

The Status and Conservation of Bears (Ursidae) of The World—1970

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INTRODUCTION

The bears (family Ursidae) have played an important role in the cultural history of man since earliest times. As a summit predator, adult bears, in their own habitat were virtually immune from natural predators. Their food habits and those of man brought them into conflict that became ever more intense as man improved his techniques for the cultivation of a diversified catalogue of food plants and his domestication and culture of animals.

Present evidence however, suggests that bears, though learning to fear man, as their only successful predators, suffered little if any decline in numbers at his hand until the invention of firearms and their wide dissemination throughout the human populations of the northern world.

Four to seven genera (depending upon the status of *Euarctos*, *Selanarctos* and *Thalarctos*, as valid genera) comprise the bear fauna of the Recent Era. All, or all but one (*Ursus*), of these genera are monospecific. No genus or species (unless the Atlas bear *Ursus crowtheri* is regarded as a species) has become extinct up to this point in time despite the constant attack by man using firearms, traps and poison for almost five centuries.

The bears, though slow breeding and potentially long lived, have proven their persistence as a life form. During the last half century however, it has become obvious that the increasing momentum of our encroachment upon the forest areas and alpine regions essential to the survival of bears has reduced many local populations to the edge of extinction. As I will record later, bears are still regarded as pests over very large areas of their range and any form of protective legislation is of recent origin even in large parts of Europe and North America where there has been a tradition of concern for wild mammals.

This review has been undertaken by means of correspondence with many people familiar with the conservation or management of bears in all parts of the world. The canvas has been particularly thorough in North America where the appropriate wildlife authority in every state and province in North America north of Mexico has been consulted. Information from certain areas and about some species has been difficult to obtain. This is particularly true of the Sloth Bear (*Melursus*) of India and Ceylon and the Spectacled Bear (*Tremarctos*) of South America.

REVIEW OF THE GENERA AND SPECIES

Malayan Sun Bear (*Helarctos malayanus*)

Gee (1967) refers to a number of recent records of this bear that substantiate its continuing occurrence in the hills south of the Brahmaputra River in Assam

and southward into the Mizo Hills and to the Manipur region of north east India. It is apparently uncommon there but whether its numbers have declined in the last 30 years is not known. It has been seen in Kaziranga.

I have no recent reports from East Pakistan.

It occurs throughout Burma, most numerous in the far north and far south, usually in heavy cover. In Burma, until 1931 there was a bounty on tiger, leopard, bear and wild dog. During the period of the bounty upwards of 1000 bears (species not stated) a year were turned in for the reward. Subsequently the recorded kill was much lower, averaging about 200 per annum between 1931 and 1938. I have been unable to obtain any recent figures.

Helarctos is still widely distributed in Malaya but is nowhere abundant (Mohd Khan *in lit.* 1970). As an indication of numbers present Khan states that between 1965 and 1969 a total of 12 of these bears was reported seen or killed in the 8000 square mile Perak State of Northern Malaya.

The present emphasis upon timber production in Burma and adjacent countries to the east is resulting in rapid destruction of habitat and a decline in abundance of many of the larger carnivores including the forest inhabiting bears.

The species still occurs on Sumatra and on Borneo but there is no information on its present status there nor in Indo-China (Davis 1962).

Protection. This bear sometimes causes damage to coconut trees in plantations and under such circumstances some are shot. It is classified as big game in Malaya but is seldom hunted. Khan regards the legal protection as effective, illegal shooting carries a \$1000 fine, snaring a maximum fine of \$2000 or 2 years imprisonment. The major cause of destruction by man is the steel wire snare set mainly for wild pig. In other parts of its range effective protection for the species is lacking.

Sloth Bear (*Melursus ursinus*)

This species formerly inhabited Ceylon and South India with the northern boundary of its range at the Himalayan foothills and the Indian desert. It is still present in India but I have been unable to obtain any up to date information on its status or distribution. In Ceylon the Sloth Bear survives in the wilder dry jungles. It inhabits only the driest areas of the low country and does not reach the hills or wet jungle zones.

The species is protected in the National Parks and may be considered abundant in the Ruhunu and Wilpattu National Parks, although even here its crude density runs at about 1 animal per 8 square miles (2073 hectares). Land clearing and deforestation are having a greater impact than hunting (J. Eisenberg *in lit.* 1970).

In India it was abundant over large areas twenty years ago but is reduced now to vanishing status over most of its range. Objective data have been impossible to obtain but M. Krishnan (*in lit.* 1970) reports that serious efforts to find bear or their signs in Mudumalai Sanctuary (Nilgiris) in 1966, '69 and '70 failed. The species was regularly observed there as recently as 1963.

The same correspondent points to the burgeoning human population with its attendant invasion and denudation of forest areas and accompanying harassment of the bears as the cause of the decline.

In Kanha National Park, Schaller (1967) saw bears on 7 occasions during his months of field work there.

Protection. There is no effective protection in India. Even in sanctuaries poaching has been rife. Unless the protection of this species is recognized as urgent and is undertaken with vigour it appears unlikely that the Sloth Bear will survive.

In recent years Ceylon has imposed some protective legislation, including license restrictions. It is not known whether these can be effectively enforced where bears and man are in conflict of interest in the vicinity of remote villages. Apparently, apart from destruction induced by human fear and crop damage, the fat and baculum are in strong demand and serve as a further incentive for killing the Sloth Bear.

Spectacled Bear (*Tremarctos ornatus*)

The only information available on the status of this species is given by Grimwood (1969) and Erickson (1966).

To quote Erickson (*op. cit.*) the Spectacled Bear is now, and has probably always been, rare at the northern end of its range in Venezuela. In Colombia the species occurs in the west, east and central Andes mountains where its numbers have been markedly reduced. In Ecuador the status of the Spectacled Bear remains good with near pristine populations remaining throughout areas of suitable habitat, usually above 2,000 ft. elevation. Less is known about the species in Bolivia but it appears to be in fair numbers.

Grimwood (*op. cit.*) states that in Peru the Spectacled Bear is scattered in small groups in most parts of its range west of the Andes and it is under heavy hunting pressure. To the east of the Andes its status is perhaps somewhat better but only where its range is remote from habitation.

The total Peruvian population is said to have been, at that date, not less than 800 nor more than 2000. Some are in Manu National Park and a few others in the proposed Cordillera Blanca National Park. The effectiveness of protection in these parks is not known.

This is one of the species more immediately threatened by hunting than by habitat destruction.

Asiatic Black Bear (*Selenarctos thibetanus*)

This species occurs through southern and eastern Asia from West Pakistan, Baluchistan and Afghanistan east to Indo-China, through much of China, Manchuria, Korea and Japan. There is an isolated population on Taiwan. In eastern Asia the species extends northeast through the Chinese Peoples Republic along the Boreinsky mountain ridge to the Baranja River. It crosses the Amur River into USSR between latitudes 131°50' and 136°15' north to about longitude 50° (Bromley 1965).

The main surviving population in West Pakistan is probably in the mountainous area between Dir Stab and extreme north west Swat Kahistan. 'Here again no proper population surveys... have ever been taken and the population could be under 200 head' (Roberts *in lit.* 1970). A few survive in the forested valleys of Chitral State and elsewhere through the forested lower mountain slopes under monsoon influence. They are frequently in close contact with human populations and under heavy pressure. There is a market for cubs for training as performing bears.

An isolated population, recognized as subspecies *S. t. gedrosianus*, occurs in the tropical thorn scrub forest of southern Baluchistan (Kolath region). It is

now but a relict population, is under heavy local pressure, and is in danger of extermination. Its survival will probably depend upon the provision of total protection, vigorously enforced, along with a programme of compensation for crop damage.

The Black Bear was formerly quite common in the narrow belt of West Pakistan that receives some summer rain, i.e. the Murrie Hills, southern Azad Kashmir and Hazara, and the lower parts of the valleys of Swat, Dir and Chitral. They have now virtually disappeared from the Murrie Hills (one killed 1969) (Grimwood *in lit.* 1970).

They are frequently involved in killing young sheep and goats and for this reason are shot at whenever seen. There is virtually no sport hunting of this bear. Forest destruction is the primary cause of decline in numbers. Human populations are increasing in all valleys and the result is grazing of sheep and goats, cutting of timber, collecting underbrush for firewood, and cultivation of all arable land.

Protection. The West Pakistan Wildlife Protection Ordinances (1959) gave no protection to the Black Bear as it appeared neither as a game species nor a protected species. There was no provision for game reserves or national parks for the protection of large mammals including bear. Gilgit and Baltistan are administered by a special department of the central government and they too have no protective legislation. Until about 1968, Chitral, Dir, Swat and Kalam were semi-independent states whose rulers issued no written conservation laws but could, and sometimes did, take fairly effective steps to protect game. Most of the rulers maintained private hunting preserves where game, including bears, became abundant. Since these preserves were eliminated the areas have been heavily poached and all game is rapidly disappearing.

Present efforts are being devoted to promulgating a uniform wildlife conservation law to apply throughout the whole of Pakistan. The Baluchistan race of the Black Bear (*Selanarctos t. gedrosianus*) will be given protected status and the other race game status. A high fee will be levied for hunting it. However, enforcement is likely to prove difficult.

The draft of the new law also provides for national parks and reserves and two areas proposed for national parks (in Kalam and Gilgit) will include modest populations of Black Bears. Again the success of these areas for large animal conservation will depend upon the effectiveness of the law enforcement effort (Grimwood *loc. cit.*).

In East Pakistan forest destruction has virtually eliminated bears.

I have been unable to obtain any specific information upon the status of the Black Bear in India. It still occurs in some of the forested areas but in greatly reduced numbers. Schaller (1969) reports sighting Black Bears on 17 occasions between October 6 and 21, 1968, in Dachigam Sanctuary, Kashmir. If these were not repetitive sightings of one or two individuals a fair population is indicated.

The species occurs throughout Burma where it is most plentiful in the mountainous country of heavy forest, less common in the south (Yin *in lit.* 1970). The greatly increased forestry activity has brought many more people into the remote areas of Burma, Assam, Thailand and adjacent countries and has led also to greatly accelerated alteration of the forest habitat. There has been a coincident decline in bear populations but substantial data are lacking.

Small populations occur in some of the National Parks and Wildlife Sanctuaries. Specifically I am informed that there were 15 *Selanarctos* in Shursettaw Wild-

life Sanctuary of Burma. The Sanctuary is 213 square miles in area (Yin *in lit.* 1970). Three others were seen in August and September 1970, in Shur-u daung Sanctuary, Shan State (126 square miles).

The Black Bear occurs through the forested areas of China, Korea and onto the islands of Honshu, Shikoku and Kyushu in Japan. There has been no attempt to census the number of the Japanese race of the Black Bear (*S. t. japonicus*). Masatomi (*in lit.* 1970) says they are scarce on Kyushu and Shikoku but abundant on Honshu.

Numbers killed per year have been:*

1925	803	1961	802
1935	964	1962	1124
1945	613	1964	908
1955	768	1965	629
1960	777	1966	880

Mean 1925-55 decades = 787/yr. Mean 1960-66 = 853/yr.

*From Masatomi (*op. cit.*)

If kill is an accurate indicator of population there is no evidence of a decline in numbers through the last 40 years. There is steady invasion of bear habitat by human land clearing and almost certainly numbers will decline.

Brown and Grizzly Bears (*Ursus arctos*)

This species has the widest distribution of any of the bears. In pre-firearm days its range included the continental holarctic where it was largely confined to the tundra and subtundra and was generally absent from the heavily forested taiga. In Europe it occurred through all the mountainous areas south into Italy and the Caucasus. In Asia its western limits were in the mountains of Asia Minor, southern limits were reached in the Himalayas of India and West Pakistan and eastward through this and associated ranges through Mongolia. Hokkaido of the Japanese Islands had a population. There was an isolated population in the Atlas Mountains of North Africa.

In North America it inhabited the western mountain ranges south into Chihuahua, Sonora and northern Baja California, Mexico, and eastward across the Canadian prairies as far as western Manitoba. Insular populations flourished on Kodiak, Afognak, Baranoff, Montague, Chichagoff and Admiralty Islands. A population on the Arctic tundra and subtundra area from Alaska eastward across the Northwest Territory of Canada did not reach much beyond the Thelon River in primitive time (Banfield 1960).

Present Status in Eurasia. It is interesting to note that the species still occurs at or near both its northern and southern extremes of original distribution in both Eurasia and North America even though its numbers are greatly reduced and in vast areas it has become extinct. The North African race was exterminated about a century ago.

In the northern areas of Europe, Grenquist (1970) refers to apparent recent increases in the Brown Bear in Finland. He refers to annual kills in the 1870's of 100 bears per year, declining to 20 per year in the decade 1910-20, rising to 95 per year in the decade 1920-30; 48 per year in 1930-40; 40-50 per year in 1940-50. More recently 75 bears were shot in 1965, 97 in 1966 and 51 in 1969 (Pulliainen 1971).

This suggests a population of close to 1000 bears. Not until 1965 was there protective legislation. In that year hunting was prohibited during the winter months.

The primitive Norwegian population in about A.D. 1500 was probably less than 2000 bears. Sharp decrease in numbers began with the arrival of firearms about A.D. 1600 and continued at approximately the same rate through the 19th century and until the beginning of the 20th century, by which time the population had been reduced to isolated remnants (Myrberget 1969). The total Norwegian population is now estimated to be between 25 and 50 individuals. A particularly interesting population is that in Vassfaret, estimated at 10-20 individuals (Elgmork 1966). This has been virtually unmolested since 1949, but there appears to be a slow decline in numbers. The area is experiencing greatly increased human activity.

Despite the very small numbers, hunting is still permitted by local land owners during an open season June 15 to November 1. The late opening is a recent (1966) innovation to prevent hunting from snow-mobiles. I have no figures upon the number killed.

The population in Sweden reached a low point in the 1930's. Total protection was in force for many years but was removed in 1943. A two month open season led to intensive hunting in the mountains of Swedish Lapland. There appears to have been a movement of bears out of these mountains into the provinces of Norrbotten and Vasterbotten, where there was an increase in numbers. The total population decreased during the 1940's and 1950's. During the 1960's improved management led to a slow increase. A census in 1957 gave 252 bears (Curry-Lindahl 1965). The total population after the hunting season in 1967, appears to approximate about 400 animals though the published statistics are ambiguous (Haglund 1968).

The status of *Ursus arctos* in the USSR has been summarized for me by A. A. Kistchinski of the Central Laboratory on Nature Conservation, Moscow (*in lit.* 1970). He lists about 180 bears in Estonia, 80 in Byelorussia, 6000 in Northwest European parts of USSR, 10,000-12,000 in the Northeastern parts of USSR, 4000-5000 in Central European parts of USSR, and in Asiatic USSR 'several dozens of thousands' including 15,000-20,000 in Kamtchatka. The total USSR population was estimated by Verestschagen (1967) to be in the vicinity of 100,000 bears.

Kistschinski reports densities of up to 1-3 bears per 10 sq. km. (about 3.8 sq. miles) in some of the most densely populated areas as in the Sikhate-Alyn Mts., Northwestern Caucasus, Altai and Sayan Mts., and near Baikal regions.

In Yugoslavia the Brown Bear has been increasing since 1940 until today there are about 2000 in the central part of the country (Isakovic 1970). In 1971 there are reported to be more than 3000 bears chiefly living in the Carpathian region of Rumania (Curry-Lindahl, *in lit.* 1971).

The southernmost population in Western Europe is the 60-80± individuals in Abruzzo National Park and adjacent mountains of central Italy. This stock inhabits an area of 600 sq. km. and offers unique opportunities for research into population dynamics. Franco Tassi (*in lit.* 1970) reports that the main reason for the shrinkage of range and decline in numbers has been the destruction of its forest habitat. Inevitably the increased contact with man gives rise to some illegal killing. Though 500 sq. km. of its range are within a National Park the area has been difficult to protect and its attenuated shape is ineffective in providing for the total needs of even a small part of the bear population.

A new programme of reimbursing farmers for bear damage is hoped to take some of the pressure off the remaining population.

Dr. Tassi also reports a population of 8-10 brown bears in the mountains near Adamello-Val di Genova-Lago di Tovel. The two relict groups are not in contact.

Small populations of such long lived animals are subject to shifts in age and sex structure and productivity that may predispose them to extinction even under conditions of total protection. Details of the numerical status of small populations existing in steady state, and the area needed to support such populations, are important in view of increasing human pressure on bears in all parts of the world.

The Syrian race of the Brown Bear is reported to still survive (Simon 1969) in the mountains of Kurdistan, in northern and eastern Iraq and possibly also in northern Syria. This is the form inhabiting the Black Sea coast up to Abkhazkaya SSR, the southern part of Transcaucasia to the south of Lake Sevan, the Gori region in Armenia and the region to the west and southwest of Sevan, Talysk and Kopet-Dag.

The Brown Bear probably occurs in high mountains from Afghanistan through southern Mongolia but I have information only on the situation in West Pakistan. Here Roberts describes the species as inhabiting the mountains generally above 10,000 ft. It is scarce in the arid mountains of Chitral but is still present in Gilgit. The largest numbers occur further east, in Baltistan and in the Deosai Plateau immediately south of the Indus River. The species still occurs in the Pir Panjab Mountain Range and in Kashmir.

Roberts (*loc. cit.*) does not regard hunting as an important factor in the continued survival of this bear in West Pakistan. Sport hunting is infrequent and few are shot by shepherds high on the alpine pastures. Schaller (*in lit.* 1970) found that continuous pressure by armed pastoralists in the Himalayan areas of India was responsible for steady and perhaps rapid decrease in numbers. There is at least one record of a Brown Bear shot in Bhutan, north of Bumthang, 1945.

Information upon *Ursus arctos* in Hokkaido, Japan has been supplied by Professor Tetsuo Inukai of Hokkaido University and by Professor Hiroyuki Masatomi of Senshu University. Both report that there has been little if any change during recent decades in the number of bears inhabiting the island. They estimated the present population as 3000-4000. Between 1964 and 1969 there were 3321 Brown Bears killed in Hokkaido, mean 554 per year (extremes 479-795). Because of damage to field crops, domestic livestock and some human attack (1-5 deaths/yr.) the Brown Bear is hunted throughout the year and even killed with strychnine baits (Inukai 1939, 1969). Bounties of 5000 yen or more per bear are paid, and there is also a hunting subsidy of 1000 yen per day. Persistence of the present population appears to result from very thick forest and difficult hunting conditions. However increasing forest removal and land clearing for agriculture will probably produce conditions leading to a decline.

Present Status in North America. At the present time, small populations are found in Washington, Idaho and Montana and substantial populations occur in Alaska, Yukon Territory, British Columbia, Alberta and Northwest Territories.

Glacier and Yellowstone National Parks in the United States and the complex of Rocky Mountain national parks composed of Waterton Lake, Banff, Jasper,

Yoho, Kootenay and Glacier National Parks in British Columbia and Alberta include large and self-perpetuating populations.

The annual kill and estimates of total population size are shown on Table 1. Estimates are that approximately 1300 bears are killed annually out of a population estimated by my correspondents at 31,000.

It is interesting to compare these estimates with those earlier arrived at independently by Cahalane in 1964. At that time, he estimated that the population in Canada lay somewhere between 12,000 and 16,000 while that in Alaska lay between 8,000 and 18,000 as represented by 2 different contributors. There was little difference of opinion on the number of bears in Wyoming and Montana. My own figures lie within a smaller range but the indication

TABLE 1. POPULATION ESTIMATES & KILL FIGURES FOR GRIZZLY & BIG BROWN BEARS IN NORTH AMERICA

Region	Mean annual kill	Estimated population	Notes
Alaska	700 (1961-64)	12,000	Kill includes 33% for illegal or unreported kills
Yukon Territory	90	10,000	
Northwest Territory	3+ (1966-69)	500-1,000	Protected except where life or property are attacked
British Columbia	400 (1964-69)	6,800*	Est. illegal kill 25% in addition
Alberta	45	800±	Considerable poaching in addition
Washington	Nil	10±	
Idaho	1±	50±	
Montana			
outside park areas	40	200-300	
Glacier Nat. Parks	2 (1960-70)	200±	
Wyoming			
outside park areas	10±	50	30 permits issued
Yellowstone Nat. Park	10 (1967-69)	200	
	1272	31,000 [†] 26,000*	

*Estimated by the author

[†]Sum of estimates by correspondents together with author's estimate for B.C.

is that there has been no substantial change in the population of Grizzlies and Big Brown Bears in the intervening years. It is certainly true that there have been local reductions arising from progressively expanding use by man of certain parts of the mountain habitat occupied by these bears. In a few areas these declines have been consequent upon the use of alpine ranges for pasturing cattle and sheep. In other areas over-hunting has probably been the main cause. In part this has resulted from the development of extractive industries in mountain habitat of these bears, but intensive sport hunting can reduce bear populations and Pearson has pointed out verbally the particular vulnerability of the females on their relatively small home ranges. Even though these local declines may involve a relatively small part of the continental populations they may well have greater biological importance than numbers indicate. They may represent important reductions in local genotypes. They are important inasmuch as these declines will represent permanent withdrawals of some fairly large areas from habitat of the species.

The figure for the total kill is probably reasonably accurate. Departure from it will be dependent upon the number of bears taken illegally, particularly those so taken in British Columbia and Alberta. The Alaskan estimate of 33% illegal kill is based upon the number of untagged pelts from Alaska reaching outside taxidermists for processing during the last two years (37%).

It is difficult to assess the survival status of different subspecies of the Grizzly and Big Brown Bears of North America because there is no unanimity on the taxonomy. A thorough review of the systematics of the species in North America is needed. It is interesting to note, however, that the Barren Ground Grizzly (*U. arctos andersoni*) continues to exist in the Northwest Territories and, indeed, as reported by Banfield (1960), may have been gradually extending its range eastward over the last half century.

In 1953, a relict population of grizzlies was discovered in the Swan Hills of Alberta approximately 150 miles northwest of Edmonton. Bowes (1959) estimated that there were less than 400 bears inhabiting this 8,000 square mile region. In view of later information, I think it can be safely said there were possibly less than 100. This population persists and is under management plan by the Province of Alberta. At the time of the discovery it was suggested by some that this stock was a surviving remnant of the Great Plains Grizzly (*U. a. horribilis*) that was once so widely distributed across the Canadian prairies. This requires verification. Recently there has been a suggestion that Grizzly Bear still survive even in Saskatchewan. Tracks were seen in the Pasquias Hills in February 1970, and there is photographic evidence of one shot there in 1954 (Lane 1970).

In 1967, Leopold made known the discovery of a small population of Grizzly Bear in the Sierra del Nido of central Chihuahua, Mexico. The population (30± individuals) was believed to range also into Sierra Santa Clara and Cerro Campana.

This population is of interest because it had been self-maintaining since the early days of history. Unfortunately, it probably has been exterminated by poisoning shortly after it was discovered (Simon 1966). However, another population is known to still exist in Mexico (Leopold 1969), so this southern race, *Ursus arctos nelsoni*, is not yet extinct. Survival for very much longer appears to be unlikely.

Densities in North America. I have attempted to determine maximum densities of these bears using figures for insular or relatively isolated populations. Thus, Kodiak Island with a total area of 1.6 million acres is reported to

support approximately 3,300 bears or 1 per 500 acres (200 hectares). Similarly, Glacier National Park, of about 990,000 acres (40,810 hectares), is reported to have approximately 200 bears or 1 per approximately 5,000 acres (2000 hectares). While the population of Yellowstone National Park approximates 1 to 7,000 acres (2,800 hectares).

The figures for the two national parks differ from that for Kodiak Island in that a relatively larger part of the total terrain included in the parks is unsuitable to this species of bear. On the other hand, the carrying capacity of the coastal islands such as Kodiak is probably greater than that of the alpine country in the interior of the continent.

On a 96 square mile sub unit of the Kodiak National Wildlife Refuge 160 different bears were identified, to give a population density of 1 per 384 acres (Troyer & Hensel 1964). This is the greatest density reported for an area of this size in any part of the world.

Pearson (*in lit.* 1971) estimates Grizzly densities upon his study area in southwestern Yukon to be 1 per 10 square miles.

It is interesting to compare these density figures with the maxima suggested by Kistchinski for the USSR. His figures are 1 to 3 bears in an area of 10 square kilometres or roughly 1 bear per 800 to 2400 acres (390-1000 hectares) (*in lit.* 1970). A density figure for Kamchatka (Ostroumov 1968) is 1 Brown Bear for 18 sq. kilometres and thus slightly lower than those on Kodiak Island.

Conservation Measures. Generally, throughout the area of its distribution in North America north of Mexico, the Grizzly and Big Brown Bears are regarded as game animals and given some form of specialized protection. In Washington, Idaho and within the national parks of both the United States and Canada, protection is officially absolute and only animals that become a danger to the public are destroyed.

In the Northwest Territories of Canada, again, the surviving population of Barren Ground Grizzlies is officially accorded complete protection, though an unknown number are killed illegally each year. MacPherson, in 1965, estimated that the number so killed might be as high as 30 per annum and if so it probably approaches closely the annual recruitment potential of the population. In Wyoming, an attempt is made to take a small harvest from the fifty or so bears that exist outside the park. To this end, thirty permits are issued annually with the anticipation, of course, that success will be very limited. In British Columbia, there is a spring and an autumn open season with a limit of one trophy per licensed hunter. Under these circumstances the bears are decreasing in local areas, and where this is apparent, it is planned to initiate a permit system in 1971. It is hoped that this will serve to further control killing in these areas. Approximately half of the annual kill is taken by non-resident hunters hunting with licensed guides. Hunting over baits is prohibited in southeastern British Columbia where these bears are present in only small numbers, but is still permitted in the north of the province.

In Alberta, a spring and an autumn season were in force for many years, but the bears may now be shot only during two spring months immediately after they have emerged from hibernation.

Alaska has made the most determined effort to introduce scientific management to the annual harvesting of its Brown-Grizzly Bear population (Erickson 1965). Many detailed statistical reports have arisen from their repeated attempts to determine accurately the size of the population, particularly those

on the Alaska peninsula, on the Kodiak and adjacent islands and in the islands of southeastern Alaska. Useful statistics on percentage of cubs and yearlings in the population have been obtained, but aircraft census has proven to be inadequate for obtaining reliable data on total population or on the percentage represented by single animals (Erickson & Siniff 1963).

Hunting regulations to control the take are under constant review and are more elaborate than those enforced in other parts of North America. Apart from the usual spring and autumn open seasons, there are regulations that require all non-residents to hunt with a guide. Other regulations prohibit successful hunters from again embarking on a hunt for one of these bears within four years of taking a specimen. A recent attempt was made to limit the number of bears that could be taken by parties under the direction of a single guide in any one year, but this apparently has been ruled unconstitutional. Inasmuch as aircraft are usually used for transporting parties into the field and can easily be used for spotting bears and even for landing sportsmen near them, certain parts of Alaska have introduced regulations to the effect that a hunter may not hunt on the same day that he has travelled by aircraft.

In all parts of the north the increasing use of fixed wing aircraft and of helicopters for transport of hunters, miners, prospectors and others into remote areas poses an ever-increasing hazard to the bears. The use of helicopters for research purposes during the capture and marking of bears has revealed how effective this vehicle can be in bringing a hunter close to the large bears.

In all parts of Alaska, an attempt is made to regulate the harvest to a pre-determined number. So far, this has met with considerable success despite the problems of remoteness and the difficulty of accurately assessing the size of the population to be harvested.

Hensel (*in lit.* 1970) estimates 3,300 Brown Bears on the Kodiak Island group including Afognak Island and Shuyak Island. Of these, 2,000 occur on Kodiak National Wildlife Refuge, 300 on the northeast end of Kodiak Island and 1,000 on the other two islands combined. The refuge population of 2,000 could not withstand successive harvests of 200 bears per annum for three calendar years and showed decline. The maximum kill forecast that is allowable in the management plan for the refuge is 120 bears per annum or 1 per 17 live bears pre-hunt. It is emphasized to me that even the estimates of total population size on Kodiak and adjacent islands is an informed guess arrived at after many attempts to take counts from the air and on the ground. There are great difficulties in the way of arriving at population figures even in relatively open country.

The Montana kill figure of 23 bears per year that are believed to be removed from a wild population of 200-300 would represent 1 taken for 10-14 alive. This is beyond normal theoretical tolerance limits and suggests either that the population is overharvested, the wild population is larger than that estimated or, most probably, that dispersal from Glacier Park is subsidizing the kill and thus bringing the kill ratio close to 1:17-22. This ratio seems to be a useful estimate of the conditions applying over most of the range in North America.

It is interesting to note that in Yugoslavia the 3 most productive regions, with a population of about 1220 bears, provided a harvest (1967) of 102 animals or 1 taken for 12 alive pre-hunt (Isakovic 1970). In Sweden (Haglund 1968) the most productive area, comprising Swedish Lapland together with the province of Norbotten, has produced 1 bear per 15-16 alive pre-hunt, in a mean population of about 300 bears (9 years), while providing for a steady increase.

Natural mortality is estimated at an additional 5-6% annually. The specialized situation of managing free-living bear populations in national parks will be treated later.

The American Black Bear (*Ursus (Euarctos) americanus*)

Black Bears primitively ranged over virtually all areas of North America except the central regions of the Great Plains. The species has proven more adaptable to contact with human habitation and human alteration of the environment than have the Big Brown and Grizzly Bears, and consequently, it still occupies a very large part of its former range. Black Bears still occur in at least twenty-three of the states of the United States of America, and in all Canadian provinces and territories.

Greatest densities are found in Washington, Oregon and Idaho with substantial populations also in Montana, Wyoming, Colorado, California and Arizona (Table 2). In eastern United States, the largest populations exist in Wisconsin, Michigan, New York and Maine. States reporting the complete or almost complete absence of resident populations of Black Bears include North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Iowa, Illinois, Indiana, Ohio, Mississippi, and probably Alabama, Connecticut, Delaware and Maryland. Populations in Nevada, Texas, New Jersey and Massachusetts are, in each instance, probably less than fifty bears, and the matter of continued survival must be in doubt. The densest populations reported are those from the State of Washington which estimates its total stock at between 25,000 and 30,000 Black Bears and Idaho which estimates upwards of 40,000 bears. Hatler (1967) reports a 51.5 square mile area in Alaska carrying a population at the rate of 1:10-13 sq. miles. The reported figures for populations and kills are given on Table 2.

The estimated mean annual kill in the United States, excluding Alaska, which keeps no record, over the last several years is between 17,600 and 20,000 and this level continues under present management practices.

Though most states were willing to provide an estimate of total population, most of the correspondents admitted that the figures offered were guesses. In matching the reported kills with the estimated total population, it is interesting to note that, of 15 states providing both figures, eight showed a relationship between kill and total population of 1 to 9 or 10; three others showed a relationship of 1 to 7 or 8; three had a relationship of approximately 1 to 20; and two had a relationship of approximately 1 to 3 or 1 to 4. Inasmuch as the biology of Black Bears would make it impossible to harvest at the latter figure for any considerable period of time without inducing a reduction in the population, it is probable that the total population estimates in these states are well below actual numbers. The states with the 1 to 20 relationship, Florida, Georgia and Texas had small populations from which only about 25 animals a year are shot. It is probable that with the very low population, little purposeful hunting of bears occurs and the kill arises largely from accidental encounters.

The total recorded kill of the Black Bears taken in the Canadian provinces amounts to approximately 7,000 to 7,600 bears per annum (Table 3). In Canada there is little purposeful hunting for Black bear and the kill probably has little direct relation to the available populations.

Management. There are no data fully adequate to permit the calculation of population models that would be useful in relating continually sustainable kill to population size under known population characteristics. Age specific mortality is the parameter most difficult to obtain.

Studies by Jonkel (1967) in Montana, in an almost un hunted population, reflect a mortality to first year of life approximating 5%. This is followed by very heavy mortality through the first year of independence from the mother. Mortality there may be as high as 50%. Adult mortality was estimated to be approximately 14% per annum under circumstances where there was virtually no hunting. Tentative figures from the eastern parts of North America suggest that age specific mortality there may be somewhat lower except where heavy hunting pressure is present.

During the year of Jonkel's study, there were great changes in rate of recruitment that were immediately reflected in the size of the population. Further data of this sort on Black Bear populations living under widely different environmental conditions are urgently needed if scientific management is to be applied.

A request was made for each state to indicate any obvious direction of the trend in population size. Twenty-nine states reported on this matter. Of these, 13 reported the population as increasing, usually slowly; 6 reported the population as decreasing; the rest reported no apparent change.

Regulations designed to control the harvest and thus to conserve the animals as a resource, vary greatly from state to state. In some states, as for instance in Texas, where the animal is very rare, there is no closed season. In others, such as Pennsylvania, there was no closed season on bears as recently as 1969, but there was no open season in 1970 because of a decline.

In most states where bear hunting is managed, there are either very long seasons, starting in the autumn and running through till the spring, or there are two seasons—spring and autumn. In almost every state and province females with cubs are protected. Similarly, in almost all states and provinces, snaring or trapping of bears is prohibited. In very large measure this prohibition arises from the danger that bear snares or traps have to both man and other large mammals.

In some western states and in many areas of the deciduous hardwood forests of the eastern United States hunting with dogs is customary throughout all or part of the season, and there are some interesting regulations with respect to the number of dogs permissible. In Colorado, dogs are permitted in the spring only, with the restriction that not more than eight dogs can be used with any one hunting party. In North Carolina, ten dogs are allowed per party, whereas in California the number permitted is one dog per hunter.

The pursuit of bears with dogs is prohibited in Canada.

In general, the bag limit is one animal per hunter per annum. In British Columbia, the permitted number is two and in Alaska three, of which no more than one may be of the blue color phase.

Over most of the areas of North America where a decline in bear numbers has been noted, the emphasis has been put on habitat change induced by settlement, rather than shooting, as the most destructive influence.

In Pennsylvania, on the other hand, concentrated hunting is now the dominant influence on numbers. It is quite obvious that in many parts of North America the attitude toward the Black Bear as a sporting animal has been changing rapidly. As an example, New Hampshire reports an interesting timetable for the chronology of its bear legislation. In 1955, for the first time, the bounty was removed though the bears remained unprotected by legislation and without a closed season, the state was made responsible for damage, and it became

TABLE 2. BLACK BEAR GAME STATUS STATISTICS & POPULATION IN THE UNITED STATES OF AMERICA

State	Pop. est.	Kill/ annum	Status	Trend	Open seasons approximately
Washington	25, 000	3, 500-4, 000	game	?	
Oregon	36, 000*	3, 600	game	steady	20 wks., split
Idaho	40, 000	3, 000	game	steady	
Montana	3-6, 000	1-2, 000	game	steady	
Nevada	25	0	protected	rare	none
California	6-12, 000*	6-1, 200	game	?	13 wks.
Arizona	2, 060	268	protected	rare	4 zones (9 wks. ea.)
Wyoming	3, 200	400	game	steady	
Utah	300*	24	game	down	21 wks., with exception
Colorado	4, 000	550	game	up	20 wks., split
New Mexico	3, 000	3-500	game	steady	7 regions, 4-16 wks., split
Minnesota		100	not game	?	open all year (except 5 counties)
Wisconsin	6-8, 000	600	game	steady	4 wks. split & bow season
Michigan	7-8, 000	850	game	up	11 wks.
Maine	8-10, 000	1, 000	game	up	30 wks.
New Hampshire	3, 000*	300	game	up	13 wks.
Massachusetts	25-50	8+	game	?	10 wks.

New York	4-6, 000	500	game	up	4-6 wks.
Pennsylvania	15-1, 800	400	game	down	none 1970
New Jersey	20	1-4	game	down	?
Connecticut	0-10	0	not game	rare	12 mo.
Virginia	1, 000-1, 200	1-300	game	up	4 areas, 7-8 wks.
West Virginia	550	55	game	steady	3± wks., divided
N. Carolina	4, 000*	400	game	up?	5 wks., divided
Tennessee	350	30	game	up?	none 1970
Kentucky	75	0	not game	?	open all year
S. Carolina		10-	game	up?	2 wks.
Georgia	500-	25	game	up	
Florida	500-1, 000	25-50	game	up?	3 zones, 6-12 wks., split
Louisiana	300	?		up	
Arkansas	250	0	game	up	none
Missouri	100	0	protected	up	none
Alaska	?	?	game	?	several regions, 9-12 mo.
S. Dakota	10	0	not game	rare	12 mo.
Texas	50	2-4	game	steady	8± wks.
Vermont	1, 200-2, 000	300	game	up	

* Estimated by the author.

TABLE 3. KILL FIGURES FOR BLACK BEAR IN CANADA

British Columbia	2,000-2,500	Quebec	1,000†
Alberta	400-500	New Brunswick	1242/3*
Saskatchewan	447-438/2*	Nova Scotia	156/9*
Manitoba	500	Newfoundland	58/8*
Ontario	800	Yukon Territory	120
Northwest Territories	335/12*		

† Guess; number not supplied.

* Indicates number of years represented.

necessary to report the shooting of a bear. In 1957, a special open season during which dogs could be used was established between April 1 and June 1. In 1961, the dog season was changed to May, September and October, and a regular open season was established between October 1 and December 10. In 1963, the dog season was from September 1 to November 14, while the regular open season was September 1 to December 10. In 1965, special regulations were brought in with reference to the use of the bow and arrow. In 1969, legislation went into effect requiring that all bear kills be reported within 48 hours to the nearest deer registration station. This was largely to facilitate research study of the population. In the same year there was a special season introduced for the hunting of Black Bears using primitive muzzle-loading weapons.

Thus we see, over a period of 14 years, the complete change in attitude toward the Black Bear from one that regarded the species as a pest animal to be destroyed under state sponsorship, to one of high regard for its sporting qualities. The regulations are now designed to provide a variety of different specialized recreational opportunities. Similar changes in attitude are to be seen in the evolution of regulations in a number of other states.

In the State of Louisiana there has been a re-stocking programme with bears obtained from Minnesota. Between 1964 and 1967, 156 bears were transplanted. It is interesting to note that several of the adjacent states report that some of the newly planted bears wandered across into their regions.

In the State of Maine, claims for damage incurred by farmers from bear depredations are still paid and amount to approximately \$7,600 per annum. Few other states pay for damage.

It is well known that the proportion of black to brown color phases in the population changes with geographic distribution (Cowan 1938). It is also known that two unusual color phases occur. In certain parts of coastal British Columbia, white individuals, that are really dilute brown with brown eyes, occur infrequently in an otherwise black population. This color phase is known from Princess Royal Island and adjacent islands off the central coast of British Columbia and from scattered areas in the Skeena River Valley. Recently, legislation has been introduced to prohibit killing of these white individuals. They were never common, and they have been becoming progressively more scarce.

In parts of coastal Alaska, a steel blue color phase occurs and was the original source of the description of a unique race believed to be characterized by this color—*U. a. emmonsii*. Here again the bulk of the population is black, but the blue individuals are so sought after that special legislation for their protection

has been enacted. Of the permissible kill per hunter in Alaska, only one may be of the blue color phase. This phase occurs also in a limited area of western Yukon Territory where no special legislation is in force.

The Polar Bear (*Ursus (Thalarctos) maritimus*)

The Polar Bear is circumpolar in distribution and with the exception of some local reductions still occupies its primitive range. There is general agreement that the total numbers of this bear have been substantially reduced since the turn of the century and more particularly in the last 30 years. Since 1963, a well organized cooperative international research programme has been in progress. The cooperators have met formally on three occasions. The First International Scientific Conference on the Polar Bear was convened in Fairbanks, Alaska, 6-10 September 1965, a working-party met at IUCN headquarters at Morges in Switzerland 29-31 January 1968, and the Second Conference gathered again at Morges, 2-4 February 1970.

There is difference of opinion among the best informed specialists as to the probable total number of Polar Bears alive today. Figures of 8,000 to 10,000 appear with most frequency and the most recent statement (IUCN Bull. N-S, Vol. 2 No. 14: 118) states that fewer than 15,000 are thought to exist. This may be a quotation of figures produced by Uspenski & Shilnikov (1969), who estimated world population as 10,000-15,000 and Soviet population 7,000-8,000. The divergent figures arise from their being no firm basis for census over the large areas of the arctic polar bears inhabit. Estimates derived by the USSR researchers are based upon denning densities converted into numbers of breeding females in the Soviet Arctic and then using sex ratios, age ratios and the proportions of females with young to lone bears. On this basis the world population was estimated to be not more than 8,000 individuals (Maksimov and Sokolov 1965). At the 1970 conference the total number, estimated again by Soviet biologists was placed at not more than 10,000 (IUCN News Release, Feb. 5, 1970). I doubt that there was evidence to indicate 20% increase during the interval.

There is agreement that the kill in 1968 totalled about 1250. About 500 of these were shot by Canadian Eskimos. This is not significantly different from the figures estimated in 1965.

Uspenski (1969) attempts to summarize the mean annual kill of Polar Bears in the Soviet arctic and in the world by decades since the 18th century. One of his tables is given here as Table 4.

TABLE 4. MEAN ANNUAL POLAR BEAR HARVEST IN THE WORLD FROM 1900 TO THE 1960's

Decade	Eurasia	Soviet Arctic	Greenland	Canada	USA	Total
1900	820	420	150	400		1,370
1920	1,020	720	200	500		1,720
1930	1,350	1,050	200	250	150	1,950
1940	950	650	150	350	150	1,600
1950	700	400	150	450	200	1,500
1960	300	50	150	500	250	1,250

The research already undertaken has led to the concept that there are regional populations in various parts of the holarctic that are relatively sedentary and that the interchange between them is probably low and probably also involves males more than females. These populations differ in their density, and in the extent to which they are hunted. Further research may indicate that they differ in other important ways (Jonkel 1970). On the world scene 5 more or less identifiable populations probably occur: (1) Spitzbergen-Franz Josef Land-east Greenland (2) Hudson Bay (3) the high Canadian Arctic (4) high Canada-eastern Alaska (5) western Alaska-eastern USSR. In the more detailed view of Canadian biologists there is evidence for regarding the Canadian Polar Bears as consisting of 8 such populations for management purposes (Jonkel 1970 *op.cit.*).

Conservation. Protective measures include total prohibition of the shooting of Polar Bears in the USSR since 1956; and a prohibition upon shooting by other than Eskimos in Canada, with the recent modification that a quota has been established in the Northwest Territories limiting the permissible kill to 386 bears per year. These are assigned on a village or regional basis. It is also possible for a village through an eskimo hunter, and with permission of the Northwest Territories game authority, to authorize the filling of a quota-right by guiding an outside hunter upon a hunt. Cubs, yearlings and females with young are totally protected.

Greenland has enacted regulations to protect cubs and females with young, designated suitable firearms, prohibited traps, snares or set guns and hunting from aircraft or over-snow vehicles.

Somewhat similar regulations are in force in Norway where sport hunting is limited to one bear per tourist. Here however set guns were still permissible in 1970, but prohibited in 1971, at which time also quotas were established.

In Alaska hunting with the use of aircraft is standard practice. The season there is relatively long, extending from April 21 to October 14. This is in interesting contrast with the Greenland season which prohibits hunting between June 1 and October 1. There is no doubt that the difference reflects availability and the class of hunter participating.

There are no reliable data yet upon the vital questions of age specific mortality rate or reproduction rate within any of the populations but the research in progress is the best organized, best funded and best planned of any research on the Ursids and should lead to the development of scientifically sound conservation measures. Already some populations have been identified that are being hunted well below the replacement capacity.

Another most important outcome of the research has been to identify the most important denning areas. Protection of these from disturbance arising from human activity is of critical importance and should constitute a significant stricture upon plans for oil and mineral exploration in these areas of the Soviet and Canadian Arctic. The extent of denning upon the sea ice is unknown. The small number of females with cubs sighted off Alaska as compared with the much larger component of females with yearlings suggests that few bears den on the ice in this region.

MANAGEMENT OF BEARS

It is possible to identify some generalizations on matters of management. It is obvious that within the last 50 years, with few exceptions, bears of all species

throughout the northern hemisphere have ceased to be looked upon as serious competitors to man. No longer are they subject to destruction by any means at any time and frequently with government subsidy.

Bounties have disappeared except for a private bounty on Black Bears in a small area of West Virginia and an official bounty upon Brown Bears on Hokkaido. There are still large areas in Asia Minor, Afghanistan, Pakistan, India, Burma, and possibly China, where Brown Bears are afforded no protection. In general however throughout Europe, USSR and North America all bears are regarded as important members of the biota and regulations are operating to perpetuate the species for sport hunting or for their contribution to the native economy.

No very ingenious management devices have been conceived and management, in the absence of reliable population data, can only be regarded as crude. Under these circumstances rule of thumb calculations suggest that for the Brown-Grizzly and Polar Bears harvests may not exceed more than 1:17-20 except under unusual circumstances that give rise to high recruitment rates. A somewhat higher harvest ratio may be tolerable for the American Black Bear, but this will depend on local circumstances arising from the food production of the environment, density tolerance, and the degree to which hunting substitutes for natural mortality.

In some areas of the United States the tenor of regulations is to improve and manage the recreational aspects of bear hunting as well as maintaining the population. In general there has been a tendency to shorten seasons. In some places emphasis is placed upon the spring season and thus to separate bear hunting from the open seasons for deer and other ungulates.

The increasing use of aircraft for industrial transport and for movement of hunters into remote areas has introduced a new threat to effective management of the Brown-Grizzly Bear in northern North America. No effective techniques have been devised for controlling the illegal use of such vehicles in the hunting and killing of bears.

In the prospect that expansion of human populations into now wild lands will continue, it is important to seek information upon minimum viable populations, and the size and nature of ranges capable of supporting such bear numbers. Some clues are available from existing data. Relict populations of Grizzly Bears in Yellowstone and Glacier Parks demonstrate that populations of 200± bears occupying range at 5-7,000 acres per bear are successfully self maintaining. Some island populations in Alaska could certainly yield data on this point. The Sierra del Nido population of 30± bears on 2-5,000 acres was apparently self sustaining; the Abruzzi Park group of 60-80± bears occupies only about 600 sq. kilometers.

When we look at the Black Bears in the United States we find that Erickson *et al.* (1964) had a population that varied through the years from 84 to 168 animals on the 400 square mile study area in Northern Michigan. Jonkel (1967) on his 80 sq. mile area had a maximum density of 1.2 per sq. mile.

The smallest kills are from Georgia 25/yr., Texas 2-4/yr., Mass. 8/yr., West Virginia 55/mean over 21 years, Tennessee 31 (19-50), New Jersey 1-4, Florida 25-50, a total of 146-177. These states estimate their populations as 500, 50, 25-50, 525-594, 350, 20, 500-1000, or a total of about 2000-2600 for a kill approximating 1 bear per 1.3 to 1.8 sq. mile.

It appears therefore that minimum harvests have been taken on a continuing basis from populations estimated to be 50 bears or less. The total of the three

smallest takes is 11 bears from a total number of about 120 bears or roughly 1 in 10. I do not know whether this 1/10 relationship has been built into the statistics by a conversion factor used at the department level to estimate total population from their reported kill. The three smallest apparently self-sustaining state populations are thought to be in the order of 20-50 animals.

A population of 50 bears with normal distribution of sex and age categories would include but 6 or 7 females of breeding age, producing not more than 4-5 surviving cubs per year. Thus the entire recruitment would be only 3 or 4 animals per year and the yield on a long term basis could not be more than that or 1 in 12-18. It seems likely therefore that viable populations as small as 50 bears could exist but they could not support a sport hunting programme of consequence. A population of Black Bear to yield 25 trophies a year would have to be about 300 bears as a minimum.

In Grizzly-Brown Bears, with their lower reproductive rate, similar figures would suggest 400-500± bears as necessary to provide an annual take of 25-35 animals. This comes very close to the calculated permissible take on Kodiak Island.

Among the world's bears the two species in greatest danger seem to be the Spectacled Bear and the Sloth Bear. Very little is known about either species and it would be well worth while stimulating long term studies of each of them. At the subspecies level the Baluchistan race of the Asiatic Black Bear, the Mexican Grizzly, the Syrian and Alpine Brown Bears, and if identification is correct, the relict populations of the plains Grizzly in the Swan Hills area of Alberta, are those in greatest hazard of extermination. In most instances human encroachment on habitat, that reduces its essential wildness and intensifies contact and conflict with man, are the forces likely to result in permanent loss of these interesting types of bears.

MANAGEMENT IN PARKS AND PROTECTED AREAS

The management of the bears in National Parks and protected areas is of increasing importance as the use of such areas by people increases rapidly. Larger numbers of visitors into the more remote areas of parks will increase the number of contacts between people and bears (Martinka 1970) and perhaps render the 'wilderness' less suitable as bear habitat. Most species, however, readily respond to man based food sources, habituate to people, lose their fear of them, and thus invite contacts that can result in serious injury or death to people and a resulting outcry against the presence of bears (Martinka *op. cit.*, Cole 1970, Craighead 1970).

There are two major sources of injury to man by bears. One is as old as man himself—accidental and sudden close contact in densely vegetated terrain that gives rise to reflex agonistic behaviour on the part of the bear. The other is the habituation of bears to expect food from man, via garbage, handouts, or food stores in tents and automobiles. Both participants in such contacts tend to lose fear of and respect for the other. Krott & Krott (1962) have proposed that the nature of the interaction has bear to bear characteristics. The problem faced by National Park administrators then becomes one of educating visitors to understand and respect bears and to re-educate bears into living wild and avoiding close contact with man. The matter has been closely studied recently by the National Scientific Advisory Committee for U.S. National Parks with special reference to the problems of Glacier and Yellowstone Parks in Montana. It is under review in Canada.

Management goals that have been identified include (a) to maintain population of Grizzly and Black Bears at levels compatible with natural carrying capacities, (b) to regulate the behaviour of man in the park so as to minimize conflicts, and (c) to encourage bears to live their natural lives with minimum interference by humans (Leopold 1969).

The demands of the management exercise can be summarized under the following headings: (1) Removal of all trash and garbage from access by bears (Cole 1970, Martinka 1970). This will involve garbage disposal by incinerators or burial in bear proof areas, as well as bear proofing all waste containers in all parts of the park.

There can be legitimate differences of opinion in the likely reaction of bears to the withdrawal of a food source they have been accustomed to for many generations. We are familiar with the upsurge of bear damage complaints that arise when even a fully wild population faces a mast or berry crop failure. The anticipated consequences will be heavily dependent upon local circumstances and will certainly differ from one park to another.

It is urgent therefore to maintain constant and sensitive contact with the changed behaviour and to be prepared to counteract events likely to lead to added problems. These will involve:

(2) Intensive public education and enforcement of regulations involving people and behaviour even to temporary exclusion of hikers from some areas.

(3) Special concern for campgrounds such as patrols by night, drift fencing with electrified components, closing or relocation of campgrounds that prove to be particularly prone to bear contact.

(4) Research to develop a variety of means of deterring bears from campsites and similar situations as well as in the direct confrontations that may occur. The responses of bears to ultrasound, lights, repellent odours, repellent gases and similar devices, explosives such as noise grenades, roman candles or railway flares and other novel devices, should all be the subject of experimentation.

(5) Under certain circumstances provision of temporary food supplements, in areas remote from human activity—such as helicopter drop of carcasses of surplus big game or old horses etc. to encourage movement of bears away from traditional garbage areas and a return to appropriate patterns of natural feeding during a phasing out period of the education.

(6) Some bears will prove intractable. They must be removed, preferably by live trapping and transplanting into areas far removed from the ranges of their experience and with due concern for potential troublesome contacts with people. In making such transplants it is particularly important that the release plan acknowledges normal return distances.

For example, studies by Pearson (verbal report) in Yukon Territory suggests that relocation of mature grizzlies within 50 miles for females or 100 miles for males is likely to be unsuccessful. Cole (1970) reports 60% success with 50 Grizzlies of mixed age transplanted distances of 6-49 miles. Only 20% of yearlings and 2 year olds returned after transplant. Helicopter transport will probably be required but the cost may be justified when dealing with rare species. Careful documentation of experiences with distance transplant should be published to increase our knowledge on this point.

Troublesome bears that resist re-education and cannot be removed alive by

transplant or into zoos may have to be killed. Where very rare genotypes are involved special effort should be made to avoid this necessity.

In the case of the Grizzly, Sloth Bear or Spectacled Bear, the rare and locally endangered species, the responsibility of the authorities is heavy. For example, 250-300 Grizzlies may contain no more than 15-20 breeding females in any one year. Thus a particular concern should be to protect this group. They should occupy a position of special priority.

Furthermore the re-education may have consequences far beyond the immediate scene. It may drive garbage habituated bears out of the parks onto areas where they will find their way to community food sources where they will enjoy none of the respect they merit within the park. A stock can be destroyed as effectively by moving it out of a protected into an unprotected area as it can be by shooting it on the spot. Coordinated local and regional action is called for.

At the present level of our understanding of bear populations and bear behaviour all such projects should be conducted in a research framework and the opportunity for learning is great.

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