FURBEARER MANAGEMENT GUIDELINES

BEAVER *Castor canadensis*

BRITISH COLUMBIA

Since 1926, separate trapline areas in British Columbia have been assigned and registered to individuals licensed to harvest the province's plentiful fur resources. To obtain a license, 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 beaver 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, muskrat, 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 beaver 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

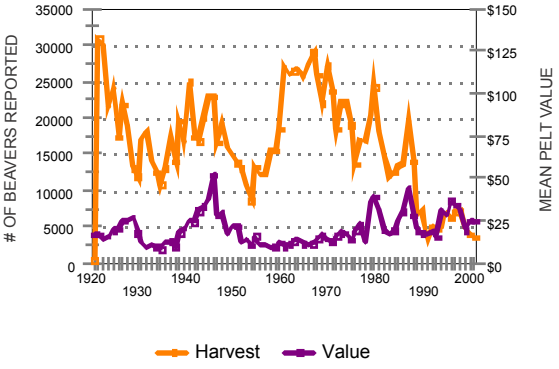
Although beavers are fast and extremely agile in water, North America's largest rodent appears to be slow and clumsy on shore. Measuring up to 120 cm in length, beavers have heavily muscled bodies, often with thick layers of fat, and adults may weigh from 16 to 39 kg. The characteristic flat tail, which can be up to 32 cm long and 18 cm wide, is used for a number of purposes including propulsion and steering in water, balance on land, and fat storage. A thick, heavy tail is an indicator of good local habitat conditions.

The beaver's large, open-rooted incisors grow continually and are kept at normal length (and razor sharp) through the frequent grinding and almost constant chewing that is typical of rodents. Nimble forefeet are used for digging and to handle objects such as building materials, food and kits. The large, webbed hind feet are used for propulsion when swimming. The second hind-toe is equipped with a split nail which is used as a "comb" during grooming. Beaver fur ranges in colour from light brown to almost black The greyish, dense underfur insulates this semi-aquatic animal and the long guard hairs protect the underfur from abrasion and soiling. Lush and versatile, beaver fur is a prized international commodity.

ECONOMIC CONSIDERATIONS

The most recent official population estimate for beavers in British Columbia was 400,000 to 600,000 animals, in 1979, and there is no reason to believe that there has been a dramatic change, either increase or decrease, since then. Most authorities agree that beavers can sustain annual harvests of at least 25 percent of their population, potentially 100,000 or more in British Columbia, but annual harvests since the 1920s have never exceeded one-third of that (see Figure 1).

Figure 1: REPORTED BEAVER HARVESTS AND PELT VALUES, 1920-2000.

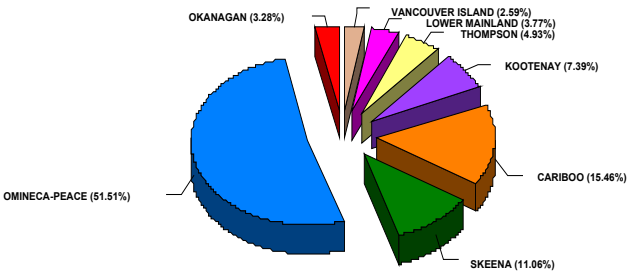


Beavers are taken in all eight of the administrative regions of the province but, as shown in Figure 2, the largest harvests are taken in Regions 5 (Cariboo) and 7 (Omineca-Peace). The average price received by trappers for beaver pelts peaked during the 1940s, to a maximum of $52 during the 1945-46 season (Figure 1). With a harvest of 23,070, the total provincial revenue from beaver pelt sales in that year was $1.2 million. In contrast, recent beaver prices (1985-2000) have averaged about $27 and annual provincial revenues have averaged about $221,000.

In addition to fur, beaver castoreum, used in the perfume industry, is sold on the international marketplace. The tail leather and teeth are frequently used in crafts and jewellry, and there is also a market for cleaned skulls.

However, the importance of beavers is not limited to consideration of direct economic values. They create and maintain wetland habitats important to numerous other wildlife species, including other furbearers (otter, muskrat, mink), moose and other ungulates, and a large variety of birds, fish, amphibians, and many kinds of invertebrates. Their damming and channelling activities also help stabilize watersheds, filter sediments, and enhance the local cycling of nutrients and biological productivity.

Figure 2: BEAVER HARVEST BY REGION 1985-2000



On the negative side, beavers cost North Americans millions of dollars every year by causing flooding and associated damage to roads, agricultural lands, and private and public property. The exact dollar value of the damage done by beavers in British Columbia is not known, but it may be substantial in some areas. Beaver structures on rivers and streams can also be detrimental to fisheries interests by impeding fish movements at critical times of the year.

Balanced management of the beaver resource, the theme of this publication, can increase the benefits to British Columbia through more revenue from the sale of beaver products and decreased damage to property and fisheries.

BIOLOGY

DISTRIBUTION AND HABITAT

Beavers occur throughout British Columbia, including Vancouver Island, the Queen Charlottes, and many other coastal islands with fresh water features (ponds, lakes or streams). The best habitats are along the slower-moving sections of rivers and streams and on ponds and lake shores not exposed to heavy wave action. Beavers prefer muddy shores and bottom areas because rock and

gravel make burrowing, channelling and damming difficult. Relatively stable streams, such as those draining lakes, are preferred over those where water levels fluctuate more extensively.

Along northern waters that freeze over in winter, an important component of habitat is an accessible supply of the woody vegetation needed by beavers for their cache of winter food. The water near the lodge must be deep enough so that ice does not block access to the food cache or prevent escape from predators.

The most productive beaver colonies are often in newly-occupied stands of poplar (both aspen and cottonwood) that naturally regenerate in forest clearings created by fire, blowdown, bug-kill, or logging, and on old sedimentation bars along large rivers. Poplar regrowth may support population expansion for beavers as early as 8 to 10 years after a burn, but on most sites it takes 20 to 30 years to produce poplars of a size that will provide the maximum amount of useable food. It can take only two or three years for a colony to use up the poplars within safe and efficient foraging distance from the water's edge (about 50 metres). Fortunately, willow often takes hold in the increased moisture and nutrient conditions of beaver impoundments, and the willow growth is often vigorous enough to allow the beavers to live a few more years at the same site after the poplar has been exhausted.

In short, active beaver systems are not permanent. Local shifts in activity centres and colony expansion through raised water levels may occur, but the local carrying capacity and population numbers will eventually be reduced to much lower levels by the beavers' own activities. As outlined below, it may be only 10 years between the time a beaver colony is established and the time it is abandoned or the beavers die of starvation, especially in aspen habitat. However, periodic removal of some animals by trapping, predation, or local catastrophes can extend the period of occupancy and minimize the damage to habitat, allowing an earlier and more complete recovery of woody vegetation.

FOOD

Beavers eat a variety of plants in the summer, including grasses, forbs, the leaves of shrubs, and aquatic plants such as pond lilies. However, their mainstay throughout the year in most areas, especially during the long winter season, is the bark and twigs of certain deciduous trees and shrubs, particularly poplars and willow. They often overuse their food supply, especially when it is aspen. A new colony will usually cut more than it needs, wasting up to 65 percent of the available food in "hang ups" (felled trees that don't reach the ground) and by not using bark on the larger pieces. Potential food trees are also inadvertently killed by drowning in the rising waters behind beaver dams.

SOCIAL BEHAVIOUR

Beavers live in colonies, which are family groups usually consisting of a pair of adults and one or two generations of offspring. In the fall, a colony of nine beavers might consist of the adult pair, three yearlings, and four kits. Such colonies might maintain more than one lodge and several dams, but will usually prepare only one cache of winter food. Some colony sites may support larger numbers, from 12 to 15 animals, in which case there are usually more than two full sized adults. Others sites support only single animals or pairs. The singles, which may be of either sex, are most often the sole survivors of former colonies. The pairs are usually newly-dispersed young animals (male and female).

The normal cycle of beaver life over one year is depicted in Figure 3. The usual pattern for two-year-old juveniles involves their leaving the colony of their birth in late spring. By leaving the home colony, the juveniles ease the pressure on the local food supply and reduce the risks of inbreeding. Their dispersal also provides for the opening of new areas to beaver activity.

Colonies stay well separated from each other. Even in optimal habitats, average population densities rarely exceed one active colony per kilometre of shoreline, and one colony per 2 or 3 km of shoreline is more common. Beavers communicate in various ways including tail-slapping, vocalization, specific movements when antagonized, and scent marking. Scent mounds, composed of mud and vegetation and perfumed with castoreum, are built in high activity areas near a beaver lodge. Found on or near dams and trails, and on the lodge itself, the scent mounds are believed to

serve as sign posts for dispersing animals, perhaps warning them to stay clear of active colonies and signalling vacancy in cases where one or more adult members have been lost. Other behaviour, especially aggression, probably helps to reinforce the scent signals and extends the colony's influence beyond the main activity centres where most scent mounds are built.

Normal social patterns can be disrupted when a large proportion of available colony sites are occupied. Two-year-olds may have trouble dispersing, and may stay at the home site where they increase pressure on local food supplies. High-density populations can also increase the incidence of disease and fighting, with associated damage to pelts.

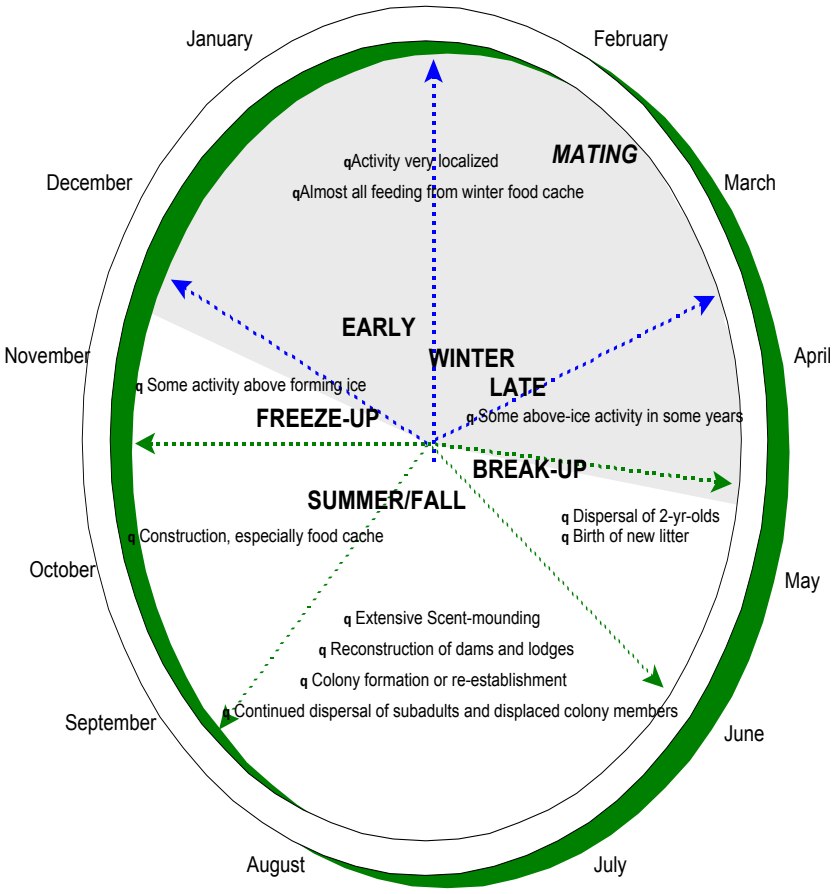


Figure 3

ACTIVITY AND MOVEMENTS

Beavers are out of the lodge and active primarily between dusk and dawn. Except for dispersing juveniles in spring and summer, all activity is within a fairly well-defined area within range of the lodge. On moving streams, the area used by a colony will usually extend further upstream than down, probably because it is more difficult to move food and building material against the current than with it. A study done in Alaska showed that the maximum distance between a food cache and the cutting site was 800 m upstream, 300 m down stream and 600 m along backwater sloughs.

The distance that young beavers move when they are dispersing from the colony site of their birth no doubt varies greatly, depending upon population density and habitat availability. The few studies that have been done have generally found that distance to be relatively short, mostly less than 20 km, although one two-year old male in Alaska moved at least 240 km. There have been several records of movements in excess of 200 km by transplanted beavers.

REPRODUCTION

Although there have been no direct studies, beavers in BC probably breed primarily in February or March, and the young are born from late April to early June, following a gestation period of about 105 days . Although beavers are capable of breeding as yearlings, most do not until they are approximately 21 months old. A colony usually produces only one litter per year, and that by the dominant pair. As many as nine embryos have been found in pregnant females, but three or four are most common and live litters of more than five kits are very rare. Litter size increases with the size and age of the female. A female beaver reaches maximum reproductive capacity between the ages of five and nine years but the differences among age classes are too small to be of practical significance. Habitat quality also affects litter size with the largest litters born in newly-colonized aspen habitat and the smallest in older, degraded sites.

When colonies are confined beneath the ice, they are isolated and sedentary around their food cache and appear to remain so throughout the breeding season. If adults are trapped or lost to other

causes early in the winter, there is little chance they will be replaced by immigrants before the breeding season ends. Younger colony members may try to take over the reproductive role but local productivity will usually be reduced, if not temporarily lost.

CARE AND DEVELOPMENT OF THE YOUNG

Beaver kits are born fully-furred with their eyes open, and they walk, swim, and explore their surroundings within several minutes of birth. They nurse for approximately two months but start taking solid food brought to them by adults or older juveniles in the colony at 4 to 14 days after birth. All colony members, including the male and juveniles born in previous years, share in the care of the young. Despite their relatively advanced development, starting at birth, the kits do not attain full independence for many months and remain in the home colony for at least two years.

MORTALITY, PARASITES AND DISEASE

In northern areas, climatic factors are particularly important to beavers, potentially affecting entire colonies. Low temperatures with light snowfall can increase the beaver's energy needs by depriving the lodge of its insulating layer of snow. Ice that becomes too thick in the beaver pond can entrap the food cache. Under these harsh conditions, beavers will either starve or dig out, but survival rates are poor for beavers that are forced to forage above the ice. Winter and spring thaws that raise water levels may flood out colonies at a time when there is nowhere else for them to go, sometimes resulting in mass drownings or displacement to areas where they are more vulnerable to predation. Additionally, rapid spring breakups can be accompanied by a violent grinding action of ice, that may destroy food caches and lodges and sometimes the beavers as well.

Beavers die from a variety of other natural causes. They are sometimes killed by the trees they are felling, from wounds inflicted by other beavers in territorial conflicts, and by wolves or other predators. Beavers are most vulnerable to predation in the advanced stages of colony occupation when they are foraging far from the water, and when they are foraging above the ice in winter. The latter may occur because of climatic factors that prevent or interrupt construction of the food cache in the fall, winter conditions that make the cache inaccessible, or because the food cache was initially inadequate due to locally declining habitat conditions. Kits are relatively secure in their home colony. Juveniles are vulnerable to predators during dispersal and in the first year on their own, but suffer relatively low rates of predation for a number of years after that.

Beavers are not known to be particularly susceptible to large losses caused by parasites or disease. However, there are records of widespread outbreaks of tularemia, a disease fatal to beavers, which attacks the liver, spleen, lungs, and lymph nodes, and is usually associated with the stresses of overpopulation. Tularemia can also be transmitted to humans, occasionally causing death.

POPULATIONS

Local beaver populations are usually censused by counting the number of active lodges (those with food caches in late fall) and multiplying that number by an assumed average number of beavers per colony (usually five in most areas). For example, in a 198.5-km section of the Nechako River in northcentral BC, intensive surveys over a 13-year period found an average of 119 active lodges which, using the factor of five, translates to a population averaging 595 beavers in the area over that time period.

HARVEST MANAGEMENT

GENERAL CONSIDERATIONS AND OBJECTIVES

Despite their tendency to increase beyond their habitat's ability to support them, beavers can be over-harvested because they are confined to watercourses, their lodges and dams make them easy to locate, and they are relatively easy to trap. Fortunately, their conspicuousness also makes them easier to manage than most other furbearers, since it is possible to determine the approximate numbers and relative security of animals at individual colony sites before trapping begins.

Adult beavers, particularly females, appear to be the most important to maintenance of a colony, but there is no certain way to avoid catching them in a local trapping effort. That is generally not desirable in any case, because females usually provide the largest pelts. Maintaining a colony at one site for long periods is neither possible nor desirable for habitat quality reasons, and it is generally recommended that no more than 60 to 70 percent of the lodge sites in an area be occupied by beavers in any one year. The remaining sites should be left open to allow regeneration of food supplies and to provide colonization opportunities for dispersing animals. For these reasons, the best policy is to trap all or most members of a colony and to target no more than 30 to 40 percent of the colonies on the trapline. With that general plan, good management in beaver trapping primarily involves two strategic objectives:

1) SUBSTITUTING HARVEST FOR NATURAL MORTALITY WHEREVER POSSIBLE
To meet this objective, the colonies to target are those judged to have a poor chance of surviving the winter (see below).

2) CONTROLLING ANIMAL NUMBERS TO PREVENT OR REDUCE HABITAT DEGRADATION AND PROMOTE RENEWAL In this case, the colonies of interest are those with large or extra-large food caches, since they are clearly using up the food supply at the fastest rate and, in most cases, will also provide the largest return in numbers of pelts.

PLANNING AND INFORMATION CONSIDERATIONS

Optimal management of the beavers on a trapline involves systematic inventory, assessment, and planning before trapping begins. The best time for inventory survey activity is in the fall, usually late September through October, when the animals are most active in their final preparations for winter. Surveys can be done on foot, by boat, or from a small aircraft after leaves have fallen. During the survey, each lodge site with a winter food cache can be considered active, and those without are inactive. The status of each of the active sites should be assessed, with the following considerations in mind:

STANDING FOOD SUPPLY Is the available food supply aspen, willow, or some other winter food? Is it abundant and accessible, generally adequate, or depleted? A rich supply of aspen may indicate a new, expanding colony that can be left another year or two so that it can provide the highest possible yield. Colonies subsisting on barely adequate supplies of willow or other vegetation have little potential for increasing their numbers and are candidates for immediate trapping, since they may not even survive the winter.

SIZE OF FOOD CACHE Cache size may give some indication of colony size and vigour. Colonies with small caches on older sites are least likely to survive, even in the absence of trapping, although those with small caches on new sites may have a strong future.

EXPANSION POTENTIAL Some sites, though largely depleted of food, can easily be expanded by further damming upstream or downstream, while others are limited in growth potential by surrounding vegetation and topography. The highest long-term yields may be realized by letting some colonies expand where they are able and, in other cases, by preventing such expansion. The decision to prevent expansion will

depend on the available food supply, security, the proportion of active sites elsewhere in the system, and the threat of damage to property.

SECURITY Some beavers, especially inexperienced two-year-olds, may try to settle in inappropriate areas, such as on a stretch of stream that will freeze too deeply in winter or along stream sections in which caches and lodges regularly "wash out" in winter and spring. Such animals are best trapped before freeze-up.

DAMAGE POTENTIAL Colonies in areas where they may conflict with the interests of property owners should be trapped when pelts are of value.

THE COLONY CYCLE

As has been indicated elsewhere in this document, beaver colonies can not be maintained on the same site continuously because they eventually use up the accessible food and building material components of their local habitat. The length of time a particular site may support a healthy, viable colony probably varies from place to place in British Columbia, but the following generalized description of a "colony cycle" may be helpful for interpretation of fall survey results:

YEAR 1 A pair of dispersing two-year-olds colonizes a prime, formerly unoccupied aspen site. The fall food cache size is likely to be small or medium, and the total number of beavers at that site for the first trapping season will likely be two animals of about the large (L) pelt size category.

YEAR 2 The pair develops the site and produces the first litter. The cache size is medium to large and the total number of beavers available in the second trapping season will likely be two adults, probably both XL, and as many as three or four in the S-cubs pelt size category.

YEAR 3 The beavers are starting to have a noticeable impact on the aspen stand. The second litter is produced. The fall cache size is likely to be large, and the number of beavers available during the trapping season will likely be two adults in the XL to XXL category, as many as three or four yearlings mostly in the M and LM category, and as many as four S-cubs.

YEARS 4 AND 5 These are the peak years. The food supply is still ample, providing for food cache sizes in the large to extra-large categories. The two-year-olds strike out on their own before the next litter is born, thus the total number of beavers and sizes will likely be about the same as in Year 3.

YEARS 6 TO 8 The aspen is becoming depleted and the beavers are making more use of other foods such as willow. The colony make-up is similar to that in years 4 and 5, but with decreased reproductive performance because of the deteriorating habitat. The food cache may still be large, and one or both adults may be at XXXL sizes, but there will likely be progressively fewer of the smaller classes.

YEARS 8 TO 10 The habitat is now poor, and is beginning to affect the condition and survival of adults as well as reproductive performance. The food cache may be back to the medium or small size, and remaining colony members may starve or be forced to relocate over winter. Note that this cycle may be shorter where the primary winter food is not aspen or cottonwood.

HARVESTING STRATEGY

The trapper's inventory and assessment work provides the necessary background information on the number and distribution of beaver sites that are available for trapping. Since no beaver colony can maintain itself in a productive state indefinitely, the trapper's general plan should be to trap all sites in a rotation of three to five years. That will serve to minimize the number of colonies that reach the higher levels of habitat depletion and lower levels of productivity (years 6 and later, as outlined above). However, the best long-term plan for a particular trapline may depend upon a number of factors, as follows:

TRAPLINE CHARACTERISTICS On a large, remote trapline with extensive wetlands, the only practical approach may be to divide the total area into sections, trapping each heavily during one year then leaving it for several years while the others are being exploited. In other areas, the trapping might be done on a drainage or colony basis, trapping intensively on a particular drainage once every few years or targeting only every second or third colony along a drainage in any given year.

RECOLONIZATION POTENTIAL Although some upland movements occur, most beaver dispersal is along waterways, both upstream and downstream. Therefore, landlocked lakes and ponds or stream sections above rapids and falls may be recolonized more slowly than more accessible sites. Where two or more colonies live in such situations, it may be possible for the trapper to keep at least one colony active so that a nearby dispersal source remains available. Transplants of beavers to such sites, or to other suitable sites not currently occupied, may also be undertaken. That is a particularly good use for "problem" beavers that must be removed during times of the year when their pelts are not prime. Transplants should involve more than one animal, preferably a pair of juveniles, and should be done in late summer when wanderlust is least and the construction urge is greatest.

PELT QUALITY Pelts reach maximum primeness in January and February. On stable systems, such as lakes and dammed streams, it may be most profitable to conduct most of the trapping under ice during those months. On moving water bodies with large or fluctuating flows, the safest and most effective trapping would be in late fall, before freeze-up. Late spring (May/June) trapping is potentially wasteful, both because the pelts are past prime and often damaged, and because it removes animals that have survived the winter and are poised to provide the year's increase.

HABITAT MANAGEMENT

On the largest scale, widespread suppression of forest fires has reduced the amount of new or renewed beaver habitat coming into production in many areas. Locally, riparian protection standards and silvicultural practices that eliminate or shorten the deciduous shrub and tree stage of the forest regeneration cycle may also impact on beaver populations. In addition, extensive logging changes drainage patterns and can reduce the carrying capacity of once-stable stream systems. The extent and quality of beaver habitats has also been dramatically altered in many areas by streamside clearing of deciduous trees for agricultural and residential purposes.

In addition to providing input to government agencies on the impacts described above, there are a few things trappers can do directly to improve beaver habitat at known colony sites. During visits to those areas in late summer and fall, trappers can clean up around aspen-felling sites, making "hang up" trees accessible by knocking or cutting them down and moving larger chunks to the water so beavers can use them in building. Cleaning up an aspen stand for beaver use also reduces the number of hiding spots for predators. Trappers can also help in the recovery of overused and abandoned beaver sites by breaching old dams to reduce water levels around areas where forage trees can take root, and by planting cuttings of poplar and willow in selected areas. Cuttings are best collected in the late fall or winter, after leaf fall, for planting in the spring.

SPECIAL NOTE: HUMAN HEALTH RISK

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

Note also that the risk of water-borne diseases such as Giardia (beaver-fever) increases when beavers are over-abundant and is another reason why trapper management of beaver populations is important.

SUMMARY

The potential yield on a beaver trapline depends upon the number of colonies and the number of beavers per colony. The number of potential colony sites is determined largely by landscape features that are beyond the trapper's control. However, the number of colony sites that are occupied and the number of beavers per active colony are related to habitat conditions that can be influenced by the trapper's harvesting system and occasionally by local enhancement. The number and sizes of the beavers available for harvest at particular sites depends on both habitat quality and the rotation (trapping) schedule. The largest pelts are produced in the best habitats and over rotations of three to five years. Failure to work a beaver trapline for long periods may result in widespread habitat and population stagnation. Although fur prices may fluctuate from year to year, beavers cannot be "stockpiled" and maintained in a productive state while the trapper is waiting for better prices.

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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.