

# FURBEARER MANAGEMENT GUIDELINES

## MUSKRAT *Ondatra zibethicus*



Since 1926, separate trapline areas in British Columbia have been assigned and registered to individuals licenced to harvest the province's plentiful fur resources. To obtain a licence, trappers must successfully complete a three-day course that focuses on humane trapping methods, fur handling, and trapline management. The trapline management component includes knowledge of, and fosters respect for, provincial trapping regulations, adherence to professional and ethical standards established by the Ministry of Water, Land and Air Protection and the BC Trappers Association, and practices that help to manage and maintain furbearer populations. There are approximately 2900 registered traplines in British Columbia, and 19 mammal species are officially classified as furbearers.

For management purposes, the muskrat is a Class 1 species, which means that it has a home range that is small enough for a viable population to be contained within one trapline area and can therefore be managed on an individual trapline basis. Other Class 1 species are marten, mink, beaver, raccoon, squirrel, weasel, fox, and skunk.

This document is intended primarily to provide British Columbia's professional trappers, government managers and industry with information on muskrat biology, and on principles to consider in the sustainable management of the species. The material presented is generalized from the results of many studies conducted over a wide geographic area and local variations and exceptions may occur.

### DESCRIPTION

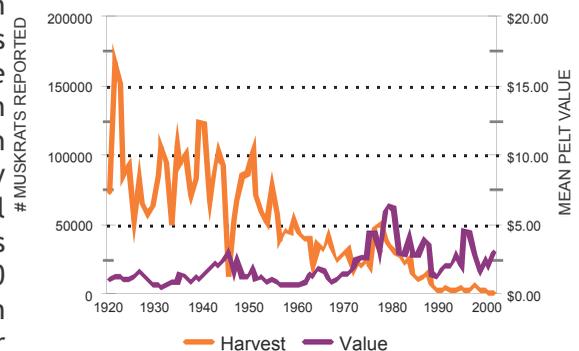


The muskrat is a semi-aquatic rodent closely related to the common field vole. Adult muskrats are about the size of a cottontail rabbit, measuring about 50 to 60 cm in total length (approximately one half of which is the tail) and weighing 1 to 1.5 kg. Males average slightly larger than females. The general shape is chunky, suggestive of a small beaver, but with a long, narrow, scaly tail that is flattened from side to side rather than in the "paddle" shape of the beaver. The head is relatively large and broad, the eyes are small, and the rounded ears are short and generally inconspicuous. Muskrat pelage consists of a dense layer of underfur that is often greyish, overlaid by thick, glossy brown guard hairs that cause most animals to be some shade of brown in general appearance.

### ECONOMIC CONSIDERATIONS

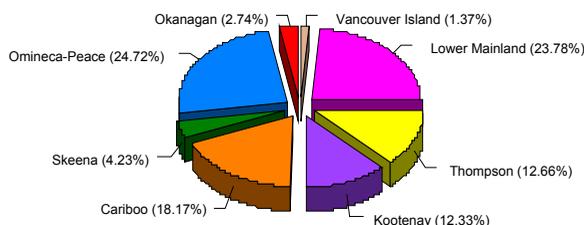
The muskrat has long been one of the most valuable furbearers in North America, yielding annual continental catches of as many as 11 million animals and fur sale values exceeding \$30 million as recently as the early 1980s. Canadian totals in those years were usually on the order of 1.5 to 2 million muskrat pelts worth \$4 to \$6 million. Although muskrat habitat is relatively limited in the mostly mountainous terrain of British Columbia, annual harvests in this province exceeded 150,000 animals in the early 1920s, and averaged almost 100,000 through 1950, but have steadily declined since then as the buying power of the revenue received per pelt has decreased. Harvests have averaged only

Reported Muskrat Harvests and Pelt Values, 1920-2000.



about 3000 pelts per year since 1990 (Figure 1). Even though some muskrat habitat has been lost to development over the past few decades, it seems evident that the total potential harvest in the province is not currently being realized.

Muskrat Harvest by Region,  
1985-2000.



The proportion of total fur harvest value contributed by muskrats in British Columbia has been as high as 15 percent historically, and as high as 12 percent in the mid-1970s, but has averaged less than one percent since the mid-1980s. Muskrats are harvested in all eight of the administrative regions of the province but, as shown in Figure 2, the largest harvests are taken in Region 2 (Lower Mainland) and Region 7 (Omineca-Peace).

Muskrats have values beyond that of their pelts, serving as food for some people in northern communities and for a number of other furbearers. They commonly benefit waterfowl by thinning dense stands of aquatic plants in marshes, and their lodges are often used by swans and geese for nesting. On the debit side, muskrats may cause some damage by burrowing in dikes and roadways, and by eating farm crops along the edges of marshes and streams. Trapping programs can help reduce muskrat-related damage.

## **BIOLOGY**

### **DISTRIBUTION AND HABITAT**

The muskrat is found in suitable aquatic habitats throughout North America, from Alaska south to the Gulf of Mexico, and has also been widely introduced in Europe, Asia, and South America. The Canadian distribution is coast-to-coast south of the arctic tundra. Muskrats occur throughout most of the mainland in British Columbia, but are apparently rare or absent in many areas west of the Coast Range. They are well established as an introduced species on Vancouver Island and the Queen Charlotte Islands, and are also found on several of the smaller islands between Vancouver Island and the mainland.

The essential feature of muskrat habitat is a body of fresh water, usually standing (marshes, lakes, ponds) or slow-moving (sloughs, rivers, drainage ditches, beaver ponds on smaller streams). The most productive habitats are permanent marshes and lake or pond margins that are shallow enough to support thick growths of plants such as cattails, bulrushes, sedges or horsetails, but deep enough to not freeze to the bottom in winter. Moderate numbers of muskrats also occur in lakes or ponds or along rivers with little or no marsh growth and subsist by feeding on submerged plants such as pondweeds. The best habitats in British Columbia are ditches, dikes, and river channels in the lower Fraser Valley, major river floodplains such as Creston Flats and the Columbia marshes, wetlands and lakes of the Interior Plateau, and a variety of lakes, ponds, and beavers systems in the far north, especially in the Peace-Liard area.

In typical marsh habitat, and along some rivers, muskrats live mostly in lodges which they construct by creating piles of coarse vegetation, sometimes with layers of mud, and hollowing them out to form dry, well-insulated, and moderately protected den cavities. The largest lodges, which may be up to 1.5 m high and 2.5 m in diameter, are usually built in the fall and are used for overwintering. In habitats where soil conditions allow, muskrats may dig and live in burrow systems termed "bank dens." Both lodges and bank dens are accessed by one or more underwater entrances. Dens in stumps, hollow logs, debris piles, and beaver lodges (both active and abandoned) have also been reported.

Muskrats also build support and cover structures for feeding, including vegetation platforms and mini-lodges termed "feeding huts" in summer and "push-ups" in areas where ice forms in winter. Push-ups are so-named because they are constructed by the animals pushing up piles of vegetation through a natural crack or a hole gnawed in the ice. Like lodges, they are hollowed out from below and are used as protective sites for feeding, enabling the animals to use vegetation that is remote from the home lodge.

## **FOOD**

Cattail is a primary food for muskrats throughout much of North America, often constituting as much as 80 percent of their diet. However, muskrats also eat the shoots, roots, bulbs, and leaves of a variety of other aquatic plants including bulrushes, horsetails, sedges, smartweeds, water lilies, duckweeds, and pondweeds and, especially in summer, upland plants such as grasses, clovers, various forbs, and cultivated crops such as alfalfa and corn. Primarily herbivorous, muskrats occasionally eat animal matter such as clams, snails, and bird nestlings, as well as items such as fish and other muskrats that are probably taken primarily as carrion.

## **SOCIAL BEHAVIOUR**

Muskrats have small home ranges that rarely extend more than about 100 m from their lodges or bank dens. The basic social unit is a breeding pair, which defends its home range territory against occupation by other adults, especially during the breeding season, although lodges may be as close as 8 to 10 m apart when population density is high. Fighting among muskrats is common, especially when populations are high. Fighting appears to be most prevalent around spring break-up, when juveniles and displaced animals are dispersing and adults are attempting to re-establish territories, and possibly in association with mating activity.

## **ACTIVITY AND MOVEMENTS**

Muskrats are active year-round, primarily from dusk through dawn during seasons of open (ice-free) water, but daytime activity is common when populations are high and competition for food and space may be intense, and in the late fall when animals are preparing for winter. Creatures of habit, they consistently use the same travel routes, feeding sites, and landing areas.

Daily movements are generally small in terms of distance from den sites, often less than 50 m, but movements of up to 34 km have been recorded for dispersing animals. Most dispersal occurs in the spring and involves juveniles of the previous year in search of mates and unoccupied territories. Muskrats of all ages may sometimes be forced to disperse from home ranges in other seasons as a result of habitat changes caused by drought, flood, or excessive ice build-up, or if food becomes scarce. Dispersing muskrats usually suffer a high rate of mortality but the few that do survive may be important colonizers of vacant or newly created wetlands.

## **REPRODUCTION**

In the interior of British Columbia, where winter conditions occur, the breeding season begins immediately after spring break-up. Muskrats probably breed earlier in the spring and for a longer period into the fall in Lower Mainland and coastal habitats that remain ice-free. Pairs usually remain together throughout the breeding period, often producing more than one litter during that time. Litters average six to seven young in most areas, and are born between early May and early August. In some areas farther south, young muskrats may become sexually mature and breed successfully in their first summer, but most in British Columbia probably do not breed for the first time until the spring following their birth. With the combination of early maturity, large litters, and occasional multiple litters, muskrats have a very high reproductive potential. However, reproductive success is lower in poor habitat or at high density, when local food supplies may be depleted.

## **CARE AND DEVELOPMENT OF THE YOUNG**

Muskrat kits are blind, naked and helpless at birth, and weigh about 20 g, but they grow and develop quickly. Their eyes are open and they are fully-furred, active and swimming at two weeks, are weaned and largely independent by four weeks, and near full size by about 3.5 months. Although the adult male remains as an occupant of the den in which the young are born and raised, it does not participate in their care.

## **MORTALITY, PARASITES AND DISEASE**

As is typical for animals with high reproductive rates, muskrats have high natural mortality rates and are short-lived (maximum about three years). Many are killed by predators and others, especially when population density is high, die from disease, starvation, exposure, and wounds suffered during fighting. In addition, surveys have identified more than 70 species of parasites. Although there do not appear to be significant health effects in muskrats from most of those,

muskrats may be a source of water contamination with parasites such as Giardia that are of interest in relation to human health.

Because of their small home ranges and therefore close contact with each other when at high density, muskrats are known to occasionally suffer major die-offs from bacterial diseases such as yersiniosis, tularemia, Errington's disease, and Tyzzer's disease. These diseases act quickly, and animals may be found dead with little signs of illness. Yersiniosis and tularemia can be transmitted to humans by handling infected carcasses, eating poorly cooked meat or from water contaminated with the bacteria that cause the disease, so care should be taken when handling muskrats.

Death rates are highest for juveniles in the first few months of life as they set about exploring their environment and may fail to find food or shelter at crucial times, suffer accidents, or fall easy prey to predators such as minks, raccoons, foxes, coyotes, and various hawks and owls. Some North American studies have shown that natural mortality between spring and autumn ranges from 30 to 65 percent for juveniles and is about 10 percent for adults. Mortality continues through the winter, at varying rates depending upon local conditions, and probably increases slightly at spring break-up when muskrats are again more exposed to predators. That is also the time when they fight among themselves as they disperse in search of mates and new territories. Usually, only about 20 percent of the animals produced in any one summer are still alive at the start of the next breeding season.



## **POPULATIONS**

The size of muskrat populations fluctuates widely, but they are generally largest in late summer and smallest in the spring. An individual muskrat consumes vegetation equivalent to about one-third of its body weight daily and that, coupled with the species high reproductive rate, results in the potential for massive over-use of a local food supply. When that happens, major die-offs due to starvation and disease may occur, and low numbers and depleted habitat may persist in that area for many years. In some areas, populations may also change over a series of years due to cycles of wet years and drought. In the best marsh habitats, densities as high as 86 muskrats per hectare have been recorded, and 25 or more per hectare is common. In muskrat habitats with less aquatic vegetation or with unstable water levels, densities may be as low as two animals per kilometre of shoreline.

## **HARVEST MANAGEMENT**

Muskrats are scattered in small numbers in marginal habitats along many BC stream and lake shorelines, but those animals are generally not subject to intensive trapping pressure or interest, and are of no particular concern in relation to either habitat protection or species conservation. The following discussions and recommendations are directed primarily to habitats where muskrats are conspicuously abundant and there is the potential for a significant return for trapping effort expended.

## **GENERAL CONSIDERATIONS AND OBJECTIVES**

When pelt prices are low for a particular furbearer, it can be tempting to discontinue trapping for it in hopes that the population will “build up” and provide more value later on, when prices improve. That is a particularly poor strategy for muskrats, which can attain high numbers and over-use their food supply in a short time. Muskrat populations can be maintained in a vigorous and productive state only in high-quality habitat, and habitat quality is best maintained by continuing management of muskrat abundance. Muskrat populations can normally sustain annual harvests of more than half of the animals present and, for long-term habitat and population productivity, taking less than that may be more detrimental than occasional over-harvests. Nevertheless, trapping strategies that will contribute to population maintenance over the short term should also be a consideration. Good management in muskrat trapping primarily involves two strategic objectives:

**1) CONTROLLING ANIMAL NUMBERS TO PREVENT OR REDUCE HABITAT DEGRADATION AND PROMOTE RENEWAL** As discussed above, this is primarily a matter of maintaining a sufficient level of exploitation of the population.

**2) SUBSTITUTING HARVEST FOR NATURAL MORTALITY WHEREVER POSSIBLE** This is best accomplished by focusing the harvest on the least secure members of the population, mostly juveniles and those in peripheral areas around the main muskrat habitats.

## **PLANNING AND INFORMATION CONSIDERATIONS**

In typical marsh habitat, it is possible to get a rough estimate of muskrat abundance prior to trapping by counting the number of active lodges in the fall, when the muskrats are most active and at their annual population peak. The number of active lodges, distinguished by the presence of fresh cuttings or other sign, is then multiplied by the average expected number of animals per lodge. Although the actual average varies somewhat between years and between areas, five is the “rule-of-thumb” number most commonly used for population estimates in most areas and, at the practical level, it will generally be sufficient. Trappers with large marsh systems may wish to determine an average specific to their location and year by conducting complete trap-outs of several lodges (10 recommended) at the start of the season. For habitats in which many or most muskrat dens are in bank burrows, an accurate pre-trapping inventory is not possible.

## **HARVESTING STRATEGY**

**GENERAL** With their high reproductive potential and propensity to over-use their food supply, muskrats can and should be heavily harvested. Studies have shown that muskrats can sometimes sustain harvests of up to 75 percent of total numbers without noticeable long-term decline, although 60 percent is the most commonly recommended target. Where both fall and spring trapping are undertaken, it should be noted that the 60 percent figure is not applicable to both seasons. An experiment in New Brunswick showed that taking 60 percent of a muskrat population in either fall or spring had no negative effect on population levels, but removal of 60 percent in both fall and spring caused a decline in total numbers the following year.

The establishment of refuge (untrapped) areas, a practice commonly used in harvest management for other furbearers, is not recommended for muskrats, because it could result in local over-population and become a focus for habitat degradation and disease. A moderate level of trapping over the whole habitat area is preferable, unless a population is clearly below local capability and needs temporary respite from harvest.

**TIMING** For muskrat habitats that remain ice-free, such as those in the Lower Mainland and on the coastal islands, trapping can be undertaken at any time during the long open season. In the Interior, muskrats are usually trapped in the fall before freeze-up and/or in the spring, either through the ice at push-ups or in open water after break-up. Among the factors that may be considered in the selection of harvest timing in any particular area are the following:

a) Since natural mortality occurs throughout the fall and winter, the number of animals available for harvesting is larger in fall than in spring.

- b) Since juveniles are the most vulnerable to causes of natural mortality and therefore the most likely to die before the next breeding season, the potential for substituting harvest for natural mortality (Strategic Objective 2, above) is highest in the fall.
- c) Juveniles continue to grow during the winter, and will therefore be larger and potentially more valuable the later in the season they are caught.
- d) Muskrats present in the spring are those which have demonstrated hardiness and a suitable living situation, and are desirable breeding stock.
- e) Pelts begin to prime up in mid- to late October, but are not fully prime until about early December and remain so throughout the winter from then until about mid-April.
- f) Although prime, many pelts taken after spring break-up may be damaged from wounds sustained in fighting and territorial defence, and may be of low value.
- g) Thickly vegetated wetlands may be difficult to access before freeze-up in the fall.

For the trapper in normally ice-free areas, optimal timing may involve finding the balance between delaying harvest to obtain maximum pelt value (size and primeness considerations per items "c" and "e" above), but beginning before large natural losses ("a" and "b" above) have occurred. That timing may vary consistently between areas, and may also vary between years in the same area. For example, in a dry year resulting in lower than normal water levels, an earlier and more intensive trapping effort may be indicated.

In areas where freeze-up occurs and access is not a problem, fall trapping will likely produce the largest number of pelts, the least risk of negative population effects and, in the balance between pelt primeness and pelt damage, the highest overall value. However, in reference to Strategic Objective 1 (controlling muskrat numbers to protect habitat), some spring trapping will be sustainable and may be advisable if early freeze-up or other factors reduce the fall effort.

**HARVEST GOALS AND MONITORING** Following are four methods that have been used to establish the level of harvest that should be undertaken in any given year, and to help determine when trapping activity should stop. All are approximations, and may need to be modified based on observed habitat, water level, or weather conditions, and/or the age of the animals being caught (see below).

- 1) On marshes where the pre-trapping inventory of muskrat lodges can be undertaken, a harvest goal can be established based on the estimated population. For example, if 100 lodges were counted, the projected population based on five muskrats per lodge would be 500 muskrats, and the harvest goal would be 60 percent of that or 300 animals.
- 2) Even without the pre-trapping inventory, the trapper can approximate the above results by limiting the harvest to about three muskrats (60 percent of five) for each lodge encountered during trapping operations.
- 3) Where lodge inventories are not practical, or where bank dens predominate, the harvest level may be gauged by changes in the success rate over time. For example, the trapper may monitor the harvest on successive days, with the expectation that a particular bank of trap sets will be pulled after the daily harvest falls to 40 percent of that taken on the first day.
- 4) Based on long-term local experience, traps may be left set for only a prescribed number of days. For example, for trapping at push-ups in late winter, experienced BC trappers recommend that traps be set for only three checks, pulling them on the last of those regardless of the number of muskrats caught.

For all of those methods, it is useful to keep careful records. For the first three methods the appropriate target percentage may vary from place to place, and may be determined locally over time by experimentally increasing the proportional catch each year until the return drops off noticeably from the previous year. The trapper can then return to a lower

harvest intensity in future years. In other cases, reference to long-term records may indicate trapping periods that worked best for individual trappers in particular habitats.

When trapping from fall through early winter, 75 percent or more of the harvest will usually be juveniles. If the first 40 muskrats do not include at least 25 to 30 juveniles, that may indicate a poor production year and the need to cease trapping operations earlier than usual. Juveniles can be distinguished from adults in that season by their smaller size, and by differences in primeness patterns on the back as viewed on the leather side. The pelts of juveniles are mostly dark bluish or show a broad dark band down the back, while the dark markings on adult pelts show a blotchy pattern (Figure 3).

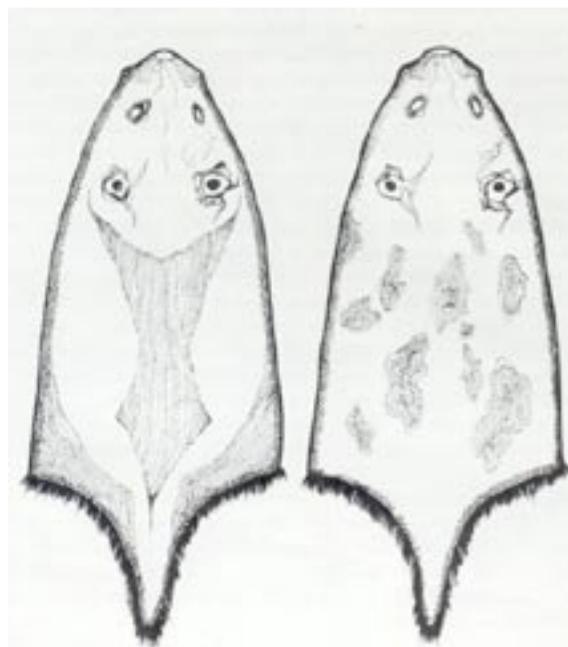


Figure 3: Differences in pelt priming patterns of juvenile and adult muskrats taken in the autumn harvest(after Boutin and Birkenholz 1988).

**RECORD KEEPING** This publication is intended to provide the general rationale and some broad guidelines for muskrat management, but cannot provide specific details that are workable in every situation. Trappers are encouraged to monitor habitat conditions and population indicators on their traplines, and to experiment with various trapping systems and trapping pressures. In this way, they may be able to compare years and adjust their trapping efforts accordingly. Although it is possible to detect some trends and patterns based on memory, it is generally advisable to systematically record information on paper. Data that may be useful for each location and time period are: number of active lodges and known bank dens; number of inactive lodges; number of feed piles along a designated route (or push-ups in winter); number and kinds of trap sets; trap check interval (days); and numbers and ages of animals caught by date and set type. Also of potential interest is information on water levels, general weather patterns (colder or warmer than usual, more or less snow/ice than usual), potentially catastrophic events (flood or drought), and observations of predators and their sign. The objective, to optimize management of the local muskrat resource, may take a number of years to achieve, but the effort is likely to be worthwhile in the long term.

## **HABITAT MANAGEMENT**

Most muskrat habitat in British Columbia is in the lowland areas most heavily occupied and used by humans, and some has been lost or degraded as a result of urban, industrial, and agricultural developments. Included in those categories are the flooding of wetlands by Hydro reservoirs, winter flooding of downstream muskrat habitats by water releases from hydro dams, the filling in of wetlands and sloughs for highway and railway rights-of-way, drainage of wetlands to increase farmland or in support of urban developments, and water diversion for irrigation. Trappers are usually the first people to see or learn about developments which can damage muskrat habitat, and may be able to help minimize damage by working with local landowners and providing input to government planners and managers. Development and water management plans can often be modified to protect key habitats, or to include arrangements to compensate for losses by providing or improving other muskrat habitats nearby.

Controlling water levels is the most important habitat improvement technique for muskrats. Water depth is important because it affects the kind and number of marsh plants available, and because it can directly affect muskrat survival as related to either drying up in summer or freezing to the bottom in winter. Water levels are important both seasonally, and over the long-term. Within

a particular season, relative stability is desirable, but occasional drying out over a span of years may be necessary to stimulate the germination of desirable marsh plants.

Most water control projects that provide significant potential to improve muskrat habitat are done by groups with a particular interest in wetlands, particularly Ducks Unlimited. Trappers are advised to be active in identifying and supporting such projects.

Stocking muskrats in natural marshes is usually not necessary. Muskrats disperse readily and only a few are needed to populate vacant areas. Exceptions can occur in newly created marshes, in marshes not connected to existing muskrat habitat, or in isolated marshes where catastrophes such as drought have occurred.

## **SPECIAL NOTE: HUMAN HEALTH RISK**

Due to the risk of being contaminated with the tularemia bacteria, trappers and others handling muskrats are advised to take every possible precaution to minimize the risk. The use of rubber gloves when handling muskrat carcasses is recommended, particularly for muskrats that were found dead or in poor condition. Symptoms may include a slow-growing ulcer at the point where the bacteria entered the skin, and swollen lymph nodes. If the bacteria have been inhaled, symptoms include sore throat, pneumonia, diarrhea, vomiting, and stomach pain. Tularemia cannot be spread from person to person, and is treatable with antibiotics.

## **SUMMARY**

Muskrats have a limited distribution in British Columbia due to the mostly mountainous terrain, but high productivity can be achieved on many wetlands in the province. The best habitats have stable water levels averaging between 1 and 2 m deep, and support an abundance of marsh plants such as cattails, bulrushes and horsetail. Muskrats have a high reproductive rate, with females able to produce two or three litters of up to six kits per litter each summer. Populations can quickly grow large enough to over-use the food supply, degrade the habitat, and increase the risk of disease. Thus, good management in muskrat trapping primarily involves controlling animal numbers to prevent or reduce habitat degradation and promote renewal. The largest harvests and often the greatest value can be obtained by trapping in the fall through early winter, a practice aimed at substituting harvest for natural mortality. However, late winter and early spring trapping generally produces the best pelts, though fewer, and should be undertaken if trapping in the fall does not occur, or is incomplete, in relation to planned harvest levels.

*BY: David F. Hatler, Donald A. Blood, and Alison M.M. Beal  
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PHOTOGRAPHY: Page 1, WLAP; page 4, David F. Hatler.

RESEARCH, LAYOUT AND GRAPHICS: Wildeor Wildlife Research and Consulting  
wildeor@junction.net

## **SOURCES FOR ADDITIONAL READING**

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*NOTE: This document has been formatted for insertion into the British Columbia Trappers Association Trapper Education Training Manual and for inclusion in print documents intended for government managers and industry representatives who are involved in furbearer management in British Columbia.*