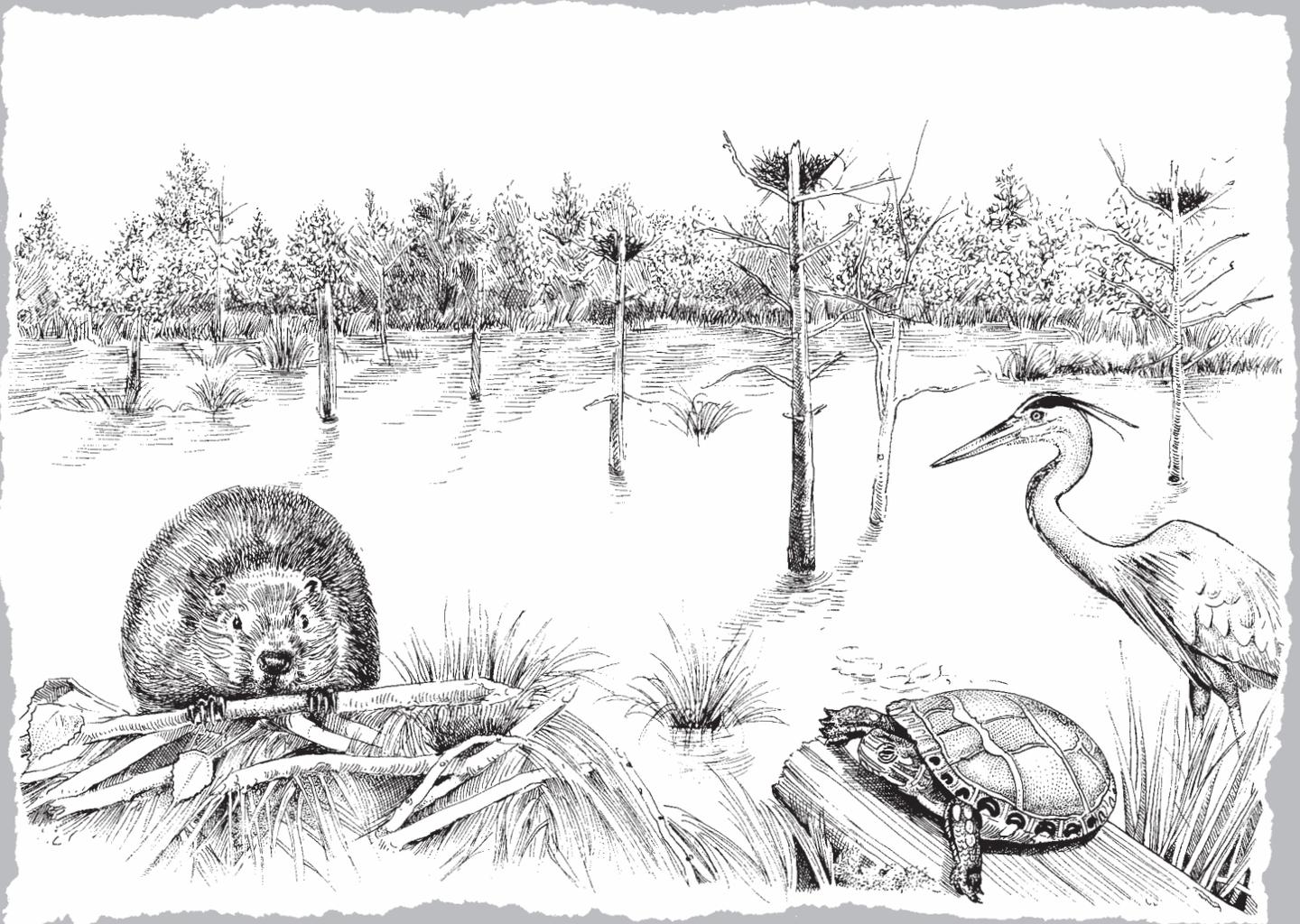
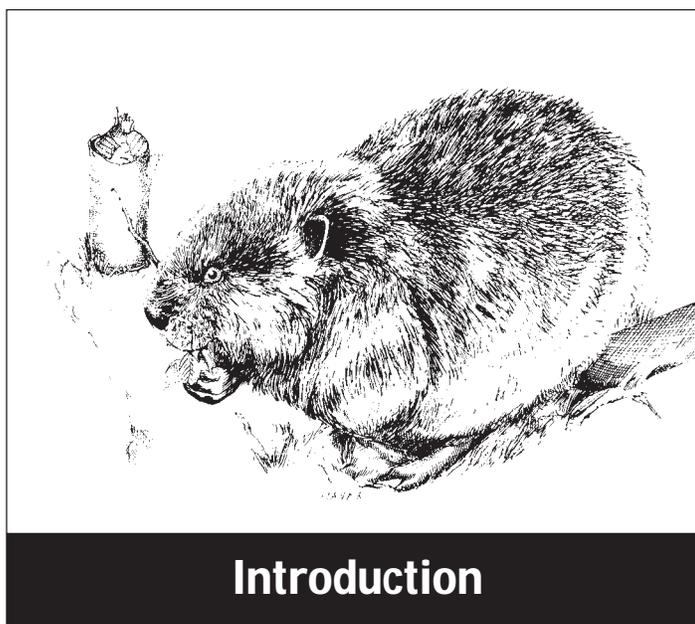

University of Massachusetts Extension · Massachusetts Division of Fisheries and Wildlife

Beavers in Massachusetts

Natural History, Benefits, and Ways to Resolve Conflicts Between People and Beavers

SCOTT JACKSON · THOMAS DECKER





BEAVERS have played an active role in New England's ecology for thousands of years. As natural "engineers" of the landscape they were agents of change, creating wetlands out of uplands and streams, and providing habitat for a variety of plants and animals. For native peoples, beavers were a source of meat, skins and medicine. As Europeans colonized New England, beaver pelts served as a form of currency, creating an incentive for settlers to move further west and changing the relationship between Native Americans and Europeans, and Native Americans and beavers.

Intensive hunting and trapping, and deforestation that followed European colonization eliminated beavers throughout much of North America, including southern New England. They were re-established in Berkshire County in the 1930s and, thanks (in part) to an active restoration campaign, have since reclaimed most of their

former range in Massachusetts. When the beavers returned, an important component of our native ecosystems was restored. However, beavers returned to a landscape that had been substantially altered by people. In some areas, beaver activity conflicted with human needs. Property damage, *Giardia*, and the flooding of roads, buildings and septic systems continue to be sources of concern for many communities.

Finding ways to co-exist with beavers that allow us to benefit from their role in the environment yet minimize conflict between beavers and people can be a challenge for many communities. This booklet provides information on the natural history and population dynamics of beavers, their beneficial aspects and potential problems, techniques for avoiding or resolving conflicts between people and beavers, and management programs for beavers in Massachusetts.

Natural History

Description

Beavers (*Castor canadensis*) are North America's largest native rodents, weighing between 35 and 80 pounds as adults. They can range from two to two and a half feet in length, with an additional ten to eighteen inches

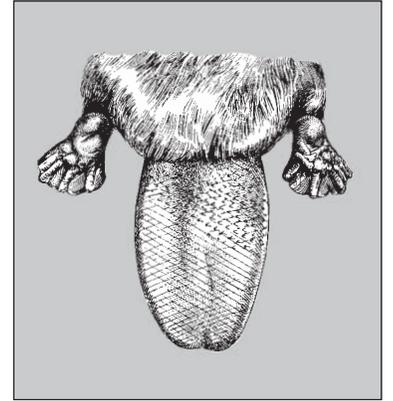
for the tail. There is no size difference between males and females.

Long, shiny guard hairs covering thick, soft underfur give Massachusetts beavers a dark brown to reddish brown color. They are muscular animals with large bones, well-developed incisor teeth and a massive skull that supports strong chewing muscles.

Beavers have hind legs that are longer than their fore legs. They rise

up on their hind legs to chew trees, gather food or just look around. Although they are slow moving and awkward out of water, they do venture out on land in search of food and building materials. Most of their time, however, is spent in the water.

Beavers have large, webbed hind feet and a flat, leathery tail that serves as an aid for swimming. They also use their tails for temperature regulation, fat storage, as a prop while standing upright, and for communication (beavers slap their tails on the water when alarmed). In the water it is easy to confuse beavers with muskrats (another aquatic mammal common in Massachusetts). Muskrats, weighing only two to three pounds, are much smaller than adult beavers and have narrow, vertically flattened tails (as opposed to the wide, horizontally-flattened tails of beavers). Both species have small eyes and ears, but muskrat ears are generally less noticeable than those of beavers.



Distribution

Beavers are distributed throughout most of North America from northern Mexico to northern Canada. They are both common and abundant throughout most of Massachusetts. They are absent from southeastern Massachusetts, Cape Cod, and the Islands.

An important requirement for beavers is water deep enough to provide aquatic habitat beneath winter ice. As a result they are generally associated with rivers, ponds and lakes, or areas that can be converted to beaver ponds. Although beavers are found in areas with steep slopes, they generally prefer fertile valleys with flat terrain and perennial streams that can be dammed to create ponds. These areas also produce an abundance of food preferred by beavers.

Food

Beavers do not eat fish; they are strict vegetarians. As such, they feed on a variety of aquatic plants (especially water lilies) and the shoots, twigs, leaves, roots, and bark of woody plants. In particular, the bark and inner bark of trees and shrubs are important foods, especially in winter. Aspen, birch, alder, and willow are favored food plants.

Trees and shrubs are felled by beavers to gain access to twigs, leaves, and bark. Bark and leaves may be stripped where they fall or transported back to the safety of water. Well-used beaver trails typically lead from a beaver pond to upland stands of important food trees. Trails near the pond often fill with water forming canals that are used by beavers to float sticks and logs from uplands to the pond. As winter approaches, branches are stockpiled on the pond bottom near the lodge. Beavers rely on this cache of

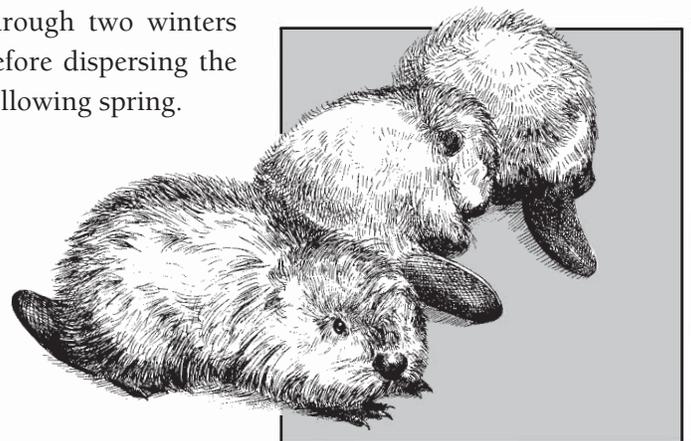


food to see them through until spring. Once stripped of leaves and bark, branches and logs are often used as construction material for dams or lodges.

Life Cycle

Beavers stay with the same mate for life. They mate in winter (January to March) and females give birth in a lodge sometime between April

and June. A single litter each year usually contains four kits (but may have as many as nine). Young kits spend most of their time in the lodge where they are relatively safe from predators. Although they are weaned by three months of age, young beavers will stay with their parents through two winters before dispersing the following spring.



A single family unit of beavers is typically made up of two adults, that year's kits, and young from the previous year. Such a group is called a colony and usually contains six to eight individuals in areas where harvest pressure is low. Most beavers become sexually mature in their third year at which time they leave, or are driven out by the parents, to seek mates and territories of their own. Adult beavers have few predators, and may live up to twenty years or more in the wild.

Dam and Lodge Building

Beavers are renowned for their ability to modify their surroundings to meet their needs. They accomplish this by damming up small rivers and streams to form ponds. These ponds are areas of still, deep water that provide access to food, protection from terrestrial predators and shelter in winter.

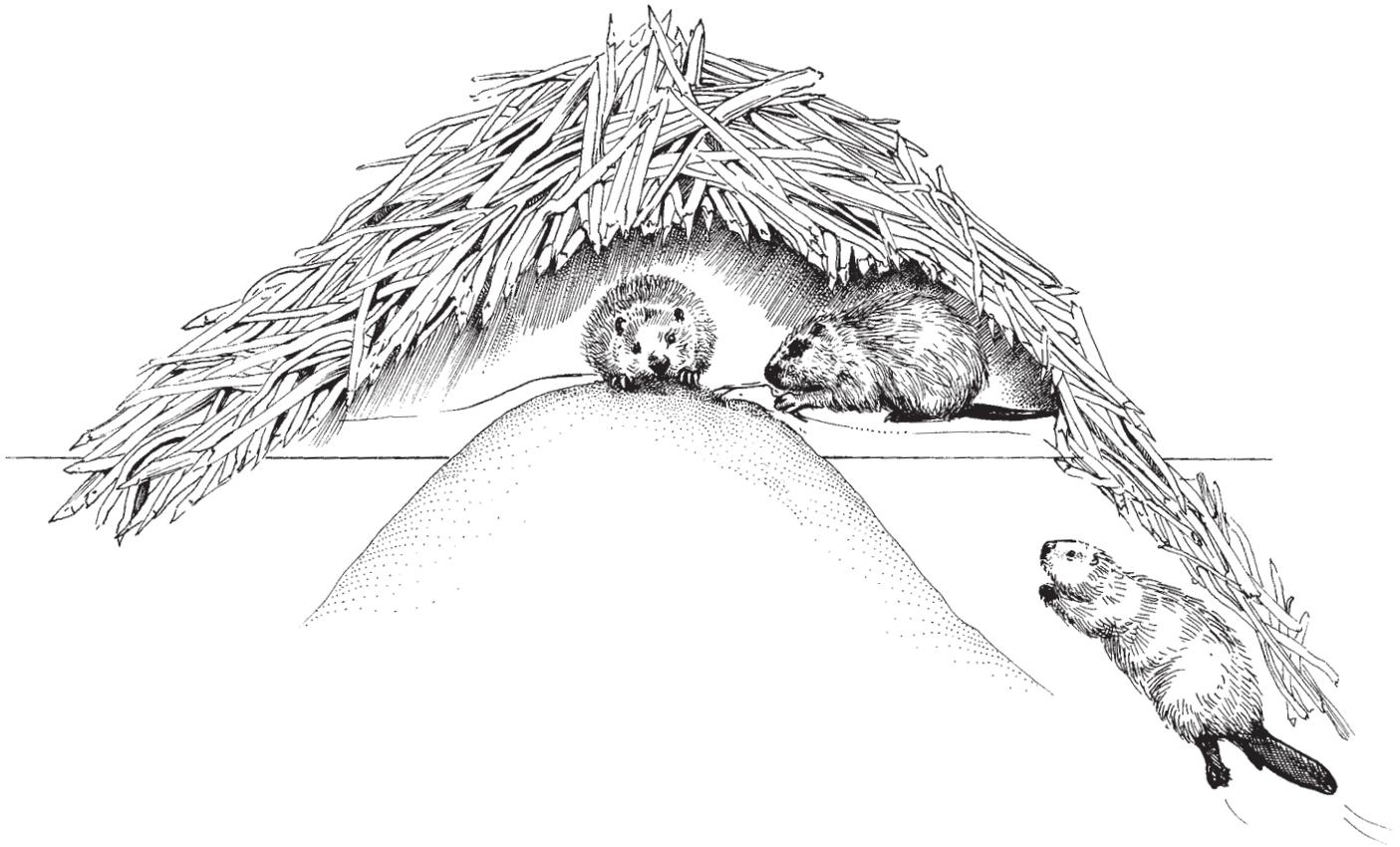
Dams are impressive structures made out of sticks and mud. The base of a dam is made up of mud and stones. Upon this, beavers pile branches and sticks, oriented with the butt ends upstream. Mud, stones and aquatic vegetation are used as plaster. Despite what you may have learned from cartoons, beavers do not pack the mud down with their tails. Instead, they scoop it up with their forepaws and apply it to the dam with their feet and snouts.

Although most dams are less than 100 feet long, some have been recorded at over 1,500 feet in length. Several dams may be constructed close together along a brook, creating a series of terraces with standing water. Beavers are constantly on the look-out for leaks or breaches in their dams. Tipped off by the sound of escaping water, beavers will act quickly to plug any leak with mud and sticks.

Ponds created by beavers provide habitat for many of their favorite food plants (water lilies, cottonwood, willow, and alder). Water also means security for these agile swimmers because most of their predators live on land.

Within ponds created by dams, beavers construct lodges out of sticks and mud. Lodges may be fifteen to forty feet across at the base and protrude three to six feet above the water. Within each lodge, a single internal chamber is





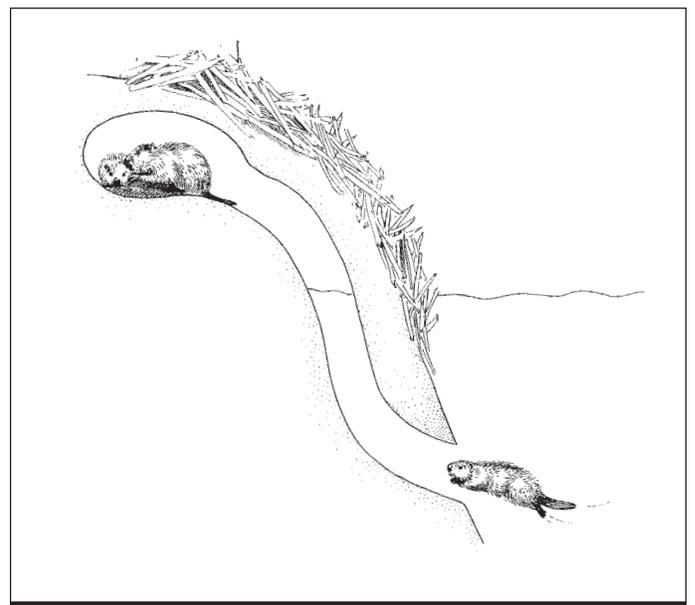
situated above the water line and is lined with dry plant material. A vent leading from this chamber to the surface of the lodge provides for air circulation. One or more underwater entrances offer the only access into the lodge. Thick walls of sticks and mud provide substantial protection from predators and the elements.

In winter, the pond offers sufficient aquatic habitat beneath the ice that the beavers are active year-round. Once the pond freezes over, beavers are confined to the pond until ice-out in the spring. Tree branches, cached on the bottom of the pond, provide winter food and are brought into the lodge to be eaten.

Beavers will also use bank dens for shelter, usually on rivers or lakes. Underwater entrances lead to tunnels that extend back as far as thirty feet, ending in a den situated above water. Over time many of these bank dens take on the appearance of lodges as sticks and mud are piled around the entrance.

Eventually, these ponds are abandoned, either when preferred food plants become scarce or when silt accumulation makes them too shallow. Lacking repairs, dams

break and the ponds drain. In the nutrient rich silt, herbaceous plants flourish, forming beaver meadows. Over time, shrubs and trees eventually come to dominate these areas, setting the stage for the beavers' return.





Beneficial Aspects of Beavers

Creation of Wetlands

Since the time of European settlement, more than half of the wetlands in the lower 48 states have been lost. Estimates of losses in Massachusetts range from 28 to 40 percent. By damming streams and forming

shallow ponds, beavers create wetlands. These shallow and deep marshes, wet meadows and swamps created by beavers are valuable for the numerous benefits they provide for people.

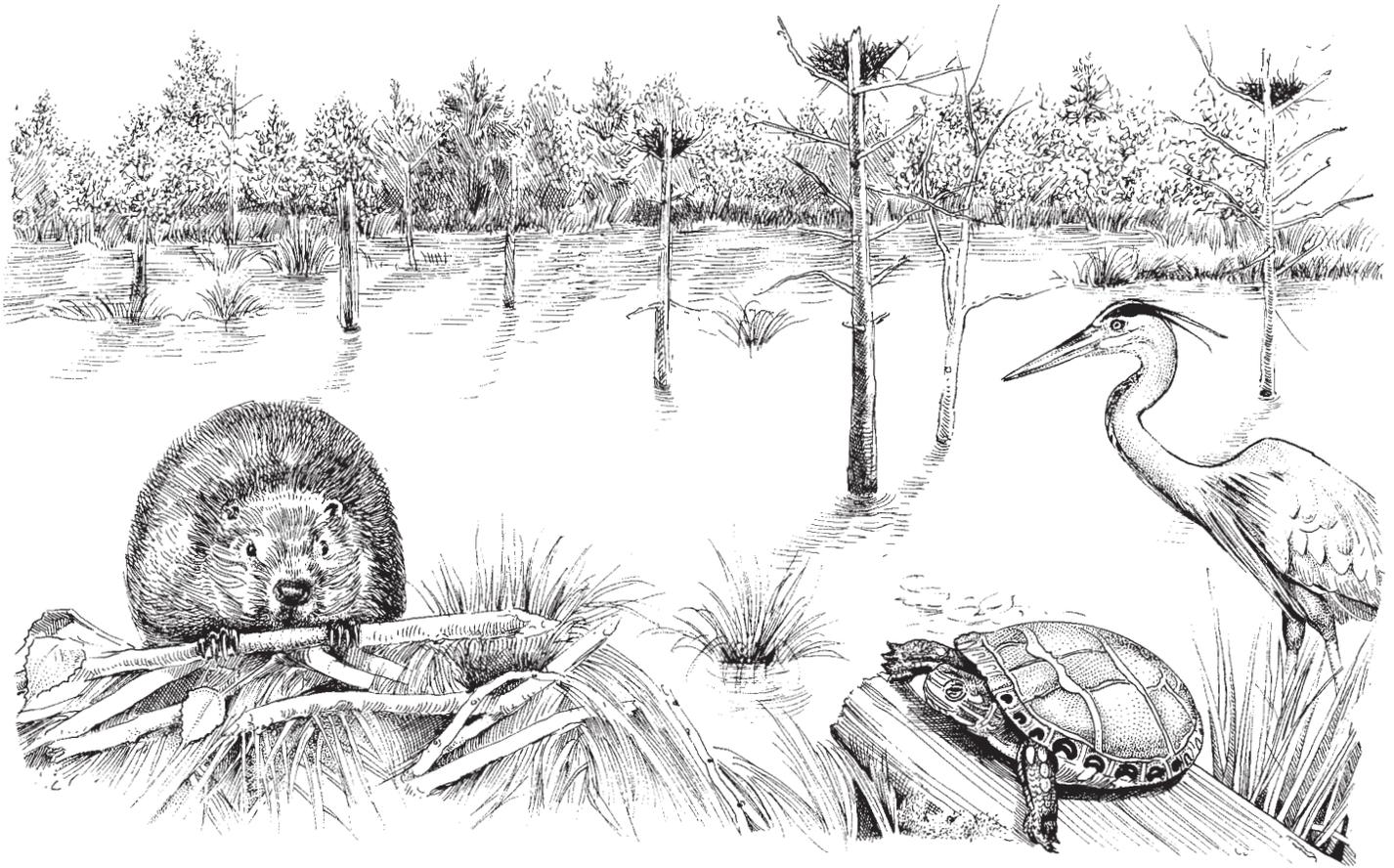
Along rivers and streams, wetlands control downstream flooding by storing and slowly releasing floodwater. They improve water quality by removing or transforming excess nutrients, binding and removing toxic chemicals, and removing sediment. Beaver-created ponds and wetlands are especially important because they trap large amounts

of silt. Areas flooded by beaver dams are often recharge areas, places where surface water re-supplies groundwater. As filters for ground and surface water supplies, wetlands are critically important for protecting public and private drinking water.

Beaver wetlands are also highly productive systems, due to an abundance of water and nutrients. As such they support a tremendous diversity of plants and invertebrates, are havens for wildlife, and provide important spawning and nursery habitat for fish.

Creation of Wildlife Habitat

Beaver ponds and wetlands provide habitats for a variety of wildlife species. Minks, muskrats, and bats forage in and around beaver ponds. Salamanders, frogs, turtles, water snakes, herons, grebes, ducks, rails, swallows, hawks, owls, flycatchers, and kingfishers all rely quite heavily on



beaver-created habitats. Historically, extensive beaver marshes were critically important breeding areas for marsh birds in Massachusetts, including American and least bitterns, pied-billed grebes, common moorhens and rails.

Similar wildlife habitats can sometimes be created by human beings using dams and other water control structures, but there is one big difference. While ponds built by people are relatively stable, beaver ponds are dynamic areas that produce a series of habitat types as they age, are abandoned, and turn into beaver meadows. Some wildlife species have life histories that appear to be especially well-suited for the shifting nature of beaver habitats over time.

Red-spotted newts are one such species. They have a life cycle that is unusual for salamanders. Instead of the standard, three stage life cycle (egg, larva and adult), red-spotted newts have four life stages. They are aquatic as eggs and larvae then transform into land-dwelling juve-

niles called red efts. Red efts are a dispersal stage of the red-spotted newt. After two to five years on land, efts seek out appropriate aquatic habitat (ponds or lakes) and undergo a second transformation, changing from terrestrial juveniles to aquatic adults. Red-spotted newts thrive in beaver ponds and the addition of a juvenile dispersal stage to their life cycle provided a convenient mechanism for finding and colonizing newly created habitats.

As trees are flooded by rising waters behind new beaver dams, they provide nesting habitat for colonies of great blue herons. Herons prefer to nest in flooded areas or on islands because trees in these areas offer protection from marauding raccoons and other predators. As flooded trees die, cavities form in them, providing nesting habitat for tree swallows, wood ducks, and hooded mergansers. Over time, the trees topple over, leaving herons, swallows and wood ducks to look elsewhere for breeding habitat, often to new beaver ponds.

Economic Value

Humans have utilized beavers as a fur and food product in New England for several thousand years. Like early colonists and native Americans, people continue to harvest beavers for their fur, meat, leather, and glands. The difference between the harvest of beavers today and that of colonial times is that the beaver harvest is now closely regulated by state wildlife agencies.

Beavers are a protected species in Massachusetts and there are laws and regulations that control when and how beavers may be taken. Historically in Massachusetts, approximately 1,300 beavers were harvested annually, providing a total of \$40,000 in income for households in the state. Aside from using pelts to make garments like coats, hats, gloves, and blankets, over one-third of the fur harvesters utilize beaver as a food source for themselves or their pets. Parts of beavers are used to make perfumes; other parts are used to make customized leather products like wallets. Regulated harvests also serve to maintain beaver populations at levels that are consistent with available habitat.

Aesthetic, Recreational and Educational Values

Beavers are also valued by people who simply enjoy watching or photographing them. Beaver ponds are enjoyable places to visit to observe brilliant fall foliage or watch wildlife. Fishermen and canoeists appreciate the quiet solitude of beaver ponds early in the morning. Teachers recognize beaver ponds as ideal places for “pond study,” where concepts of food webs, predator-prey relationships, and interdependence are easily demonstrated.

All told, beavers are exceptionally valuable components of healthy ecosystems in Massachusetts. As wetland creators, furbearers, creators of varied habitats for wildlife and fish, and subjects of interest for children and adults, they provide us with a myriad of benefits.

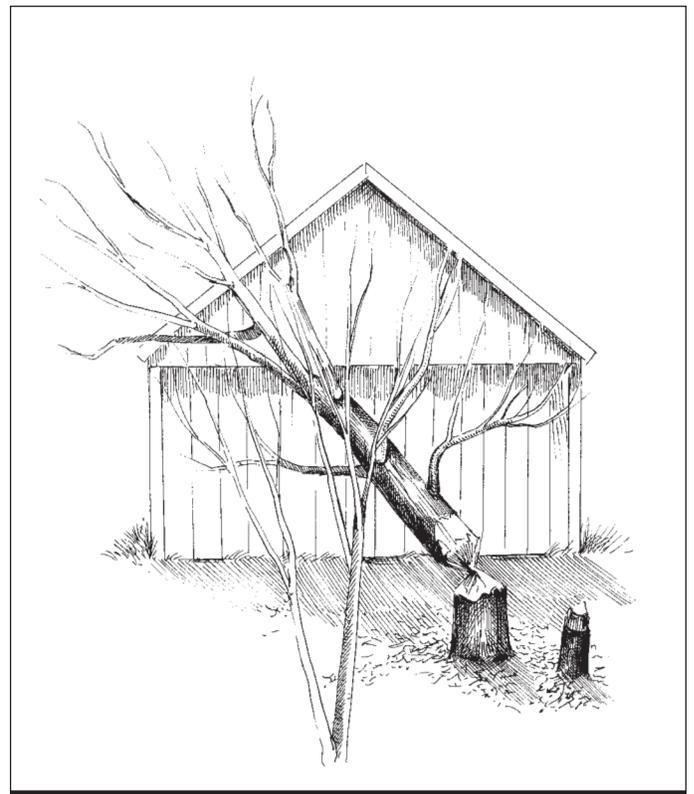
Conflicts Between Beavers and People

Damage to Ornamental Trees and Shrubs

Beavers gnaw trees and shrubs for food, for building material, and for other reasons not entirely known to us. Although this is an important mechanism for habitat creation and transformation, it can also result in damage to important shade trees, ornamental trees, and shrubs.

Houses, Roads, and Power Lines

Beavers do not appear to be able to control where trees will fall. Occasionally, beavers are crushed by trees that they themselves cut down. Where people and beavers occur together, it is only natural to expect that some trees will fall on cars, roads, railroad tracks, power lines, houses, or other structures. Although less common than other forms of damage, it can be a cause for serious concern.





Flooding

Residential, commercial, and agricultural development in low lying areas adjacent to streams and ponds is vulnerable to inundation when beavers move into the area. A common concern is the flooding of roads. Culverts are particularly susceptible to the beavers' unceasing drive to stop flowing water. Drinking water can become contaminated when wells and septic systems are flooded. Houses and other structures that are inappropriately located in floodplains are also vulnerable.

Effects on Cold-Water Fisheries

When beavers dam up a stream to produce a pond they also change the physical and chemical nature of the stream. Currents are slowed, water temperatures rise, and dissolved oxygen levels drop. Warm water fish, like perch and bass, benefit from the change. Trout prefer cold, well-

oxygenated water. Although they may benefit from beaver activity in the first three or four years, they are negatively affected by long-term beaver presence.

Concerns About Water Quality

Beavers are often associated with concerns about the quality of drinking water. Water exiting a beaver pond is high in organic chemicals and may be a cause for concern if beaver ponds are located near public water supplies. Giardiasis, an intestinal ailment caused by a *Giardia* parasite, is referred to by some as "beaver fever" because beavers are known to carry the organism. Although beavers do carry the *Giardia* parasite, so do many other animals that are found around lakes and reservoirs. Despite this, beavers will continue to be the primary focus for concern because they spend so much time swimming in our drinking water.

Avoiding and Resolving Conflicts

Tolerance

Beavers, like human beings, are adaptable and can readily tolerate living in close association with people. Likewise, people who learn to tolerate a certain amount of beaver influence

on their land generally find that co-existing with beavers provides many benefits. In situations in which beavers are simply an inconvenience to landowners, tolerance is the easiest solution. However, when beaver activity results in property damage or concerns about public health and safety, there are a number of steps that may be taken to alleviate the problems.

Exclosures

The most effective way to protect specific trees and shrubs is to construct exclosures around them. Exclosures should be constructed of heavy-gauge fencing and placed around the base of trees or shrubs. Exclosures should be a minimum of four feet tall and should be flush with the ground at the bottom. Chicken wire is no match for the incisors and powerful chewing muscles of beavers; stick to heavy-gauge fencing material.

Nurseries and orchards can be protected with fencing to prohibit beaver access. Standard fencing is usually sufficient since beavers are poor climbers, rarely burrow under fences, and generally don't chew fencing unless it is wrapped around trees or shrubs. In some cases, a single-strand electric fence placed four to six inches off the ground will effectively exclude beavers. Although removal of nuisance animals may appear to be a

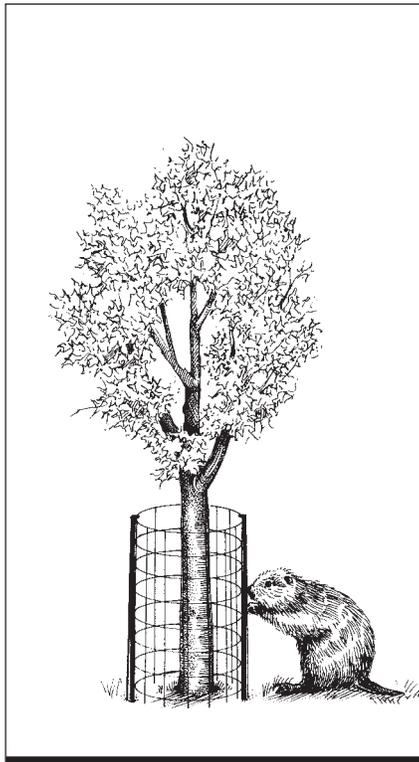
cheaper and easier method to control beaver damage, fencing provides a more long range solution and preserves the beneficial aspects of beavers, as well.

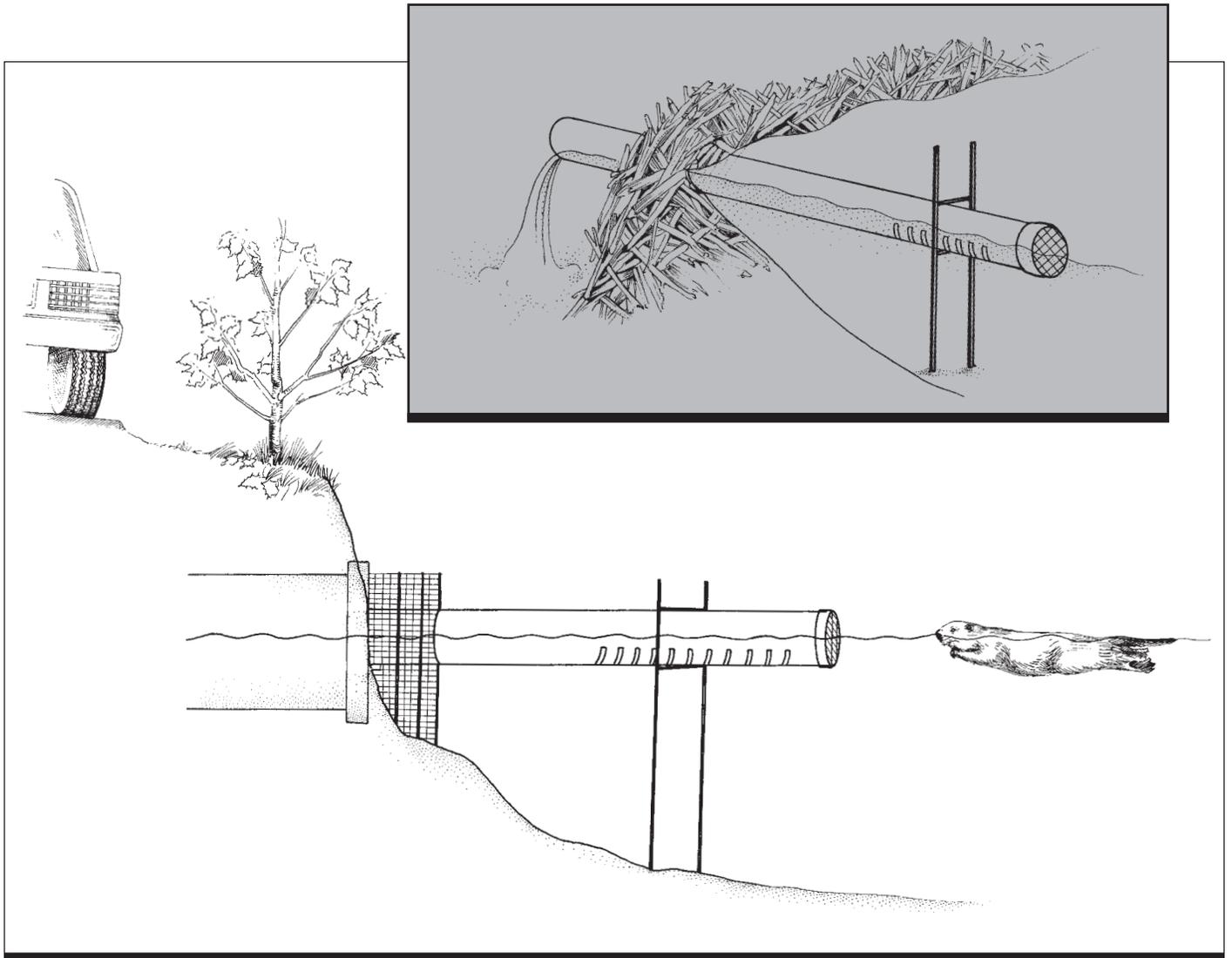
Water Flow Devices

In situations in which increased water levels resulting from beaver activity threaten property, crops, or public health and safety, water flow devices may be an appropriate way to control the flooding. Sometimes referred to as "beaver pipe," these water flow devices can be successful at regulating water levels behind beaver dams. Generally, one or more beaver pipes are placed in a beaver dam at an elevation that will regulate water at the desired level. Beaver pipes can be constructed out of a variety of materials such as PVC pipe, polyethylene tubing, or welded wire cylinders. With regular maintenance, water flow devices made of proper, durable materials can alleviate flooding for several years.

Water flow devices can also be used to maintain flows in road culverts that are repeatedly blocked by beavers. A similar kind of pipe is used, along with fencing to keep beavers from the culvert entrances. Two factors are key to the success of these devices: they must be designed to reduce the cues used by beavers to detect escaping water, and they must be difficult for beavers to plug.

Beaver pipes should only be used where appropriate conditions exist. Depth of water behind the dam, stream flow, and size of the wetland upstream are among the considerations. Proper installation of pipes is also important if flooding is to be controlled. Height of the pipe from the pond bottom, angle of the pipe, as well as number and diameter of pipes needed to accommodate the stream flow must all be evaluated upon installation. **Do not try to install water control devices on your own.** In Massachusetts, it is illegal to disturb beaver dams or beaver lodges without a permit (see "Permits" on page 12).





Repellents and Harassment

As of this writing, there are no known or registered repellents that are effective against beavers. Experience to date indicates that harassment is generally ineffective at persuading beavers to leave an area.

Removal

Removal of a nuisance beaver can be considered only when there is property damage or a threat to public health and safety. Problem animals may be trapped during the open season in accordance with Massachusetts trapping regulations. A permit from the Division of Fisheries and

Wildlife or local Board of Health is required to trap or kill beavers during other times of the year. Trapping and relocating beavers is not allowed in Massachusetts.

Removal of problem animals can be a relatively quick way to alleviate beaver problems when done by an experienced trapper. However, if appropriate habitat exists, it is possible that other beavers may eventually move into the area. Addressing habitat features at the stream site with other techniques (water flow devices) may stabilize the wetland and prevent future property damage. By allowing beavers to remain, a stabilized site will also help maintain the beneficial aspect of beavers.

Permits

Removal of Dams or Use of Flow Devices

In Massachusetts, there are several laws that govern beaver dams, beaver lodges and activities in wetlands in general.

Under fish and wildlife laws, it is illegal to disturb beaver dams without a permit. There are no exemptions for any private individual or public agency from this permit requirement. Permits are also required to modify a beaver dam to install water flow devices. Contact the Division of Fisheries and Wildlife regional office nearest you for information about permits. (See page 16.)

Activities that will affect wetlands, such as dam removal or installation of beaver pipe, are also regulated by Massachusetts wetlands protection laws. Additional permits may be required under the Wetlands Protection Act (a state law protecting wetlands). If you obtain a permit from the Division to remove or alter a beaver dam, be sure to contact your local conservation commission before initiating any work. Violations of these laws have resulted in the seizure of equipment, liens placed on private property, and assessment of stiff penalties, fines, and costs associated with wetlands restoration.

Destruction of Beavers

At sites that are not conducive to the installation of flow devices or other mitigating techniques, beavers may only be removed in accordance with the following provisions of state wildlife regulations.

LEGAL HARVEST

The preferred option for removing a beaver from a problem site is to have the beaver taken by a licensed trapper during the open trapping season (late fall and winter).

SPECIAL PERMIT TO REMOVE BEAVER

In cases of public health or safety a permit can be issued from the Board of Health. A permit may also be issued by the regional District office of the Division of Fisheries and Wildlife for the destruction of beavers causing other types of property damage. When issuing a permit, Division staff explain the uses of the permit, reporting requirements, and compliance with other laws.

Massachusetts law prohibits trapping and relocation of any wild animal, including beavers. The primary reason for this law is concern about the spread of wildlife diseases.

Beaver Population Growth

Year	1	2	3	4	5	6	7	8	9	10
Adults	2	2	2	6	10	14	26	46	74	126
2 Yr Old	0	0	4	4	4	12	20	28	52	92
1 Yr Old	0	4	4	4	12	20	28	52	92	148
Kits	4	4	4	12	20	28	52	92	148	252
Total	6	10	14	26	46	74	126	218	356	608

Beaver Management

During the 1600s and 1700s, beavers were over-exploited by fur harvesters. Many beavers were also killed and their wetlands habitats drained by settlers building homes and farms.

As a result of unrestricted utilization, habitat loss, and the destruction of beavers as pests, they were virtually eliminated from Massachusetts and from large portions of North America by the time of the American Revolution. With the loss of beavers, many of the values associated with them (wetlands and wildlife habitat creation, aesthetics, economic benefits) were also lost. Fortunately, through active restoration and management programs, their populations have recovered and beavers again occupy most of their former range in Massachusetts.

Proper management of beaver populations is needed for two reasons: to address the negative aspects of beavers (property damage, health, and safety) and to ensure that this native species is never again eliminated from our state. To understand how beavers are managed in Massachusetts, it is important to understand something about the biology and dynamics of beaver populations.

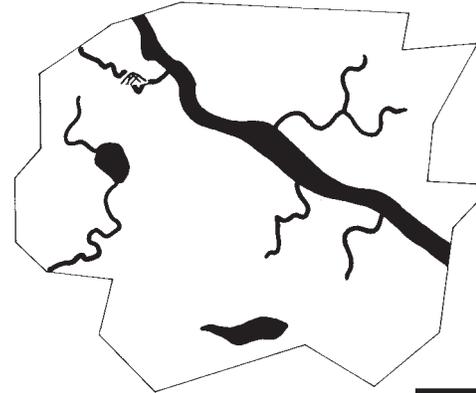
Beaver Populations

In general, two major factors affect the state's beaver population: the number of beavers born and the number of beavers that are removed from the population each year. Beaver populations are also limited by the amount of suitable habitat available to them. The *table at left and chart at right* show how quickly beaver populations can grow and use up available habitat in a given area. This simple model shows the growth of a hypothetical population, beginning with two adults and increasing with the addition each year of four young for each pair of adult beavers. This gives an indication of what could happen to the state's beaver population if no animals were removed.

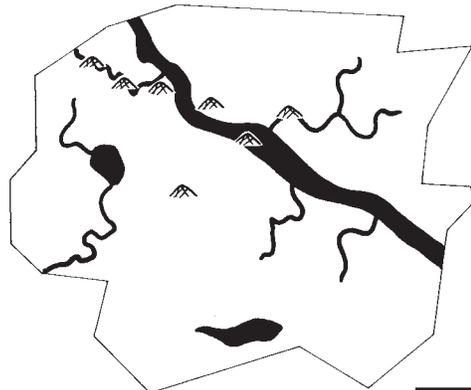
For over ten thousand years, humans and timber wolves were the most significant predators of beavers in

Population Growth Within a Watershed

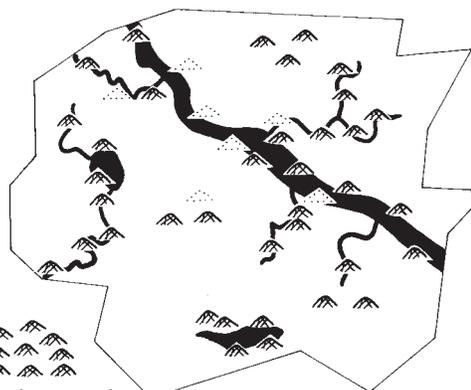
KEY:  active colony  abandoned colony



YEAR 1



YEAR 5



colonies in excess of watershed capacity

YEAR 10

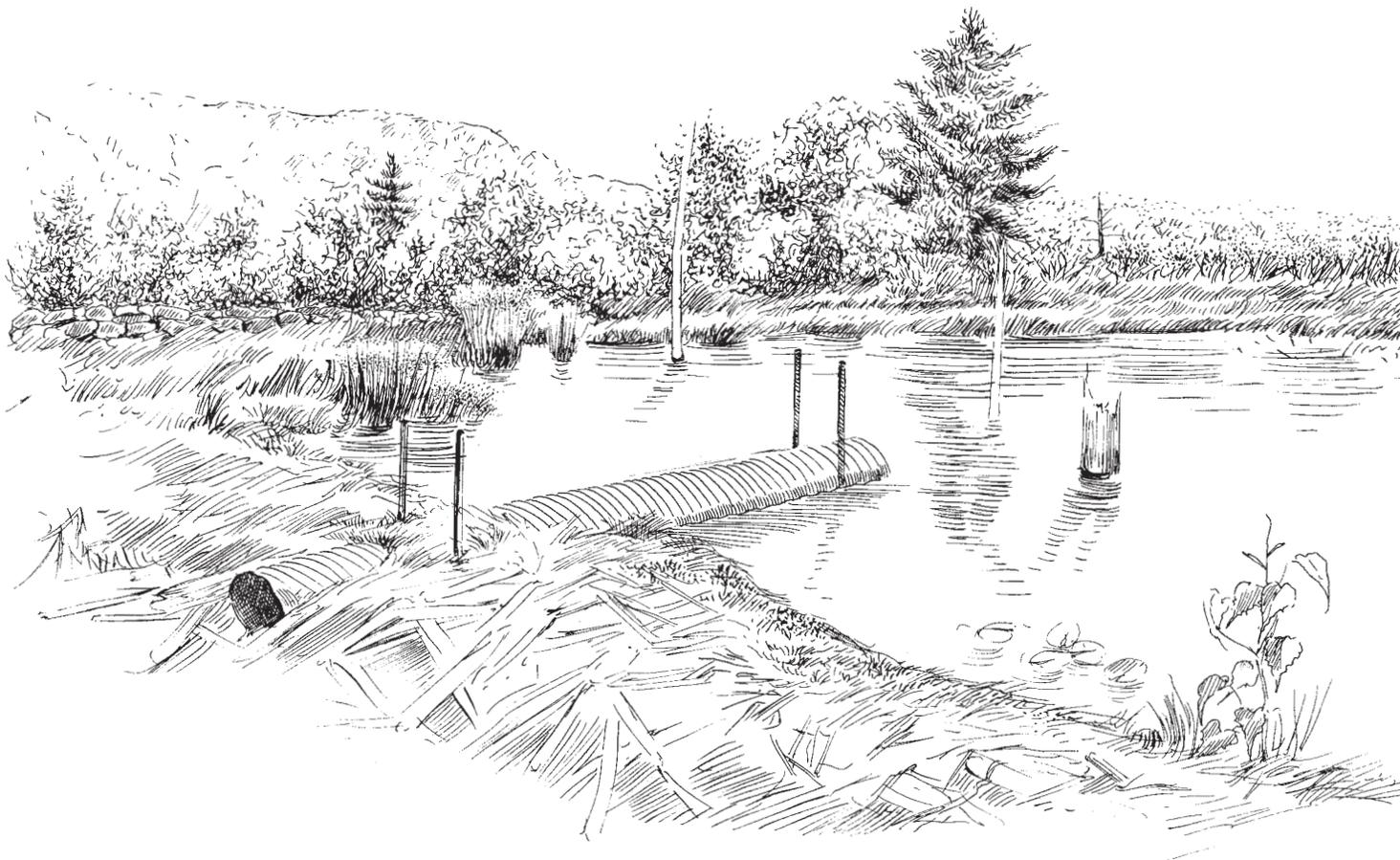
Massachusetts, hunting and utilizing beavers and thereby subtracting them from the population. Timber wolves preyed extensively on beavers and undoubtedly exerted some control on beaver numbers. However, wolves were eliminated from Massachusetts in the early 1800s and are unlikely to return. Although otters, coyotes, and bobcats occasionally prey on beavers, they generally take too few to significantly influence beaver populations. Humans (through the regulated trapping season) are the primary mechanism available for removing beavers from the population and controlling their numbers. If the state's beaver population were allowed to grow uncontrollably it would inevitably result in increased property damage and flooding.

The most serious threat to the long-term survival of beavers in Massachusetts is the encroachment of human

development on their habitats. With over six million people currently living in the state, homes and shopping centers have already had a significant impact on beaver habitat. As human developments continue to fragment the landscape, areas available for beavers and other wildlife are diminishing. As people encroach on wetland habitats, conflicts between people and beavers occur more frequently.

Management in Massachusetts

The essential challenge for beaver management is to find ways to co-exist with beavers that maximize their beneficial aspects yet minimize conflicts with people. The Division of Fisheries and Wildlife uses regulated trapping, exclosures, water control devices and public education promoting tolerance as means to meet that challenge.



Goals established for beaver management include: maintaining beaver populations compatible with suitable habitat, minimizing property damage caused by beavers and managing beavers for their associated wetland and other values.

Wildlife biologists monitor the number and types of beaver complaints, assess habitat, and monitor the annual harvest of beavers. Biologists then make recommendations to increase or decrease beaver populations as needed. Regulated trapping is used as the most feasible and effective method for reducing or controlling beaver populations. The Division also has programs for investigating beaver complaints and utilizing flow devices to alleviate damage.

Successful management of beavers in Massachusetts will require a combination of all the techniques listed in

this booklet. Solutions to beaver damage problems are rarely simple and no one technique is a cure-all for beaver damage. For example, flow devices do not control beaver populations. At the same time, trapping of beavers at a complaint site does not change the features of the site that attracted beavers in the first place. In some cases, using both techniques (a flow device to control water levels and regulated trapping to control population levels) can provide a long-term solution to beaver problems. By following practices described in this booklet we can expect practical long term solutions to beaver problems, more secure and stable wetland complexes, and the creation and enhancement of wetland habitats on public and private land.



Additional Reading

Lily Pond: Four Years With a Family of Beavers, by Hope Ryden, 1989. William Morrow & Co., New York.

The World of the Beaver, by L.L. Rue III, 1964. Lippincott Co., Philadelphia and New York.

Wild Mammals of New England, by A. J. Godin, 1977. The Johns Hopkins University Press, Baltimore.

Wild Mammals of North America: Biology - Management - Economics, by Joseph A. Chapman and George A. Feldhamer, 1982. The Johns Hopkins University Press, Baltimore.

Wild Furbearer Management in North America, by Milan Novek, James A. Baker, Martyn E. Obbard and Bruce Mallock, 1987. Ontario Trappers Association, Ontario Ministry of Natural Resources, Toronto.

Beavers, Water, Wildlife and History, by Earl L. Hifiker, 1991. Heart of the Lakes Publishing, Interlaken.

Where to Go For Help

If you have a beaver complaint or would like more information on controlling beaver damage, contact the Division of Fisheries and Wildlife office nearest you.

Western Wildlife District

400 Hubbard Avenue
Pittsfield, MA 01201
(413) 447-9789

Connecticut Valley Wildlife District

East Street
Belchertown, MA 01007
(413) 323-7632

Central Wildlife District

Temple Street
West Boylston, MA 01583
(508) 835-3607

Northeast Wildlife District

68 Harris Street
Acton, MA 01720
(978) 263-4347

Southeast Wildlife District

195 Bournedale Road
Buzzards Bay, MA 02532
(508) 759-3406



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MASSACHUSETTS DIVISION OF FISHERIES AND WILDLIFE

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