cm) with approximately 10 to 12 inches (25 to 31 cm) of that length coming from their tail. Females are slightly smaller

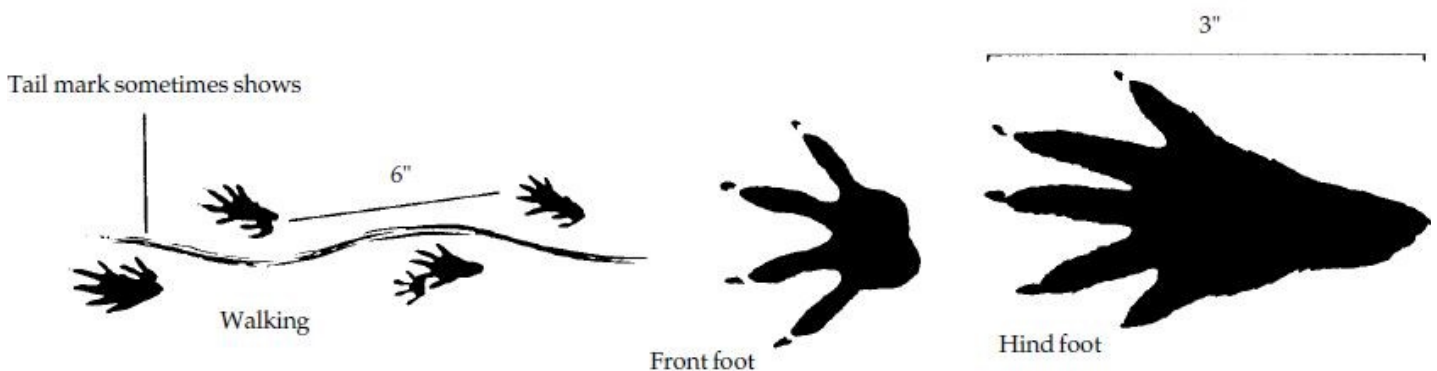


Figure 7. Muskrat tracks

than mature males, although just before parturition (i.e., giving birth) some mature females may weigh as much as or slightly more than males.

Muskrats' fur color varies both geographically and seasonally. The color of the belly fur ranges from light gray to silver to tan. Remaining fur varies from dark tan to reddish brown to dark brown and even black, with the darkest animals usually located in the northern-most portions of the species' range.

Range

The 16 subspecies of *Ondatra* muskrats in North America are widely distributed (Figure 6). They are found from northern Mexico to northern Alaska, and most of northern Canada. The round-tailed muskrat is found primarily in Florida and parts of southern Georgia. Muskrats are not commonly found in dryer, desert type habitats.

Voice and Sounds

Young muskrats squeal when wanting attention from their mother. Adults often emit low squeals and snarls when cornered or a chattering sound when fighting.

Tracks and Signs

In addition to tracks seen in the mud (Figure 7), muskrat signs include dome-shaped lodges made from vegetation and mud, and burrows. Their burrows are often seen in levees, pond banks, lake shores and along ditches. When the water is clear, active burrows are identified by the muddy appearance of the water adjacent to the burrow openings.

Fecal pellets are usually discharged randomly, but occasionally a group of 3 to 12 green to gray or even black oval pellets will be found on a vegetation raft or a grooming location like the end of a partially submerged log or exposed rock. Signs, such as partially eaten stalks or other vegetation or piles of opened and discarded freshwater mussel shells, may indicate the presence of muskrats in the area.

Reproduction

In most locations, muskrats are not sexually mature until around one year old, and females usually produce their first litter around that age. However, in Louisiana, female muskrats have been found pregnant as early as 6 to 8 weeks old.

Most breeding occurs in the water with both the male and female being partially submerged. Copulation lasts about 4 to 5 minutes. Males do not have teats. Females usually have four pair (occasionally 5 pair) of teats located on the belly between the front and hind legs.

The average number of young per litter varies with location. Litters born in northern locations (e.g., above 37° N latitude) average 4 to 7 kits per litter, with 3 or fewer litters per year. Southern locations tend to have smaller litter sizes (i.e., usually 3 to 4 kits per litter), but breeding occurs year-round with 3 to 6 or more litters produced each year depending on habitat conditions and food availability.

Muskrat populations can expand rapidly if plenty of food and territory are available. However, because of territorial conflicts, predation, competition and other mortality factors, rarely does a population double its size. In fact, only in newly populated habitats do populations "erupt" significantly. Most populations are cyclic, varying with location and other factors, such as food conditions and high and low water levels.

The estrous, gestation, weaning and dispersal periods for muskrats vary with habitat and geographical location. Muskrats are polyestrous with estrous cycles lasting from 2 to 30 days. Males and females are polygynandrous or loosely monogamous. Gestation periods vary from 19 to 30 days with the average being 28 to 30 days in most adult females.

Young kits may nurse for up to 21 days and are weaned by or before 4 months of age. Kits are independent by that time and are often dispersed by the female as she prepares to give birth to another litter. Males do not participate in the rearing of the kits. Although breeding can occur year-round, seasonal peaks are usually from October through June with many young born in March.

Denning

Muskrat dens are found either in ground burrows or in partially submerged domes of vegetation. Muskrat dens in sloughs, ditches, lakes, streams and farm ponds are predominantly located in underground burrows. The burrow's submerged entrance is usually 6 to 12 inches (15 to 30 cm) below the surface of the water (Figure 8). In habitats with stable water levels and abundant aquatic vegetation, dens are most often found within domes of vegetation with underwater entrances. Underground dens may have multiple entrances.

Mortality

Although muskrats have a high reproductive potential, they usually have a short life span. Primary causes of muskrat mortality are hunting and trapping, disease, predation, climatic conditions, parasites, and competition including interspecific strife (i.e., fighting with other muskrats).

In places where muskrats are considered a nuisance animal, population control via hunting and trapping can occur year-round. Before initiating control efforts, check state fish and game agency regulations for allowed methods and seasons.

Juvenile mortality rates vary with geographic location. They may be as high as 87 percent in extreme northern

locations and as low as 16 percent in southern locations. Approximately 60 percent of muskrats die before the end of their first year.

Adult mortality rates vary as well based on latitude, weather conditions, hunting/trapping, competition, food availability and habitat conditions.

Population Status

Muskrats are considered abundant throughout most of their range and, as such, are one of the most commonly hunted furbearers in North America. In some freshwater and coastal marshes, and in areas where rice is grown and crops are irrigated, muskrat population cycles may cause them to be designated as “overabundant” and considered a serious pest.

Population densities and carrying capacities vary with habitat type. For example, muskrat densities in predominantly sedge habitat have been recorded at 3 muskrats per acre (7.4 per hectare), while those in cattail marshes have been recorded as high as 35 muskrats per acre (86 per hectare).

Habitat

Muskrat habitats include both freshwater and brackish water including coastal marshes, marshy areas within ponds, lakes, sloughs, ditches, streams, canals, water storage areas, strip-mined pits, borrow pits along highways and other aquatic habitats.

The size of their home range is highly variable and dependent on the size and diversity of aquatic habitats, social pressures, environmental conditions, sex, age and season of the year. A muskrat located in a farm pond may have a very small home range (basically the size of the pond) while muskrats in a large marsh may have home ranges exceeding 197 feet (60 meters) in diameter with seasonal dispersal exceeding 735 feet (224 meters).

Denning or nesting habitats also vary. Along streams, ditches, lakes, canals and ponds, muskrats usually burrow into banks, making their dens underground with multiple

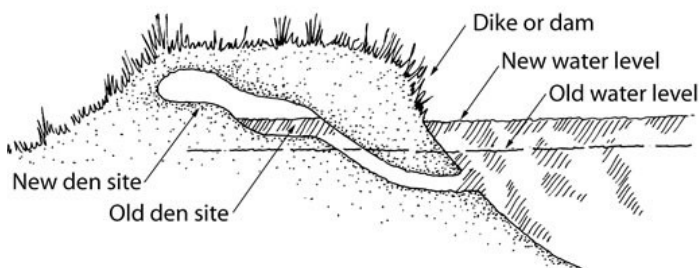


Figure 8. Muskrat burrow with den site.

tunnels. In large marshes, muskrat dens are usually located within floating domes of vegetation with underwater burrow entrances.

Behavior

Musk rats are primarily nocturnal, however, during the spring season they may become more active at dawn and dusk with their behavior tied to environmental conditions, weather and foraging.

Musk rats are territorial especially during the breeding season. They are considered semi-colonial when their densities cause overlaps in their territories. Because muskrats often breed with multiple partners, fighting often occurs among individuals in semi-colonial populations.

Although they do not hibernate, during extreme winter weather conditions, muskrats will stay in their underground dens or floating lodges where food is cached.

Musk rats are excellent swimmers and can stay submerged for long periods of time (i.e., 15 to 20 minutes) before briefly surfacing. While swimming with their hind feet and tail, their front feet are usually pressed under their chin and their tail is used as a rudder (Figure 9). They also are excellent diggers and burrowers with limbs well adapted for digging as well as swimming. They move fairly slowly on land and usually enter the water slowly. Although they can

jump, muskrats generally walk or take small hops on land unless alarmed.

Musk rats use their large front incisors to cut through woody vegetation, shoots, bulrush, sedges, cattails and other vegetation while submerged or above the water.

Food Habits

Musk rat food preferences are highly variable. Although generally herbivores, muskrats will eat animal matter, such as clams, mussels, crayfish, turtles and frogs when vegetation is scarce. In the Appalachian Region of the United States, muskrats feed upon endangered mussels which is a major conservation concern.

Preferred foods are cattails, roots, bulbs, sedges, bulrush and whatever aquatic vegetation is commonly available where they live (Figure 10). They also eat crops, such as corn, sugarcane, rice and carrots when available near aquatic habitats.

Musk rats are dependent on aquatic habitats. During droughts or floods, and following “eat-outs,” those animals remaining will often move long distances to locate new aquatic habitats or will die of starvation, predation, accidents or disease.



Figure 9. Musk rats are excellent swimmers. They use their tail for propulsion and steering.



Figure 10. Musk rats are primarily herbivores, feeding on aquatic vegetation.

Legal Status

Muskrats are common throughout aquatic habitats in North America. They are pursued by fur trappers in virtually all states and territories, and are one of the most commonly harvested furbearers in North America.

Laws, regulations, and ordinances regarding the take of muskrats varies by state and province where they are found and regulations on seasons, bag limits, and type of traps or devices that can be used to take them must be carefully followed.

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Figure 1. Photo by Tom Koerner, USFWS
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Figure 9. Photo by U.S. Fish and Wildlife Service
Figure 10. Photo by Linda Tanner, Wikimedia Commons

Portions of *Prevention and Control of Wildlife Damage, 1994, Muskrats* by James E. Miller were used in development of this publication.

Glossary

Eat-outs: Areas where vegetation has been overgrazed by muskrats. Resulting damage can make the habitat unusable for muskrats and other animals for many years.

Furbearer: An animal whose fur is commercially valuable.

Herbivore: Eats only plants.

Nocturnal: Active at night.

Polyestrous: Seasonal breeders having more than one estrous cycle during a specific time of the year.

Polygynandrous: Mates with multiple partners.

Stovepipe or colony trap: A long, narrow, tubular or boxed-shaped trap made of galvanized wire mesh with a one-way door at either end. Muskrats can enter, but not exit the trap.

Key Words

Burrows, Furbearer, Herbivore, Marshes, Muskrat, *Ondatra zibethicus*, Semi-aquatic, Wetlands

Disclaimer

Wildlife can threaten the health and safety of you and others in the area. Use of damage prevention and control methods also may pose risks to humans, pets, livestock, other non-target animals, and the environment. Be aware of the risks and take steps to reduce or eliminate those risks.

Some methods mentioned in this document may not be legal, permitted, or appropriate in your area. Read and follow all pesticide label recommendations and local requirements. Check with personnel from your state wildlife agency and local officials to determine if methods are acceptable and allowed.

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Miller, J.E. 2018. Muskrats. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center. Fort Collins, Colorado. 13p.

Resources

Association of Fish and Wildlife Agencies. 2014. Best Management Practices for Trapping Muskrat in the United States. Washington (DC): Association of Fish and Wildlife Agencies. 13 pp.

http://www.fishwildlife.org/files/Muskrat_BMP_2014_F.pdf

Chapman, J.A. and G.A. Feldhamer. 1982. Wild mammals of North America: biology, management and economics. The Johns Hopkins University Press. Baltimore, MD. pp. 282-325.

Miller, J.E. 1972. Muskrat and beaver control. Proc. First Nat. Ext. Wildl. Workshop. Estes Park, CO. pp.35-37.

Miller J.E. 1974. Muskrat control and damage prevention. Proc. Vert. Pest Control 6:85-90.

Miller J.E. 1976. Muskrat control. AR Coop. Ext. Serv. Leaflet No. 436. Little Rock, AR.

Miller, J.E. 1994. Muskrats. Pages B61-B70 in S.E. Hygnstrom, R.M. Timm, G.E. Larson, editors. Prevention and Control of Wildlife Damage. University of Nebraska-Lincoln. 2 vols.

Nowak, R.M. 1991. Walker's mammals of the world. 5th Ed. The John Hopkins Univ. Press. Baltimore, MD. 1,699 pp.

Schwartz, C.W. and E.R. Schwartz. 1981. The wild mammals of Missouri. Revised edition. Univ. Missouri Press, Columbia. 356 pp.

Today's Trapper: Trapper Education Student Manuals-Trapping and Furtaker Basics. 2015. Kalkomey Enterprises, Inc. Dallas, TX. 75244. (Page numbers dependent on specific fish and wildlife agencies regulatory and education information provided for each state or province.)

Trapping and Furbearer Management in North American Wildlife Conservation. 2001. Northeast Furbearer Resource Technical Committee. 41 pp.

Appendix

Damage Management Methods for Muskrats

Type of Control	Available Management Options
Exclusion	Install fencing or other barriers to prevent access
Fertility Control	None available
Frightening Devices	Typically do not deter muskrats
Habitat Modification	<ul style="list-style-type: none"> • Conduct prescribed burns to reduce marsh vegetation • Drain water channels when no longer needed for irrigation; Remove water from fields after harvest • Place stone rip-rap on the front edge and slope of pond dams to prevent burrowing
Repellents	None available
Shooting	Allowed with proper State permits
Toxicants	Zinc Phosphide Concentrate (EPA Reg. No. 56228-6)
Trapping	Allowed with proper State permits; Effectiveness dependent upon trapper skill, trap type used and persistence