BC Environment

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FORWORD

In cases where a Wildlife Working Report or Bulletin is also a Species Status Report, it may contain a recommended status for the species by the author. This recommended status is the opinion of the author and may not necessarily reflect that of the Wildlife Branch.

Official designation will be made by the Wildlife Branch in consultation with experts, and the data contained in the Status Report will be considered during the evaluation process.

ABSTRACT

The population of the Badger (*Taxidea taxus*) in British Columbia is small, spread over the southern interior of the province. Badgers are furbearers that are trapped in most of their range, including Alberta, Saskatchewan, Manitoba and Ontario, but they have not been legally harvested in B.C. since 1967. It is not known if overharvesting has contributed to a decrease in Badger populations, but habitat loss has played a significant role. Badgers inhabit the bunchgrass grasslands and open ponderosa pine forests in valleys of the Cariboo and Thompson-Nicola areas, and from the Okanagan Valley through to the southern Rocky Mountain Trench. Over the years, human activities have been concentrated in valley bottoms and thus many lowland wildlife species have lost their habitats to agricultural, forestry, hydroelectric and urban development. An effective program for managing Badgers must include the protection and enhancement of habitat. An education program for the public and agriculturalists will help people to understand the role of the Badger in its ecosystem, and help to change negative attitudes of agriculturalists towards Badgers. Much research is needed because there has never been a study of Badgers conducted in B.C. Priority should be given to mapping Badger locations, identifying and rating potential Badger habitat, surveying valuable Badger habitat, and providing this information through the Conservation Data Centre to habitat managers that are reviewing development plans. Conscientious management of rangeland and forests, and conservation of other grassland species, such as the Burrowing Owl (*Athene cunicularia*), will benefit Badger populations. Badgers are a Blue-listed species in B.C., meaning that they are considered sensitive or vulnerable to extirpation.

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GENERAL BIOLOGY

The Badger (*Taxidea taxus*) is a medium-sized carnivore with a distinctive appearance. Total length ranges from 60 cm to 90 cm and weight ranges from 6 kg to 14 kg (Messick 1987). The species is sexually dimorphic in size: adult males are larger (an average of 26% larger by weight) than adult females (Wright 1966). Generally, the pelt is long and silvery to yellow-brown on the back, with a cream-coloured underside (Lindzey 1982). Markings include bold black badges behind the eyes on each cheek, and a white medial stripe that extends from the muzzle down the neck. Also, ears are white with a black fringe, and legs are brown with black feet (Messick 1987). However, there is some geographic and individual variation in body size and in the colour and pattern of the pelage: Badgers from the south tend to be smaller and have a shorter medial stripe than Badgers from the north (Long and Killingley 1983).

Badgers hunt for burrowing prey and have several adaptations appropriate for this lifestyle. The body is stout and dorso-ventrally flattened (Messick 1987). The head is small and wedge-shaped, and the eyes are small and protected by a nictitating membrane (Long 1973). The ears are short and rounded. The legs are short with subdigitigrade feet. The forefeet are broad with long curved claws, while the hind feet are smaller with shovel-like claws (Long and Killingley 1983). The toes are partially webbed, which facilitates digging. The tail is short, 9 cm to 17 cm, and bushy (Messick 1987). There are prominent anal glands and a belly gland that exude a musky odour when the animal is excited (Banfield 1981).

Reproductive Capability

Badgers have a low reproductive capability compared to other furbearers (Long and Killingley 1983). Conception occurs between late July and September, but the young are not born until between March and May because of a six-month delay in implantation of the blastocyst (Hamlett 1932, Wright 1963, 1966, Banfield 1981). True gestation is approximately six weeks long (Hamlett 1932, Neal 1986, Messick 1987). The young are altricial and suckle for six to eight weeks after birth before dispersing from their natal area (Neal 1986). The maximum litter size is five, with an average of two or three (Lindzey 1971, Todd 1980, Banfield 1981, Messick and Hornocker 1981, Neal 1986).

Breeding Age and Frequency — Some juvenile females (less than one year old) do breed (Wright 1963, 1966, Wright and Coulter 1967, Messick and Hornocker 1981), but juvenile males do not. It is estimated that 30% to 50% of the females breed in their first season (Messick and Hornocker 1981). Lindzey (1971) observed that while 100% of adult females ovulated in summer, only 62% of juvenile females ovulated in their first summer. Messick and Hornocker (1981) examined female fecundity for the following age classes: less than a year old, one to two years old, two to three years old, and older than three years old. They report that female fecundity increases with age (Figure 1), but because of problems with aging methods (see Aging Techniques) this trend may be artificial. Messick and Hornocker (1981) also report that the proportion of females of all ages that were pregnant varies be-

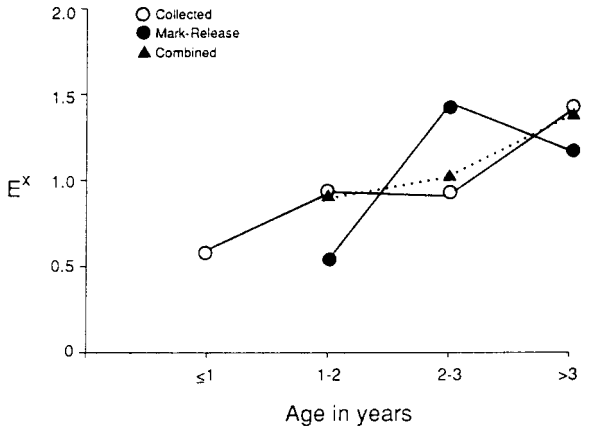

Figure 1. Estimated m_x (female births per female) for Badgers on the Snake River Birds of Prey Study Area, Idaho, 1975-1977 (from Messick and Hornocker 1981).

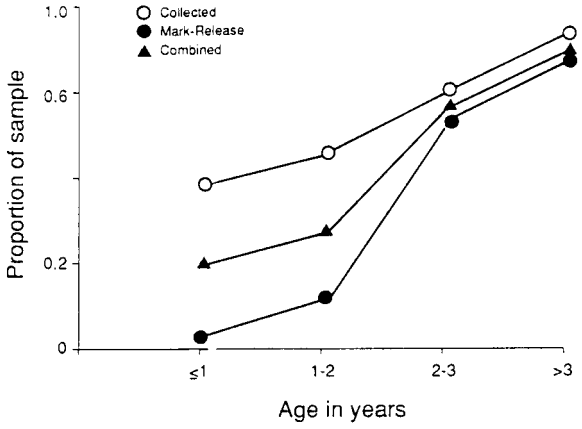

Figure 2. Estimated proportion of productive female Badgers on the Snake River Birds of Prey Study Area, Idaho, 1975-1977 (from Messick and Hornocker 1981).

tween 52% and 72% (Figure 2), and that females do not breed (successfully) every year. Wright (1966) discovered that neither placental scars nor corpora albicantia are reliable indicators of a female's reproductive history.

Age Structure — The age structure of four known Badger populations has been recorded (see Table 1) by three studies conducted in Idaho, Wyoming and Utah (Lindzey 1971, Crowe and Strickland 1975a, Messick *et al*. 1981, Figure 3). Proportions in each age class are fairly consistent among the four populations despite difficulties in aging Badgers (see Aging Techniques). If the differences in the frequency of age classes are used as an estimate of survivorship (Figure 4), then juveniles (less than one year old) suffer the highest mortality rates. Very few Badgers (less than 10%) were found to live beyond seven years old.

Aging Techniques — There are several techniques available for aging both live animals and collected specimens. In general, juveniles are smaller than adults, but weight is not a reliable criteria because all Badgers vary in weight seasonally (Messick 1987). Juveniles show the replacement of deciduous teeth by permanent teeth. Several researchers have examined the possibility of using cementum annuli in teeth as an age criterion (Lindzey 1971, Crowe and Strickland 1975b, Todd 1980, Matson 1981, Messick and Hornocker 1981). Using cementum annuli is not a reliable aging technique and it is also a technique of intermediate difficulty (Matson 1981). The chronology of the first annulus varies individually and geographically, and the number of annuli do not always agree in different teeth from the same animal (Messick and Hornocker 1981). Although canine teeth provide

Table 1. The age structure of four badger populations: Study 1 from southwestern Idaho (n=328), Study 2 from south-central Idaho (n=250) (Messick *et al.* 1981); Study 3 from Wyoming (n=80) (Crowe and Strickland 1975a); and Study 4 from both Utah and south Idaho (n=51) (Lindzey 1971); Combined (n=709).

Age	Study 1	Study 2	Study 3	Study 4	Combined
<1	45%	45%	48%	35%	44%
1	26%	22%	15%	16%	22%
2	11%	18%	12%	20%	15%
3-7	18%	15%	16%	23%	17%
8-14	<1%	<1%	9%	6%	2%
TOTAL	100%	100%	100%	100%	100%

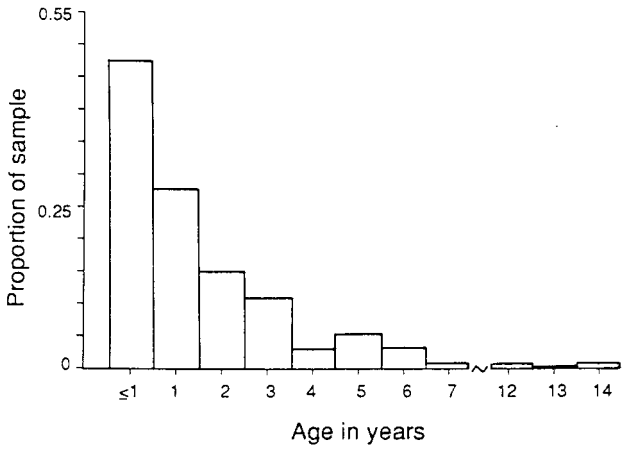

Figure 3. Standing age structure of the Badger population on the Snake River Birds of Prey Study Area, Idaho, 1975-1977 (from Messick and Hornocker 1981).

relatively reliable results, they should not be removed from live animals (Messick and Hornocker 1981, Messick 1987). Besides cementum annuli, other features can be used to classify Badgers into two broad age classes. Closed skull sutures and a prominent midsagittal ridge indicates an adult Badger (Messick 1987). Wright (1969) used dried eye lens weight to separate juveniles from adults. Adult females can be distinguished from juvenile females by measuring the diameter and length of their nipples (Petrides 1950, Larson and Taber 1980), but the reliability of this technique has not been tested. Ages of male Badgers can be estimated by inspecting the baculum, which changes in length, weight, and shape with age (Petrides 1950, Wright 1969, Lindzey 1971, Messick and Hornocker 1981).

Messick and Hornocker (1981) used a combination of methods in aging live Badgers for their extensive study in Idaho. Counts of cementum annuli of incisors or premolars were used. When results from cementum analysis were ambiguous, additional criteria were used: tooth wear, pulp cavity size, cementum thickness, tooth replacement and body size. These subjective criteria were only helpful in distinguishing between juveniles and adults. Messick and Hornocker (1981) were able to age 98% of the Badgers examined (n=435).

Sex Ratio — Badgers are difficult to sex without handling them, but Badger skins can be easily sexed: females have four pairs of nipples, while males have an opening for the penis. Although Badgers are sexually dimorphic and males are significantly larger than females, size is not a definitive criteria in sexing individuals in the field because body size also depends on age, subspecies, and nutritional status (Messick 1987). One can assume that an adult accompanied by several juveniles in spring or summer is a female and the group is a family, but juveniles only stay with their mother until late summer. Several researchers have found that the sex ratio tends to be 1:1 (Lindzey 1971, Crowe and Strickland 1975a, Messick and Hornocker 1981).

Population Growth Potential in B.C. — Although there is a considerable amount of information available on the reproductive biology of North American Badgers, nothing is known of the reproductive rates of Badgers in B.C., where

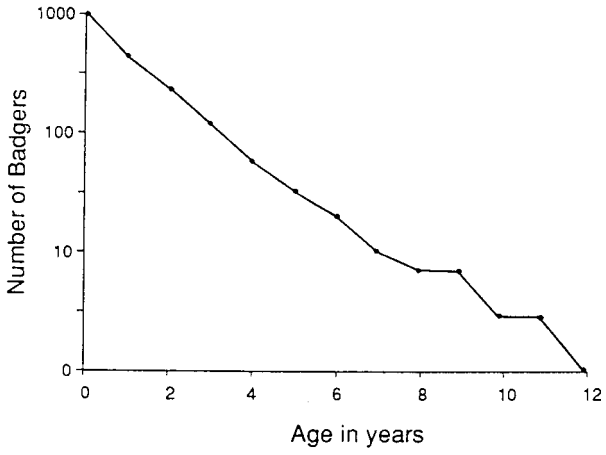

Figure 4. Survivorship (l_x) curve for Badgers on the Snake River Birds of Prey Study Area, Idaho, 1975-1977 (from Messick and Hornocker 1981).

they are at the northern limit of their range west of the Rocky Mountains. Population reproductive rates depend on a number of factors: habitat quality, population, age structure, prey availability, and Badger density. Badgers in B.C. occupy a variety of habitats and may have different reproductive rates in different areas. It is unknown if recruitment is replacing mortality or what the growth potential of the populations in B.C. is because mortality, immigration, and emigration rates are also unknown. Without more basic information about Badgers in B.C., the present and future population dynamics of Badgers in this province cannot be predicted.

Movement

Badgers are a sedentary species; for most of their lives, they remain in the same home range. They do, however, disperse from their mother's home range after weaning during their first summer. At this time they can move up to 110 km from their natal area (Messick and Hornocker 1981). Juvenile Badgers are more erratic and extensive in their movements than are yearlings and resident adults, whose movement increases in the breeding season and decreases considerably in winter (Long and Killingley 1983, Messick 1987). Badgers will inhabit new areas as prey become available. In the Pend d'Oreille Valley southeast of Trail, it is thought that Badgers from Washington have followed Yellow-bellied Marmots as they emigrated along the new dam road and its rocky roadsides (Guy Woods, pers. comm.).

Home Ranges — Home ranges of Badgers vary in size between the sexes and seasonally. Males use larger home ranges than do females (Table 2), and the home ranges of males and females overlap, especially during the breeding season (Lindzey 1978, Messick and Hornocker 1981). Because Badgers reduce their activity during winter, especially in the northern part of their range and in alpine areas, their winter home ranges are a fraction of the area of their summer home ranges. Sargeant and Warner (1972) followed a single female from July through December, and her home range shrank dramatically as the year progressed: July - September, 761 ha; October - November, 53 ha; and December, 2 ha. Home range size also varies with the availability of prey species, the population density of Badgers, and habitat quality. Badger home ranges measured by different researchers vary considerably (Sargeant and Warner 1972, Lindzey 1978, Messick and Hornocker 1981). Although sizes of Badger home ranges in B.C. are not known, they are likely between 100 ha and 500 ha. They may even be larger if habitat quality in B.C. is on average less than that in western United States. Ritcey *et al*. (1988) indicated that 800 ha per Badger is required in summer to meet feeding and reproductive needs.

Seasonal Activity and Den Use — Badgers respond physiologically and behaviourally to seasonal fluctuations in climate and prey availability by reducing their activity during winter. They are not true hibernators, but they can minimize

Table 2. Sexual differences in home range size from two studies.
[1] Lindzey 1978, [2] Messick and Hornocker 1981.

Sex	Average Home Range Size (ha)	Sample size	Locality
Female	237	3	Utah-Idaho[1]
	130	11	Idaho[2]
Male	583	2	Utah-Idaho[1]
	170	5	Idaho[2]

thermoregulation costs by entering a torpor state (Harlow and Varnell 1980, Harlow 1981a,b,c, Harlow and Seal 1981). When snow covers the ground, Badgers cannot efficiently hunt hibernating fossorial animals, so they reduce their energy requirements by retreating into a den (Harlow 1979). Messick and Hornocker (1981) reported a female remaining in her den for 72 consecutive days during winter. Fewer dens are dug and used by Badgers in winter than in summer. In summer, a new den is used almost every day, whereas in winter, a Badger may use only one den for the entire season (Sargeant and Warner 1972). In spring, females with young change dens less frequently than do solitary adults (Lindzey 1978, Lampe and Sovada 1981). Lindzey (1976) described the distinguishing characteristics of maternal dens, which have more elaborate designs than other den types.

Behaviour

Food Habits — Badgers are predators that are proficient at hunting fossorial and semi-fossorial prey (Messick 1987), and can adjust their food habits to prey availability. Although their staple food is almost always small mammals, such as ground squirrels (Messick and Hornocker 1981) and pocket gophers (Lampe 1982), Badgers supplement their diet with a wide variety of food: carp, reptiles, amphibians, birds and their eggs, invertebrates, and carrion (Long and Killingley 1983). They are not strictly carnivorous, so they will consume corn and other grains, as well as herbs and wild grasses, when prey availability is low (Errington 1937, Snead and Hendrickson 1942, Jense and Linder 1970, Salt 1976, Lampe 1982, Hart and Trumbo 1983). Sciurids are the most common Badger prey in Iowa (Errington 1937, Snead and Hendrickson 1942), South Dakota (Jense 1968), and Idaho (Messick and Hornocker 1981). Lindzey (1971) reports that microtine and cricetine rodents are the most common prey, followed by lagomorphs, in Utah and Idaho.

The food habits of Badgers in B.C. appear to be similar to those reported elsewhere. According to Dave Low (pers. comm.), 75% of Badger sightings on the Northern Thompson Upland are associated with Yellow-bellied Marmots (*Marmota flaviventris*) and 25% with Columbian Ground Squirrels (*Spermophilus columbianus*). On the Thompson Plateau, Badgers subsist on Northern Pocket Gophers (*Thomomys talpoides*). In the Okanagan Basin and Okanagan Range ecosections, Badgers prey on Northern Pocket Gophers and on Columbian Ground Squirrels where these prey occur in open habitats (Mike Sarell, pers. comm.). In the Chilcotin-Cariboo Basin there are no ground squirrels west of the Fraser River, so it is thought that Badgers feed on marmots and microtines; east of the Fraser, Badgers are thought to feed mainly on ground squirrels (Anna Roberts, pers. comm.). In the Rocky Mountain Trench, the main prey species of Badgers are likely to be Columbian Ground Squirrels and Northern Pocket Gophers (Bill Warkentin, pers. comm.).

There are seasonal, annual, and age-specific trends in Badger diets. Lampe (1976) reported that the greatest diversity in mammalian prey species taken by Badgers occurred during summer and the least diversity occurred during spring. He correlated decreases in prey densities with diet shifts. In an Idaho study, Badgers switched to eating other rodent species and lagomorphs when the Townsend Ground Squirrel (*Spermophilus townsendii*) population crashed in the third year of the study (Figure 5, Messick and Hornocker 1981, Smith and Johnson 1985). Apparently, juvenile Badgers eat fewer mammals and reptiles but more arthropods and birds than do adults (Figure 6). This difference can be attributed to underdeveloped predatory skills of inexperienced juveniles or to the use of different habitats; for example, juveniles frequented farmed areas that had more arthropods and birds than did habitats used by adults (Messick and Hornocker 1981).

Foraging Behaviour — Badgers hunt primarily at night and are highly exploratory when foraging for fossorial prey (Messick and Hornocker 1981). More than 180 l of soil were displaced at average sites of predation (Lampe 1976). Several authors describe Badger hunting tactics, which include

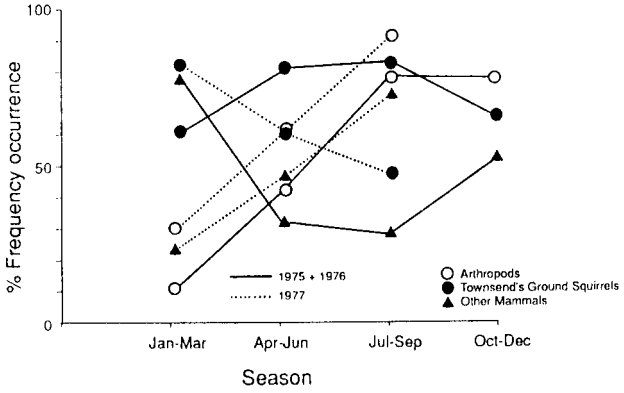

Figure 5. Seasonal changes of Badger food habits in 1975 and 1976 compared with 1977, Snake River Birds of Prey Study Area, Idaho (from Messick and Hornocker 1981).

chase and underground ambush techniques (Potter 1924, Sawyer 1925, Knopf and Balph 1950, Balph 1961, Lampe 1976). According to Lampe (1976), Badgers successfully captured gophers in 73% of the attempts. Although Cahalane (1950) suggests that Coyotes (*Canis latrans*) and Badgers will cooperate in hunting ground squirrels, it is more reasonable to assume that a Coyote occasionally takes advantage of the Badger's hunting techniques by waiting above ground for emerging squirrels. Although Lindzey (1971) reported observing a Badger caching food, Messick (1987) reports that Badgers consume their entire prey at one sitting.

Adaptability of Badgers to Human Impacts — Badgers are relatively tolerant of the presence of humans: they use roadside banks for their diggings and will venture into irrigated fields and urban developments. Humans, however, are not very tolerant of Badgers. Farmers will destroy Badgers that damage their irrigation equipment or dig in their fields, although Badgers control rodents that cause damage to farms (Silver 1928). Farmers use rodenticides to suppress rodent populations, and Badgers are poisoned by certain types of rodenticides. Ranchers will shoot Badgers on rangeland for fear that their cattle and horses will break legs in Badger holes. Besides mortality caused by agriculturalists, many Badgers die on roads. Most complaints registered with the Wildlife Branch about Badgers are expressed by people who have had a Badger hiding under their car. A Badger becomes defensive when confronted by an adversary or person and appears ferocious until it can escape. If it cannot dig its escape, it will retreat under an object like a car and defend its position vehemently. Clearly, education programs should be enlisted to increase understanding of Badger behaviour and elicit a sympathetic response from the public and agriculturalists towards Badgers.

Social Behaviour — Social behaviour of Badgers appears to be limited to interactions between mates and between females and their young. The breeding system is probably polygynous, as suggested by the transient pair bonds, sexual dimorphism, and overlapping of large home ranges of males with several small home ranges of females during the breeding season (Messick and Hornocker 1981, Neal 1986). Females den with their offspring until shortly after weaning them between June and July (Neal 1986). Badgers are

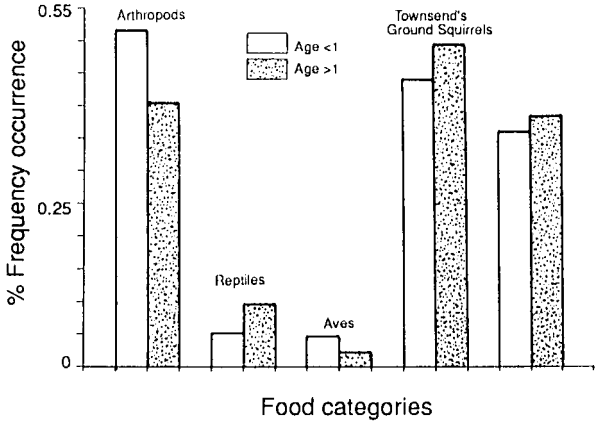

Figure 6. Comparison of annual diets in juveniles versus older Badgers, Snake River Birds of Prey Study Area, 1975-1977 (from Messick and Hornocker 1981).

equipped with scent glands and display marking behaviour in captivity (Lampe 1976, Messick and Hornocker 1981), but the use of scent glands for communication in Badgers is poorly understood. The Badger is a solitary species and, although home ranges can overlap, individuals tend to avoid each other except during the breeding season (Messick and Hornocker 1981). Male Badgers will fight over a female during the breeding season (Campbell and Clark 1983). Intraspecific aggression occurs when Badger densities are high. These higher densities can occur when their habitat is encroached by development (Hornocker *et al*. 1983). There is little indication that North American Badgers are territorial. Lindzey (1978) reports that Badgers use dens along boundaries of their home ranges more frequently than they use dens within their home ranges. The consensus of most researchers is that little is known of Badger social behaviour or of the effects of social behaviour on population dynamics.

HABITAT

Habitat Description

Badgers have few known life requisites: friable soil to dig in and prey to eat. Badgers do not appear to require grassland or open pine forests, but they probably prefer them and may attain higher densities in open habitats. In B.C., Badgers use at least five different biogeoclimatic zones: Bunchgrass, Ponderosa Pine, Interior Douglas-fir, Interior Cedar-Hemlock and Montane Spruce. Very little investigation or description of Badger habitat use has been done anywhere in North America. Two of the studies that have been conducted on Badgers were located in shrub/grassland habitats (Lindzey 1978, Messick and Hornocker 1981, Green and Anthony 1989) and their results may not directly apply to Badgers in B.C. that are living in open forest habitats. Badger densities in Manitoba are highest on the open prairie, but their denning areas are found extending into aspen and pine forest edges (Stardom 1978). It has been suggested that Badgers in B.C. prefer the ecotonal areas between forests and grasslands (Bea Burlingham, pers. comm.). There is no documented evidence of ecotonal preferences and they may be an artifact of habitat fragmentation.

Badgers in western North America are closely associated with open dry grasslands with deep friable soils that are suitable for excavating burrows. The Bunchgrass zone is the only grassland biogeoclimatic zone in B.C. and it is confined to the lower elevations of the driest and hottest valleys of the southern interior (B.C. Ministry of Forests 1988). Bluebunch wheatgrass (*Agropyron spicatum*) is the dominant grass on undisturbed sites, and at lower elevations big sagebrush (*Artemisia tridentata*) is common, especially on overgrazed sites. Ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) occasionally occur in draws and on coarser-textured soils, although the dry climate restricts their growth .

Badgers also use open dry forests, such as ponderosa pine and a mix of Douglas-fir with ponderosa pine (Cowan and Guiguet 1975, Ritcey *et al*. 1988, Stevens and Lofts 1988). The Ponderosa Pine zone is the warmest and driest forest zone in B.C. It is limited to a narrow band in valleys of the southern interior where it often borders the Bunchgrass zone. Ponderosa pine is the dominant tree species, but Douglas-fir is common on the colder and wetter sites. Where it is not overgrazed, the understorey includes abundant grasses such as bluebunch wheatgrass and rough fescue (*Festuca scabrella*).

Badgers have often been sighted in the Interior Douglas-fir zone, which is the second warmest forest zone in B.C. This zone is distributed throughout the dry southern interior in the rainshadow of the Coast, Selkirk and Purcell mountains. Although Douglas-fir is the dominant climax tree species, fires have frequently resulted in even-aged lodgepole pine (*Pinus contorta*) stands at higher elevations, while ponderosa pine is the common seral tree of the lower elevations. Pinegrass (*Calamagrostis rubescens*) and feather moss (*Ptilium crista-castrensis*) dominate the understorey with common shrubs like kinnikinnick

(*Arctostaphylos uva-ursi*). Along its drier limits, the Interior Douglas-fir Zone often becomes savannah-like and supports bunchgrasses.

There are reports of Badgers from the Interior Cedar-Hemlock zone and the Montane Spruce zone. The Interior Cedar-Hemlock zone occurs in the interior wet belt at low to middle elevations. Western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) are characteristic species, but Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) are common. Douglas-fir and lodgepole pine are generally found on drier sites. The Montane Spruce zone also occurs in the south central interior at middle elevations and is most extensive on plateau areas. Engelmann spruce and some hybrid (Engelmann-white, *Picea glauca*) spruce grow with subalpine fir in this zone, while the earlier post-fire successional forests have lodgepole pine, Douglas-fir and trembling aspen (*Populus tremuloides*).

There are also reports of Badger in the Sub-boreal Spruce zone in the Bonaparte River area. In this zone, Badgers were found in grassland phases associated with eutric brunisols on dry sites on and adjacent to south-facing slopes. These grasslands are interspersed with scattered Douglas-fir, and with aspen patches in the early stages of succession. Fire suppression has resulted in these areas becoming forested, with subsequent disappearance of Badgers (Dave Low, pers. comm.).

Not enough is known of Badger habitat requirements to identify critical habitat types, but habitats can be rated according to relative use by Badgers. Ritcey *et al*. (1988) rated the bunchgrass grassland habitat as having high value to Badgers for both feeding and reproductive requisites, while various stages of other biogeoclimatic zones have medium, low, or no value to Badgers (Table 3). The grass/forb stage of big sage shrub/grassland, ponderosa pine and Douglas-fir/ponderosa pine habitats have medium value. The value of these habitats to Badgers is low for the shrub/seedling stages of ponderosa pine habitat regardless of canopy closure and low for sparse or medium canopies of Douglas-fir/ponderosa pine habitat. The other seral stages of ponderosa pine forests (pole-sapling to old growth) have low value to Badgers only if the canopy cover is sparse, otherwise they have no value. The value of Douglas-fir/ponderosa pine forests is low for sparse canopy closures of pole-sapling and young forests, while other stages and canopy closures have no value. Pasture has low value to Badgers, unless it is occupied by ground squirrels; then Badgers spend some time digging them out.

Table 3. A rating of the value of seral stages of five habitat types to badgers, adapted from Ritcey *et al.* (1988). Canopy closure densities are abbreviated to S - sparse, M - medium, D - dense. Habitat value to badgers is ranked: L - low, M - medium, H - high.

Habitat Type	Grass/ forb	Shrub/ seedling			Pole sapling			Young forest			Mature forest			Old growth		
		S	M	D	S	M	D	S	M	D	S	M	D	S	M	D
Bunchgrass grassland	H															
Big sage grassland	M	L	L	L												
Ponderosa pine	M	L	L	L	L			L			L			L		
Douglas-fir/Ponderosa pine	M	L	L		L			L								
Pasture	L															

In the East Kootenay, Badgers have been seen in open forested areas where there are ground squirrels and rabbits, and also in less open forested areas with small openings. They have occasionally been seen in logged areas where there are Columbia Ground Squirrels (Bill Warkentin, pers. comm.).

Badgers live at a broad range of elevations within North America: sub-sea level desert valley bottoms (Death Valley) to alpine habitats at 5000 m. In B.C., Badgers are usually found in the range of 400 m to 1500 m, and occasionally above 1500 m up to 2400 m (David Fraser, Bill Warkentin, pers. comm.).

Habitat Distribution

The biogeoclimatic zones that are most valuable to Badgers are some of the least common zones in British Columbia. The Bunchgrass zone (BG) covers only 1.4% of the southern interior of B.C. and is dispersed over several valleys, while the Ponderosa Pine zone (PP) is slightly more common at 1.5% and less fragmented (Table 4). The Interior Douglas-fir zone (IDF) is the most common of the three principal biogeoclimatic zones used by Badgers, at 19.4% of the southern interior, and is particularly widespread on the Fraser Plateau and Thompson-Okanagan Ranges ecoregions. The Interior Cedar-Hemlock zone (ICH) and the Montane Spruce zone (MS) comprise 16.8% and 11.0% respectively, but are rarely used by Badgers. For distributions of these biogeoclimatic zones and ecosections see Table 5.

Trend in Habitat Alteration — Human pressure on the land base is increasing, which results in a decrease in the quality and quantity of habitats available for many species of wildlife. Most of the Badger habitat in B.C. occurs in bottoms and on lower sides of valleys at low elevations. These areas are also subject to strong development pressures: agriculture, hydroelectric, transportation, and urbanization, as well as forestry and mining. Grasslands that have been irrigated for alfalfa fields and orchards have become some of the province's most valuable agricultural land. The Ponderosa Pine zone is used as rangeland and, when cleared, for farming or pastureland. The Interior Douglas-fir zone is important for livestock summer range and for forestry. Prescribed burning of range for wild ungulates and cattle may benefit Badgers by main-

Table 4. Areas and relative areas of the five biogeoclimatic zones that badgers use in the southern interior of B.C. (1000s of ha, and % of region). ([1] Dennis Lloyd, [2] Ordell Steen, [3] Tom Braumandl, pers. comm.)

Zone type	Forest Regions Kamloops*[1]		Cariboo*[2]		Kootenays*[3]		Total**	
BG	223.3	2.8%	96.6	1.2%	0	0%	319.9	1.4%
PP	254.6	3.2%	2.8	0.03%	85	1.2%	342.4	1.5%
IDF	2340.6	29.0%	1715.8	21.4%	460	6.4%	4516.4	19.4%
ICH	1117.7	13.9%	333.2	4.2%	2460	34.1%	3910.9	16.8%
MS	1098.9	13.6%	1043.7	13.0%	430	6.0%	2572.6	11.0%
Other	3027.3	37.5%	4829.4	60.2%	3765	52.3%	11 621.7	49.9%
Total	8062.4	100%	8021.5	100%	7200	100%	23 283.9	100%

* These are regions of the Ministry of Forests rather than regions of the Ministry of Environment, Lands and Parks and the total.** represents the total for the southern interior of the province, which excludes the lower mainland, south coast and Vancouver Island.

taining open areas (Bill Warkentin, pers. comm.). Both the species composition of prey and the biomass available to Badgers change as habitats are altered. Also, rodent control programs that accompany agricultural development result in loss of prey and increase the potential for secondary poisoning of Badgers. The number of urban centres and extent of suburban use is increasing in the southern interior and south of the B.C. - United States border (Steve Zender, pers. comm.). The loss of habitat to urban development is accompanied by busy roads on which many Badgers die. The impact of forestry practices on Badgers is unclear. Forestry creates temporary openings in the canopy, but Badgers cannot use these early seral habitats unless they are inhabited by suitable prey. Forestry and road building can cause changes in drainage patterns and may result in soil erosion. Since Badgers require deep friable soil, soil erosion could prevent use of these areas by Badgers.

The rate of habitat change varies by region. The southern Okanagan is experiencing rapid habitat changes, while habitat in the Kootenays is changing at a moderate rate. Elsewhere, new development is slow and the rate of habitat change is low.

Habitat Status

Use of Protected Areas — Badger habitat in B.C. is not adequately protected. The B.C. Ministry of Forests estimates that 6%, or 6 million ha, of B.C.'s land area is protected in national and provincial parks, recreation areas and wilderness areas as of March 1988 (Terje Vold, pers. comm.). Table 5 gives the percentage of land in protected areas by ecosection. Total area of protected land in Badger range is 553 719 ha, which is 4.4% of their range. The Bunchgrass and Ponderosa Pine zones are small in area, and unless they are protected from

Table 5. List of the ecoregions, ecosections and biogeoclimatic zones in which badgers have been sighted, and the percent of protected area of each ecosection (Terje Vold, pers. comm.).

Ecoregion	Ecosection	Biogeoclimatic Zone	Protected Area
Fraser Plateau	Chilcotin-Cariboo Basin	BG, PP, IDF	7.4%
Chilcotin Ranges	Eastern Chilcotin Ranges	BG, PP, IDF	1.3%
Thompson-Okanangan Ranges	Clear Range	PP. IDF	1.2%
	Northern Thompson Upland	IDF	0%
	Eastern Thompson Upland	IDF	0%
	Southern Thompson Upland	BG, PP, IDF	0.1%
	Thompson Basin	BG. PP, IDF	0%
	Okanagan Basin	BG, PP, IDF	2.0%
	Okanagan Highland	PP, IDF	2.0%
Okanagan Range	Okanagan Range	BG, PP, IDF	18.5%
Columbia Mountains and Highland	Quesnel Highland	ICH	11.4%
	Southern Columbian Mountains	ICH	0.9%
	McGillivray Range	IDF	0%
Southern Rocky Mountain Trench	East Kootenay Trench	PP, IDF	0%
Southern Rocky Mountains	Southern Continental Ranges	IDF, ICH, MS	24.4%

various types of development, preferred Badger habitats will continue to be lost. There has been no organized survey of Badgers in protected areas, hence use of these areas by Badgers is unknown. Badgers have been sighted in several provincial parks: Kikomun Creek, Wasa, and Jimsmith Lake. In Kootenay National Park, Badgers have been sighted on four occasions. Badgers have been reported to use Ecological Reserve 100 in the Okanagan and land owned or leased by the Wildlife Branch in the Kootenays, Kamloops area, and Cariboo. The South Okanagan Critical Areas Program (SOCAP) has identified habitats found in 21 protected areas in the south Okanagan. There are 14 protected areas with suitable Badger habitats but use by Badgers is unknown (Hlady 1990). Only eight of these 14 areas are large enough to encompass one Badger home range (*i.e.* >100 ha), three are large enough for two or three Badgers (>500 ha), and one could support as many as ten Badgers (>10 000 ha) depending on habitat quality. The SOCAP does plan to protect and rehabilitate at least two areas that are currently used by Badgers: White Lake and the Chopaka area. In the future, grassland habitat may be bought by government agencies and non-government organizations in Canada and the USA to ensure the survival of grassland species such as the Badger, Burrowing Owl, Sage Grouse, Sharp-tailed Grouse, Pygmy Rabbit, White-tailed Jackrabbit, and Nuttall's Cottontail (Steve Zender, Washington, pers. comm.).

DISTRIBUTION

North America

The Badger, *Taxidea taxus*, occurs only in North America. There are four subspecies of *Taxidea taxus*, and they range from central Mexico to northern Alberta, and from the Pacific coast to Connecticut. The most recent distribution map of Badgers in North America comes from Messick (1987, Figure 7). The known distribution of Badgers in North America has changed very little since 1959 (Hall and Kelson 1959, Figure 8), although local densities have fluctuated with impacts of habitat alteration, changing harvest pressures and rodent control. Badgers have extended their range northward and eastward to Ohio, Connecticut, Missouri, and New York since development of the land by European settlers (Moseley 1934, Leedy 1947, Nugent and Choate 1970, Messick 1987). This range extension is attributed primarily to the clearing of forests for agricultural development, and to the release of captive Badgers in the east (Long and Killingley 1983, Messick 1987).

Canada

Of the four subspecies of Badgers, three are represented in Canada. *Taxidea taxus jeffersoni* (formerly known as *Taxidea taxus neglecta*) is the most common subspecies of Badger found in B.C. *Taxidea taxus taxus* is found in Alberta, Saskatchewan, Manitoba, and rarely in B.C. (Dick Cannings, pers. comm.). *Taxidea taxus jacksoni* is occasionally seen in southern Ontario. The most recent distribution of Badgers in Canada was compiled by Banfield (1981, Figure 9). Long and Killingley (1983) mention a small population of Badgers establishing itself in the Yukon. Apparently this claim was based on one unconfirmed sighting of a Badger in the Yukon reported to Stardom by a Yukon biologist (R. Stardom pers. comm.). There is no evidence that there are currently Badgers in the Yukon (Brian Slough, pers. comm.). Although Badgers extend into northern Alberta, the Yukon would be an unexpected extension of their range. Stardom (1978) speculated that the range of *Taxidea taxus* in Canada seems to be expanding northward, although densities are dropping in some areas. He compared his range map to that of Seton (1909, Figure 10) and concluded that the range had expanded. Long and Killingley (1983) suggested that at least some of this expansion reflects increased knowledge of known range rather than immigration into new areas. Without complete records, it is difficult to say how much the range of Badgers has changed in Canada since extensive settlement by Europeans. The extent of Badger distribution has likely changed little, although local densities of Badgers have fluctuated.

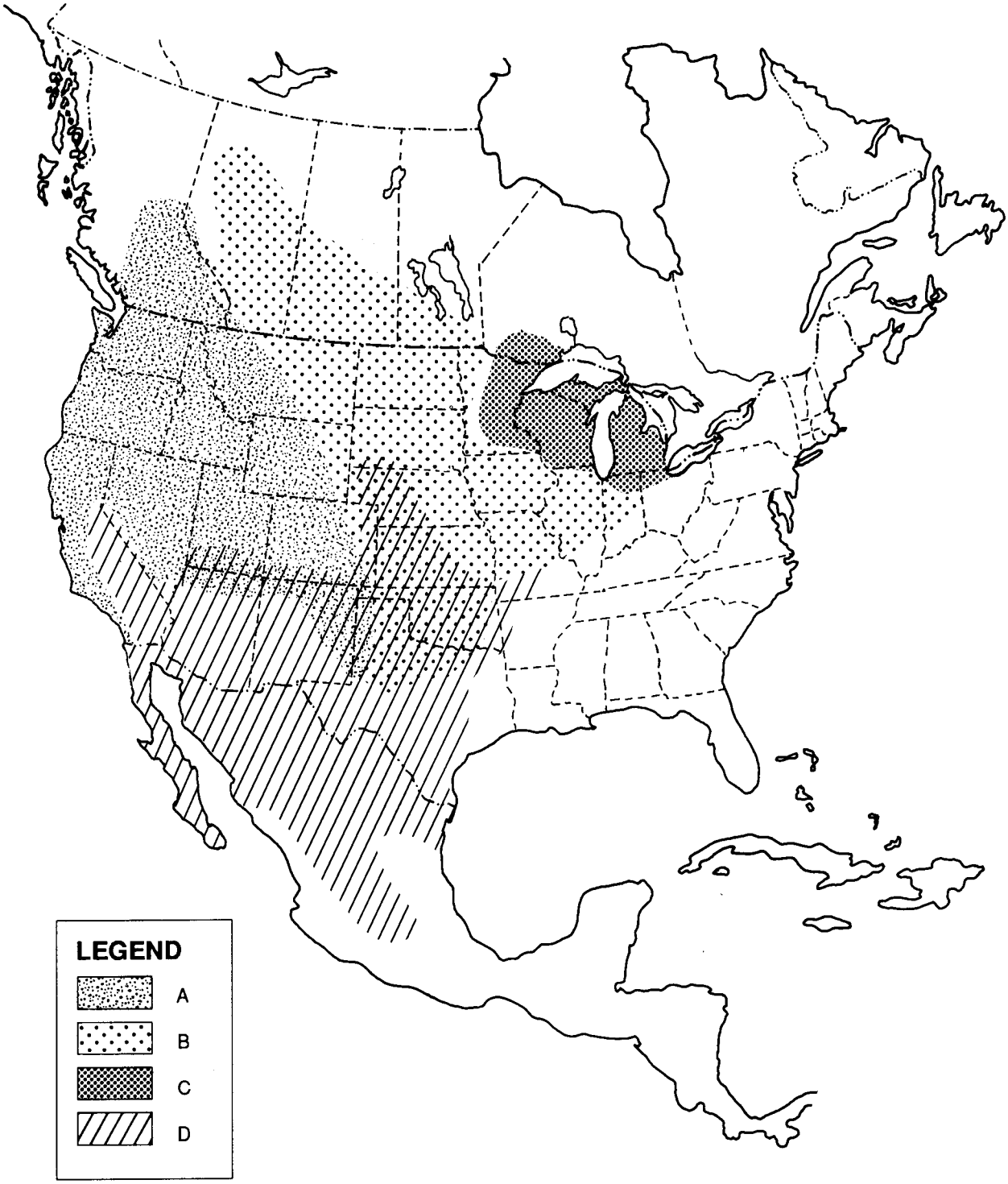

Figure 7. The 1987 distribution of Badgers in North America (from Messick 1987). A *Taxidea taxus jeffersonii*, B *T. t. taxus*, C *T. t. jacksoni*, D *T. t. berlandieri.*

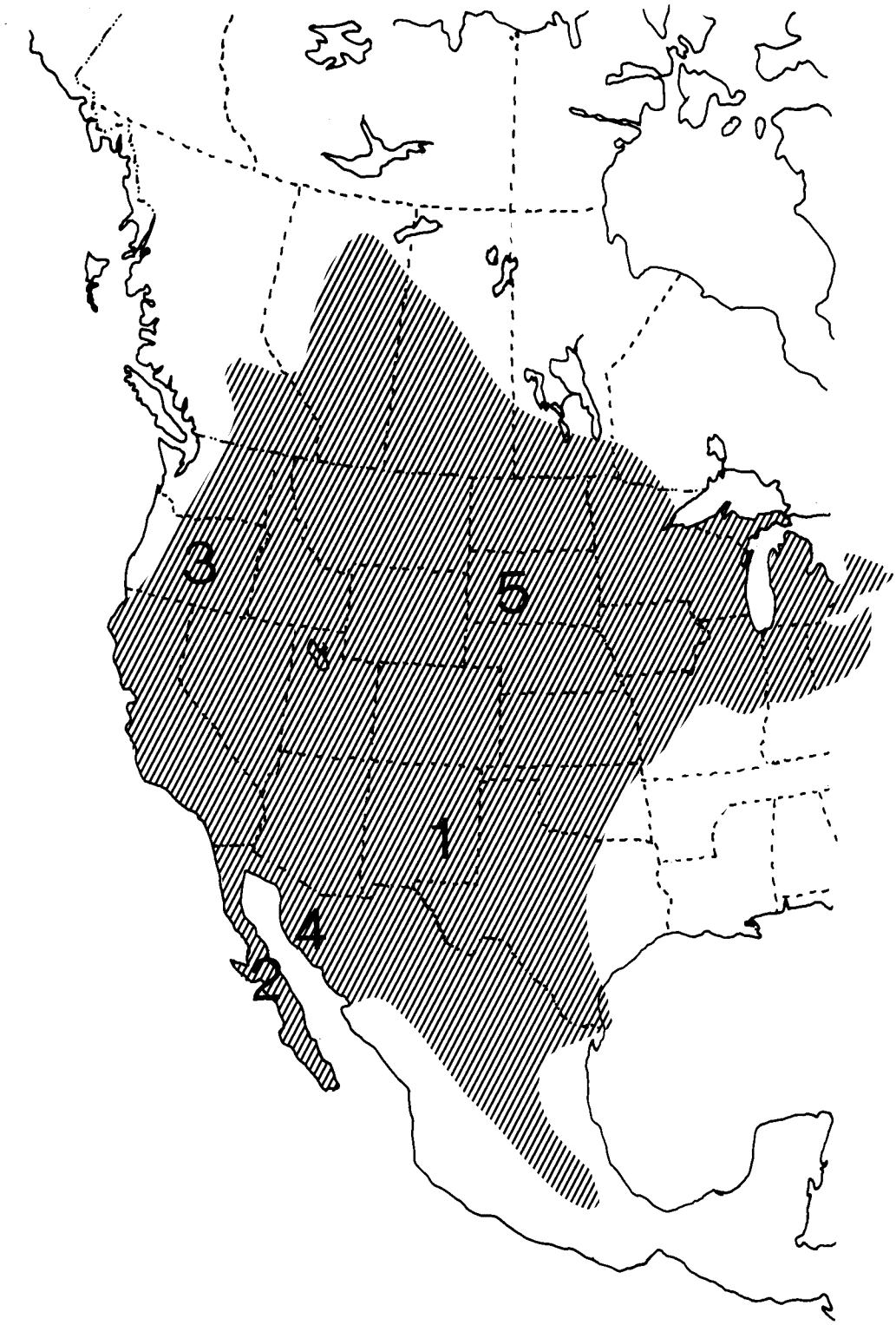

Figure 8. The 1959 distribution of Badgers in North America (from Hall and Kelson 1959).
1 *Taxidea taxus berlandieri*, 2 *T. t. infusca*, 3 *T. t. neglecta* (*jeffersonii*), 4 *T. t. sonoriensis*, 5 *T. t. taxus*.

British Columbia

There are no distribution maps for Badgers in B.C. older than 1979 (Figure 11). Although there are few differences between the 1979 distribution and more recent distributions (Figures 12 and 13), there is some discrepancy regarding continuity of the distribution. Stevens and Lofts (1988) have shown the small population of Badgers west of the Fraser River in the Cariboo to be isolated from the rest of the distribution, where Taylor (1979) did not. There are records of Badger sightings between the Cariboo and the North Thompson Upland ecoregions. The 1988 range map of Badgers in B.C. (Figure 12) is updated (Figure 13) using more than 300 records collected from many sources, including sightings and museum specimens. The records date as early as 1913 and as recently as November 1990. These records are listed in Appendix 1 and will be available to biologists through B.C.'s new Conservation Data Centre and SOCAP. The number of records by B.C. Ministry of Environment, Lands and Parks regions are: 118 in the South Okanagan, 57 in the Thompson region, 110 in the East Kootenays, 16 in the West Kootenays, and 16 in the Cariboo. There have also been two sightings of Badgers in Manning Park (which is in the eastern section of the Lower Mainland region), probably as a result of a westerly movement of ground squirrels (Maria Leung, pers. comm.) . The

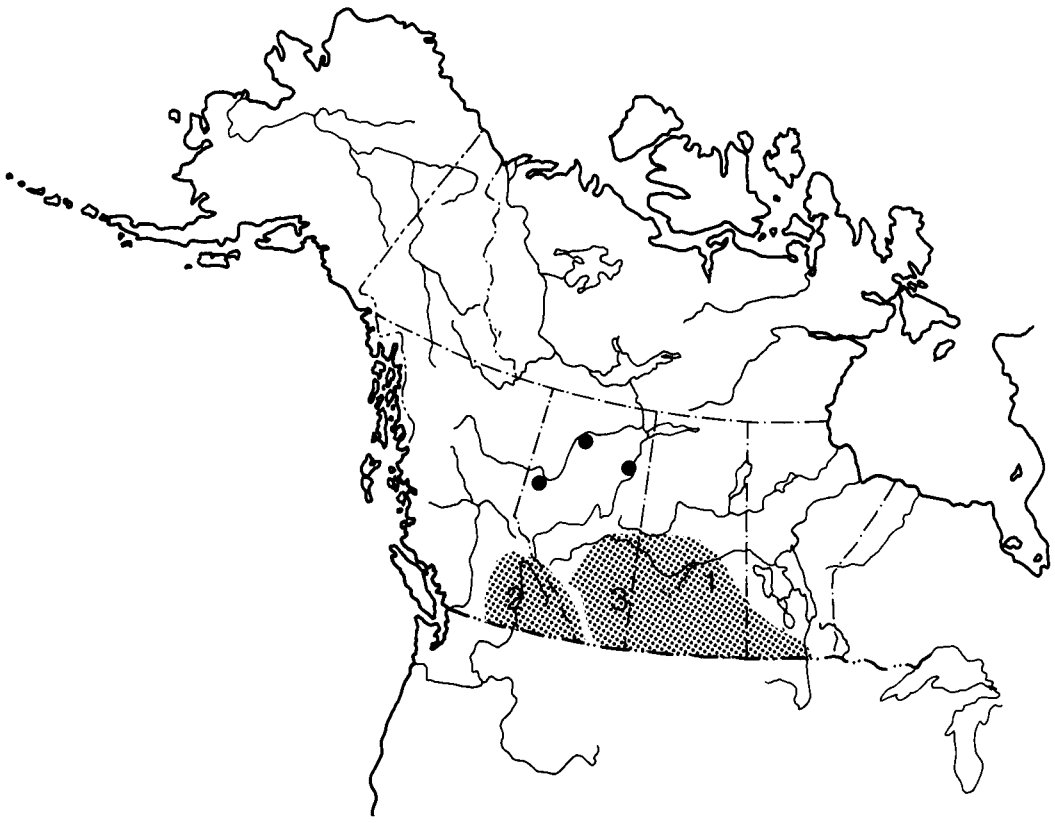

Figure 9. The 1981 distribution of Badgers in Canada (Banfield 1981).
1 ***Taxidea taxus jacksoni*****, 2** ***T. t. jeffersonii*****, 3** ***T. t. taxus.***

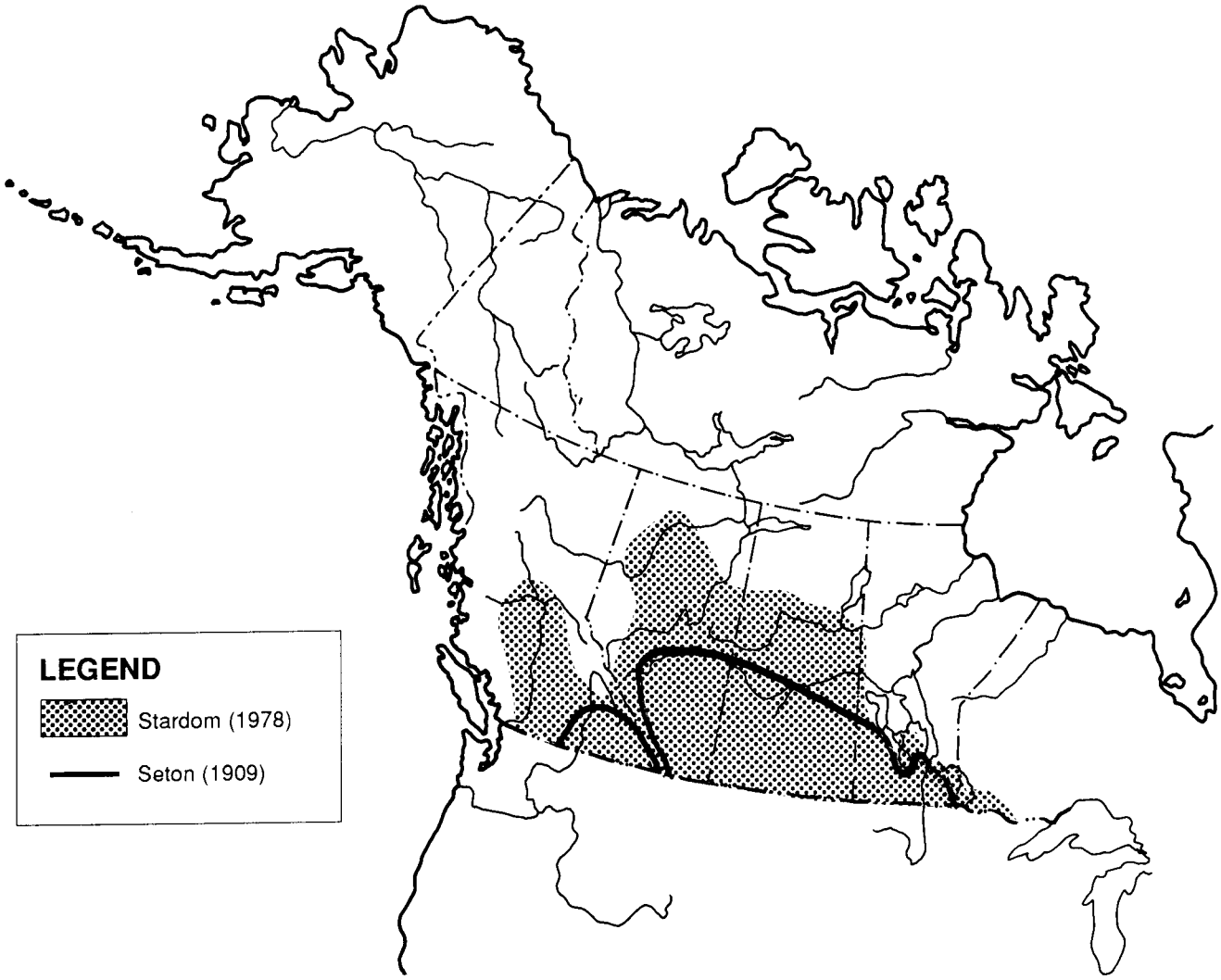

Figure 10. The 1909 distribution of Badgers in Canada (Seton 1909, from Stardom 1978).

distribution of Badgers in B.C. correlates with the distributions of its major prey species (Northern Pocket Gopher, Columbian Ground Squirrel and Yellow-bellied Marmot; Stevens and Lofts 1988) and to the distributions of its preferred biogeoclimatic zones (Bunchgrass, Ponderosa Pine, and Interior Douglas-fir).

POPULATION SIZE AND TREND

Badger populations are not easily censused. Badgers cannot be counted directly because they are nocturnal and semi-fossorial. There is no correlation between the number of Badger burrows in an area and population size (Messick 1987); burrows merely indicate the presence of Badgers. The rate of deterioration of a Badger burrow has not been measured and would depend on the soil type and climate, among other factors. Because North American Badgers usually defecate within their dens, their scats cannot be counted, and the use of radioactive isotopes to mark faeces (Kruuk *et al.* 1980) is unlikely to succeed (Messick 1987). Harvest surveys of Badgers may indicate population trends, especially if their pelts have low commercial value (Erickson 1981, 1982), but there is no longer a legal harvest of Badgers in B.C. Lindzey (1971) suggested that a frequency of Badgers trapped/1000 trap-nights would give relative densities. Messick and Hornocker (1981) estimated

minimum resident population size with an intensive mark-and-recapture program that identified most of the resident Badgers. Scent post surveys, spotlighting, and road-mortality rates could potentially be used as population indices (Clark and Andrews 1982). B.C. Ministry of Environment, Lands and Parks biologists currently "get a feeling" for Badger status from the number of complaints, sightings, and road kills, but would prefer to have more reliable and sophisticated (and costly) methods.

The population size of Badgers in B.C. has been low for at least the last 12 years. In 1978, Badgers were said to be rare and decreasing and have an unsatisfactory status (Stardom 1978). A year later, Munro and Jackson (1979) prepared a "Mustelid Management Plan for B.C.," in which they estimated that there were 100 to 1000 Badgers in B.C. Their estimates were based on the best guesses of regional wildlife biologists and not on quantitative field censuses; the same is true for the 1990 estimates (Table 6). These estimates are by no means accurate and have little quantitative value; they merely demonstrate that Badgers are uncommon in B.C.

Badger populations in the South Okanagan and East Kootenay regions appear to be stable or increasing, perhaps in response to increasing prey

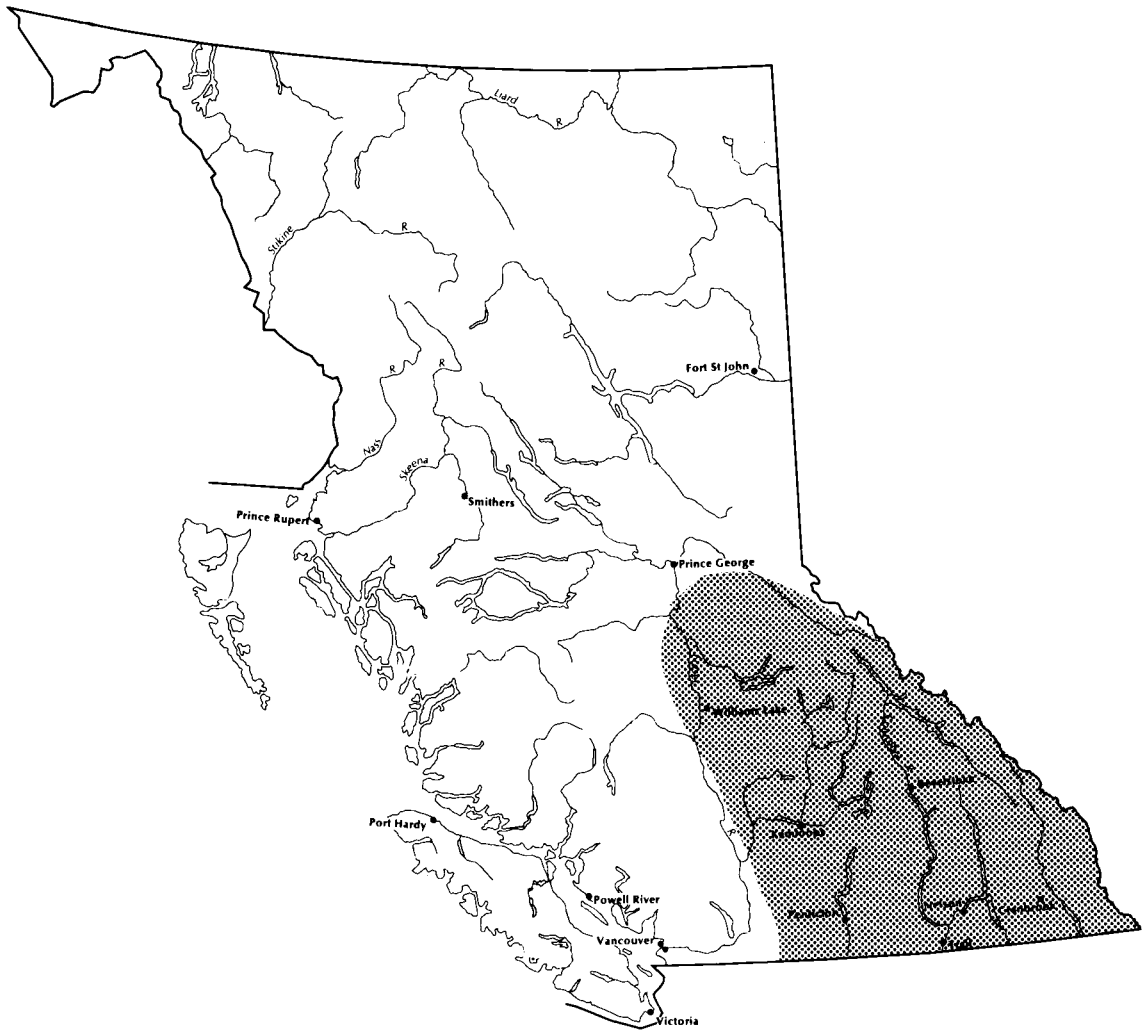

Figure 11. The 1979 distribution of Badgers in British Columbia (Taylor 1979).

Table 6. Qualitative estimates of regional badger populations. [1] Munro and Jackson (1978). ([2]Orville Dyer, [3] Fred Harper, [4] Bill Warkentin, [5] Guy Woods, [6] Randy Wright, pers. comm.)

Region	1979 estimate[1]	1990 estimate	Trend in 1990
South Okanagan	(50)*	200-400[2]	increasing
Thompson	*	uncommon[3]	decreasing
East Kootenays	(40)*	100-500[4]	increasing
West Kootenays	*	10-50[5]	stable
Cariboo	10	rare[6]	stable
Total	100-1000	300-1000	

*Note that in 1979, the estimates for the Thompson and South Okanagan regions were combined, as were the estimates for the East and West Kootenay sub-regions.

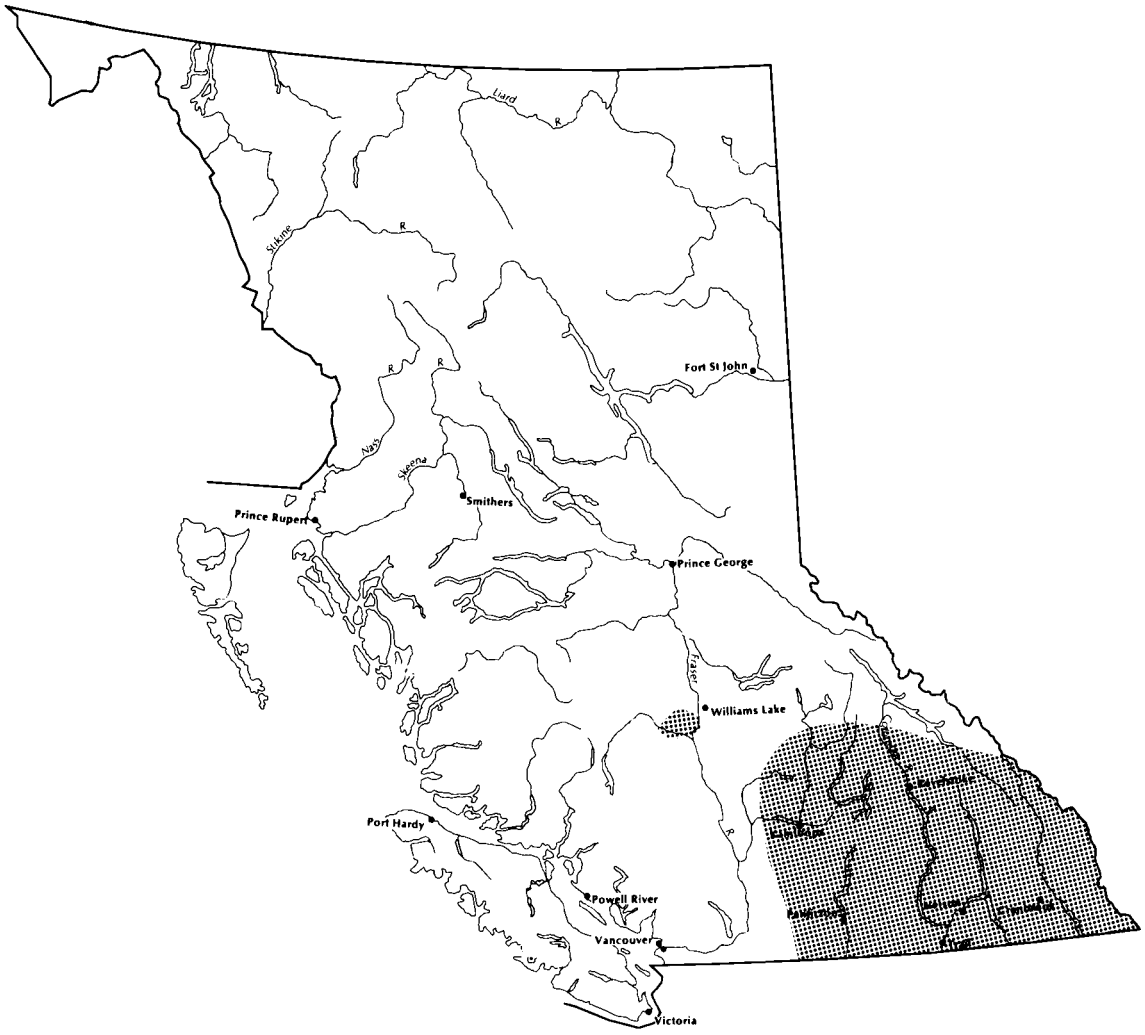

Figure 12. The 1988 distribution of Badgers in British Columbia (Stevens and Lofts 1988).

populations (Orville Dyer, Bill Warkentin, pers. comm.). Rodenticides may be used less frequently now than in previous years (Orville Dyer, pers. comm.). Meanwhile, Badger populations are decreasing in the Thompson Region due to decreasing prey populations and loss of habitat (Dave Low, pers. comm.).

Badger populations in the Cariboo and West Kootenay regions are stable at low levels (Randy Wright, Guy Woods, pers. comm.). It is likely that these populations have never been high. The Cariboo is at the northern extent of the badger's range west of the Rocky Mountains. Old trapping records may indicate the size of historical populations. The West Kootenays have little suitable habitat.

The population of Badgers in B.C. is low and therefore vulnerable to regional and provincial extirpation. Whether Badger populations have increased, decreased, or stabilized since 1978 is unknown without quantitative census information. Undoubtedly, there are fewer Badgers inhabiting B.C. now than there was historically (*i.e.*, pre-European settlement). Badger populations are especially vulnerable at the local scale because they are sedentary and solitary animals.

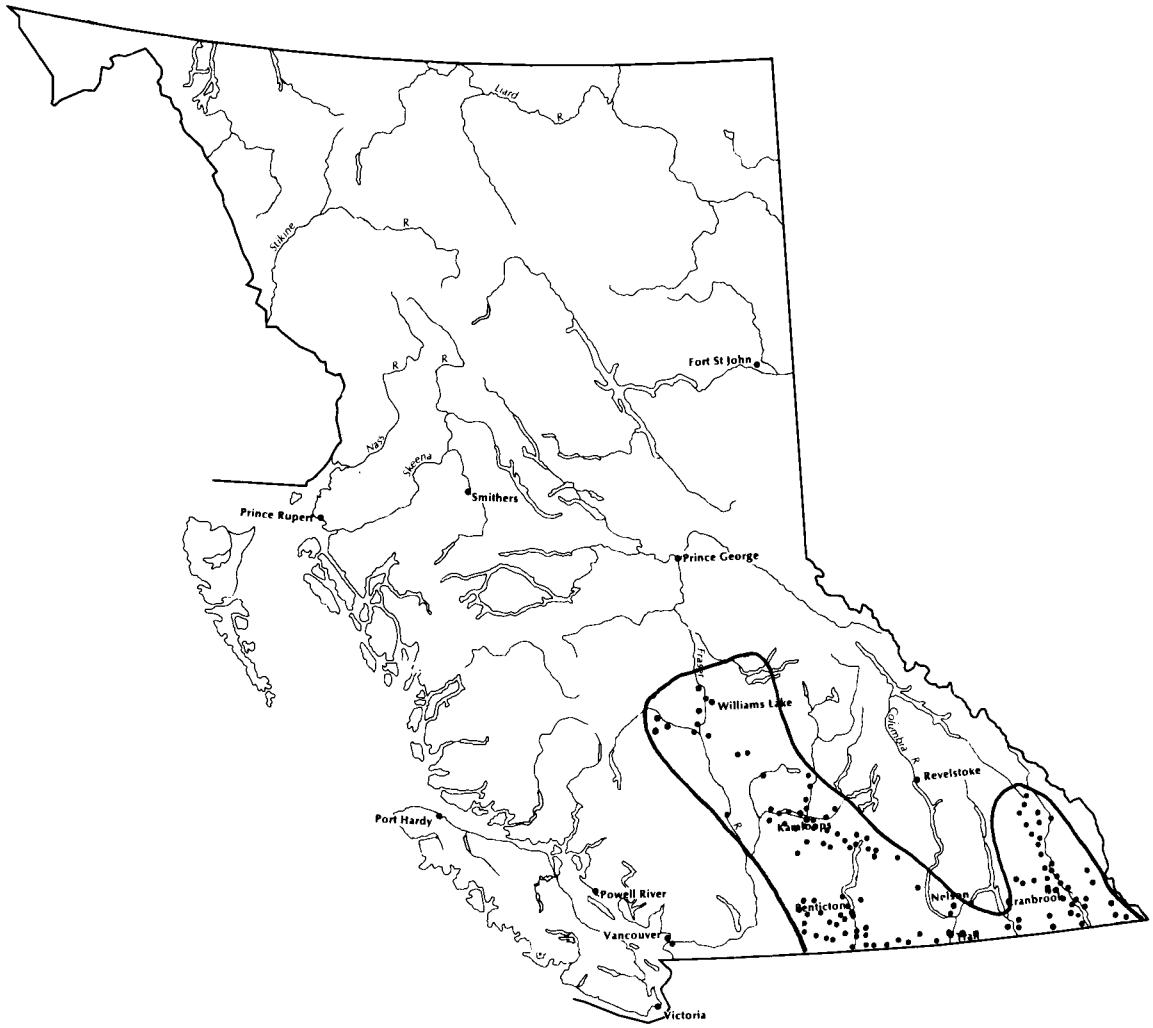

Figure 13. The 1990 distribution of Badgers in British Columbia (unpubl. data).

LEGAL PROTECTION

British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario have listed the Badger as a furbearer and all but B.C. have limited trapping seasons on Badgers: Alberta, December 1 to March 15 or April 15; Saskatchewan, November 1 to April 15; Manitoba, November 15 to December 31; and Ontario, October 25 to December 31. Alberta has a closed season on Badgers in its two northern zones (No. 1 and 2), where Badgers occur only very rarely. Since 1967, when the trapping season was first closed, there has been no legal trapping or shooting of Badgers on Crown Land in B.C.

As a furbearer with a closed season, Badgers in B.C. are protected from trapping and sport hunting. It is also illegal to buy or sell Badger pelts; all pelts from accidental mortalities must be submitted to a Conservation Officer. However, in B.C., a landowner can kill "problem" Badgers on private property where the animal is a threat to livestock. Where the Badger is merely causing damage to "real estate," a permit is required (Chris Dodd, Barry Saunders, pers. comm.). Biologists in the Wildlife Branch of the Ministry of Environment, Lands and Parks would rather see problem Badgers transplanted than destroyed (Orville Dyer, Dave Low, pers. comm.). There is no protection for Badgers from dying in traps set for other furbearer species, but apparently this occurs rarely. Badgers are protected from secondary poisoning by rodenticides on Crown Lands because the chemicals are prohibited on Crown Lands, although not on private or leased Crown Land.

Long and Killingley (1983) believe that giving Badgers a furbearer status and forcing trappers to pay for trapping licenses has helped to protect Badgers from overharvest. Ontario has a short harvest season on its small and vulnerable Badger population in order to gain knowledge of its distribution and density (Milan Novak pers. comm.).

In the USA, there are four levels of protection (Long and Killingley 1983). Wisconsin and Illinois have no trapping seasons for Badgers ; Wisconsin has designated the Badger its state animal. There is seasonal protection of Badgers in states where the trapping season is limited: Washington, California, Iowa, Oklahoma, and New Mexico. Badgers have furbearer status in Wyoming and Arizona, but they may be trapped year round. Badgers have no status and are not protected in Oregon, Idaho, Montana, Utah, Nevada, Nebraska, or Minnesota.

Badgers are reportedly scarce and unprotected in Mexico (Long and Killingley 1983).

LIMITING FACTORS

There are a number of factors that could be limiting Badger populations in B.C. Each will be commented on, but it should be noted that loss of habitat, loss of prey, and human disturbance are certainly major limiting factors.

Predation and Competition

Badgers, as a semi-fossorial carnivore, have few natural enemies (excluding humans) or competitors. Coyotes (Bond 1939, Rathbun *et al*. 1980, Weintraub 1986), Common Ravens (*Corax corax*), and Golden Eagles (*Aquila chrysaetos*) (Messick *et al*. 1981, Dekker 1985) will occasionally prey on young Badgers. Juvenile Badgers experience the highest mortality rates and are probably especially vulnerable while dispersing from their natal area during their first summer. At this time, juveniles are vulnerable to predators, starvation, and road mortality. Coyotes are apparently not limiting Badger populations through predation or competition in the Kootenays, where the Badger population is increasing despite high Coyote densities (Bill Warkentin, pers. comm.). It is unlikely that either predation or competition are limiting Badger populations in B.C.

Table 7. List of helminthetic endoparasites found in badgers. [1]Pence and Dowler 1979, [2] Pederson and Leiby 1969; [3] Keppner 1969. [4] Long and Killingley 1983, [5] Lindzey 1982. (WGP=Western Great Plains).

Parasite type	Parasite Species	Locality
Trematodes (Flukes)	*Alaria taxicdeae*	Minnesota, Iowa, South Dakota[1]
	Eupharyphium melis	Iowa, S. Dakota[1]
	E. spp.	Minnesota[1]
	Fibricola cratera	Iowa[1]
Cestodes (Tapeworms)	*Atriotaenia procyonis*	Iowa, S. Dakota[1]; Wyoming[3]
	Mesocestoides carnivoricolus	Kansas, Texas, WGP[1]
	M. corti	Utah[5]
	M. lineatus	Iowa[1]
	Monordotaenia taxidiensis	Iowa, S. Dakota[1]; Montana, Wyoming, Wisconsin, Colorado, N. Dakota[2]
Nematodes (Roundworms)	*Ancylostoma caninum*	Arizona[5]
	A. taxideae	Iowa, S. Dakota, WGP, Kansas, Texas[1]
	Angiocaulus gubernaculatus	California[5]
	Ascaris columnaris	Minnesota, Kansas, Texas, WGP, Iowa, S. Dakota[1]
	Capellaria aerophila	Kansas, WGP[1]
	C. plica	Iowa[1]
	Dracunculus insignis	Iowa[1]
	Filaria martis	Kansas, Mexico[5]
	F. taxideae	Kansas, S. Dakota, WGP[1]
	Filaroides milksi	Kansas, WGP[1]
	Metathelazia capsulata	Kansas, WGP[1]
	Molineus felineus	Utah[3]
	M. frenata	Montana[3]
	M. mustelae	Wyoming[3]
	M. patens	Minnesota[3]
	M. spp.	Kansas, Texas, WGP[1]
	Monopetalonema spp.	Wyoming[5]
	Physaloptera maxillaris	Minnesota[1]
	P. torquata	Minnesota, Iowa, WGP, S. Dakota, Kansas, Texas[1]
	Trichinella spiralis	Iowa[1]

Parasitism

Although Badgers are host to a number of internal and external parasites, there is no evidence indicating that parasites can limit Badger populations. Parasite loads are usually not fatal except in conjunction with other physiological conditions such as starvation or injury. Table 7 lists endoparasites known to infect Badgers; ectoparasites are listed in Table 8. Badgers can contract plague (*Yersinia pestis*) from sciurids, but only suffer transient symptoms. Badgers are also susceptible to the protozoan coccid, *Sarcocystis campestris*, which is transmitted to them by ground squirrels, the intermediate host (Cawthorn *et al*. 1983).

Table 8. List of ectoparasites found on badgers.
[1]Wittrock and Wilson 1974; [2] Whitaker and Goff 1979.

Parasite type	Parasite Species	Locality
Ticks	*Amblyomma americanum*	Texas[1]
	Dermacentor andersoni	Montana, Idaho, Canada[1]
	D. variabilis	Texas, California, Iowa, Oklahoma[1]; Indiana[2]
	Ixodes cookei	Wisconsin, Iowa[1]; Indiana[2]
	I. kingi	New Mexico, Texas, Wyoming, Alberta, Idaho, Oregon, Utah, Iowa[1]
	I. sculptus	Alberta, Utah, Idaho, Iowa[1]
Mites	*Androlaelaps fahrenholzi*	Indiana[2]
	Haemogamasus liponyssoides	Indiana[2]
	H. reidi	Indiana[2]
	Hirstionyssus staffordi	Indiana[2]
Biting lice	*Neotrichodectes interruptofasciatus*	California, Colorado, Iowa[1]; Indiana[2]
Fleas	*Chaetopsylla lotoris*	Kansas[1]
	Echidnophaga gallinaceae	California, Texas, Arizona[1]
	Hystrichopsylla dippiei	Colorado[1]
	Opiscrostic bruneri	Manitoba, Iowa[1]
	O. labis	Alberta, Wyoming[1]
	O. tuberculatus	Colorado, Wyoming[1]
	Oropsylla arctomys	Iowa, Manitoba, Wisconsin, N. Dakota[1], Indiana[2]
	O. idahoensis	Colorado[1]
	O. rupestris	Alberta[1]
	Pulex irritans	Montana, Alberta, Texas, Arizona, Idaho, Utah, Oklahoma, California, Wyoming North Dakota[1]
	P. simulans	Colorado[1]
	P. spp.	Iowa[1]
	Rhadinopsylla sectilis	Colorado[1]
	Thrassis bacchi	Iowa[1]
	T. acamantis	Montana[1]
	T. pandorae	Colorado[1]

Harvest

The harvest of Badgers in B.C. has been prohibited since 1967. However, there is probably an unrecorded harvest of Badgers through poaching, accidental captures, and control of “problem” Badgers. It is unlikely that poaching occurs because the price of Badger pelts has been relatively low since 1980, between $10.00-$20.00 (Wayne Runge, pers. comm.). Badgers are occasionally caught in traps set for other wildlife species, such as Coyotes, Red Fox, or Raccoon (Al Preston pers. comm., Huey 1959, Lintack and Voigt 1983, Messick 1987). A study in New Mexico, Colorado, and Wyoming demonstrated that Badger populations increased during a 20-year Coyote con-

trol program despite the fact that Badgers are susceptible to the same traps and baits as Coyotes (Robinson 1961). Years ago, ranchers and farmers in B.C. may have destroyed a significant number of problem Badgers, but Badgers are rare enough now that regional wildlife offices and conservation officers hear very few complaints about Badgers from ranchers or farmers (Barry Saunders, pers. comm.).

Human Disturbance

Human disturbance to wildlife is the result of many different kinds of activities by humans, including wildlife viewing and urban development. Significant losses of Badger habitat and prey populations can be attributed to human activities. Badgers are subject to the risk of secondary poisoning from rodenticides and to road kills. In comparison, the unknown environmental impacts of Badger viewing are likely relatively trivial.

Loss of Habitat — Natural grasslands and open dry pine and Douglas-fir forests, which are the common habitats of Badgers, are rare in B.C. and are under high demand for development. These habitats are generally located at low elevations in valleys and so are often developed for agriculture, forestry, urban, and hydroelectric uses. Badger habitat has been lost piece by piece since the turn of the century, and the trend continues today. Most of the Okanagan Basin has been converted into orchards, vineyards, and residential areas. The majority of the Southern Thompson-Okanagan Plateau is used for forestry and rangeland. One of the few natural grassland areas in the east Kootenays that was used by Badgers was covered by Koocanusa Lake after construction of the Libby Dam in Montana. In this region, due to fire suppression, grasslands are being replaced by successional stages of Douglas-fir forest. This reduces the amount of habitat available to Badgers. In addition, increased grazing pressure on the remaining grasslands further erodes the ability of the habitat to support Badger prey species. Unless some land is consciously put aside for grassland wildlife, the Badger will probably be extirpated from B.C.

Loss of Prey — Badgers may be excluded from some habitats because of low prey abundance induced by rodent control. As of May 1990, it is illegal to use pesticides on Crown Land without a permit. According to Wayne Weber (pers. comm.), very little intensive rodent control was being implemented on Crown Land, so the new legislation on use of pesticides will have little effect on populations of rodents or their predators. Most of the rodent problems that the public are concerned with are on private lands. The regional staff of the Wildlife Branch in the East Kootenays is lobbying to make the use of pesticides on private lands illegal. Their concerns are with the populations of rodents that are the main prey for wildlife species of special interest, such as Badgers and raptors. Also, rangelands that are overgrazed have lower carrying capacities for rodents and Badgers. It is very likely that rodent control programs on private land are impacting Badger populations directly and indirectly, but the extent of this rodent control is not recorded.

Secondary Poisoning of Badgers by Rodenticides — The policy of the B.C. Ministry of Agriculture, Fisheries and Food is to recommend the use of pesticides only when there is no other viable option, such as habitat alteration (Wayne Weber, pers. comm.). The Ministry of Agriculture, Fisheries and Food recommends two rodenticide products from the approved list of products by Agriculture Canada for ground squirrels and pocket gopher problems: zinc phosphide and chlorophacinone. There is a strychnine product approved by Agriculture Canada for “gopher” control, but it is not endorsed by the B.C. Ministry of Agriculture, Fisheries and Food, and is unlikely to be in the future (Chris Dodd, pers. comm.).

Of the rodenticides used in B.C., there are varying degrees of potential for secondary poisoning. The experts generally agree that the secondary hazards to wild predators from zinc phosphide are minimal (Hegdal *et al*. 1981, Marsh 1987). Matschke (unpubl. from Hegdal *et al*. 1981) reported that 90% of the zinc phosphide ingested by rodents is detoxified in their digestive tracts. The toxicity of

zinc phosphide has been tested on Siberian Ferrets (*Mustela eversmanni*) (Hill and Carpenter 1982), Coyotes (Evans *et al*. 1970), three species of foxes (*Vulpes vulpes*, *Vulpes macrotis*, *Urocyon cinereoargenteus*) (Schitoskey 1975, Bell and Dimmick 1975), Mink (*Mustela vison*) (Tietjen 1976), domestic cats (*Felis catus*) and mongoose (*Herpestes auropunctatus*) (Doty 1945); all of which showed no ill effects after eating rodents that had died from zinc phosphide poisoning. However, Evans (1966, unpublished report cited in Hegdal *et al.* 1981) reported that a domestic cat and a dog (*Canis familiaris*) died from secondary poisoning after eating the stomach contents of Nutria (*Myocaster coypus*) poisoned by zinc phosphide. It appears that zinc phosphide may only threaten predators with secondary poisoning when the digestive tract is eaten. It is unlikely that Badgers suffer mortalities from secondary poisoning of zinc phosphide because Badgers tend to eviscerate rodents before eating them and generally do not eat the stomach and intestines (Tietjen and Matschke pers. comm. in Hegdal *et al*. 1981).

Chlorophacinone is an anticoagulant that has a potential for causing secondary poisoning of Badgers. During a study by Fisher and Timm (1987), five of six domestic ferrets (*Mustela putorius*) died of internal hemorrhaging after feeding on chlorophacinone-poisoned prairie dogs (*Cynomys ludovicianus*). Anticoagulants have been reported to be toxic to dogs, mink (Evans and Ward 1967), rats (*Rattus* spp.) (Bull 1976, Savarie *et al*. 1979), and mongoose (Pank, unpubl. from Hegdal *et al*. 1981) when these species are fed poisoned rodents. The B.C. Ministry of Agriculture, Fisheries and Food recommends the use of chlorophacinone for the control of ground squirrels (Wayne Weber, pers. comm.) and so it is a potential threat to Badger populations.

Strychnine is probably not toxic to Badgers in doses normally present in poisoned rodents. Strychnine is widely used in the prairie provinces for ground squirrel control and, although its use is not recommended in B.C. (Wayne Weber, pers. comm.), it probably is used in some areas by ranchers and alfalfa farmers (Dave Low, pers. comm.). Two teams of researchers tested for effects of strychnine on Badgers and found no indication of secondary poisoning when they fed Badgers poisoned pocket gophers (Hegdal and Gatz 1976) or prairie dogs (Stephl and Cates 1928, unpubl. from Hegdal *et al*. 1981). Evans *et al*. (1970) found that strychnine was secondarily toxic to coyotes only when the stomach contents of the prey were eaten. As in the case of zinc phosphide, Badgers are unlikely to be susceptible to secondary poisoning by strychnine because of their habit of eviscerating prey before eating them.

It would be useful to know how extensively rodenticides are used, which rodenticides are used, where they are used, and if there are ways to safeguard against secondary poisoning. There are wildlife pest management committees at both the provincial and regional levels to deal with this issue, but their discussions and conclusions are not always being shared with other wildlife managers (Wayne Weber, Orville Dyer, pers. comm.).

Road Kills — The cause of most recorded deaths of Badgers in southwestern Idaho is attributed to road kills: 59% of 157 Badger deaths; while in south-central Idaho, 21% of deaths were attributed to road kills (Messick *et al*. 1981). The dispersal of young away from their natal areas coincides with the season of heaviest tourist traffic in southern B.C. As a result, it is the time of the greatest number of road kills. Case (1978) observed that road kills of Badgers more than doubled between May and June, increased more slowly through July and August, and dropped sharply in September. Road kills have a significant impact on Badger populations, especially the juvenile cohort.

SPECIAL SIGNIFICANCE OF THE SPECIES

Taxonomic Status

Taxidea taxus is not a threatened species in Canada or the United States, and none of the four subspecies appear to be endangered; but some political units have chosen to protect Badger populations within their boundaries. In B.C., the Badger is on the Blue List for sensitive or vulnerable species (Harper *et al*. 1994), and the trapping season for Badgers was closed in 1967. With SOCAP, Badgers are priority three and in management category 4, which means that management plans for Badgers will be implemented in 1993-95 (Hlady 1990). Stardom (1978) surveyed furbearer biologists in Ontario, Manitoba, Saskatchewan, Alberta, and B.C. about the status of Badgers in their provinces. His results are tabulated in Table 9. The status of Badgers has changed little in these five provinces during the last 12 years (Table 10). Ontario has reclassified the Badger as a furbearer, and both Manitoba and Saskatchewan have decreased the length of the trapping season on Badgers. The decrease in harvest (Table 11) probably doesn't indicate a population decline but rather reflects decreases in trapping pressure due to the decline in raw pelt prices ($5.89/pelt, 1989) and trapping season length (Wayne Runge, Richard Stardom, Fred Neumann, pers. comm.). The Nature Conservancy in Ontario has given Badgers an S2 classification because there have only been 10 recent sightings.

In the absence of confirmatory field work, the status of the Badger in British Columbia is rare and vulnerable.

In the USA, most states within the Badger's range offer Badgers some form of protection: a closed trapping season, seasonal trapping, or simply furbearer status (Long and Killingley 1983). Badgers are rare in Michigan and common or fairly abundant in other states within their range. Badgers are reportedly scarce and unprotected in Mexico (Long and Killingley 1983).

Public Interest

The general public is becoming more interested in biodiversity and non-game animals, but no special attention has been focussed on the Badger. Burrowing owls, which nest in abandoned Badger dens, are being reintroduced to the Okanagan. This reintroduction program may result in increased interest in the Badger.

Agriculturalists have mixed feelings towards Badgers. Badgers are effective predators of rodents and other agricultural pests, but they are sometimes considered to be pests themselves. Long and

Table 9. The status of badgers in five provinces during 1978 (Stardom 1978).

Province	Legal Status	Abundance	Status
Ontario	non-game	rare	not satisfactory
Manitoba	no protection	stable, low	not satisfactory
Saskatchewan	no protection	limited range	satisfactory
Alberta	furbearer	common	satisfactory
British Columbia	protected, furbearer	rare, decreasing	not satisfactory

Table 10. Current status of badgers in the five provinces included in its range. [1] Milan Novak, [2] Richard Stardom, [3] Wayne Runge, [4] Fred Neumann.

Province	Legal Status	Abundance	Status
Ontario[1]	furbearer	rare	satisfactory
Manitoba[2]	furbearer	stable, low	satisfactory
Saskatchewan[3]	furbearer	limited range	satisfactory
Alberta[4]	furbearer	common	satisfactory
British Columbia	protected, furbearer	uncommon	?

Killingley (1983) pointed out that the damage that Badgers supposedly do on agricultural land is greatly exaggerated. Badger holes pose a threat to clumsy livestock and machine operation, and Badgers dig up cultivated fields and irrigation dikes. Literature produced by management agencies can do much to influence the public image of Badgers.

Commercial Use and Value

The Badger is trapped over most of its range for its fur. Pelts are used for clothing, rugs, and shaving brushes. Currently, long-haired pelts are not in demand and the average price of a Badger pelt had dropped to $5.95 in 1989-90 from $30.74 in 1981-82 (Wayne Runge, pers. comm.).

RECOMMENDATIONS AND MANAGEMENT OPTIONS

Research Needs

So little is known about Badgers in B.C. that there are many research needs to ensure effective management. In particular, there have been no studies investigating habitat use by Badgers. For example, it is not known whether Badgers require, prefer, or just use grassland habitats. In order of priority, the following is a list of research questions that, if answered, would improve our ability to manage Badgers.

Table 11. Annual harvests of badgers during 1975-76 and 1989-90 in five provinces (Stardom 1978). [1] Milan Novak, [2] Richard Stardom, [3] Wayne Runge, [4] Fred Neumann.

Province	Harvest 1975-76	Potential Harvest	Harvest 1989-90	Potential Harvest
Ontario[1]	0	unknown	5	unknown
Manitoba[2]	727	500	55	400
Saskatchewan[3]	2350	2500	303	4000
Alberta[4]	2047	2000	290	2000
British Columbia	0	unknown	0	unknown

1. Where are Badgers?
Badger distribution is poorly known. Habitat capability maps could be created by rating various habitats for their value to Badgers, using distributions of prey species, biogeoclimatic zones, soil types, urban or industrial development, and Badger sightings. Areas of highest capability could be surveyed for Badger use to test the validity of the map. A capability map would be an invaluable tool to wildlife managers and could be produced in conjunction with the Conservation Data Centre program. It would help biologists understand why Badgers use some areas and not others. It may also be necessary to examine historic trapping records to determine if over-harvesting or control of Badgers occurred in some areas. The capability map could be used by habitat managers who review development plans and help to estimate potential impacts of development plans on Badgers and their prey. This mapping process has been developed for the South Okanagan and could be extended to other areas, benefiting management for all wildlife species.

2. What habitat requirements do Badgers have?
Badgers need prey to eat and they need the opportunity to dig. What else do they need? Badgers use a variety of habitat types in B.C., but their habitat requirements are obscure. It would be useful to know if population parameters, such as reproductive rates, mortality rates, and densities, vary with habitat type.

3. How many Badgers are in B.C.? the Okanagan? the Kootenays?
A knowledge of population size would indicate how vulnerable the species is, and allow detection of future population changes. Methods for estimating the sizes of Badger populations were outlined previously.

4. What are the dispersal patterns of juvenile Badgers ?
Juvenile Badgers suffer higher mortality rates than do other cohorts of Badger populations. They are the most vulnerable to starvation, predation, and accidental death when they are dispersing from their natal home range. With the use of radio-collars, patterns in juvenile dispersal could be determined. It would also be interesting to know the net flux of Badgers dispersing in or out of B.C. This would indicate whether southern populations in the Okanagan and Kootenays are self-sustaining or if they are dependent on Badger populations south of the B.C. - U.S. border.

5. Does Badger habitat use change seasonally?
Several studies have found winter home ranges to be smaller but not distinct from summer home ranges, implying Badgers may be using the same habitats during winter and summer. Is this true in B.C.?

6. What is the impact of rodenticides on Badger populations?
An investigation into the use of rodenticides on private lands may reveal the threat of secondary poisoning to Badgers. The frequency of use and which rodenticides are being used should be documented and made available to wildlife managers.

7. What is the impact of forestry practices on Badgers?
The answer to this question is probably quite complex. In general, the creation of openings in a forest is good for Badgers, but forestry only creates temporary openings. Forestry practices can change drainage patterns and result in soil erosion, which is not beneficial for Badgers or their prey. Initially, a survey of cutover areas of various ages to determine prey abundance and Badger presence should be conducted.

Education Programs

The purpose of an education program would be to increase the public's understanding of Badger ecology and behaviour and its role in ecosystems, with the goal of improving the Badger's image. No Canadian province has an educational program about Badgers. There may be an American state that has such a program, but Wisconsin, which has the

Badger as its state animal, does not and neither do Washington, Idaho, or Montana. Long and Killingley (1983) believe that the image of Badgers projected in government programs for the public influences public opinion.

The general public may think of the Badger as a ferocious animal that sometimes wanders into urban areas and tears up golf courses or seeks refuge under cars. A pamphlet explaining the role of Badgers in grassland ecosystems and how to deal with cornered Badgers may make people more sympathetic to them and less likely to harass or destroy them. The reporting of Badger sightings should be encouraged to provide managers with more information and to give the public a sense of involvement. Although Badgers are difficult to view (due to their nocturnal and underground activities), viewing Badger digging sites could be combined with education about Badger ecology.

A separate education program is needed for ranchers and farmers. In this case, the program should stress the role of Badgers in controlling rodent populations, and de-emphasize the possible damage that Badgers can do. It should be explained that these rodent predators are susceptible to secondary poisoning of rodenticides. Damage by Badgers is usually exaggerated. Badger holes are rarely the cause of livestock injury, but they are often destroyed because they are seen to pose a risk to livestock and machinery. There should be encouragement to leave Badgers alone or to have them transplanted by the Wildlife Branch. Old Badger holes are used by Burrowing Owls, which are presently being re-established in the south Okanagan by introduction of the owls from Washington state.

The Wildlife Branch will probably need more information and materials if it is to transplant Badgers frequently. It will need information on how to handle and trap Badgers, a list of locations to which they can be moved, as well as traps and a transplant-related budget (Orville Dyer, pers. comm.), The Wildlife Branch's transplant policy would be followed.

Management Actions

The most effective management actions will be those that enhance or preserve habitats because habitat loss is almost certainly the major cause of the decline in Badger populations. There are also other management actions that will benefit Badger populations.

1. Habitat Conservation

Programs by government agencies or non-government organizations to buy wildlife habitat will help to ensure the preservation of particular species and ecosystems like the rare grassland ecosystem. Badgers will benefit from conservation efforts directed at higher profile grassland species, like the Burrowing Owl.

2. Range Management

The prevention of overgrazing will maintain a high carrying capacity of rodents and Badgers on rangeland. Prescribed burning of range for bighorn sheep benefits Badgers where their distributions overlap. Close monitoring of the use of rodenticides on private land is needed to prevent prey loss and secondary poisoning of Badgers.

3. Forest Management

Careful planning of forest practices will prevent soil erosion and changes in drainage patterns. Badgers use open forests that have understoreys of grasses and herbs. Forest practices that promote growth of grasses and forbs should be beneficial to Badgers. To ensure continued inhabitation of harvested areas, cutting patterns that provide a mosaic of seral stages are likely needed.

4. Badger Transplants

Badgers can be transplanted from areas of high density or from where they are causing problems to areas of low densities or, preferably, areas of historic use (Dave Low, pers. comm.). Before releasing Badgers, the transplant areas should be investigated carefully to assess prey abundance and habitat suitability. Released Badgers should be of the same subspecies and ecotype as those in the transplant area.

5. Road Kills

Wildlife crossing signs could be erected in areas with a history of Badger road kills. Although wildlife fences would not exclude Badgers from highway areas, Badgers would probably use underpasses and culverts if they were placed in appropriate places, especially if some form of "drift fencing" guided the animals into them.

EVALUATION

Habitat loss is the primary force behind Badger population decline in B.C. Badgers use rare biogeoclimatic zones (Bunchgrass and Ponderosa Pine) that mostly occur in valley bottoms. Valleys usually suffer the highest development pressures. Habitat loss to development has progressed since the late 1800s and shows no sign of slowing down.

Two other factors have contributed to the decline in B.C. Badger populations. The first is the historic control of rodent populations, which has resulted in the loss of prey for Badgers, and secondary poisoning of Badgers from rodenticides. The second is the control and harvest of Badgers. Badgers may currently be extirpated from areas where they were historically overtrapped and from areas where ranchers and farmers systematically destroy Badgers. The impact of these two factors on Badger populations is unknown, but potentially significant.

The future of Badgers in B.C. can be ensured by catering to their requirements in the face of development. The following points are suggestions for effective management of Badgers in B.C.

1. A capability map of Badger habitat will be an invaluable tool to habitat managers when they review development plans.
2. Concessions must be made in development plans in order to preserve ecosystems and wildlife.
3. Rangeland and forests can be managed more conscientiously and some of the rare grasslands should be preserved.
4. Badgers can be transplanted into appropriate sites where Badger densities are low or non-existent and habitat capability is high.
5. The use of rodenticides on private lands should be minimized to ensure prey availability and to reduce the threat of secondary poisoning.
6. Public education programs can be used to improve the public's understanding and appreciation of Badgers, and to discourage harassment and destruction of Badgers and their habitats. With the increasing interest in non-game species like the Badger, government programs for the protection of rare species will likely be supported by the public.

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Individuals contacted:

B.C. Ministry of Environment, Lands and Parks

Biologists and technicians: Ralph Archibald, Victoria; Greg Ashcroft, Williams Lake; Vivian Banci, Victoria; Chris Dodd, Victoria; Orville Dyer, Penticton; Bob Forbes, Surrey; Andrew Harcombe, Victoria; Fred Harper, Kamloops; Bill Harper, Victoria; Rick Howie, Kamloops; Greg Jones, Victoria; Dave Low, Kamloops; Judy Miller, North Vancouver; George Ralph, Manning Park;

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Conservation Officers
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Museum Personnel
Dick Cannings, Cowan Vertebrate Museum, UBC, Vancouver; Mark Engstrom, Royal Ontario Museum, Toronto; David Nagorsen, Royal B.C. Museum, Victoria.

Naturalists
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Authorities consulted

Bea Burlingham, 408 26A Ave. S., Cranbrook, B.C. V1C 4V7, Tel: (604) 426-7551.

Dr. Maurice G. Hornocker, Idaho Cooperative Wildlife Research Unit, University of Idaho, Moscow, Idaho 83843 USA, Tel: (208) 885-6871.

Dr. Fred G. Lindzey, Dept. of Physiology and Zoology, P.O. Box 3166, University of Wyoming, Laramie, Wyoming 82071-3166 USA, Tel: (307) 766-4207.

Dr. Charles A. Long, Museum of Natural History and Dept. of Biology, University of Wisconsin - Stevens Point, Stevens Point, Wisconsin 54481 USA, Tel: (715) 346-2455

Dr. John P. Messick, Dept. of Biology, Missouri Southern State College, Joplin, Missouri 64801 USA, Tel: (417) 625-9617.

David Nagorsen, Curator of Mammalogy, Royal BC Museum, Victoria, B.C. V8V 1X4, Tel: (604) 387-2933

Richard R.P. Stardom, Wildlife Branch, Ministry of Natural Resources, Box 14, 495 St. James St., Winnipeg, Manitoba R3H 0W9, Tel: (204) 945-6816

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Appendix 1. A list of Badger sightings in B.C.

Key to the acronyms used in Appendix 1

DATE	Day/Month/Year, historic or not specified
OBSERVER	Observer or Collector's name
	Cowan and Guiget 1975 - see references
	CO = conservation officer
LOCATION	MU = Ministry of Environment, Lands and Parks Management Unit
	TU = Ministry of Environment, Lands and Parks Trapping Unit *
	E. R. = Ecological Reserve
	I. R. = Indian Reserve
	KNP = Kootenay National Park
MAP	Topographic map, scale 1:50,000
DETAILS	A = Adult
	F = Female
	J = Juvenile
	M = Male
	RBCM # = specimen number at the Royal B.C. Museum
	ROM = specimen at the Royal Ontario Museum
	UBC # = specimen number at the Cowan Vertebrate Museum at UBC
	complaints = A Conservation Officer has received complaints concerning badgers

* Trapping records were provided by Guy Woods, Ministry of Environment, Lands and Parks.

Appendix 1. (Continued).

#	Date	Observer	Location	Map	Details
1	historical	Rick Howie	O'Keeffe Ranch	82L6	Many trapped
2	5/13	E.M. Anderson	Vaseux Lake	82E5	1, RBCM
3	10/7/27	T. Tockler	Anarchist Mtn.	82E3	1 AM, UBC 6257
4	10/7/31	UBC	Anarchist Mtn.	82E3	1 AM, UBC 540
5	21/6/36	I. McT. Cowan	Anarchist Mtn.	82E3	1 M, RBCM 1736
6	6/40	Allan Brooks	Okanagan	82E5	1 F, UBC 2323
7	24/8/47	J. Wynne	Grindrod	82L11	1 M, UBC 9088
8	5/51	C.J. Guiguet	Anarchist Mtn.	82E3	1 A
9	1/52	I McT. Cowan	Penticton	82E5	1 M, UBC 4122
10	6/61	A.H. Bawtree	Coldstream	82L5	1
11	6/62	D.J. Spalding	Grand Forks	82E1	1
12	6/62	D.J. Spalding	Granby River	82E8	1
13	6/63	D.J. Spalding	Baffield Range	82E12	1
14	9/63	D.J. Spalding	Spences Hill	82E1	1
15	10/63	D.J. Spalding	Rock Creek, Midway	82E2	
16	6/64	D.J. Spalding	Princeton	92H8	1
17	64-65	D.J. Spalding	Bridesville	82E3	1
18	2/2/65	D.J. Spalding	Black Knight Mtn.	82E14	burrows
19	6/65	D.J. Spalding	Kelowna	82E14	1 J captured
20	7/65	D.J. Spalding	Midway	82E2	1
21	7/65	D.J. Spalding	Black Knight Mtn.	82E14	1 captured
22	5/7/65	D.J. Spalding	Kelowna	82E14	2 captured
23	9/66	D.J. Spalding	Flatiron Mtn.	92H11	1
24	5/67	D.J. Spalding	Vaseux Lake	82E5	burrows
25	5/67	David Clemson	Deep Creek, Armstrong	82L6	1
26	4/6/67	Len Rice	Kedleston	82L6	1
27	26/6/67	Warren Croft	Vernon	82L6	1
28	4/7/67	Bill Hurst	Bradley Creek	82L6	1
29	27/7/67	W.M. Spriggs	north of Westbank	82L3	
30	9/8/67	R. Coldicott	west of Armstrong	82L6	1
31	8/9/67	Syd Draper	Silverstar Lookout	82L6	1
32	9/10/67	D.J. Spalding	Trout Creek	82E12	1
33	21/6/88	Lynn von Krosigk	east of Vernon	82L6	1
34	7/7/68	Karl Gruener	NE of Okanagan L.	82L3	1
35	16/7/68	D.J. Spalding	Midway	82E2	2
36	15/8/68	Kay Bartholomew	Sugar Lake	82L7	1
37	5/69	D.J. Spalding	Naramata	82E12	2 A, 2 J
38	6/69	D.J. Spalding	White Lake	82E5	1
39	7/69	Geoff Barr	Flatiron Mtn.	82E4	1 MA, 1FA
40	9/6/69	Mrs. Tamasi	north of Vernon	82L6	1
41	27/769	D.J. Spalding	Hedley	92H8	1 FA
42	10/69	D.J. Spalding	Trout Creek	82E12	1 A
43	26/5/70	Mrs. Bingliy	Coldstream	82L3	1
44	6/70	Kay Bartholomew	Flatiron Mtn.	82E4	
45	6/70	Kay Bartholomew	Armstrong	82L6	7 sightings
46	6/70	Kay Bartholomew	Vernon	82L6	5 sightings

Appendix 1. (Continued).

#	Date	Observer	Location	Map	Details
47	6/70	Kay Bartholomew	Silverstar Lookout	82L6	
48	6/70	Kay Bartholomew	Sugar Lake	82L7	
49	6/70	Kay Bartholomew	w. of Okanagan L.	82L6	2
50	8/6/70	Peter Brodie	West Hill, Vernon	82L6	1
51	20/10/70	Jim Lindsay	Otter L., Armstrong	82L6	1
52	6/74	Peggy Sowden	Yellow Pine E.R.	92H7	1 MA, roadkill
53	18/7/74	Mada Rendell	Coldstream	82L3	1
54	8/8/74	P. Martin	Manning Park	92H	1 M. RBCM 9076
55	8/75	George Long	Spallumcheen	82L6	2
56	6/76	N. Pelletier	Peachland	82E13	1
57	6/76	N. Pelletier	Needles	82E16	1
58	23/6/77	A. Charbonneau	Westbank	82E13	1 FA, 3 J
59	8/78	Des Belton	Manning Park	92H	1 M, RBCM 9875
60	79	Mrs. S. Parsons	Keremeos	82E4	1
61	6/81	Wayne Weber	Chopaka	82E4	1
62	6/7/81	R.J. Cannings	Anarchist Mtn.	82E3	1
63	82	RBCM	Naramata	82E12	1, RBCM 11404
64	6/82	Steve Titus	Joe Basin, Ashnola	82E4	
65	10/2/82	RBCM	south of Vernon	82L3	1, RBCM 11438
66	26/5/83	Bill & Terry Harper	Flatiron Mtn.	82E4	1 A, 3 J
67	8/83	Bill Harper	Joe Basin, Ashnola	82E4	burrows
68	83-84	Malcolm Martin	east of Vernon	82L6	burrows
69	12/84	Malcolm Martin	east of Vernon	82L6	1
70	84-85	Wayne Weber	Coldstream	82L3	1
71	85	Al Preston	White Lake	82E5	1
72	85, 86	Malcolm Martin	east of Vernon	82L6	1
73	4/5/85	RBCM	Anarchist Mtn.	82E3	1 F, RBCM 14682
74	87	Mike Sarell	Mt. Brent	82E5	3
75	87	Mike Sarell	Agur Lake	82E12	1 M trapped
76	6/9/87	Mike Sarell	Summerland	82E12	1 road kill
77	before 88	MOELP	Princeton	92H8	1 M, RBCM 16758
78	88	Mike Sarell	Princeton-Coalmont	92H8	
79	88	Mike Sarell	Crater Mtn.	82E4	1
80	27/4/89	Mike Sarell	McIntyre Bluff	82E4	1
81	88-90	Mike Sarell	south of Agur Lake	82E12	2
82	88-90	Mike Sarell	Sumac Farms		1, road kill
83	88-90	Mike Sarell	MU8-03		1, burrows
84	88-90	Mike Sarell	Flattop Mtn.	92H1	2
85	88-90	Mike Sarell	Strawberry Creek	82E4	
86	88-90	Mike Sarell	Flatiron Mtn.	82E4	burrows
87	88-90	Mike Sarell	White Lake	82E5	1
88	88-90	Mike Sarell	Crater Mtn.	82E4	1
89	88-90	Mike Sarell	s. of Anarchist Mtn.	82E3	burrows
90	88-90	Mike Sarell	east of Osoyoos L.	82E3	burrows
91	88-90	Mike Sarell	Oliver effluent	82E4	burrows

Appendix 1. (Continued).

#	Date	Observer	Location	Map	Details
92	88-90	Mike Sarell	Veronica Lake	82E13	burrows
93	88-90	Mike Sarell	Summerland	82E4	burrows
94	88-90	Mike Sarell	Vaseaux Farms	82E5	burrow
95	88-90	Mike Sarell	Chopaka	82E4	burrows
96	88-90	Mike Sarell	Fairview	82E4	burrows
97	88-90	Mike Sarell	north of Osoyoos	82E4	burrows
98	88-90	Mike Sarell	Seacrest scout camp	82E4	1
99	5/90	Dave Carter	south of Cawston	82E4	1 trapped
100	10/90	Dave Carter	south of White Lake	82E5	1
101		Kay Bartholomew	Bald Peak		
102		Al Preston	Sheep Rock Mtn.	82E5	burrows
103		Al Preston	Agur Lake	82E12	2 trapped
104		Al Preston	E.R. 100	82E4	tracks
105		Ron Pendergraft	Bridesville	82E3	2
106		Mr. Allison	Cawston	82E4	1 road kill
107		Mr. Allison	Sterling Creek		
108		Aaron Stelkia	SE of Osoyoos L.	82E3	burrows
109		Aaron Stelkia	Wolf Creek	82E3	1
110		Aaron Stelkia	East of E.R. 100	82E4	burrows
111		Aaron Stelkia	Anarchist Mtn.	82E3	1 road kill
112		George Carter	Kalamalka Park	82L3	
113		George Carter	Vernon I.R.	82L6	
114		George Carter	O’Keeffe Ranch	82L6	
115		Fred Reheis	Princeton-Coalmont	92H8	
116		Fred Reheis	Otter Valley	92H10	
117		Fred Reheis	Princeton-Osprey L.	92H8	
118		Bill Conag	Anarchist Mtn.	82E3	1

Appendix 2. A Bibliography for the Badger (*Taxidea taxus*).

(This bibliography is the result of a literature search conducted in the preparation of this status report.)

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