

MAINTAINING VIABILITY OF BROWN BEARS ALONG THE SOUTHERN FRINGE OF THEIR DISTRIBUTION

BRUCE N. McLELLAN, British Columbia Ministry of Forests Research Branch, RPO #3, Box 9158, Revelstoke, BC V0E 3K0, Canada, email: BMCLELLAN@GALAXY.GOV.BC.CA

Abstract: In North America, threatened brown bears (*Ursus arctos*) and brown bear recovery are usually viewed as United States' issues. Most of the southern fringe of brown bear distribution, however, is in Canada; approximately 3,050 km of occupied–unoccupied fringe are in British Columbia and 1,570 km are in Alberta compared to 1,700 km in the lower 48 states. The distribution of brown bears in southern Canada has been poorly documented and publicized but, in addition to their inherent value, these bears are critical to the viability of brown bears in the U.S. In this paper I present a British Columbian view of brown bears along their southern fringe and human influences related to industry, settlement, hunting, and fragmentation. I also describe scales of land-use planning in British Columbia and the consensus process on which they are developed. Even with well intended plans, maintaining brown bear numbers and distribution is an increasingly difficult challenge because human populations are rapidly growing in and adjacent to brown bear range. Given the increase in people, human behavior will have to change to accommodate bears, and changing human behavior will involve reducing individual rights and privileges that are enjoyed in western North America.

Ursus 10:607–611

Key words: Alberta, British Columbia, brown bear, fragmentation, hunting, industry, land-use planning, settlement, *Ursus arctos*.

Although details were poorly recorded and what was once known has died with memories, the general demise of the brown bear (*Ursus arctos*) in North America is well documented (Storer and Tevis 1955, Brown 1985). When pioneers of European descent settled the West, brown bears were viewed as a threat to be sought out and destroyed. Within a century, brown bears were either eliminated or their populations greatly reduced wherever people and their livestock had settled. In rugged mountains with dense underbrush and in most northern areas, permanent human settlement and ranching were rare. Although the early loggers, miners, and railroaders that struggled into inhospitable areas treated bears in much the same way as did the ranchers, their effects on bear populations were often more localized in space and time. Fortunately for brown bears, many areas that were inhospitable during the last century have remained largely unsettled today; in some of these areas, brown bears have persisted.

Today, human values are gradually changing. Although pioneer values remain common, particularly in people who reside in rural areas of the North and West, increasing numbers of people view naturally functioning ecosystems as treasures to be maintained for their own intrinsic value and for future generations. Even with changing values toward wildlife, the low density and often fragmented brown bear populations along the southern and southeastern fringe of their distribution are at a crossroads. The decisions we make in the next few decades will determine the difference between the inevitable extirpation of some southern brown bear populations or their continued persistence.

In North America, threatened brown bears and brown bear recovery are usually viewed as issues for the Un-

ted States. Their distribution in 4 separate areas of the lower 48 states has been well documented by the U.S. Fish and Wildlife Service (1993) and well publicized in the literature and media. Compared to their distribution in the U.S., brown bear occurrence in southern Canada has been poorly documented and publicized. The lack of documentation and publicity is unfortunate because southern brown bears in Canada are as important as those in the U.S. and because without viable Canadian populations, brown bears in the U.S., would be even more vulnerable.

I discuss current conditions of brown bear populations, their habitat, and human influences along the southern fringe of their distribution from a British Columbian perspective. I also discuss critical issues facing southern brown bears and various scales of land-use planning in British Columbia that will have important ramifications for the species' persistence in southern Canada and the lower 48 states.

I thank T. Hamilton, S. Herrero, F. Hovey, and J. Schoen for their careful review of this manuscript. T. Hamilton, F. Hovey, and numerous other biologists assisted with delineating and mapping brown bear distribution.

DISTRIBUTION OF BROWN BEARS ALONG THE SOUTHERN FRINGE

Excluding Alaska, the largest populations of brown bears in the U.S. are found in the 23,300-km² Yellowstone Ecosystem and the 24,800-km² Northern Continental Divide Ecosystem (U.S. Fish and Wildl. Serv. 1993). There are fewer bears in the 2,800-km² Selkirk Ecosystem and very few in the Cabi-

net–Yaak Ecosystem that covers 5,100 km². If any brown bears remain in the North Cascade Ecosystem and the Bitterroot Ecosystem, they are extremely rare. Brown bears are listed as threatened in the U.S. south of Canada under the U.S. Endangered Species Act (16 U.S.C. 1531–1544).

Most of the southern fringe of brown bear range, however, is not in the lower 48 states but in Canada (Fig. 1). If occupied brown bear habitat is defined as areas where at least 1 female with offspring has been observed in the past 5 years, there is approximately 3,050 km of occupied–unoccupied fringe in British Columbia. The eastern fringe in Alberta is approximately 1,570 km long, running the length of the province, while in the lower 48 states there is approximately 1,700 km of fringe.

There is no evidence that brown bears ever occupied the Queen Charlotte Islands or Vancouver Island of British Columbia. On the mainland coast, they are relatively abundant from Alaska south to Bute Inlet, although they are also found in lower numbers at the headwaters of Toba and Jervis inlets and the upper portions of the Squamish River.

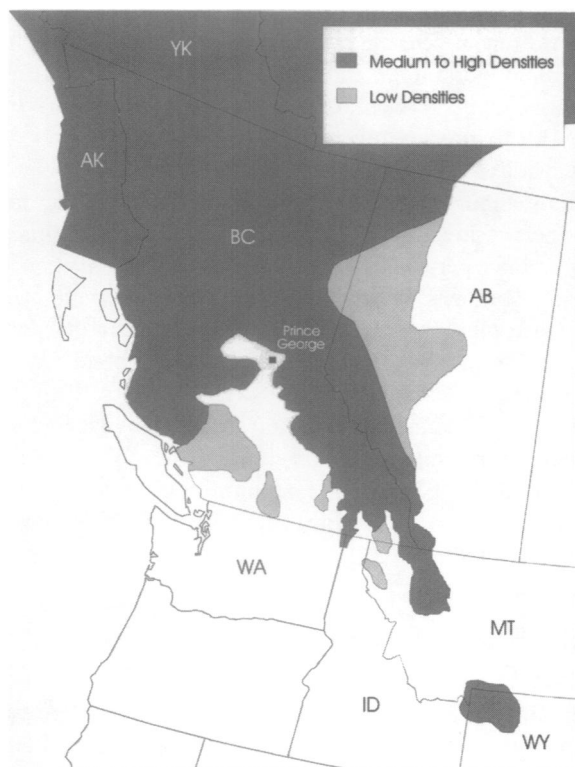


Fig. 1. Current distribution of brown bears including portions with very low density.

Brown bears are present at low densities over an area of approximately 25,000 km² in the Coast Mountains from Chilco Lake south to the Nahatlatch drainage. There is a small, likely isolated population of brown bears in and to the north of Manning Provincial Park. Some of these bears could use the North Cascades Ecosystem in the U.S. There are no brown bears east of Manning Park for almost 200 km, forcing the southern fringe of brown bear range northward about 400 km beyond Prince George, British Columbia, until it moves south again on the eastern edge of the interior plateau.

Relatively healthy brown bear populations occur in the mountain ranges of eastern British Columbia. The breadth of their distribution, however, narrows towards the south, and at the U.S. border only the population in the Rocky Mountains can be classified as healthy. Bears live at low density in the Yahk and Southern Selkirk Mountains of British Columbia and a small and perhaps isolated population remains in the Kettle and Granby drainages.

The eastern fringe of brown bears is found in Montana and in Alberta close to where the foothills of the Rockies meet the Great Plains. A low-density population of bears extends to the Swan Hills of central Alberta (Nagy and Gunson 1990).

PEOPLE AND BROWN BEARS ALONG THE SOUTHERN FRINGE

It is clear that humans have been and remain the dominant factor limiting brown bear distribution and population densities over most of their range, and in particular along the southern and eastern fringe. It is along this fringe, however, that human numbers are increasing quickly. In 1971, British Columbia had 2.25 million people and Alberta 1.63 million, but by the end of 1995, their populations were estimated to be 3.82 million and 2.78 million, respectively (Alberta Bureau of Statistics 1992, BC Stats 1994, Statistics Canada Telecommunication Serv., Ottawa, Ont. April, 1996). Although the rate of increase is expected to decrease, the population of British Columbia is predicted to reach 5 million by 2014; Alberta should reach 3 million early in the next millennia (Fig. 2) (Alberta Bureau of Statistics 1992, BC Stats 1994). Most of this growth will likely be in urban centers and valleys along the edge of brown bear range. A similar pattern is happening in Montana; Flathead County is situated next to the Northern Continental Divide Ecosystem and has the second fastest growth rate of any county in the U.S. (R. Mace, Mont. Dep. Fish, Wildlife and Parks, Kalispell, Montana, pers. commun., 1995). The recovery of brown bear populations as the human population

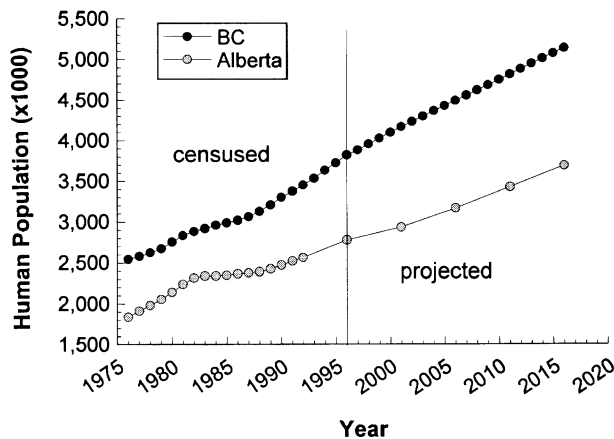


Fig. 2. Censused and projected human population of British Columbia and Alberta, 1975–2016.

grows rapidly demands a dramatic change in people's behavior. Which human activities and how much of each activity can brown bears tolerate within core areas and along the fringe are critical questions and the focus of much research during the past few decades. Due to the variety of ecosystems and diversity of human activities, answering these questions is difficult; however, generalizations follow.

Industry

Industries such as forestry, mining, grazing, hydroelectric, and tourism can all affect brown bears and their habitat. These industries can affect bears by reducing the short- and long-term habitat quality, displacing bears from favored habitats, and by killing bears (McLellan 1990). In addition, industrial developments create and maintain road access into brown bear habitat. Enhanced access results in more people in brown bear habitat, habituation of some bears to human presence, and food conditioning at industrial and recreation camps; all these factors contribute to increased bear mortality (Schoen 1990, Titus and Beier 1994, Mace et al. 1996).

Integrating industry with brown bears requires land-use planning and implementation from a regional scale through the planning continuum to the operational or forest stand level. In British Columbia, sub-regional, Land and Resource Management Plans (LRMP) cover areas of 15,000–25,000 km². LRMPs require participation from the public, industry, aboriginal groups, and government agencies so that all resources are represented (Province of B.C. 1993). Brown bears are often lumped with other wide ranging carnivores but are usually the focal species of this group. LRMPs are based on negotiated consensus

among many sectors and therefore are a great commitment of time and resources and results are never ideal for any single resource. Products include maps at the 1:100,000 or 1:250,000 scale depicting resource management zones with a variety of guidelines depending on negotiated resource emphases for each zone (Province of B.C. 1995a). Once endorsed by government, LRMPs guide lower level plans, including coordinated access management plans, protected area system plans, and the Forest Practices Code, which has specific landscape and stand-level prescriptions for brown bears in certain areas.

Human Settlement and Agriculture

Because most people will not tolerate brown bears near their homes, camps, or farms, brown bear populations persist only where there is a low density of human settlement. The density of settlement that brown bears can tolerate depends largely on the attitudes, knowledge, and behavior of people and the quality of the bear habitat. If people choose to minimize their impact on bears by properly managing garbage and other potential attractants (e.g., livestock, fruit trees, aviaries, compost piles, harvested fish and game), some level of coexistence is possible. In general, however, brown bears only survive in the presence of human settlement if there is sufficient unsettled, high-quality habitat nearby that acts as a population source to offset the sink associated with the settlement (Doak 1995). Although future settlement is part of the LRMPs, it is clear that local land-use zoning, adequate garbage management, educational programs, and laws governing acceptable behavior will be necessary to maintain the current distribution of brown bears. In addition, governments and conservation organizations may have to purchase critical privately owned land in some areas.

At serious population sinks, grass-roots committees involving all stakeholders must be formed to identify the sources of the problem and develop focused management plans. For example, a minimum of 120 brown bears and 311 black bears were destroyed or translocated between 1986 and 1995 from the municipality of Revelstoke, British Columbia (Procter and Neumeier 1996). As outlined in the draft LRMP for this area, a committee including concerned individuals, citizen groups, plus municipal, provincial, and federal agencies was formed. This group identified problem areas, secured funding from a variety of sources, and hired people to educate and work with community members to eliminate attractants and handle bears within the municipality.

Hunting

Sport hunting of brown bears is viewed as an acceptable form of recreation over most of their range, including

some of the southern and eastern fringe that occurs in Canada. Where it is permitted along the fringe, brown bear hunting is regulated by a quota for guides and their non-resident clients and a limited entry draw or lottery for resident hunters. However, there is growing opposition to brown bear hunting based on both biological and ethical grounds. Miller (1990) has shown that sport harvest can rapidly reduce brown bear densities, and because brown bears cannot yet be inexpensively censused, setting acceptable quotas is problematic. In addition, it has been suggested that sport hunting small, peripheral populations of brown bears may encourage immigration of young male bears that are unrelated to existing cubs and are thus aggressive, disruptive, and even cannibalistic toward family groups (Stringham 1980, Weilgus 1993). It is apparent that if brown bear hunting is to continue in fringe areas, it must be conservative and closely monitored.

In some highly productive habitat along the fringe, human presence should be reduced, brown bears left unharmed, and the bear population encouraged to expand so that dispersing individuals become a source for areas requiring natural augmentation. The potential value of this strategy was demonstrated by the theoretical investigation by Doak (1995) and by the documented rapid rate of increase and movements of bears from the Flathead drainage of southeastern British Columbia, which even had limited hunting (McLellan 1989, Hovey and McLellan 1996).

The brown bear conservation strategy (Province of B.C. 1995b) will link hunting regulations to LRMPs by designating bear management units that cover areas of 3,000–20,000 km². Within some bear management units, there may be unharmed refugia, while other entire bear management units may be classified as brown bear conservation areas with no hunting and restricted motorized access.

Fragmentation

Even without human intervention, the geographical distributions of many large mammals in western North America have shifted over the past few hundred years (Spalding 1989, 1992). Brown bear distribution has naturally fluctuated as well (Guilday 1968, Spiess and Cox 1976) but the causal factors, rate, and degree is unclear, making models of extirpation rates in a stochastic environment speculative at best. Now that people have such deterministic influence on bear distribution, natural shifts may be relatively insignificant. Because people settle, farm, and build roads and railroads in valleys, the southern fringe of brown bear range is gradually becoming a

series of islands isolated from each other. A metapopulation consisting of scattered islands can no longer ebb and flow, but may simply become extirpated 1 island at a time with no chance of natural recolonization. It is likely that small populations that are isolated due to human presence around the perimeter are increasingly susceptible to being extirpated because they have a relatively large fringe for the area of occupied habitat and it is along the fringe that bears often experience a higher rate of mortality (Aune and Kasworm 1989).

Brown bear populations may be particularly easily fragmented. Although their dispersal behavior remains poorly understood (Doak 1995), there is evidence that it is sometimes a gradual process for both sexes, often taking several years for new ranges to bud-off from maternal ranges (McLellan and F.W. Hovey unpubl. data). Unlike carnivores such as wolves (*Canis lupus*), dispersing brown bears may not only have to pass through a corridor between subpopulations, but may have to live in a corridor for months or years. Because bears are attracted to such a variety of human products, it may be difficult for bears to disperse across even a thin strip of settlement and survive to breeding age.

Maintaining connectivity for all organisms was emphasized by some participants developing LRMPs in British Columbia. Fracture areas for brown bears were identified and the need for detailed linkage plans recommended. The first linkage plan is being developed along the Highway 3 corridor between Elko, British Columbia, and Blairmore, Alberta. The plan will combine grassroots public input with GIS analyses using the linkage zone prediction model developed by Servheen and Sandstrom (1993). Because most of the fracture area is privately owned land, this process requires strong local participation.

THE CONTINUING CHALLENGE

It appears that 3 variables are most significant in predicting bear distribution and numbers along the south and eastern fringe: habitat quality, average daily human density, and the behavior of people. Implementation of a negotiated planning continuum that considers the requirements of people and other organisms including bears has the potential of maintaining the current distribution of brown bears. With the human population rapidly increasing, however, maintaining or reducing the average human density in and adjacent to brown bear range will be increasingly difficult. Even with settlement plans and other industries incorporated in LRMPs, there will be continued pressure to modify plans to permit new devel-

opments. Although plans may remain effective for years, a short-term socio-political change can result in modified plans and new developments. Human development in bear habitat operates like a ratchet; it tightens in stages but has little ability to slacken.

Stopping the long-term development ratchet while the human population increases will be difficult and will require a continued change in human values. In the past, brown bear managers pressured industries such as forestry and mining to modify their behavior; behaviors that were recently thought to be their rights. With the increasing number of people wanting to live, recreate, and otherwise develop brown bear range, individuals are also going to have to modify their behavior and lose more of their rights. Changing the rights of individuals may be more difficult than changing the rights of industries. The pioneer value system that remains common with people who reside near wild areas will have to change, and with this change will go most of what remains of our frontier culture.

LITERATURE CITED

- ALBERTA BUREAU OF STATISTICS. 1992. Alberta statistical review: third quarter, 1992. Alberta Bureau of Statistics, Edmonton, Can. 68pp.
- AUNE, K., AND W. KASWORM. 1989. Final report, East front grizzly studies. Montana Dep. Fish, Wildlife and Parks. Helena. 332pp.
- BC STATS. 1994. BC Regional District population projection: P.E.O.P.L.E. 19. British Columbia Ministry of Government Services, Victoria, Can. 158pp.
- BROWN, D.E. 1985. The grizzly in the southwest. Univ. Oklahoma Press, Norman. 274pp.
- DOAK, D.F. 1995. Source-sink models and the problem of habitat degradation: general models and applications to the Yellowstone grizzly. *Conserv. Biol.* 9:1370-1379.
- GUILDAY, J.E. 1968. Grizzly bears from eastern North America. *Am. Midl. Nat.* 79:247-250.
- HOVEY, F.W., AND B.N. McLELLAN. 1996. Estimating population growth of grizzly bears from the Flathead River drainage using computer simulations of reproductive and survival rates. *Can. J. Zool.* 74:1409-1416
- MACE, R.D., J.S. WALLER, T.L. MANLEY, L.J. LYON, AND H. ZUURING. 1996. Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana. *J. Appl. Ecol.* 33:754-772.
- McLELLAN, B.N. 1989. Population dynamics of grizzly bears during a period of resource extraction development. III. Natality and rate of change. *Can. J. Zool.* 67:1865-1868.
- . 1990. Relationships between human industrial activity and brown bears. *Int. Conf. Bear. Res. and Manage.* 8:57-64.
- MILLER, S.D. 1990. Detection of differences in brown bear density and population composition caused by hunting. *Int. Conf. Bear. Res. and Manage.* 8:393-404.
- NAGY, J.A., AND J.R. GUNSON. 1990. Management plan for grizzly bears in Alberta. *Wildlife Manage. Planning Ser. No. 2.* Alberta For., Lands, and Wildl. Edmonton. 164pp.
- PROCTER, M., AND L. NEUMEIER. 1996. Bear handling as a result of bear-human interaction in the Revelstoke, British Columbia area during 1986-1995. B.C. Minist. of Environ., Lands, and Parks, Nelson, Can. 28pp.
- PROVINCE OF BRITISH COLUMBIA. 1993. Land and resource management planning: a statement of principles and process. Province of British Columbia, Victoria, Can. 21pp.
- PROVINCE OF BRITISH COLUMBIA. 1995a. Kamloops land and resource management plan. B.C. For. Serv., Kamloops, Can.
- PROVINCE OF BRITISH COLUMBIA. 1995b. A future for the grizzly: British Columbia grizzly bear conservation strategy. B.C. Minist. of Environ., Lands, and Parks, Victoria, Can. 15pp.
- SCHOEN, J.W. 1990. Bear habitat management: a review and future perspective. *Int. Conf. Bear Res. and Manage.* 8:143-154.
- SERVHEEN, C., AND P. SANDSTROM. 1993. Ecosystem management and linkage zones for grizzly bears and other large carnivores in the northern Rocky Mountains in Montana and Idaho. *Endangered Species Tech. Bull.* 18:10-13.
- SPALDING, D.J. 1989. The early history of moose (*Alces alces*) distribution and relative abundance in British Columbia. *Contrib. Nat. Sci. B.C. Mus. No. 11.* Victoria, Can. 12pp.
- . 1992. The history of elk (*Cervus elaphus*) in British Columbia. *Contrib. Nat. Sci. B.C. Mus. No. 18.* Victoria, Can. 27pp.
- SPIESS A., AND S. COX. 1976. Discovery of the skull of a grizzly bear in Labrador. *Arctic* 29:194-200.
- STORER, T.I., AND L.P. TEVIS. 1955. California grizzly. Univ. Nebraska Press, Lincoln. 335pp.
- STRINGHAM, S.F. 1980. Possible impacts of hunting on the brown/grizzly bear, a threatened species. *Int. Conf. Bear Res. and Manage.* 4:337-349.
- TITUS, K., AND L.R. BEIER. 1994. Population and habitat ecology of brown bears on Admiralty and Chichagof Islands. Alaska Dep. Fish and Game Study 4.22, Grant W-24-2, Juneau. 35pp.
- U.S. FISH AND WILDLIFE SERVICE. 1993. Grizzly bear recovery plan. U.S. Fish and Wildl. Serv. Missoula, Mont. 181pp.
- WEILGUS, R.B. 1993. Causes and consequences of sexual habitat segregation in grizzly bears. Ph.D. Diss. Univ. British Columbia, Vancouver, Can. 88pp.