

Brown Bear Conservation Action Plan for Europe

IUCN Category: Lower Risk, least concern **CITES Listing:** Appendix II
Scientific Name: *Ursus arctos*
Common Name: brown bear

Figure 6.1. General brown bear (*Ursus arctos*) distribution in Europe. European Brown Bear Action Plan (Swenson, J., et al., 1998).



Introduction

In Europe the brown bear (*Ursus arctos*) once occupied most of the continent including Scandinavia, but since about 1850 has been restricted to a more reduced range (Servheen 1990), see Figure 6.1.

Status and management of the brown bear in Austria

Georg Rauer

Distribution and current status

At present, there are just a few brown bears living in Austria, but the situation is promising and bear numbers are rising. Austria is apparently in the first stages of a repopulation process. Since the extermination of the last indigenous populations in the 19th century (Rebel 1933; Tratz 1964) the bear has never disappeared completely from Austria for long periods. Time and again, individuals from the Slovenian population migrated into Carinthia and sometimes even further north (Amon 1931, Puschnig 1928 and 1930, Thurn-Valsassina 1965). These pioneers generally disappeared after a short stay and the efforts to shoot them were unsuccessful. In the fifties, the number of bear visits increased, and since then, tracks, observations, or damages have been recorded by the Carinthian hunting organization Kärntner Jägerschaft nearly every year (Anderluh 1987, Gutleb 1993a, Knaus 1972). In the 1980s, bears in Carinthia were still considered sporadic migrants (Bauer and Spitzenberger 1989). The incidence of females with cubs of the year in 1989 and 1990 in the mountains around the Weissensee (Carinthia) marks the transition point from a migrant to a resident population in southern Austria.

Today in Austria the brown bear occurs in two small populations (Figure 6.2). Three to six individuals are

assumed to live in southwestern Carinthia, representing an outpost of the southern Slovenian population expanding into the border area with Austria and Italy (Gutleb 1993a and b). The second population is located in the Limestone Alps of Styria and Lower Austria and comprises 8–10 individuals; it is the result of a reintroduction project started by WWF-Austria in 1989. In addition to these populations, the Alps of Styria and Carinthia and to a lesser extent also of Salzburg and Upper Austria, are visited by migrating individuals with increasing frequency. A third center of bear distribution is emerging in northwestern Styria and the bordering areas of Upper Austria (Dachstein, Totes Gebirge, and Sengsengebirge) where, since 1990, 1–3 bears have been present almost continuously (Frei, J., Bodner, M., Sorger, H.P. pers. comm.)

Aste (1993) determined the distribution of suitable bear habitat over all of Austria by investigating these parameters: fragmentation of forests, density of human population, and intensity of tourism. According to this survey, appropriate habitats are found in central and southern Austria; in western Austria there are suitable areas only if the impact of tourism is reduced (Figure 6.2).

Legal status

In the majority of the federal states (Burgenland, Niederösterreich, Oberösterreich, Steiermark, Kärnten, and Tirol) the brown bear is protected by hunting law as a species with no open season. In Vorarlberg it is protected by natural conservation laws. Salzburg is the only state where the protection of bears is embodied in both laws. The capital of Austria (Wien) is the only federal state where the brown bear is not protected by law because it is regarded as non-existent (Kraus and Kutzenberger 1993). Most of these regulations came about 20 years ago as a reaction to the increase in the occurrence of migrating bears. At that time, public attitudes began to change

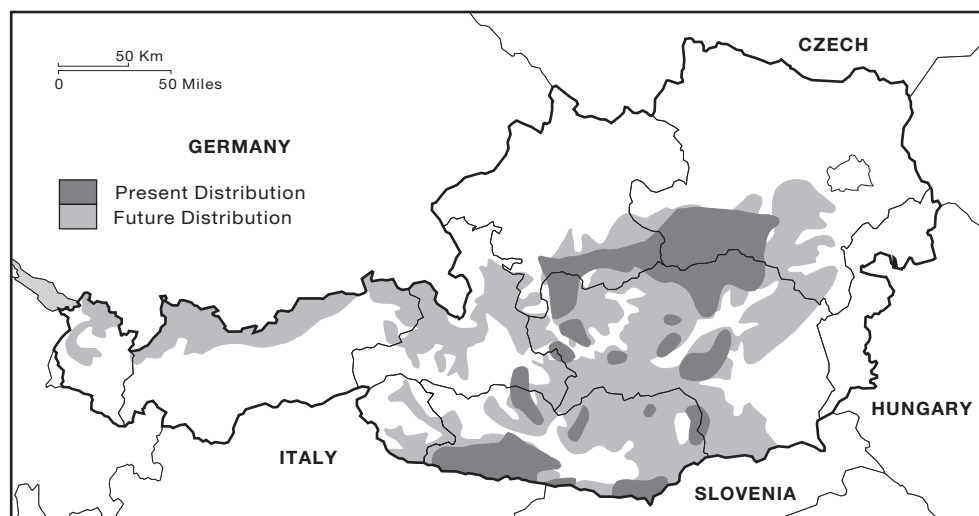


Figure 6.2. Present distribution of the brown bear (*Ursus arctos*) in Austria 1989–1993 (Gutleb 1993a; Rauer 1993; and Steirische Landesjägerschaft pers. comm.). Potential bear habitat in Austria (Aste 1993).

towards nature in general and, in particular, toward large predators and their right to exist.

Population threats

Bears in Austria are not endangered by direct persecution because the problem of poaching does not exist. Nevertheless the survival and growth of this fragmented population is not at all certain as the numbers are still far below the size of what is generally considered the minimal viable population. The expected increase of the Austrian bear population heavily depends on the increase of the Slovenian population and the continued existence of migration corridors to enable the Slovenian surplus individuals to reach Austrian bear habitats.

Habitat threats

The increase in human recreational activities and mobility put a heavy strain on bears and other wildlife. An increase in the impact of tourism on bear habitats of Lower Austria and Styria to the level of Northern Tyrol would shatter all the hopes for the establishment of a viable Austrian bear population.

The continual rise in the intensity of road traffic requires the construction of highways and the improvement of national roads, thus leading to increased dissection of potential bear habitat (e.g. Phyrnautobahn and Liesing-Palten Tal). In the Carinthian government's plans to build a new road through an undeveloped forest in the lower Gailtal to improve highway (Gailtalzubringer) access, it was stressed that this unspoiled forest, growing on the debris of an enormous ancient land slide, is an important corridor for bears to use in crossing the valley, and should not be destroyed (Mattuschka 1992).

Austria is a country with a very high forest road density (0.45m/km² productive forest including public roads used for logging; Österreichischer Waldbericht 1992 des Bundesministeriums für Land- und Forstwirtschaft). Although forest roads are generally closed to public traffic by barriers, they are constant sites of disturbance because they attract hikers, mountain bikers, and mushroom or berry pickers. The Austrian government still supports the construction of forest roads, especially in a program aimed at managing protected forests, where the accessibility is comparatively low (0.093m/km²). As a result, possible refuge areas are deteriorating.

Management

In most of the states where bears occur regularly, programs exist to compensate people for damages caused by bears.

These insurance arrangements are funded by the federal hunting organizations in Carinthia, Styria, and Salzburg. In Lower Austria the insurance is paid by WWF-Austria. In Upper Austria, a full compensation program is still outstanding. The damages from 1994 were paid partially by a special fund with money from WWF, the hunting organizations, and nature conservation agencies of the state. In the northeastern part of the bear range (where a project is releasing bears), WWF also offers electric fences to beekeepers who set up hives at sites where the chances of bear encounters are high.

The aim of the WWF Bear Project is to build up a viable bear population in the Alps of Lower Austria and Styria. The idea for this project was prompted by the existence of a lone male bear who had migrated to this region in 1972. Between 1982 and 1986, a group of interested people and organizations headed by the hunting organization of Lower Austria investigated the feasibility of a release project (Hager 1985), but finally abandoned these plans. WWF-Austria continued this work and started the reintroduction (augmentation) project in 1989 with the release of a young female. This test bear was followed in 1992 and 1993 by an adult female and a young male respectively. The released animals have been radio tracked to gather data on their habitat use, foraging strategies, and migration patterns, and to document the fate of this small initial population (Dieberger and Rauer 1991; Rauer 1993). Three cubs in 1991 (of which only one survived until late autumn) and five cubs (three and two) in 1993 warrant the hope that this experiment will be successful. Because several migrants showed up in the project area in 1994, the release of further individuals has been canceled for the near future.

WWF-Austria and the hunting organizations of Carinthia and Styria are presently strong proponents of bear conservation in Austria. The efficient management of a growing bear population requires intensified cooperation from all the groups and organizations concerned, including the governmental nature conservation agencies, the hunting organizations, the beekeepers' unions and farmers' committees, and the private nature conservation associations. Realizing these demands, the governments of the states sharing the Austrian bear population have ordered wildlife biologists to conceive a management plan in 1995. Thereby all the organizations mentioned above will be invited to clarify their points of view and contribute their ideas and help to achieve common solutions to the problems inevitably arising in human-bear coexistence.

Human-bear interactions

Attacks on sheep and beehives make up the bulk of damages reported to the insurance companies, and attacks on cattle

and pigs are exceptional (Gutleb 1993a; Steirische Landesjägerschaft pers. comm.). Sheep grazing in or close to forests are particularly in danger. Electric fences have proven successful in keeping bears away from beehives. A new phenomenon is the special interest of some bears in a rather surprising source of food, the rapeseed-oil used by lumbermen in chain saws. Radio tracking revealed that in late summer/early autumn, bears often visit old and nowadays barely used orchards in the vicinity of farms. In Lower Austria and Styria bears regularly come to roe deer feeding stations to feed on maize, oats, and pellets. Bears are also successful in locating the cereals and apples distributed by hunters to attract red deer to specific hunting areas at the beginning of the rutting season. One of the females released by WWF has acquired the strange habit of approaching sites where a shot has been fired in order to look for the dead deer before the hunter has secured it (four reported cases in autumn 1993). In 1993 a bold bear roaming the western parts of Styria, had the peculiar ability to let the water out of fish ponds in order to exploit the trout therein. The appearance of several bold individuals in 1994 caused a tremendous rise in the number of incidents where damage occurred and an alarming change in the quality of the damage (opening of rabbit-hutches in the rear of houses, entering into sheepfolds etc.). Stirred up by the frightened public, the local authorities issued shooting orders, and finally two bears were killed in autumn. Apparently the guilty bears were shot since the wave of damage ended.

The fact that bears are increasingly observed in areas close to farms, villages, mountain cabins, and hiking trails has led to a debate about the shyness of bears. This shy nature has always been emphasized in discussions of the potential danger posed by these new members of the Austrian fauna. It is a common view that bears in Europe are as shy as they are because of centuries of intensive persecution. But what happens if persecution stops as is the case in Austria? Will bears in general (not only particular problem individuals) become more and more reluctant to avoid humans? What sort of measures can be taken to maintain this shyness without resuming hunting? Shall we conceive scaring programs for the beloved and feared newcomers to keep them at the right distance? It is certainly too early to decide if and to what extent this problem exists and what can be done, but constant awareness will be necessary to be able to react in time if these apprehensions turn out to be true.

Public education needs

Interest in bears and especially a positive reception of the aim to increase their numbers is primarily found in the cities. People living in the areas where bears occur are often much less satisfied about their presence. This

group is the most important to be addressed by public education programs. People are not used to living with bears and often exaggerate the dangers associated with them. There is a need for basic information on how to avoid bears or how to behave in an encounter, as well as for general information on the biology of bears and their ways of life. "What do we need bears for?" is the central question of all debates on bears. Public education has to find a way to make people feel that the protection of bears is not a question of utility and economy but of ethics – that the bear is part of the nature we want to conserve.

Specific conservation recommendations

1. Austrian bear habitat is dissected by barriers such as highways or densely populated valleys. It is evident that the Austrian bear population can only survive and grow as long as bears can cross these barriers. At the moment, we have only a very general knowledge of these barriers and corridors (Aste 1993). As a first step, it is necessary to gather all the basic data on the location and character of these crucial structures for bear migration. Not until then would it be possible to conceive how to preserve existing or to create new corridors. Special attention should be paid to planned highways or highways in construction.
2. In order to increase the efficiency of bear conservation measures, a greater involvement of the federal governments should be envisioned. For instance, governmental support of the reimbursement programs would strengthen the confidence of farmers and beekeepers through the assurance of the "bear lobby" that damages will be paid for in the future when bear numbers rise. The willingness of livestock farmers to accept the presence of bears will also depend on the settlement of questions concerning the repayment for the breeding value of the killed animals, the reimbursement for consequential damages, and the criteria to decide when a lost animal should be regarded as a bear kill.
3. Often enough people have asked that endangered species protected by hunting law be listed in the nature conservation law as well. At present, federal nature conservancy agencies are not supposed to use their financial resources for species listed exclusively under hunting legislation. Enlarging their competence would greatly improve the situation. In a step that points the way ahead, the government of Lower Austria intends to create a fund for the protection of endangered species (NÖ Artenschutzfonds). Its aim shall be to initiate and support programs to improve the status of endangered species. The brown bear will be one of the target species (Kraus 1993).

Status and management of the brown bear in Bulgaria

Nikolai Spassov and G. Spiridonov

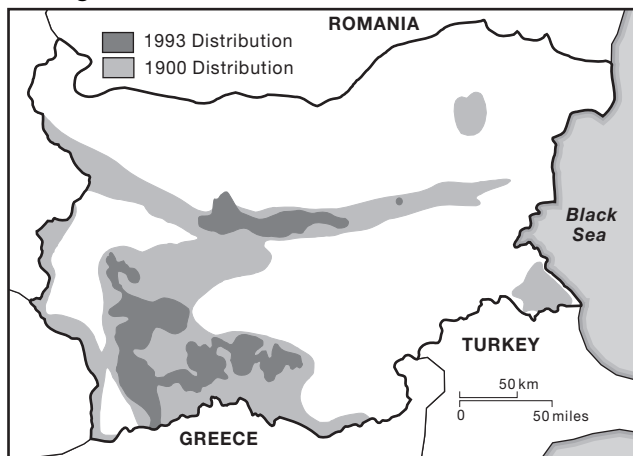
Historic range and current distribution

Bear remains have been discovered in a number of prehistoric sites, e.g. the Neolithic sites of Yasa Tepe, Kovatchevo (Stara Zagora District) and Malo Pole; the Eneolithic sites of Golyamo Deltcheva, Dolnoslav, Ovtcharovo, and Kovatchevo (near the town of Petritic); and from the Early Bronze site of Ezero. Although these finds consist of less than 1% of the total number of bones in separate sites, their presence shows that the bear used to be widespread throughout the country, even in the plains and lowlands of southern and northern Bulgaria.

Roman signs dating back to the second century BC from the town of Montana and the village of Staliiska Mahala (northwestern Bulgaria), describe huge bear and European bison hunts, with the participation of more than one Roman ally, as well as the transporting of dozens of bears along the Danube to fight in Roman arenas. During the Middle Ages, bears still inhabited large areas in the mountains, on the plains, and in forests that occurred throughout the country. The bear probably occurred in the now deteriorated Ludogorie forests of northeastern Bulgaria until the nineteenth century.

Data presented by Irecek (1899), as well as data obtained by Spiridonov and Mileva (unpublished questionnaire of the State Forestry Departments 1989–1990), gives a good idea of the species' distribution until 1900 (Figure 6.3), when its extermination was encouraged by the state through payment of incentives. This resulted from the bear's consideration as a species harmful to livestock. During the 1920s and 1930s, the species gradually disappeared from the regions of the Eastern and Western Stara Planina Mountains, and its distribution became similar to its present range.

Figure 6.3. Distribution of the brown bear (*Ursus arctos*) in Bulgaria, 1900 and 1993.



Current distribution encompasses four basic local populations (Spiridonov and Spassov 1990):

1. Central Balkan Mountain Range (Central Stara Planina Mountain Range): on the northern and southern slopes at elevations above 800m, spread over an area of 120km² along the range from Zlatitsa-Teteven to the Tryavna Mountains.
2. Rila Mountain: at elevations above 1,000–1,200m.
3. Pirin Mountain: at elevations above 1,000–1,200m.
4. Western Rhodopes Mountain: at elevations above 700–1,000m.

The micro-populations from the last three mountain ranges maintain permanent contact and make up a single Rila-Rhodopes population, while the Central Balkan micro-population has remained isolated since the beginning of the century (Figure 6.3).

To the south of Pirin, the Rila-Rhodopes population reaches the Slavyanka Mountains, where, according to the latest data, separate animals migrate sporadically into Greek territory. To the north of Rila Mountain this population reaches the smaller mountains, located south and southwest of Sofia, such as the mountains of Verila, Ljulin, Vitosha, Plana, inhabited by an insignificant number of bears. Current data show that there are isolated cases of migration to the west up to the Bresink region. A casual migrant to the western Balkan Mountains (Tchuprene) was recently reported. Present observations indicate the occurrence of a new micro-habitat in the Elena section of the Balkan Mountain Range (Eastern Balkan Range). Data on the occurrence of bears in the Vlahina and Malashevska Mountains, near the western Bulgarian border (see map in Spiridonov and Spassov 1990), have not been proven by a recent (Spiridonov and Mileva, unpublished questionnaire of the State Forestry Departments 1989–1990). It seems that these individuals were occasional migrants. The population of the western Rhodopes expanded its range to the west and to the south. According to the most recent data, single migrants have permanently settled in some parts of the eastern Rhodopes, e.g. near the village of Ardino in the Kurdjaly region (Gunchev pers. comm.) Separate bears reach the southern Bulgarian border in the region of Mugla village, near Smolyan, and probably in the region of the town of Dospat. It is likely that these regions are the points of contact with the limited Greek population, that is maintained through migrants from the Bulgarian population. Pictures of bear sign support the supposition that, in the region of Smolyan, there were separate migrants reaching the Greek border up to ten years before.

If the present conservation measures and optimum living conditions are successfully maintained, it is expected that the bear population will increase its numbers to roughly 1,000 individuals. It is also expected that the population density in certain regions will increase, and the

range will be extended. Such an extension could be predicted for some regions in the central Balkan Mountain Range and in the western Rhodopes during the next ten years. These regions are not currently inhabited by bears. In the eastern Rhodopes, it is unlikely that bear range will be significantly broadened. Theoretically, it may be expected that the Ihtiman and the central sections of the Sredna Gora may serve as a corridor linking the Rila-Rhodopes population and that of central Balkan Mountain Range

Status

The brown bear is listed in the Red Data Book of the People's Republic of Bulgaria (1985). According to IUCN Red List criteria (IUCN 1996), the brown bear should be considered a rare species in Bulgaria. The species is potentially threatened, owing to the limited population number and distribution that results from human pressure. At the same time, its numbers have slowly increased in the last fifty years. Excluding Russia, the Bulgarian bear population ranks as the second largest national population in Europe after the Romanian population. Thus, the importance of Bulgarian bear conservation goes beyond the national scale.

The genetic peculiarities of the Balkan population (see below), add to the significance of, and reasons for, the conservation of this population. One of the largest populations in Europe, it numbers 2,700–3,000 individuals and follows the Finnish-Scandinavian, the Caucasian, and the Carpathian populations in size (Sorensen 1990). The Bulgarian micro-population inhabits the Rila-Rhodopes Mountain Massif (including the smaller mountains north of Rila), and numbers some 500 specimens. It is of specific significance for the preservation of the Balkan bear population, as the bears from this region have the opportunity to interact freely. It is likely that they are also crucial for the maintenance of the limited Greek population (see page 72). The Central Balkan population is of a high conservation importance because of its vital status and its high density (approximately 1 bear/20km² in the inhabited areas). One of the reasons for this is the fact that the population numbers in the Central Balkan NP (IUCN category II) and its adjacent areas are close to optimum.

Bear population numbers in the beginning of this century were likely quite close to current numbers, although the species used to have a broader distribution and inhabited some regions that are now unfavorable. The reason for this was mainly intensive hunting. According to Irecek (1899), 567 bears were killed between 1893 and 1898. During the 1930s the bear population reached its minimum – some 360 specimens (Katsarov 1935). The data referring to the period after 1941 when bear hunting was prohibited show gradual increases in population numbers – 450 bears during the

1950s (Ruskov 1961), and 600 bears during the 1980s (Spiridonov and Spassov 1985).

The 1980s data are contradictory. According to Stenin *et al.* (1983), the population numbered 850 at the time of publication. According to Genov and Gancev (1987) and Rosler (1989), whose data are also based on the statistics of the Committee of Forests, bear population numbers are significantly over 800. According to the Committee of Forests' annual count, bear population numbers increased from 486 in 1971 to 579 in 1972. Statistics also show that the bear population increased from 698 in 1985 to 921 during 1986. It is obvious that these data are not based on objective surveys and do not correspond to the real status. During this period, trends in rapid population growth were stimulated by promoting the bear as a significant subject of hunting.

Our current population estimations are based on:

1. Questionnaires of the State Forestry Department, aimed at the establishment of the species distribution and numbers (Spiridonov and Mileva, unpubl.);
2. Extrapolation of Raychev's (1989) data on the determination of bear numbers along the southern slopes of the central Balkan Mountain Range, as well as Spiridonov's (in print) data on the bear range along the northern slopes of the same mountain, according to the track analysis approach and;
3. Other personal observations.

Based on these data, the following picture might be drawn: 700–750 bears existed until 1986 and this expanded to hardly more than 750 bears by the end of the 1980s (Spiridonov and Spassov 1990; Spiridonov and Spassov 1993). These numbers are distributed as follows: 500–520 bears existed in the Rila-Rhodopes Massif (about 150 in Rila and over 200 in the Rhodopes Mountains), and about 200–210 individuals existed in the Central Balkan Mountain Range. These bear numbers might turn out to be slightly lower, owing to poaching which increased after social changes that occurred in 1989. It is much more likely that the present trend for increased population is obstructed, and even a reduction in the numbers could be expected.

Morphologic characteristics and taxonomic status

Inhabiting optimal habitats (see above, the natural density of the population), the Bulgarian bear not only reaches but even exceeds the maximum body parameters of the Southern, Western, and Central European bear. Adult males weigh about 200kg on average, yet there are animals reaching 300–350kg (N min=5). The visual data indicate that bears with a weight of 200–250kg represent some 6% of the total population, and those with weight over 250kg are some 2% of all (Gunchev 1990). Two males weighing

some 400kg were shot in 1939 and in the beginning of the 1980s below the peak of Mazalat and in the region of Stara Reka.

Differing from the more northern populations, Bulgarian bears, as well as Balkan bears in general, show notable polymorphism regarding their coloration: there is a high percentage of rather light (golden) specimens. According to some observations, which have not been proven by enough statistical data, the Balkan bear shows slight trends toward having a thicker body and is less aggressive, compared to the Carpathian bears.

It is traditionally considered that the bear in Europe belongs to the sub-species of *Ursus arctos arctos* L. (Heptner *et al.* 1967; Corbet 1978). The Bulgarian bear is also thought to be a representative of this sub-species (Ruskov and Markov 1974). However, current investigations indicate that the affinities and taxonomic relations of the European populations are quite complicated. Recent surveys of Balkan bear morphology show that it differs from the Russian-Carpathian population, and is closer to the other Mediterranean populations (Spasov 1990). These conclusions were proven by genetic surveys of the European bear (Taberlet and Bouvet 1992, 1994). These surveys indicate that the localized Mediterranean populations, including the Balkan population, are very close and differ significantly from the populations in Central, Northern, and Eastern Europe.

We could speculate that on the Pleistocene-Holocene boundary, the European population that had found refuge in the Mediterranean during the glaciations, came in contact with the new wave of a dominant sub-species invading from the east, and covered the whole continent parallel to reforestation. Of the native population, the sub-population localized in the Iberian refuge, and the isolated one on the southern Scandinavian Peninsula, seem to be less affected by crossbreeding. The contact between these two sub-populations was probably maintained until later periods, maybe even during the period of the Upper Pleistocene interstadials, while the Balkan-Apennines native subpopulation lost contact with them much earlier. Crossbreeding of the native and the latter Holocene forms was likely more active in the Balkans. According to Heptner *et al.* (1967) and Tihonov (1987), similar crossbreeding processes between *U. a. arctos* and *U. a. syriacus* are on-going now in Caucasus. It seems possible that the Syrian sub-species, characterized by lighter coloration, is a form rather closer to the recent European-Mediterranean population and is a remnant of the ancient Mediterranean population.

Legal status

During 1941–1984, bear hunting was restricted by the Hunting Act, except for cases of problem animals. The

bear became hunted in 1984 and the number of bears shot was strictly regulated. In relation to bear hunting development, a captive breeding farm was established in Kormisosh in 1968, and another farm was settled in Mazalat (the Central Balkan Mountain Range) in 1984. Some of these bears were released into nature.

Given that the species is comparatively rare, increased poaching and decreased hunting control justified the decision of the Ministry of Environment to designate the bear a protected species in January 1993. This decision restricted bear hunting again, except for cases of problem bears, bears that lost their fear of people, and in the case of overpopulation.

Population threats

Poaching: Increased poaching results from the weakening of a number of administrative hunting and forestry institutions after the socioeconomic change of 1989.

Problem bears: Artificial feeding of bears with carcasses in the hunting husbandries (1984–1992), until recently, was often a factor in creating problem bears. Some such animals were killed. These bears still present trouble for local farmers, yet in most cases the harm is overestimated. The practice of artificial feeding still exists. The extermination of bears treated as harmful animals is amongst the major factors affecting the population. Identifying a “harmful” bear is sometimes difficult, and at the same time other animals may be jeopardized in attempts to kill the problem bear.

Hunting: The establishment of hunting farms in the recent past led to increased international hunting tourism. The hunting may have resulted in disturbances of the structure of populations inhabiting the regions of the former Hunting Husbandries.

Destruction of genetic purity: Some destruction of the genetic purity of the Bulgarian (Balkan) bear population occurred in the Rhodopes Mountain, and to some extent in the Central Balkans. This occurred when farm-bred Carpathian bears were introduced into the Rhodopes in the 1970s and 1980s, and into the Central Balkan during the 1980s.

Isolation: The isolation of the Central Balkan micro-population represents a specific threat to the preservation of this population in Bulgaria. This is due to the possibilities of inbreeding and the consequent degeneration of the population. The gene pool of the particular population was maintained by some 100 specimens during the 1950s (Ruskov 1961). Its twofold increase is indicative of the vitality of the population for the moment.

Habitat threats

Disturbance and uncontrolled visitation in protected areas (inhabited by a quarter of the Bulgarian bear population) results from the lack of effective safe-guarding of these areas. Large highways represent barriers to the normal free migration and expansion of the range. Major obstructions of this type include the Vitinya Pass, the Sofia-Burgas motorway via Karlovo, and the Sofia-Plovdiv highway. Construction of motorways, forestry roads, and tourist facilities disturbs both the animals and their habitats.

Management

Because it was a game species until 1993, the bear population was managed by the Committee of Forests. Bear hunting, which was permitted between 1984 and 1993 (Table 6.1), and the subsequent urge to develop intensive international hunting tourism was the major reason behind efforts to increase population numbers at any price. This led to the establishment of a bear farm in Kormisosh, to the introduction of the bears bred in captivity into some of the hunting husbandries, and to the artificial feeding of bears there. This policy had decidedly negative effects on the bear population (see Population Threats). After bear hunting was prohibited, the artificial feeding of bears was also restricted by a decree of the Ministry of Environment in 1993.

After the Ministry of Environment designated two new National Parks (IUCN category II), Rila and the Central Balkans, in the beginning of the 1990s, the protected areas inhabited by bears were significantly enlarged, reaching 2,600km² (or 2/3 of all Bulgarian protected areas). Thus some 25% of the bear population is now under spatial protection:

1. Rila NP (IUCN category II) – 1,080km² inhabited by 70 individuals;
2. Central Balkan NP (IUCN category II) – 730km² inhabited by 60–70 individuals;
3. Pirin NP (IUCN category II) – 400km² inhabited by more than 40 individuals;
4. Vitosha NP (IUCN category IV) – 2600km² inhabited by 10 individuals;
5. Nine isolated Strict Nature Reserves (IUCN category I) – encompassing 120km² in total are also parts of the home ranges of several animals.

In an attempt to solve problems with the keeping of dancing bears, the Ministry of Environment registered and licensed all 24 Bulgarian dancing bears in 1993. Apart from the insignificant number of zoo and circus bears, 22 animals are still bred in captivity in the remaining bear breeding farm in Kormisosh. Most of them are either Carpathian bears or hybrids. The budget for their captive breeding comes to one million BLV or US\$20,000 per year.

Human-bear interactions

Brown bears generally avoid contacts with humans. However, instances of bears meeting people in the mountains are frequent. In the cases where aggressive bear behavior was recorded, it appears that the animal was provoked. The reasons for such behavior can be classified as follows (Spiridonov and Spassov 1990): a) wounding the animal with fire arms or other strong irritation; b) defense of young; c) Crossing within critical distance during sudden encounters; d) defense of prey.

Out of 165 instances of contact between bears and people in the Balkan Range, the bear was peaceful in 126 cases. Various aggressive acts were registered in 39 cases and seven of these persons were hurt (Guntchev 1986). Large numbers of these cases involved armed persons. In the 1980s, cases of conflict with bears increased in some regions, owing to the release of bears bred in captivity that had lost their fear of humans. This is one of the negative consequences of the establishment of Bear Hunting Husbandries (Spiridonov and Spassov 1990).

Original and summarized data regarding bear damage to livestock, beehives, game, and agriculture exist in Ruskov (1961), Raychev (1985), Genov and Ganchev (1987), and Spiridonov and Spassov (1990). According to some data, more than 1,200 domestic animals were killed by bears between 1975 and 1983. Of them, more than 80% were sheep.

Public education needs

Specific public awareness programs for local farmers explaining preventive measures that may decrease bear damage will be extremely useful in diminishing human-bear conflicts. Another important measure is the development of a program targeting visitors to National Parks, to inform them of appropriate behavior in case they

Table 6.1. Bears officially shot in hunts in Bulgaria, 1984–1994 (does not include poaching, which is estimated at 20 bears annually).

| Year | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|--------------|------|------|------|------|------|------|------|------|------|------|------|
| Bears killed | 3 | 7 | 7 | 8 | 6 | 5 | ? | 30 | 12 | 7 | 5 |

meet a bear. It is also important to organize and implement a large information campaign promoting the conservation value of the species among the local population in mountainous regions. It seems likely that such a campaign may decrease poaching.

Specific conservation recommendations

The Wilderness Fund, a Bulgarian NGO, has developed a draft Bear Conservation Action Plan based on the species status, the conservation measures undertaken, and existing threats. The Action Plan is aimed at the protection, development, and maintenance of optimum bear populations in the country. The draft was prepared and discussed by the following experts and members of the NGO: N. Spassov, G. Spiridonov, V. Velichkov, V. Tvanov, L. Mileva, K. Georgiev, B. Mihova. The draft was submitted for revision and approval as a national strategy to the Ministry of Environment in 1994. It envisions the following measures:

1. Counting the bear population to provide a recent evaluation of its status. To ensure this, an integral methodology for determining the presence and numbers of bears has already been developed and approved by a team of experts.
2. In order to develop the Bulgarian bear population in terms of range and quantity, potential habitats and optimum population numbers should be determined. This requires coordination of the efforts of all interested and managing institutions.
3. *Habitat protection*: a) New protected areas (IUCN categories IV or V) should be established in the Western Rhodopes, and additional protected areas should be developed in the Balkan Mountain Range; b) The establishment of administrative bodies for National Parks inhabited by bears should be a priority among the institutional measures that are to be officially undertaken.
4. *Ensuring contact between bears of separate mountain populations*: a) develop methods of assuring the preservation of existing ecological corridors connecting local populations of separate mountains that make up the Rila-Rhodopes Massif; b) in the longer term, a plan should be developed to alleviate the isolation of the Central Balkan population. An ecological corridor should be provided. The genetic information exchange may be ensured by introducing a limited number of animals, originating from the Rila-Rhodopes population, into the Balkan Mountains and vice versa.
5. *Decreasing bear-human conflicts*: a) develop and approve a system that will compensate local farmers for bear damage. Shooting of problem bears, permitted by present legislation, may also be combined with

limited hunting tourism. At the same time, taxes from bear hunting may be collected to form a special fund that will be used to reimburse local farmers for bears' damages. Part of the funds gained through ecotourism (e.g. wildlife photography) may also be utilized in a similar way; b) develop and implement a public awareness program for local people that will encourage the minimization of poaching.

6. *Preservation of genetic purity in the native Bulgarian (Balkan) population*: a) Issue specific permits for the elimination of bears with clear morphological and genetic features of Carpathian bears. This measure requires strict control and preliminary marking of specimens; b) sterilize bears originating from the Carpathians or bred in captivity at the former bear farm of Kormisosh.
7. *Resolving the problem of captive dancing bears*: a) Sterilizing dancing bears, preferably the females, and prohibiting the issuing of new licences to keep dancing bears. More secure marking, e.g. tattoos, of bears is needed. Thus, the practice will end when the bears die; b) meetings should be held with dancing bears owners to discuss alternatives to this activity.
8. To preserve the Balkan bear in its remaining habitats, a program should be developed with the participation of the neighboring Balkan countries. The first step of the program should be to consider joint activities with Greek organizations interested in the preservation of the bear population in the Rhodopes. The ongoing discussions between the Wilderness Fund (Bulgaria) and ARCTUROS (Greece) regarding such a joint program may be considered the beginning of the implementation of this idea.

Status and management of the brown bear in Finland

Erik S. Nyholm and Kai-Eerik Nyholm

Historic range and current distribution

In the beginning of the 19th century, the brown bear occurred throughout Finland as it does today. There are some 19th century reports on the damages caused by brown bears, as well as statistics on the numbers of killed bears (Mäensyrjä 1971; Nyholm unpubl.; Palmén 1913; Pullianen 1980; Voionmaa 1947). From these statistics, one can draw the conclusion that the brown bear population at that time was around 1000–1200 individuals. (Figure 6.4).

These statistics also show that in the first half of the century the bear population was nearly one fourth larger in numbers than in the second half of the century, when the decrease of the brown bear population began. Human population was spreading and more land was needed for

cattleraising. As a result of efficient, government-supported hunting of large predators, no bears could be found in the south, southwest, and west of Finland in the 1880s (Figure 6.4) (Mela 1882). At that time there was still a brown bear population in the wilds of eastern and northern Finland. The decline of the brown bear population in the country continued up to the latter half of the 20th century, when the bear hunting season was shortened by 206 days.

As late as the first decades of the 20th century, the brown bear population in Finland was smaller than ever before, and only after 1920 did it start to grow again (Kivirikko 1940). Based on recent data from the count of the minimum population started in 1978, as well as on the comparison of annual mortality statistics, the brown bear population appears to be over its worst crisis. Since 1978, records show that the population has grown by 30.1 % in spite of relatively heavy hunting in those years.

The brown bear has gradually spread back to its former territory, increasingly so in the 1970s and 1980s (Pulliainen 1983). Today, the brown bear population

occurs throughout the country except for the Ahvenanmaa Islands in the west and the open low mountain areas of Utsjoki rural district in the north (Figure 6.5) (Nyholm 1989a unpubl.).

Status

The species has adapted well to a growing human population and to drastic changes in its environment. Brown bears can be found quite close to human development, and some bears have even stayed for short periods within the boundaries of towns and cities. Partial changes in its habitat do not seem to disturb the brown bear very much. This species is very adaptable in making use of its surroundings, which ensures the utilization of any new opportunities that might arise. The nutritional resources in Finland could support a considerable growth of the brown bear population, but the population densities are still rather low (the average in the reindeer herding area

Figure 6.4. Distribution of the brown bear in Finland, 1820–1830 (Voionmaa 1947) and 1880 (Mela 1882).

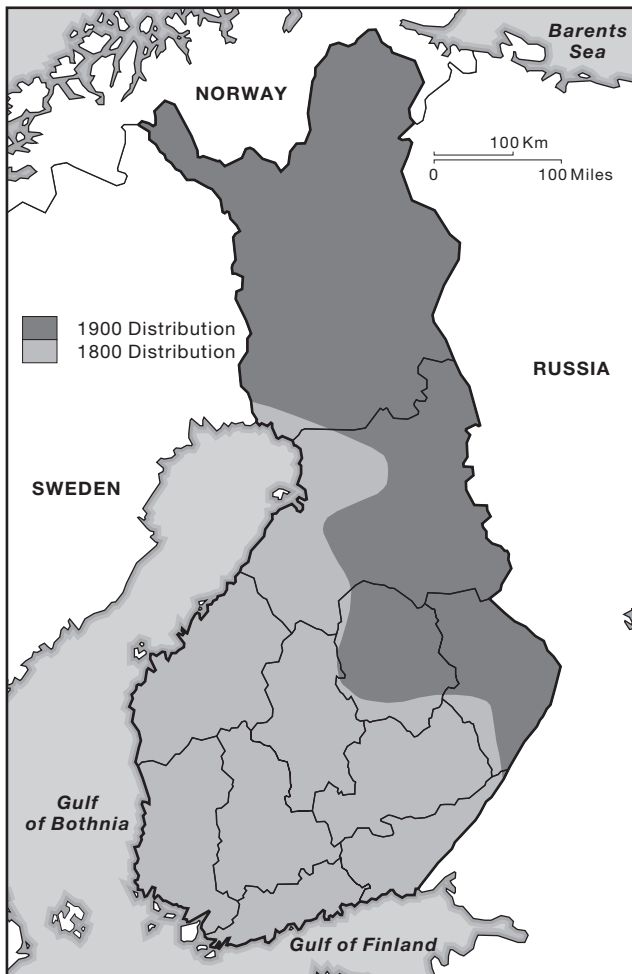
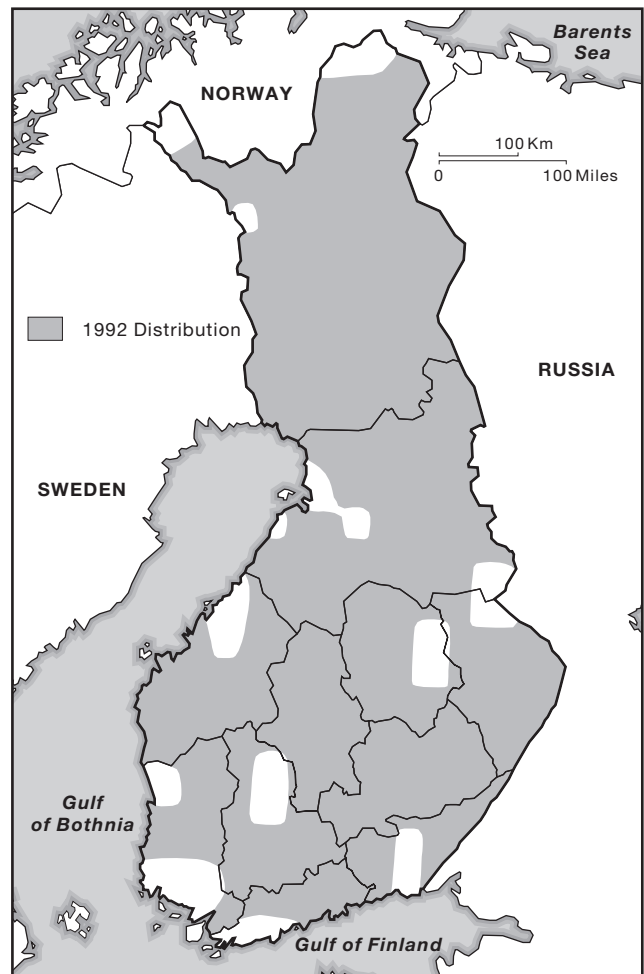


Figure 6.5. Distribution of the brown bear in Finland, 1992 (Nyholm and Nyholm manuscript).



is 1.0 individuals/km², and in the rest of the country 1.9 individuals/1000km²) (Nyholm 1991a). Reports of increasing populations in many areas have become more numerous, and bears with cubs have been observed in the western part of the country (Nyholm and Nyholm manuscript). The current population of brown bears in Finland is estimated at 430–600.

The Finnish Game and Fisheries Institute (FGFI) Predator Division (PD) in cooperation with the Ministry of Agriculture and Forestry (MAF), in 1987 developed a plan for the management of the brown bear population. The plan was prepared in accordance with a motion issued by the Natural Resources Committee (NRC) in 1986. If this plan is carried out using an annual population growth of 6–7% as a basis, then there will be a brown bear population of 900–1,000 bears by the year 2000. This is large enough to ensure a stable and viable brown bear population.

Legal status

Until 1964, hunting of brown bears in Finland was allowed throughout the year without any restrictions. It was not until April, 1964 that a statutory order was issued that allowed hunting of the brown bear from 10 May to 15 October. In another statutory order issued on 30 December 1966, the spring hunting season of the brown bear was continued; however it forbade driving the bear out of its winter den in order to kill it.

The summer hunting season continued unaltered during the next few years. A statutory order issued in 1973 was enacted as follows: in the years 1974–75 and 1976–77 in the province of Lapland and in the rural districts of Kuusamo and Suomussalmi, the brown bear hunting season was to be from 15 May to 15 October. Elsewhere in the country, the season was to be from the beginning of August to the end of September, or 31 days. Furthermore, use of carrion baits was forbidden because it had proven to be too efficient.

When the hunting season for brown bears was divided into spring and autumn seasons in 1978, the hunting areas also became limited and hunters were obliged to report every killed bear to the local Game Management Association.

When the spring hunting season was lengthened by 15 days in 1980, the use of dogs for spring hunting was allowed, provided that the dog had been tested to prove that it would not chase reindeer. In 1981, brown bear hunting regulations were made stricter by ordering that the minimum weight of a factory-made soft point bullet be 8g, and that the energy on hitting the target should be over 2,500 joules at the distance of 25m. Furthermore, female bears accompanied by a cub under one year of age were protected.

In the Parliament Act of 1984, cubs under one year were protected, the length of the hunting season being the same as before. In 1987 shooting bears in oat fields was forbidden, since this had proved to be too efficient. At the same time it was forbidden to use an unleashed dog during the spring hunting season. The hunters were also ordered to report a wounded bear immediately to the local chief of police.

In 1993, the spring hunting season remained unaltered (statutory order 1993). Thus, bear hunting in the reindeer herding area (RHA) was allowed during a period of 46 days. The new hunting law and statute came into effect on 1 August 1993; it changed the hunting of brown bears fundamentally. Spring hunting became totally prohibited. Though hunting in many respects now differed from what it had been before, the autumn hunting season still remained unaltered for the year 1993.

According to the new law concerning brown bear hunting, Finland is divided into two parts: 1) Northern Finland (RHA and Game Management District of Kainuu), and 2) Southern Finland). In area 1, where the local inhabitants have the right to hunt freely on state lands, a quota will be set based on the number of bears that can be killed without endangering the existence of viable bear populations in those areas. All those who meet the required qualifications are allowed to hunt bears provided that they have hunting rights to the area where the hunting will take place.

New Restrictions Regarding Bear Hunting:

- 1.) It is not lawful to drive a bear out of its winter den, bait it with carrion or other attractants, or kill it while it is feeding on an incompletely harvested field.
2. When using a rifle, the minimum weight of the bullet must be 9g and the hitting energy measured at a distance of one hundred meters from the muzzle of the barrel shall be at least 2,800 joules. Use of a full jacket bullet is not allowed in bear hunting.
3. Bear hunting is not allowed from 16 October to 19 August. Bears under one year of age are protected. A female bear with a cub younger than one year is protected.
4. A wounded bear has to be reported immediately to the nearest police officer.

Permits to kill bears in the rest of Finland will be given providing that the bear population in the local area concerned is large enough. Game Management Districts will issue these permits to local hunting clubs. Anyone participating in a brown bear hunt must have a lawful rifle and bullets and must be able to prove that one has passed the shooting test ordered by the MAF. According to the new hunting law, all the damages caused by bears to farms, forests, and fisheries will be compensated for by the government. With the help of these arrangements, it will now be easier to control the development of the brown bear population.

Population threats

Population counts of brown bears in Finland show that the population has grown by a third during the 16 year research period (1978–1993). Although the brown bear population decreased by 7.7% after 1982 due to intensive hunting, the overall 30.1% increase during the 15-year period indicates a positive general development of the population.

Poaching, in the strict sense of the word, is a minor problem. However, in some cases, statutory orders have not been followed, such as the obligation to report the bear kill and to have the hide marked by the authorities. The reason for this kind of negligence in most cases has been the country's taxation policy. For a middle-sized brown bear (about 150kg), the hunter may get an open market price of 17,000 FIM (US\$3128). This will increase his taxes considerably when added to his other taxable income.

Interest in brown bear hunting in Finland is increasing. The admiration and fame won by the best bear hunters in the past (Kivilinna 1936; Korhonen 1935) seems to be the secret dream of many bear hunters of today. Virtually every bear killing in the country nowadays is considered newsworthy, and almost without exception, the hunter's name is mentioned.

The food supply for the country's present brown bear population of 430–600 individuals is very good, with high numbers of reindeer (250,000 reindeer in the reindeer herding area – RHA) (Paliskuntainyhdistys 1993) and moose (120,000 individuals) (Nygren 1993). In addition to this, more than 50 nature photographers provide carrion for bears and golden eagles to get photos of them. After hibernation the brown bear needs meat badly, and carcasses brought to the forest offer hungry bears an easy way to fill this need.

In Finland, cattle are no longer left to graze freely in the forests and meadows (this practice was quite common in the first half of the century). Now both dairy and beef cattle are kept in grazing areas surrounded with fences. Only sheep are kept on islands during the grazing season. Very often even the sheep are held in enclosures close to the dwellings. It is much more difficult to try to compensate for losses caused by bears to reindeer owners. Reindeer graze freely in the reindeer herding area of northern Finland, where the forests and peatlands are wide, roadless, wilderness areas. Finding carcasses of killed reindeer is difficult because the bear usually buries its prey. Full compensation in the present situation is not possible. It is therefore quite understandable that the reindeer owners fight for their source of livelihood and are strongly opposed to the idea of letting the populations of large predators grow in the RHA.

Since the government of Finland decided to start paying compensation to farmers for damages caused by large

predators, including those made by the brown bear, the attitude towards this native mammal has become much more positive. However, the most important threat to the brown bear population in Finland is the possibility that the present positive attitude will turn negative. This might happen as a result of the first fatal bear mauling.

Habitat threats

Forests and peatlands are the typical habitats of brown bears in Finland. Since the 1950s, massive clearcutting and draining of peatlands has been undertaken. As a result of these silvicultural projects, brown bear habitat has changed considerably. This has not, however, had any significant negative effect on population growth, because the bear easily adapts to new living conditions. The seedling stands of clearcut areas have augmented the food supply of herbivorous animals such as moose and reindeer, consequently the food supply of the brown bear has improved considerably. Young seedling stands of deciduous trees are the favorite haunt of brown bears during their plant diet period (Nyholm 1991b).

Road densities in Finland have increased rapidly during the past two decades. Main roads have been straightened and re-surfaced. The worst disturbance to nature are the logging roads built by the Finnish Forest and Park Service. These roads traverse large wilderness areas, making them easily accessible. Thus, the disturbance caused by people in peaceful forested areas has increased. Though the numbers of bears seen by motorists is increasing, collisions of motor vehicles with bears are rather scarce (only 1–2 cases during a period of five years). Most of the bears killed in these accidents have been cubs between 0.5–1.5 years old.

Logging roads themselves do not seem to have disturbed brown bears very much. Quite often bears walk along the roads, leaving droppings and signs of their presence. In one instance, a temporary winter logging road ran past only one meter away from a winter bear den. Through the winter, heavy timber trucks drove past the den without disturbing the sleeping bear. This animal left its den in May when the snow started melting. A number of dens have also been found in the middle of large clearcut areas.

Management

According to the motion issued by the NRC (1986), the brown bear population in Finland should now be around 1,000 individuals. Using this as a basis, the MAF assisted by the PD developed a plan for the management of the brown bear population. This plan is intended to be put into practice by the year 2000. The plan can be realized only assuming that farmers, reindeer owners, and other

taxpayers can agree on the measures to be taken, the timetable, and the necessary financing.

The plan for the management of the brown bear population prepared jointly by the MAF and the PD (Nyholm 1987 unpubl.) is aimed at increasing the population to the proposed level (NRC 1986). This requires that the hunting of brown bears becomes more controlled. The ministry changed the methods and times of bear hunting when it was needed. When, in 1963, bears were killed using snowmobiles, an order was issued for a period of three years, which allowed the brown bear to be hunted only from 10 May to 5 October, when there is no snow on the ground.

Human-bear interactions

Encounters between people and bears are becoming more and more common as the bear population has grown and spread to densely populated areas in the south and west of Finland (Nyholm 1991b). So far no people have been killed, but several bad maulings have occurred. In 1992 a brown bear mauled a man who went tracking a bear in winter that had been disturbed and left its den. Bear attacks on people most likely occur while the bear is feeding, when it is wounded during the hunt, when it is protecting its cubs, or if it is a male bear in rut. Several cases are known outside the hunting area where a brown bear has approached a farmyard or dwelling to eat apples, berries, or honey. Within the hunting areas, brown bears are shy and very seldom seen near people's dwellings (Nyholm 1989a). From 1978 to 1988, damages caused by the bears to the reindeer stock decreased considerably when individual bears causing this kind of problem were efficiently hunted. In 1992, when management of the population was neglected, the government had to pay almost one million FIM (US\$184,000) in compensations for the damage caused by brown bears to farming and reindeer raising.

Public education needs

In recognition of the continuing growth and spread of the brown bear population to more densely populated areas, people should be given correct information about the behavior and routines of these large and strong predators. The information received through the mass media is often conflicting. This makes it difficult for people to know what to believe. In connection with the Predator Research Project of the FGFI, 1,200 local observers have been trained in different parts of the country. This unique organization has, so far, been completely voluntary.

People are very interested in brown bears and their ecology. If it were possible to arrange more public occasions

to give information about the brown bear, the information would certainly be welcomed by people. Up to the present, protection and public education activities concerning brown bears have been rather scarce due to the lack of funds.

Conservation recommendations

The brown bear in Finland is in no respect endangered. Legislative changes that were made in connection with the new hunting law will promote the growth of the population, assuming that the Finnish society accepts the bear management plan prepared in cooperation with the MAF (Nyholm 1987). Funds for research should be increased, and there should be a central research station for the study of large carnivores, which would manage the brown bear population in the best possible way. There should be a balance between the growth and the hunting of the brown bear population. This balance is supported by the new statutes to the hunting law.

Predator research supervised by the FGFI is currently being decentralized to a number of separate stations, and it is also under a process of discontinuance. If this process continues, it will have harmful effects on the future of our relatively isolated brown bear population.

There are no special reserves for the brown bear in Finland, but hunting is now under much better control than ever before. Furthermore, the frontier zone along the border between Finland and Russia offers an excellent reserve for brown bears. This peaceful and safe region reaches from Virolahti in the southeast to Muotkavaara Hill in Inari in the north. Its total length is about 1,200 km. In this area all hunting is prohibited, and berry-picking or fishing permissions are granted only exceptionally. There are exceptions, though. In the spring of 1993, Russian frontier guards shot bears marked by us because they broke the Russian controlling fences daily while crossing the border on their way to Finland for food.

The border between Finland and Russia serves as a large protection area comparable to a nature reserve. According to our follow-up studies, all large predators have made use of this area at least since the 1950s. At the moment, the significance of the border to large predators is being studied in cooperation with Russian researchers.

The 15-year follow-up study of brown bears in Finland has given authorities the facts they need to be able to manage and regulate the population according to varying needs at different times. Brown bear research should be developed further and funds should be allocated for the research. The brown bear population in Finland is living in an era of adaptation to new developments, and it would be good for the future of the species if research development could keep pace with the growth of the brown bear population.

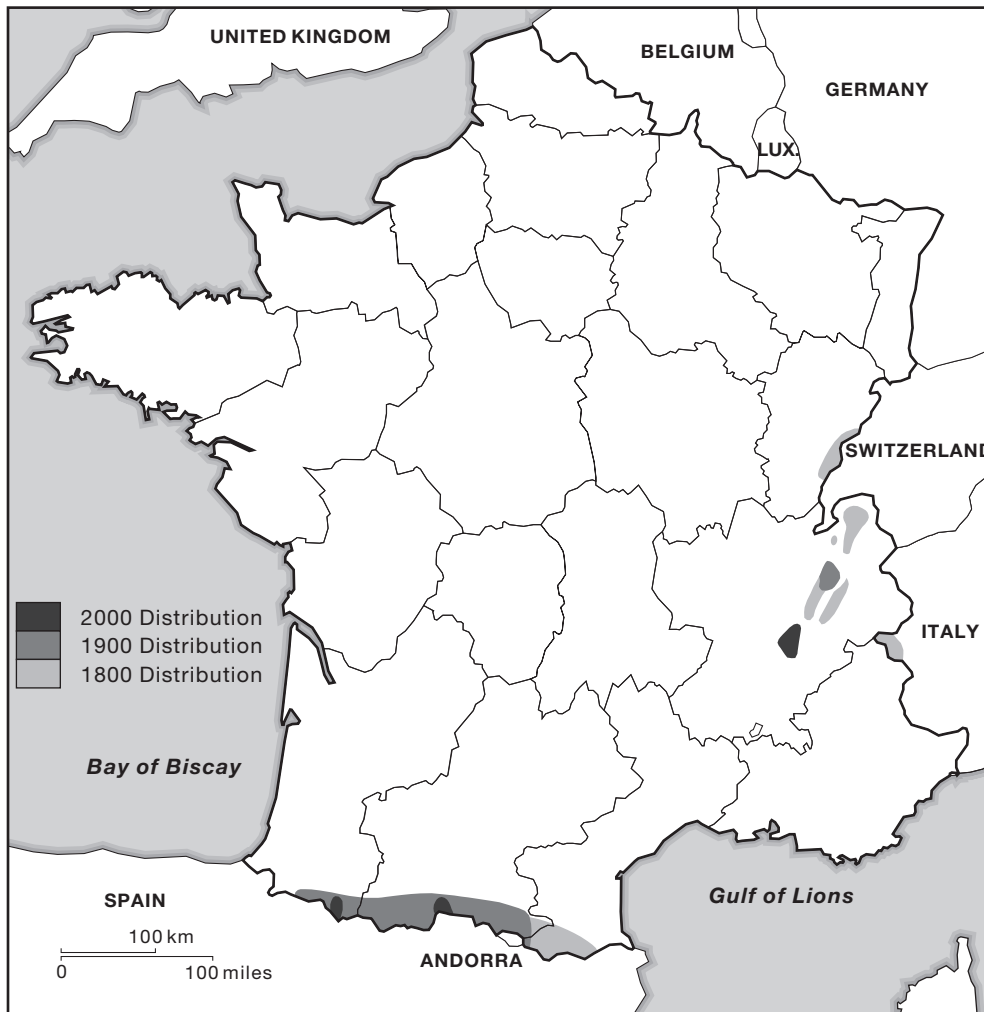


Figure 6.6. Approximate historic and future ranges of the brown bear (*Ursus arctos*) in France (Bourdelle 1937; Camarra 1989; Couturier 1954; Erome 1993; Parde 1984).

Status and management of the brown bear in France

Jean Jacques Camarra

Historic range and current distribution

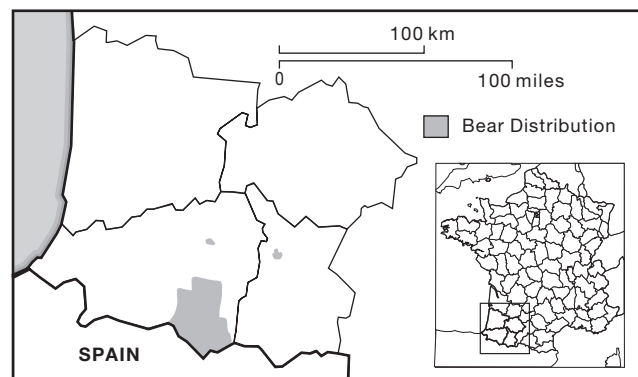
Several old accounts attested to the presence of the brown bear over the entire country in the early Middle Ages (Couturier 1954). By the end of this period, the rapid increase in human population at lower altitudes had resulted in forest destruction and brown bear habitat loss. In the mountain ranges, the species survived until the occurrence of guns and more efficient poisons. In the Ossau Valley (approx. 500km²), four to five bears were shot every year by the beginning of the 17th century. The annual harvest dropped to two by the 19th century (Bouchet 1988). Figure 6.6 shows the historic and predicted future range of the brown bear in France; Figure 6.7 shows the current range.

Western Pyrenees

The species is present on the French side and to a lesser extent on the Spanish side. Exchanges between the two

areas are usual. In France, the distribution area can be drawn in a 30km square, including the Ossau and Aspe Valleys, which total a range of about 525km² (Camarra and Dubarry 1992). Bears regularly frequent 300 to 350km² of this range and occur only occasionally in 150km² of the area. The main field data were collected in the mountains situated east of the Aspe River, with locally high densities

Figure 6.7. Present distribution of brown bear (*Ursus arctos*) in France, 1993.



on the left side of the main river in the upper Ossau Valley. On the other side of this river, the densities suddenly drop to low levels. Therefore, in contrast to observations from the last few decades, the main valley bottoms seem to be rarely frequented by bears. On the Spanish side, the bear distribution area covers 590km² (Caussimont and Herrero 1992). In the Pyrenees, the species is diffusely distributed over 1,115km², with one evident “shrinkage line” on the bottom of the Aspe Valley.

The population size in 1992, including two individuals on the Spanish slope, ranged from eight to 10 specimens, of which four to six were living in the eastern part of the distribution area limited by the Aspe River (Camarra and Dubarry 1992). The population size, monitored since 1980 (ave. n= 15–18), exhibited a sharp decline until 1986 (ave. n= 9–11). Over the last five years, one to two individuals may have disappeared (Camarra 1990b). Population density seems to be more a theoretical value rather than a realistic one in this heterogeneous country. The average value for the distribution area is one bear per 62 to 84km². In the core area, the regular presence zone reaches one bear per 44 to 58km².

Because of public pressure against trapping and radio telemetry, little is known about the population structure. However, the existing females with cubs, and a well-known male that had been monitored for 11 years by means of its foot-print size (Camarra 1992) and remote photo sensing, show us that at least one male and a few females were present until 1989, the last documented reproduction. In June 1994, we noted the high probability of the existence of a mating pair (Camarra 1994). In summary, we thus expect an older overall age structure.

From 1979 to 1984, the reproduction rate was supposedly lower (12.4%) (Camarra 1990b) than anywhere else in Europe. In the past 10 years, three cubs have been detected, both in 1984 and 1989. Such a reproduction rate cannot balance mortality. Since 1979, seven bear carcasses have been found in the area (Camarra 1992) but causes of death remain uncertain. We have only a set of presumptions, the discovery of a carcass, the population monitoring results, and some testimonies of local people to document the causes of death. In 1985, the last reliable case, a bear was most likely destroyed. The movements of three bears monitored by footprints (Camarra 1992) during the past decade confirm a shrinkage of range in 2–3 subpopulations although one specimen has sometimes been suspected to cross over. The last cub born in the area in 1989, a female, became a problem bear (Camarra *et al.* 1993).

Central and Eastern Pyrenees

During the 1970s, Parde (1984) estimated a population of 8–12 bears in this area. A decade later, the most relevant information is that only a few individuals (1–3) were present until 1988, the year of the last reliable testimony on

bear presence. Over the last decades, the species exhibited a sharp decline until the late 1980s when it seems to have vanished.

Status

At present, France likely has the most threatened population of brown bears in the world. In spite of its recent citation in the List of Protected Species, it is becoming more and more endangered every year. Small population size and a changing environment are combining their negative effects. Recent genetic studies recognize that the Pyrenean, Cantabrian, and south Scandinavian bears belong to a distinct lineage (Taberlet and Bouvet 1994). Without prompt action taken during the next 1–2 years, the Pyrenean branch of this lineage will vanish.

In the Western Pyrenees, the population has been below the minimum viable population size for a long time, and we expect that the last specimen will vanish by the beginning of the next decade. In the Central Pyrenees, a restoration plan has been decided upon. The first bear, coming from Slovenia, will be released in the spring of 1995, and five other releases are planned for the next three years.

Legal status

The current French territory has supported a large brown bear population throughout the ages. Bears have been the king’s game, pests, and objects of sporting hunts. Harvest increased during the latter part of the nineteenth century. It was primarily performed by professional hunters whose goals were to protect livestock against bear predation.

When bear hunting was abolished (1955–1958) and compensation for livestock damage was adopted, the species was only present in the Pyrenees. Animals responsible for significant and repeated damage could be killed. After some public disagreement in the 1960s, the bear became a legally protected species in 1972, and entered the List of Non-Hunttable Species in 1981. The Pyrenees NP, created in 1967, covered at that time less than 5% of bear range. In 1993, the species was delisted for better efficiency and easier intervention in human-bear conflicts.

Population threats

For a long time, the local people considered the brown bear a pest. Chases with hounds were carried out each time a bear was spotted in the vicinity of sheep flocks or during the hunting season. Poisons, such as strychnine hidden in bear-killed carcasses, were successfully used by shepherds.

In the last centuries, several thousand bears were killed for livestock safety (Bouchet 1988), causing the disappearance of the species from most of the mountain ranges except for the Pyrenees, where it has survived. In the 1970s some bears were poached by hunting parties, and rumors suggest that kills have taken place as recently as the last decade.

At present, the shepherds accept the presence of the bear better than in the past. In their traditional way of livestock tending (flocking the sheep in an enclosure close to the cabin, accompanied by big Pyrenean dogs), they easily turned bears away from the corral. With the bear vanishing from most of its range, they are slowly turning to free-range grazing. This might unfortunately attract the bears and reinforce their predatory behavior (Camarra *et al.* 1993). In fact, a problem bear appeared under such circumstances in 1991. The main limiting factor of this population is the small population size and lack of reproduction which increasing the negative impact of accidental kills.

Habitat threats

Natural components and food availability: In the Western Pyrenees, the natural components of the habitat are supposed still suitable for a viable population of brown bears. Timber harvesting by selective cutting is a common practice, but the impact of such a technique is small and often limited to the removal of big trees and the loss of habitat from erosion along remote roads. The forest productivity of nuts is uncertain from one year to the next. The most palatable species for bears are very scarce (*Castanea*), or are essentially found at lower elevations (*Quercus* sp.), but are not readily available due to human activities. The easier access to pastures draws more livestock into bear habitat and uncontrolled fires in some key sites may lead to the landscape modification of some diurnal activity habitats such as bushes of *Buxus sempervirens*, *Fagus sylvatica*, *Coryllus avellana*, and oak forests (*Quercus* spp.). Little is known about bear-wild boar (*Sus scrofa*) competition for food in spring and late fall. Large ungulates, as potential prey, are absent (*Cervus elaphus*) or occur at extremely low densities (*Capreolus capreolus*, *Rupicapra pyrenaica*).

Human disturbance: During the last 25 years, newly-built roads have allowed more access to remote sites. Human disturbance has increased dramatically in these areas which unfortunately include several potential and well-known breeding sites. Wild boar hunting with hounds may disturb bears during the major pre-denning period.

Fragmentation: In the main valley bottom of occupied bear habitat, a highway will be enlarged to service international traffic. Without some precautions, this event

will fragment the area into subzones too small for sustaining viable populations on each side.

Potential recovery area: In fact, all the areas recently abandoned by bears during the past decade are no longer managed for bears. If nothing is done immediately, we will lose all bears as well as the possibilities for recovering them.

Management

Since 1984, several plans (Camarra 1990; Servheen 1990, 1993) have been submitted for approval by local people, the traditional owners of the land. Contrary to expectations, few were applied. Therefore, in 1990, the administration created hunting preserves, against the will of the local hunters. The official Management Guideline, presented by both the Ministries of Agriculture and Environment in 1988, did not address the local people, but rather dealt with administrative policy. It consisted of field management recommendations, almost all of which were suspected to represent a loss of power by local people.

To resolve this confrontation, local Representatives and the Minister of the Environment were involved in a charter for “long-term development of the valleys and protection of the bear”. The main policies adopted by local people for the next few years are: 1) auditing the bear population status; 2) building access roads to many of the remote cabins in the area; 3) improving shepherds’ way of life in their summer cabins as well as increasing cattle and sheep densities; 4) reduction of bear predation rate on domestic animals by improving safeguarding techniques against bears; 5) banning hunting or reducing hunting with hounds to lessen pressure on some key sites; 6) the reintroduction of six bears from Slovenia in the central Pyrenees, 80km from the present distribution area.

Guidelines that will be applied for several years and then reviewed:

1. **Monitoring of the population:** Since 1983, the “Brown Bear Network”, the official field research network, has annually monitored bear presence and population parameters throughout the French Pyrenees. Footprint measurements, genetic imprinting, simultaneous presence, and remote sensing cameras are part of the monitoring techniques. Cartographic syntheses are produced every five years (Camarra 1990). In 1995, this work was to be carried out in official coordination with the recently created Spanish network.
2. **Pastoralism:** Damages due to bear predation will be well compensated (e.g. twice the slaughterhouse rate for a sheep kill). In addition, a helicopter will be provided free of charge every year to transport food and equipment to remote shepherd cabins, and radio equipment will be provided free to all shepherd cabins within the bear distribution area.

Recommendations that are under consideration but have not yet been decided upon:

1. **Carrying capacity:** Implementation of the carrying capacity by setting up additional feeding points, sowing cereal fields, and planting fruit trees.
2. **Fragmentation:** “Green bridges” large enough for bear crossings are proposed for several sites along the future international road that will cut through the Aspe Valley.
3. **Forestry:** In a few of the proposed key sites, there will no longer be any logging or road unloading of forest products, and owners will be compensated for loss of income. It is necessary to support the carrying capacity for bears by selective cutting, ceasing forest management from 1 November to 15 June, and leaving 2/3 of the bear management unit undisturbed each year.
4. **Road access:** Limit vehicle access on remote roads.

Human-bear interactions

In the Pyrenees, humans have suffered bear predation on their livestock for many years. All have learned to live with each other. The shepherds adapted their herding strategies and the bears became extremely shy. Under these conditions, a single bear was suspected of killing 3–4 sheep per year (Nédélec *et al.* 1992). Other domestic species were seldom attacked. Annual compensation for damages amounted to approximately US\$15,000. The present change in livestock herding technique to a more free-ranging one may induce a higher bear predation rate and a loss of fear of humans. Such has been the case with a subadult female in 1991 and 1992. Two provoked bluff charges towards humans by a sow with cubs have been noted during the last 20 years.

The conservation of a highly threatened bear population can often lead to restrictions in human activity. Therefore, leading groups like hunters and shepherds disagree with the protection plan. In fact, bear presence disturbs the schedule of traditional activities proposed by the local people for remote places.

Public education needs

The biology of the brown bear should be taught in all schools within occupied bear habitat, in its surroundings, and in other potential recovery zones. Political leaders and the groups directly interested in bear protection problems, such as hunters, shepherds, and commercial interests, must be motivated by concrete results from positive examples of human-bear interactions. The public's concern for animal welfare has increased and has often changed their attitude towards handling, radio telemetry, and

marking of wildlife. In fact, experience shows that with education the public can be very supportive of bear management programs.

Specific conservation recommendations

Compensation

Compensation schedules should be incorporated into the rural action plans for sensitive areas inhabited by bears. These plans should also allow the maintenance and/or enhancement of activities favorable to bears, with the help of state and EEC funding.

Habitat

Although in France, habitat factors have less immediate influence than population size, their management is the keystone for a recovery plan. Such a plan could improve the lives of the last remaining individuals and be useful in the involvement of both the general public and local people in bear protection concerns.

1. Guidelines should be applied in an officially designated French-Spanish recovery zone ranging at least from 1,000–2,000km², with the minimum range for a viable brown bear population estimated at 70–90 individuals (Shaffer 1984). The present bear distribution range could be managed in four types of areas: a) wilderness in key sites (resting, late fall, pre-denning, denning, and breeding sites); b) areas where only traditional activities are allowed; c) buffer areas with limited access by motor vehicles, and; d) areas subject to an environmental impact statement for harvesting big stands of timber.
2. Human activities should be timed to account for bear seasonal habitat utilization, with interruption of all activities during key periods.
3. Carrying capacity should be enhanced by an increase in food species diversity, favoring oak, chestnut and blueberry stands. When applying a short-term strategy, it is necessary to plant orchards, oats, and corn fields. During periods of low food availability it is necessary to manage additional feeding points. Prescribed natural fires, a common practice in the management of pastures, should be strictly controlled in order to augment bear habitat quality.
4. Management of human activities must be adapted in low elevation corridors, such as large roads running through valley bottoms, in both the present distribution and future recovery areas.
5. Livestock should be restricted from ranging freely.

Population

1. Reinforcement of the present population must be accomplished as soon as possible, before the species completely disappears. The Western Pyrenees, where brown bears still survive, must be the first target area.

From genetic and ecological points of view, this can be accomplished by introducing wild bears from nearby Slovenia and southern Scandinavia.

2. Management strategies for eventual problem bears must be devised.
3. Restocking of a captive Pyrenean-Cantabrian bear lineage is encouraged to further reinforce the population and maintain its genetic diversity.

Scientific research

Further studies are needed to assess:

1. Seasonal habitat use and the impact of human activities on bear survival in late summer and fall, when both the level of human activity and bear sensitivity are increasing.
2. Limiting factors to the reproduction rate.
3. Annual production and availability of bear food.
4. Relationships with wild boar (*Sus scrofa*) populations.
5. Potential for enhancement of the carrying capacity.

Conclusion

The brown bear population has been below the minimum viable population size for several decades. We feel that we are monitoring in detail the final stages of Pyrenean bear survival. Without population reinforcement the species will vanish within the next 15–20 years. Because of the similarity of situations in which the species currently lives in the Pyrenees and Cantabrian mountains, France and Spain should coordinate their scientific research and management efforts to save this specific lineage of brown bear.

Acknowledgments

Direction de la Nature et des Paysages of the Ministry of the Environnement, the Rangers of the Office National de la Chasse, the Parc National des Pyrénées and the Office National des Forêts, the members of the FIEP, E. Dubarry, P. Migot, L. Nédélec, P. Stahl, C. Servheen, and E. Taran.

Status and management of the brown bear in Greece

George Mertzanis

Historic range and current distribution

Over 100 localities distributed all over Greece contain the name “bear”, and these, together with historic sources, inform us about possible historic brown bear distribution. In ancient times, its range extended over nearly the entire mainland [Pausanias (200 BC) 1969; Xenophon in

Simopoulos 1984] (Figure 6.8a). Bear presence in the mountainous parts of Greece, including the Peloponnisos peninsula, seems to have been continuous until the 15th and 16th centuries (Pizzicoli, Candiloros, Guillet, and Dedreux in Simopoulos 1984) (Figure 6.8b). Brown bear range in Greece has decreased rapidly and dramatically within the last two centuries, leading to severe fragmentation. In the 18th century, there is evidence of a period of dramatic population decline (Mertzios in Papavassiliou 1963), due essentially to massive bear extermination for its skin and to habitat alteration.

More recent oral information confirms the species extinction in the 1940s from the southernmost and easternmost branches of the Pindus range (Mt. Parnassos, 2,457m and Mt. Olympos, 2,918m) (Figure 6.8d). One may assume that the main mountainous units of Greece (the Pindus range and Rhodope mountain complex), because of their inaccessibility and remoteness, have been the refuges and dispersal centers of the species in Greece throughout historic times.

Apart from some fragmentary information (Couturier 1954, Hainard 1964, and Curry-Lindahl 1972), no systematic knowledge of the status of the brown bear in Greece existed until the mid-1980s. Data on brown bear distribution in Greece have been systematically gathered since 1985 (European Union – EU Greek Ministry of Agriculture Project 1988; Mertzanis 1989, 1991, and 1992; Mertzanis *et al.* 1994; Mertzanis 1994a; Mertzanis 1994b; and Mertzanis *et al.* in prep.).

These data show that brown bear range in Greece presently consists of two separate population nuclei, located approximately 220km apart in the northwestern and northeastern part of the country, respectively in the Peristeri-Pindus range and the Rhodopi mountain complex. Total bear range comprises a surface of about 10,000km², 1,500km² of which are only occasional bear habitat.

Brown bear range in Greece is divided into four main units:

A) Peristeri-Pindus range (western nucleus: units I, II, and III):

- **Unit I:** The Peristeri range (Varnous, Vitsi, and Askion Mts.), with alpine meadows, large beech (*Fagus sylvatica*) forests between 1,200m and 2,100m, and oak forests on lower altitudes, all covering mostly granitic soils (Debazac and Mavromatis 1971; Quezel 1967).
- **Unit II:** Large parts of the northern Pindus range, including the valleys of the Aliakmon, Sarantaporos, and Aaos rivers as well as the Grammos, Voio, Smolikas, Timfi, and Lyngos mountains. Alpine meadows, large black pine forests (*Pinus nigra* ssp. *pallasiana*), beech forests (*F. sylvatica*) as well as mixed forests of black pine (*P. nigra*), fir (*Abies borisii-regis*), beech (*F. sylvatica*), and white pine (*P. heldreichii*), covering mostly limestone and ophiolitic soils. At lower altitudes the vegetation

zones of *Quercion-frainetto* and *Ostryo-Carpinion* are present in a wide range.

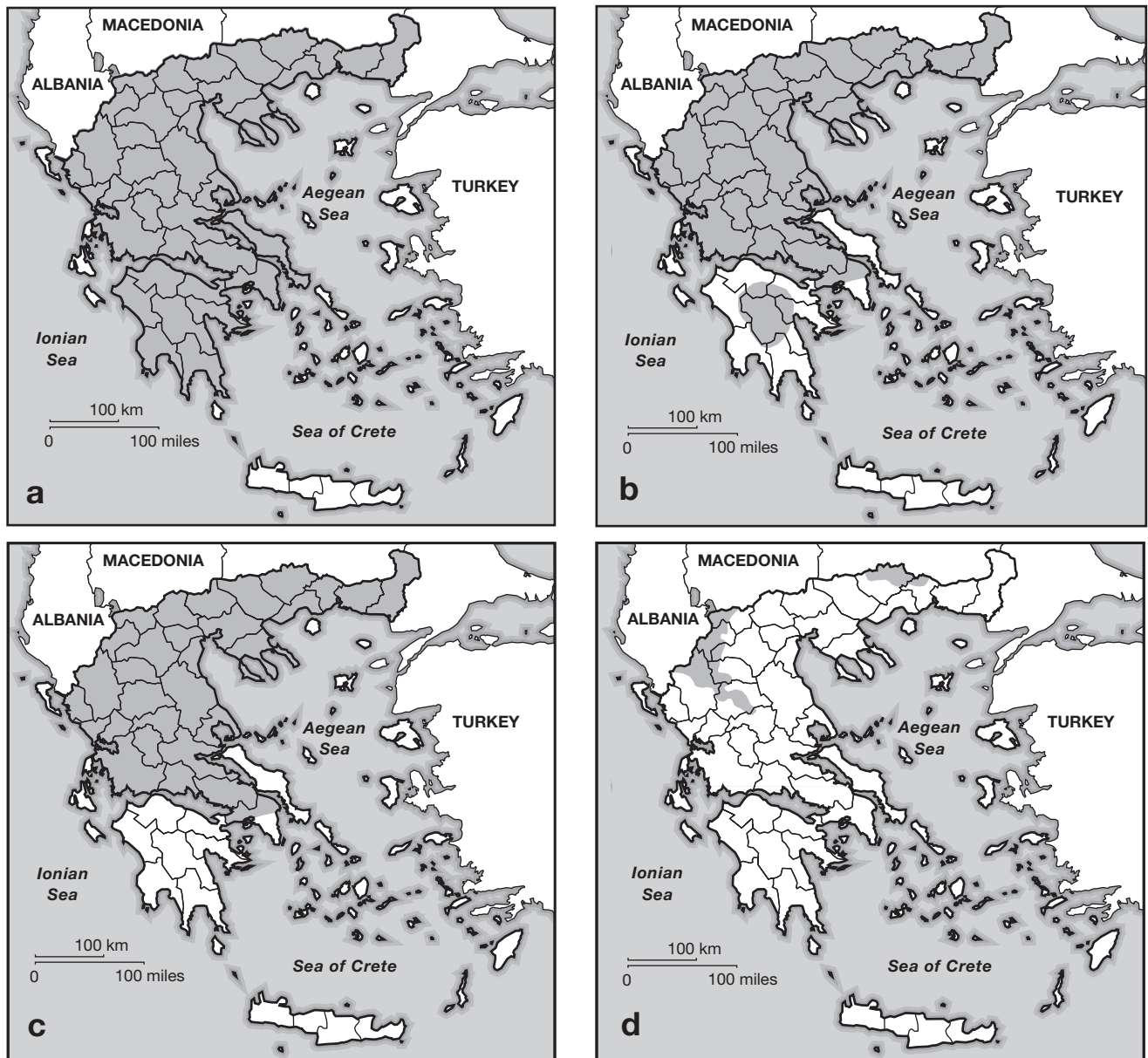
- **Unit III:** The Acheloos river high valleys including the Peristeri, Triggia, Neraida, and Avgo mountains, with mainly large fir (*A. b. regis*) forests covering limestone soils and oak forests at lower altitudes.

The western nucleus extends over an area of about 6,200km² covering the northern and central part of Pindus-Peristeri ranges. This includes Varnous, Vitsi, Grammos, Askio, Voio, Smolikas, Tymfi, Lyngos, and Aspropotamos, down to approximately the Agrafa mountains (39° latitude). This sector is considered to be the southernmost

distributional range of the species in Europe and therefore of outstanding zoogeographic importance. The western nucleus counts for about the 85% of the total bear population in Greece. The northern part of this population is connected with the populations in the “former Yugoslavia”, and probably in Albania.

Main habitat types consist of large oak forests (*Quercus conferta*, *Q. petraea*, *Q. cerris*, and *Q. trojana*) on lower elevations, mixed or pure coniferous-hardwood forests of black pine (*P. nigra*), fir (*A. b. regis*), white pine (*P. leucodermis*), beech (*F. sylvatica*), and alpine meadows at higher elevations. Elevations range between 500m and 2,600m.

Figure 6.8. Historic and present distribution of the brown bear in Greece. (a) 2nd century; (b) 15th century; (c) beginning of the 19th century; (d) present.



Density of human settlements in rural zones reaches approximately three inhabitants/km², a lower density than in other bear areas of the European Mediterranean region.

Extensive logging, a high density of forest roads, accidental and criminal forest fires, hydroelectric and highway building, and mining projects are among the threats to bear habitat conservation.

A summary of current bear distribution in the western nucleus shows the following major characteristics:

1. A concentration of bears around the major mountain units of northern Peristeri-Pindus range.
2. A geographic continuity (that has to be updated and reconfirmed) with adjacent (neighboring) bear populations (Albanian, former-Yugoslavian) characterized by bear movements along the border.
3. Severe fragmentation of the area exists at the latitude of the town of Kastoria, due to the ongoing extension of agricultural lands upon forested bear habitat.
4. Sporadic bear occurrence in the extreme eastern range (area of Mt. Askion) and south-southeastern parts of the range (area of Metsovon, Trikala). These sectors are also characterized by a shrinking species range and risk of habitat fragmentation.

Moreover, the planned construction of three segments of the “Egnatia Highway” through the above sensitive sectors will be an additional factor that will irreversibly deteriorate bear habitat, bear sub-population connectivity, and subsequently bear population viability in the wider area. After the completion of the work, about 250km² of critical bear habitat will be isolated.

5. *Occurrence of bears outside normal range:* Between spring 1987 and autumn 1989, several cases of bears occurring outside of their normal range in the extreme southern sectors (area of Karpenission, Agrafa Mts), were reported and confirmed by locating damage to beehives. In this zone, apparently isolated from the core bear range, one adult male, one subadult, and one female with a cub were seen. This is the first evidence of bears occurring in this area in the last 40 years. Recent data (Project ARCTOS 1996) confirm regular bear presence in this sector.

In spring 1990, bear sightings were reported in the NW Pogoni area along the Greek-Albanian border. This represents the westernmost extension of bear range in Greece. More recent data (Project ARCTOS 1996) confirm bear occurrence in this sector on a more regular basis.

In autumn 1990, bear sightings and damage to beehives were reported in the area of Dadia, in NE Greece (Thraci). That point represents the easternmost record of bear occurrence in Greece.

One bear that occurred outside its normal range was relocated. The bear was caught in the Pindus range (Tzoumerka Mts.) and transferred into the Rhodopi

Mts. (eastern population nucleus, B) 350km away from the “conflict” area (Mertzanis *et al.* in prep.; Project ARCTOS 1996).

Finally, bear occurrence in potential bear range in the extreme north (area of Mt. Voras and Mt. Belles) needs further confirmation. However, in the first case (Mt. Voras), recent data (Project ARCTOS 1996) give further evidence of the existence of a relic sub-population shared with the Former Yugoslav Republic of Macedonia (FYROM).

B. Rhodopi mountain complex (eastern nucleus: unit IV):

- **Unit IV:** The Rhodopi mountains are a vast granitic mountain complex including Mount Falakron, covered with large forests of spruce (*Picea excelsa*), forest pine (*Pinus sylvestris*), beech (*Fagus orientalis*, *F. mosaecus*), and oak (*Quercus frainetto*, *Q. macedonica*, and *Q. sp.*).

The eastern nucleus (Unit IV) extends over an area of about 2,400km², and includes the forested region of the western Rhodopi mountain complex as well as the northern slopes of Mt. Falakron. Bear presence has also been observed to the west in Menikio and Lailias hunting reserves. This population nucleus comprises about 15% of the total bear population.

Main habitat types consist of large oak (*Quercus conferta*, *Q. petraea*, *Q. cerris*, and *Q. macedonica*) forests at lower elevations. Mixed or pure coniferous-hardwood forests of fir (*Abies borisii regis* and *A. alba*), Scots pine (*Pinus sylvestris*), spruce (*Picea excelsa*), beech (*Fagus sylvatica*, *F. orientalis*, and *F. mosaica*), and birch (*Betula verucosa*) occur at higher elevations. Elevations range from 700m to 1,900m.

The area is sparsely inhabited, and the western Rhodopi region is almost uninhabited (most human settlements have been abandoned since World War II). Extensive logging associated with forest road construction, as well as ongoing construction of three hydroelectric units within bear range are the main threats to bear habitat quality and integrity. This population nucleus seems to still be connected with the neighboring Bulgarian bear population. Available data on bear distribution also shows that the state of linkage areas between sub-populations indicates a serious risk of further intra-nucleus fragmentation.

A summary of present bear distribution in the eastern nucleus shows the following:

1. There is a concentration of bears around the central part of Rhodopi mountain complex.
2. Severe fragmentation of the range exists near the village of Lefkogia, due to ongoing extension of agricultural lands upon bear habitat.
3. Bears are occurring on a more regular basis than before (Project ARCTOS 1996) in the extreme western sectors (area of Serres-Lailias), and the probabilities of bear occurrence in adjacent sectors (Mt. Belles) are

increasing, making delineation of the bear range there more difficult.

4. Migration across the Greek-Bulgarian border has also been confirmed by radio tracking (Mertzanis *et al.* in prep.; Project ARCTOS 1996).

Status

Population size estimation, especially trends involving parameters such as age at first reproduction, reproductive interval, and adult female survival, are difficult tasks needing long-term monitoring (10 or 12 year cycles) and intrusive methods (capture and recapture of individuals) for reliable figures. In Greece such data is lacking, but attempts have been made to estimate the minimum population size based on unduplicated direct, or reliably reported, observations of females with cubs of the year, and on the assumption that a healthy population is composed of 10–12% females with cubs (Servheen 1989). As a result, the minimum bear population size in Greece has been estimated between 110 and 1,300 individuals (Project ARCTOS, 1996). The eastern population nucleus is estimated to have a minimum 15 to 20 individuals, and the western population nucleus to have a minimum of 95 to 110 individuals (Project ARCTOS 1996).

Legal status

The brown bear is considered an “endangered-vulnerable” species in need of strict protection (Council Directive 92/43/EEC of May 21, 1992, on the Conservation of Natural

and Wild Fauna and Flora L 206/38 ANNEX IV) within the boundaries of the EU. Although the killing, capture, possession, and exhibition of bears has been illegal since 1969 in Greece (article 258, par. 2e, 2z. L.O. 86/69 of the Greek Forestry Code) such practices still continue. The main reasons for this are a misinformed public and inefficient damage compensation procedures. Another reason is the misuse of local prefectural right to abolish, when judged necessary and despite central authorities opinion (!), the bear’s protection status in case of massive damage caused by bears.

The problems of poaching and the exhibition of “dancing bears” by itinerant gypsies still persist. Moreover, only 7% of the total bear range in Greece is placed under protected area status. Legislation concerning compensation of bear depredations on livestock was improved in 1990 thanks to the efforts of the Game Management Department of the Greek Ministry of Agriculture. Complete financial compensation for livestock depredations was finally established (with some quotas on the number of animals lost). The improved compensation system does not cover cases of damage to beehives and crops.

Population threats

The status of the brown bear in Greece remains critical despite legal and institutional protection. We conclude that the major threats to Greek bear populations and habitat are: 1) human caused mortality, 2) habitat fragmentation at a range scale, and 3) habitat loss and habitat degradation.



Greek brown bear (*Ursus arctos*) rescued from dancing bear traders.

C. Servheen

Human caused mortality (poaching), although illegal since 1969, seems to be the main factor for negative population trends. An evaluation showed that this factor seriously affects brown bear populations with losses estimated up to an average of 14 bears/year (only for known and probable cases), which equals 12% of the minimum bear population in Greece (E.U.-Greek Ministry of Agriculture Project 1988; Mertzanis 1992; Mertzanis *et al.* in prep.; Project ARCTOS 1996). Recent data for the period of 1993–1995 give 11 confirmed bear kills.

The reasons for poaching are mainly: a) resentment for damage caused to livestock, beehives, etc., b) bear skin value (a good quality trophy may reach an average price of 200.000 drs., which is roughly US\$800), c) casual encounters during wild boar (*Sus scrofa*) hunting, and d) killing of females with young to capture the cubs.

The highest levels of human caused mortality are concentrated during the hunting period (September to January), especially during drives for wild boar. Data from interviews and questionnaires show that during 22% of the hunts, bears are either disturbed or seen (Mertzanis 1989, 1992). Since the known human mortality rate is only a part of total mortality, and since hunting pressure is important throughout bear range, we may reasonably assume that actual human caused bear mortality rate in Greece is two to three times higher than known mortality. Taking into account other demographic parameters such as reproductive rate and natural mortality in relation to the above figures, it is reasonable to assume that Greek brown bear populations are declining.

Habitat threats

The main threats to brown bear habitats are analyzed in Mertzanis (1992,1994) and Project ARCTOS (1996). Habitat degradation occurs as a result of: the high density of the forest road network; the chaotic dispersal of timber felling areas; clearcutting in deciduous forests (mainly coppice oak forests); forest overexploitation; overgrazing in specific areas; indiscriminate logging and substitution of broad-leaved trees with conifers; accidental or criminal forest fires and; the lack of an environmental impact process for large scale public works (such as water impoundment on the Nestos river and the Egnatia highway). Range fragmentation at a national and trans-frontier scales encompasses all the above causal factors as well as the lack of a model of economic development compatible with bear survival.

Human-bear interactions

Some bears seem specialized in preying on livestock. Attacks mainly occur on sheep and cows (in 71.5% of cases

according to veterinary authorities) and are concentrated mainly in the beginning of summer and late autumn. Damage to apiaries is often reported. As apiculture represents an important source of income for some local people, an electric antipredator fence has already been experimentally used in twenty (20) apiary units within the bear range to help to minimize damage. Results were positive. In the framework of “ARCTOS” Project, the use of this device has been extended to 50 more apiary units. Damage to orchards and crops does not seem to be of significant economic value.

Management

Conservation of Greek brown bear populations can not be envisioned within the existing protected area network because of the network’s small size, restricted habitat representation, and lack of efficient wardening. We also realize the very important role that human activities play in habitat disturbance. These threats are very often related. Therefore, in some cases bear habitat may be suitable or available but still inaccessible to bears because of high levels of human activity or very low bear population densities (due to human caused mortality). In other cases habitat loss can lead to much more vulnerable populations. It is worth noting that human-caused mortality is the most important factor in management actions, and that the most important conservation step is to minimize human-caused mortality from all sources. Distribution of human-caused mortality is very important for the identification of bear/human conflict areas (Servheen 1994). That leads to questions of habitat security in relation to human activities, which is also an important factor in bear management actions (Servheen 1994). It is therefore very important to realize the extent of human activities in order to evaluate the level of disturbance. From that point it can be easily understood that the main problem in a conservation strategy is how to manage the human component.

Government and NGO actions

In 1988 the first large-scale Bear Action Project was launched in Greece. Mainly financed by the European Union (EU), it covered almost the entire bear range. This project was conducted in 1988 by the Wildlife Division of the Greek Ministry of Agriculture with the participation of the Hellenic Society for the Protection of Nature, and was supervised by the Royal Institute of Natural Sciences, Belgium. The main goals of the project were: 1) the first delineation of brown bear distribution; 2) the first rough estimation of the brown bear population size; 3) identification of causes of direct (human caused) mortality;

4) the experimental installation and test of an electric fence to prevent bear damage to beehives (the device was tested with positive results on 10 units distributed all over the bear range); 5) the creation of a small scale wardening and information network, and; 6) a public awareness campaign that produced a pamphlet and a poster.

On completion of this project it was clearly understood that a long-term integrated management strategy, based on better understanding of both brown bear ecology and bear-human interaction, was urgently needed. To achieve this main objective, a 2-year (January 1994–December 1995) national project (“ARCTOS” Project) was jointly launched in January 1994. This project involved the Greek Ministry of Agriculture (General Secretariat of Forests and Natural Environment – Game Department), and three NGO’s: the ARCTUROS Society, WWF Greece, and the Hellenic Society for the Protection of Nature (HSPN). Because it was the first large scale project in Greece dealing with brown bear conservation at a range scale, this project encompassed several long-term goals and expectations which are outlined below.

ARCTOS Project guidelines

It was clearly understood that the complexity of bear conservation required a multilevel approach in order to evaluate the interactions between bear populations, bear habitat, and bear-human interaction.

This multilevel approach provided necessary data on the following issues: 1) bear occurrence and activity in time and space in relation to habitat suitability and availability; 2) demographic parameters dealing with direct mortality and natality for the evaluation of populations levels and trends; 3) identification of the ecological requirements of the brown bear; 4) identification and analysis of the main components of brown bear habitat, and; 5) identification of human activities versus bear activities.

The synthesis of the above information was achieved through creation and combination of thematic digitized maps using GIS. This led to the mapping of bear habitat, and identification of important bear areas in terms of needs for priority action and conflict zones. Identification and categorization of the important zones for brown bear in Greece are illustrated in Table 6.2. (Project ARCTOS 1996).

Details on distribution of important brown bear areas within the total range of the species, and total surface area of each category are presented in Table 6.3 (Project ARCTOS 1996).

The results presented in Table 6.3 have also created the framework for the development and implementation of a conservation strategy through the elaboration of: a) a general Bear Action Plan to deal with bear conservation problems at a range scale, and b) specific environmental studies to deal with bear conservation problems in priority cases.

| Table 6.2. Categories of important areas for brown bears | | |
|---|--|---|
| Category | Code name | Brief description |
| 1 | Regular bear presence, especially during all critical stages of the annual cycle | Habitat structure and suitability meets species ecological requirements dealing with the most important stages of the cycle ensuring species’ survival: reproduction, denning, use of spring habitat in combination with high food diversity, and a high degree of security |
| 2 | Regular bear presence during specific stages of the annual cycle | Systematic seasonal use in relation to important bioecological needs such as feeding, summer refuge, and probably denning |
| 3 | Sporadic and/or seasonal bear presence | Less systematic use in relation to the aforementioned ecological requirements |
| 4 | Regular bear presence in the limits of the species range | This category is of equal ecological importance with category 1 but is located in sectors of the species range which are under extreme conditions (in the limits of the range, adjacent to linkage areas) |
| 5 | Suitable bear habitat with recent absence or very low levels of bear presence | Despite high suitability of bear habitat, human-caused mortality and disturbance keep bear population density at very low levels |
| 6 | Extra-limital bear occurrence | Concerns sectors geographically disjuncted from the core bear range |
| .../S | Linkage areas between sub-populations with serious risks of bear range disconnection | Shrinkage and degradation of bear habitats in precise sectors of the species range. Connectivity and geographical continuity of bear habitats is continuously deteriorated due to human actions (changes in land-use, development of road infrastructure) |
| .../A | Definite disconnection (loss) of suitable bear habitat due to large-scale public works | About 200km ² of important bear habitat is cut due to water impoundment construction (dam on Nestos river) in Sector I (Rhodope), and 220km ² . of bear habitat are going to be cut due to the Egnatia highway project (under construction) |

Table 6.3. Distribution and surface area of important brown bear areas in the species range.

| Importance category/ sectors | Sector I (Rhodope – 2,400km ²) | | Sector II (Peristeri – 1,150km ²) | | Sector III (Pindus – 5,050km ²) | | Total range (8,600km ²) | |
|---------------------------------|---|------------|--|------------|--|------------|--|------------|
| | km ² | % | km ² | % | km ² | % | km ² | % |
| 1 | 320 | 13 | 215 | 18.6 | 1,210 | 24 | 1,745 | 20.3 |
| 1/A | 0 | 0 | 0 | 0 | 80 | 1.6 | 80 | 0.9 |
| 2 | 570 | 24 | 600 | 52.2 | 1,460 | 29 | 2,630 | 30.6 |
| 2/A | 0 | 0 | 0 | 0 | 90 | 1.8 | 90 | 1 |
| 2/S | 0 | 0 | 0 | 0 | 35 | 0.7 | 35 | 0.4 |
| 3 | 310 | 13 | 185 | 16.1 | 1,910 | 38 | 2,405 | 28 |
| 3/A | 190 | 8 | 0 | 0 | 55 | 1 | 245 | 3 |
| 3/S | 60 | 2.5 | 50 | 4.3 | 195 | 4 | 305 | 3.5 |
| 4 | 0 | 0 | 100 | 8.7 | 15 | 0.4 | 115 | 1.3 |
| 5 | 950 | 39.5 | 0 | 0 | 0 | 0 | 950 | 11 |
| 6 | 0 | 0 | 143* | - | 187* | - | 330 | - |
| Total | 2,400 | 100 | 1,150 | 100 | 5,050 | 100 | 8,600 +330* | 100 |

To achieve the above multilevel approach, a working scheme involving three main teams was scheduled, and each team was responsible for one of the following tasks: a) collection of data on bear biology and ecology, b) collection of data on bear habitat components with emphasis on forest vegetation, and c) collection of data on human activities and land use.

The results have been used as the main criterion in bear habitat mapping. Coupled with the degree of human presence and activities, they have also contributed to bear habitat ranking. They will be taken into account in the framework of management plans when scheduling human activities within bear range (logging, hunting, recreation, and natural resource exploitation).

ARCTOS Project long-term goals

1. Contribute to improving demographic parameters and distribution of the bear throughout available habitat.
2. Ensure geographic continuity of bear range in Greece. Protect and/or manage the areas required to maintain a viable population level. Within each distribution unit, preserve and/or restore habitat quality (in terms of integrity, availability, and diversity of natural resources) at suitable levels for the aimed population level. Protect or restore bear habitat, with special attention to habitat types listed in the 92/43 EC Directive.
3. Develop alternative approaches to bear-human interactions. Alter activities responsible for direct mortality, fragmentation of the bear range, degradation of bear habitat, and random and uncontrolled disturbance.

4. Create a permanent support unit for the research and management of bear population and habitat in Greece.
5. Promote cooperation among EU countries in matters related to the conservation of the brown bear and its habitat.

ARCTOS Project expected achievements

1. Ensure necessary conditions to achieve short (within the project period) and long-term positive population trends.
2. Control direct illegal mortality.
3. Preserve and/or enhance linkage areas between bear populations.
4. Ensure and/or improve habitat quality (natural resources diversity and availability).
5. Improve the efficiency of the existing wardening network.
6. Enhance efficiency of other direct protection measures involving bear-human interaction.
7. Reconsider and improve the existing network of protected areas.
8. Provide authorities with guidelines and specifications for regional planning.
9. Prepare and submit to the Ministry of Agriculture and the regional forest division, proposals for the improvement of forest policy (management and timber exploitation) in relation to bear habitat conservation criteria.
10. Prepare and submit proposals for Presidential Decrees to protect important bear zones under suitable status. Provide these zones with an integrated management plan.

11. Provide authorities with technical aid for the optimization of the socio-economic compensation procedure.
12. Increase and promote information and public awareness with special attention to different social groups.

Specific conservation recommendations

Addressing brown bear conservation needs is the major purpose of all the above efforts. But imminent threats

cannot wait for long-term scientific studies to be controlled. Therefore, a strategy had to be developed and implemented in order to simultaneously neutralize imminent threats and to address long-term conservation needs. Immediate efforts should focus on minimizing illegal killing, improving habitat security by limiting human activities in important areas, maintaining linkages within and between bear populations, and increasing public support.

Tables 6.4, 6.5, 6.6, and 6.7 illustrate the steps to achieve these goals through the Greek Bear Action Plan.

| Table 6.4. Illegal killing: list of main axes and guidelines of the Greek Bear Action Plan. | |
|--|---|
| Immediate and future actions to be undertaken through the Bear Action Plan | Collaborating authorities, organizations and associations |
| Extension of electric fences in a number of sites, including orchards, cereal cultures, etc. | Ministry of Agriculture Forestry services |
| Responsibility for the selection, distribution, and management of the installation sites will be transferred to local communities and beekeeper co-operatives. | Beekeepers co-operatives |
| Proposal for the extension of compensation system to cases not included in current regulations: damage on beehive boxes, livestock below a certain quota, crops. Ask for the issue of Presidential decree to that purpose. | Ministry of Agriculture EL GA (Organization for farmer's insurance). |
| Information to livestock raisers through specific pamphlet on compensation system. Set up of a project for breeding and provision of a local breed of Greek sheep dog to shepherds for better protection of livestock. | Ministry of Agriculture Dog breeders and trainers |
| Intensification of hunters' awareness and information through seminars. | Regional and local Hunting Associations |
| Redistribution, spatial restructure, and creation of new game refuges in relation to important areas for brown bear | Ministry of Agriculture Forestry Services |
| Intensification of wardening. Employment and special training of permanent wardening personnel. | Ministry of Agriculture Forestry Services |
| Official restrictions in construction projects of new forest roads with priority to bear area categories 1 and 2. Proposal for the issue of a relevant presidential decree. | Ministry of Agriculture Forestry Services |
| Proposal for closure of secondary forest road network during the absence of forestry work. Implement this in bear areas of category 1 as well as in linkage areas. | Ministry of Agriculture Forestry Services |
| Improvement of brown bear legal protection status. Abolition of prefectural authority to cancel bear protection status in cases of continual damages caused by the animal. Ask for the issue of presidential decree. | Ministry of Agriculture |
| Proposal for specific legislation dealing with taxidermy practices. Ask for the issue of relevant presidential decree. | Ministry of Agriculture |
| Closure of garbage dumps next to villages, with priority given to bear areas in categories 1 and /S. Cooperation between communities for the creation of common buried garbage dumps. | Regional authorities Communities |
| Creation of a new veterinary bear recovery center. Confiscation of the rest of the dancing bears. | Ministry of Agriculture Ministry of Public Order Communities of Aetos and Nympeon Veterinary School Farmers Association of Amyndeon Sponsors (Private Societies) |
| Set-up of standard protocol for cases of relocation of problem bears. | Ministry of Agriculture Local Forestry Services |
| Set-up of a standard protocol for systematic and long-term monitoring of the population and human-caused mortality, using the radio-tracking method | Forestry Services |

| Table 6.5. Habitat degradation and loss: list of main axes and guidelines of the Greek Bear Action Plan. | |
|---|--|
| Immediate and future actions to be undertaken through the Bear Action Plan | Collaborating authorities, organizations and associations |
| Development of Specific Environmental Studies in three bear sectors of outstanding importance and application of national legislation (L.1650/86) (norms have already been officially approved by the Ministry of Environment). Issue of specific presidential decree for creation of protected areas and the establishment of specific management regulations in the framework of the above studies. | Ministry of Environment, Planning and Public Works |
| Contribution to the updating of the planning legislation at a regional and local level. | Ministry of Finances Ministry of Environment |
| Proposals for the support of traditional agriculture and livestock raising in the corresponding units. | Ministry of Agriculture Local governments Prefectures |
| Concrete proposals concerning specific measures for each bear area category, with reference to actual forestry practices and norms of forest management plans. | Ministry of Agriculture Forest Research Institute |
| Provision by local forestry service plant nurseries of suitable fruit trees that would be planted in each reforestation operation. Ask for the issue of a specific presidential decree. | Ministry of Agriculture Forestry Services |
| Preparation of presidential decrees for the implementation of specific articles of the legal framework (1650/86). Upgrading of national legislation according to EU directives concerning the protection of the environment. | Ministry of Environment, Planning and Public Works |
| Proposals for strict control of land use in terms of maintaining farming, forestry, and livestock activities at their present levels and spatial limits. Specific guidelines are given for the re-organization of recreational activities in respect to the spatio-temporal patterns of bears within the tourism units. Big infrastructure works should be planned and designed in respect to bear space needs. | Regional governments Prefectures Ministry of Environment Ministry of Finances |
| Concrete guidelines are given for the incorporation of the environmental component in the initial stages of planning of large scale infrastructure works. | Regional governments Prefectures Ministry of Environment Ministry of Finances |

| Table 6.6. Bear range fragmentation and shrinkage of linkage areas: list of main axes and guidelines of the Greek Bear Action Plan. | |
|--|--|
| Immediate and future actions to be undertaken through the Bear Action Plan | Collaborating authorities, organizations and associations |
| Proposals for guidelines and standard protocol for international cooperation on joint projects for the conservation of interborder bear populations. The first steps between neighboring Balkan countries have already been achieved through international meetings. | Public authorities Universities NGO's (in the three neighboring countries: Bulgaria, FYROM, Albania) |
| Proposals for incorporation of environmental factors in regional planning. | Ministry of Environment Regional governments |
| Consider linkage areas as priority areas in the national arena. | Ministry of Environment |
| Formulation of proposals for specific management regulations in linkage areas. Ask for the preparation of a relevant presidential decree. | Ministry of Environment |
| Officially strengthen evaluation of environmental factors in the initial stages of planning for large scale public works. | European Union Ministry of Environment |

Acknowledgments

We warmly thank the European Union (DG XI/D/2), the Greek Ministry of Agriculture, the Hellenic Society for the

Protection of Nature, and the "ARCTUROS" Society for their support and collaboration. Special thanks go to Dr. Christopher Servheen for his valuable collaboration and advice on the framework of the "ARCTOS" Project.

Table 6.7. Lack of public support: list of main axes and guidelines of the Greek Bear Action Plan.

| Immediate and future actions to be undertaken through the Bear Action Plan | Collaborating authorities, organizations and associations |
|---|--|
| Seminars for the guards of the Forestry District Departments, and for the employees of districts and prefectures | Forestry Service Ministry of Agriculture |
| Printed material for ELGA | ELGA |
| Proposal for the creation of one Center of Environmental Education | Community of Aetos and Nymfaion |
| Proposal for the organization of at least two Information Centers about the brown bear in the two bear range areas | Ministry of Education |
| Increase the number of local assistants up to 8, one for each prefecture of the bear range | Local Communities |
| Continuous contacts with and seminars for hunters | Hunting associations |
| Seminars and lectures for the local people | Prefectures and Communities |
| Proposals for a documentary about the brown bear, and TV spots for public awareness | Mass Media |
| Enrichment of the material included in the brown bear kit, and increasing kit number to 50 for their distribution all over Greece | Ministry of Education Schools |

Status and management of the brown bear in Central Italy (Abruzzo)

Giorgio Boscagli

Historic range and current distribution

A progressive reduction of bear (*Ursus arctos marsicanus*) range has occurred from 1700 to the present (Figure 6.9a,b,c), but recent research (Boscagli *et al.* in press) notes the continuous presence of bears in the Central Apennine Mountains during this century. The map of 1993 distribution (Figure 6.9c) is the result of this research.

Present brown bear distribution can be considered to be continuous regardless of any ecological obstacles, such as highways, railways, and intensively cultivated areas. A high density central nucleus exists in Abruzzo NP, with peripheral parts of the population at progressively lower densities in the surrounding mountains. Thanks to the development of a chain of protected areas (regional and national parks) recently instituted by the Italian Parliament, one can expect an expansion of permanent bear range and an increase in bear numbers. We have begun to see the first evidence of this trend.

Status

Central Italy's brown bear population is considered to be the biggest in the western Europe. The last reliable estimate (1985) assessed the population's minimum at 70 to 80 bears (Boscagli 1990, 1991), and 49 of them were observed in Abruzzo NP and its buffer zone (600km²). The other individuals were indirectly estimated in the Central

Apennine Mountains surrounding the park. In 1991 these mountains were included within regional or national parks. The bears outside of the Park are much more endangered than those inside. (Boscagli 1987). The most important causes of bear mortality are poaching and accidents.

Legal status

Before the institution of Abruzzo NP in 1922, the area had been a Royal Hunting Reserve. Bears living inside were considered special property of the King, and damages caused by bears were compensated by the Royal House. Ironically, the King never came to hunt at the Reserve. After 1922, bears living inside the Park were considered legally protected but several poaching acts occurred. Many bears were killed outside the future Park's boundaries between 1900 and 1926 (Sipari 1926).

In 1939, the Hunting National Law assessed full protection for the species in all Italian territories. In 1974, the regions of Central Italy where bears live (Abruzzo, Lazio, and Molise) established regional acts to compensate for damages caused by bears to livestock and agriculture. Now the bear is fully protected and, as a penalty for poaching, the State could require the guilty party to repay the full economic value of the bear (around US\$1.28 million per bear).

Population threats

In the past, illegal killing occurred when shepherds reacted to bear attacks on livestock (sheep). Also, several parts of

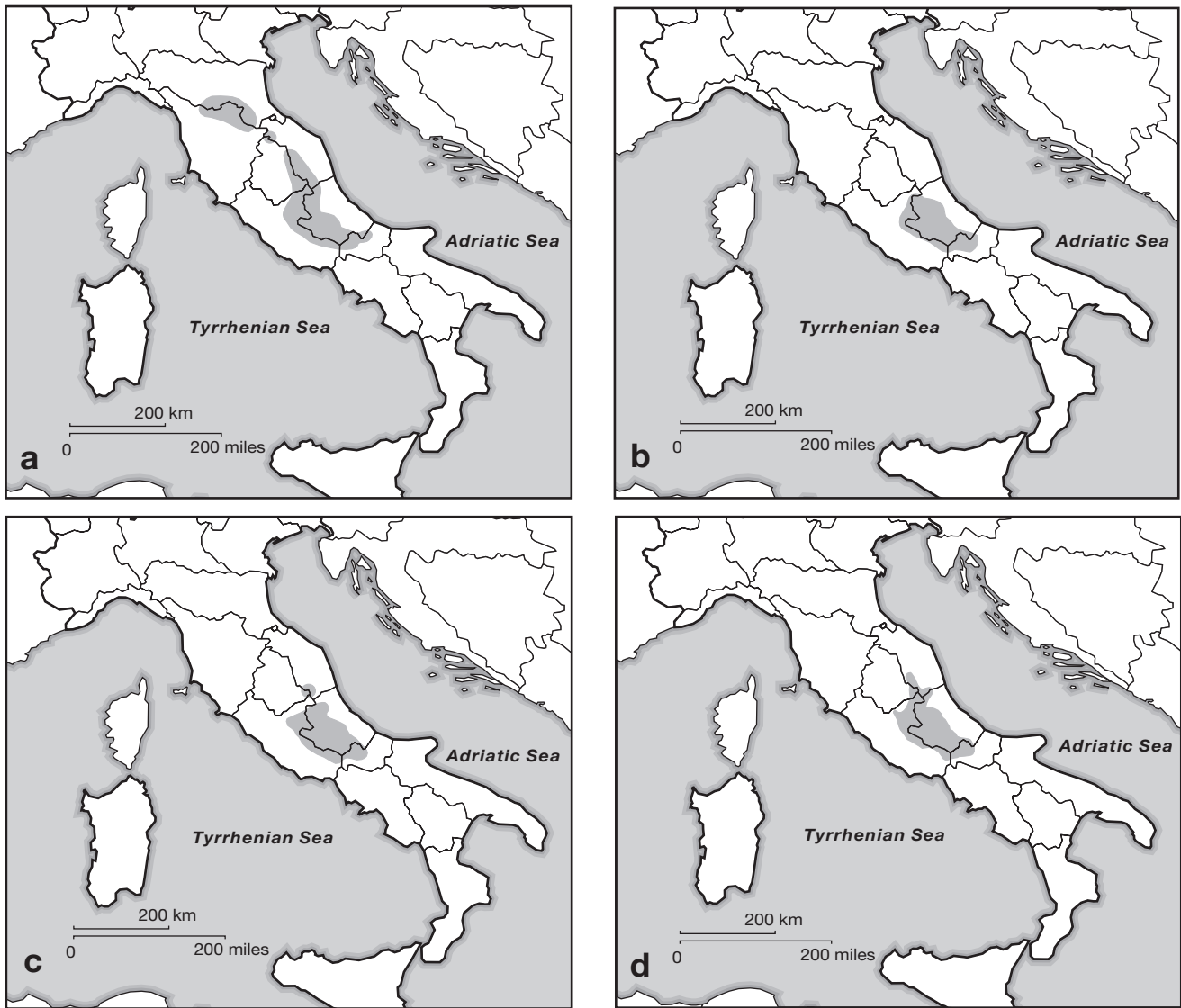


Figure 6.9. Past, present, and future distribution of the Marsican brown bear (*Ursus arctos marsicanus*) in Central Italy. (a) 1800 distribution; (b) 1900 distribution; (c) 1993 distribution; (d) projected 2000 distribution.

the bear are considered a delicacy, even to this day. Recently, illegal killings have occurred during shooting parties, or in connection with the poaching of wild boars (*Sus scrofa*). Some killings occurred as a barbaric demonstration against National Park policy. The Gruppo Orso Italia (Italian Bear Group) has collected some unconfirmed information regarding activities by foreign hunters and illegal killing for trophy mounts. In the buffer zone, a special agreement with local hunters was reached in 1989 which has achieved a strong reduction in poaching. Twenty bears were poached between 1979 and 1988, and only four cases were known between 1989 and 1993.

The “peripheral” bear population outside of Abruzzo NP may be experiencing the negative effects of genetic isolation. We have no evidence for this hypothesis, but the increasing existence of ecological obstacles could mean future isolation of small groups.

Habitat threats

The development of highways in Central Italy’s bear range increase the risks for bears. Between 1970 and 1993, five bears were killed and two wounded by cars and six killed and an unknown number wounded by trains.

The historical connection (partial dependence for feeding habitat, particularly in late summer-early autumn) between bears and traditional agriculture has been interrupted because of a decline in these practices. In the last 40 years, more than 50% of rural cultivated areas have been abandoned for economic reasons. Generally, farmers’ children are not interested in continuing the difficult, economically marginal practice of agriculture.

In order to understand the impact of the forest harvest, it is necessary to first differentiate between the areas inside and outside of Abruzzo NP. For the villages in the Central

Apennines, the forest harvest is the most important financial resource. Forest management is conducted by the Forest Service, generally, and by the park authorities inside the National Park. The park's authorization for harvest can only be obtained after performing a clear evaluation of the risks to wildlife. In those instances where harvest is not permitted, the park compensates the effected villages. (Sulli and Bernoni in press.). Outside the park, only economic evaluations are considered by local authorities and the Forest Service, except in natural reserves.

Most likely in the near future, the new regional (Sirente-Velino) and national (Gran Sasso-Laga and Majella) parks will employ a more "natural" management system within the bear's range. We suspect that, in these areas, over-harvesting of forests has affected the bear's needs. Bear signs are normally observed in those areas where more ancient and undisturbed woods exist.

In the thirty years since 1960, there has been interest in the development of ski lifts, related buildings, and other structures in the Central Apennines. Park authorities stopped the development of a ski lift in the park in the 1970s, but had no control over similar development outside. Notably, the areas inside the park (Russo and Boscagli 1992) near the ski lifts are less frequented by bears than any area of the park. This is the clearest evidence of the harmfulness of these structures. We think that, in the future, the ski lift will be the primary management problem of the Central Apennine parks.

Management

Based on recent experiences in Abruzzo NP, a new national law was enacted concerning protected areas in order to provide for a buffer zone surrounding all new parks. In these buffer zones, where hunting is normally admitted, only local hunters will be authorized. Special hunting rules will also be enforced (e.g. no collective hunting parties). In this way, the hunting pressure will be strongly reduced (less than one hunter per 0.3km²). In several of these Self Managed Hunting Reserves (SMHR), the hunting pressure is less than one hunter per 0.5km². Hunters are normally required to restore the native vegetation and fruit-trees useful for bears and other fauna (ungulates). This is an essential part of the Management Plan of the SMHR.

Within the Abruzzo NP and its buffer zone, a "feeding campaign" has been organized to support traditional agriculture. The Park also autonomously cultivates many critical habitat areas. The use of man-made insecticides and anticryptogamic chemical is not allowed. In the Park since 1969, and more recently outside, park authorities and WWF - Italy developed a program of cultivation of certain plants (*Daucus carota*, *Zea mays*, *Malus sylvestris*, *Pirus pyraster*, *Prunus avium*, *Sorbus aucuparius*, *Sorbus aria*, *Cornus mas*) for bears and a special feeding campaign

to support (with economic contributions to farmers) traditional agriculture.

In recent times, all of these management activities have been exported when possible to other areas of the Central Apennines thanks to the efforts of private conservation organizations (WWF-Italy and Legambiente). Unfortunately, it is not possible to permanently rely on these private organizations. We strongly encourage future park agencies to adopt the same strategy. A recent proposal from conservation associations advocates the coordinated management of present and future protected areas in the Central Apennines to conserve the habitats of the most threatened wildlife, including the brown bear, wolf (*Canis lupus*), and chamois (*Rupicapra rupicapra*). This proposal was submitted to the European Economic Community and the Italian Ministry of Environment, under the name "South European Park," and will include all of the protected areas of the Central Apennines.

Human-bear interactions

Human-bear interactions can be considered conflictual in three general categories: 1) Sporadic bear attacks on livestock (sheep); 2) sporadic crop depredation, and; 3) interaction between bears and hunters.

Livestock and crop depredation problems are normally resolved through damage compensation programs established by special regional acts. Some difficulties exist because of frequent delays in compensation. Interactions with hunters is the most common cause of bear mortalities, but as previously explained, attempts are made to reduce these conflicts in several ways (restrictive and collaborative measures). Public opinion of the bear is influenced by a friendly and non-aggressive image. No data exists about bear attacks on humans. In the 1930s, however, one event is known to have occurred when a shepherd approached a wounded bear.

Public education needs

The most important education needs involve increasing respect for bear habitat. These include the reduction of disturbance, proper management of the mountains for both enjoyment and forest harvest, and the development of a cultural (not only scientific) awareness that the presence of the bear is a symbol of wilderness.

A special bear museum will be built in Pizzone, a village in the Mainarde Mountains recently included in the Abruzzo NP. In the surrounding area, there are plans to build the Marsican Brown Bear Captive Breeding Center. The Mainarde Mountains are characterized by the highest bear density in Italy.

A cooperative project between Abruzzo NP and WWF-Italy began in 1993 to develop habitat management and educational programs with the slogans such as, “Plant an apple tree: you can save a bear”. A similar project aimed at schools and family groups has been developed by WWF-Abruzzo Region for use in protected areas (National and regional parks outside of Abruzzo NP.).

Specific conservation recommendations

1. The Central Italy bear distribution will hopefully be contained within protected areas, but the recently instituted National Parks (Majella and Gran Sasso-Laga) and regional parks (Sirente-Velino, Ernici Mountains, and Alto Molise) are only “on paper.” In other words no agency exists for the operation of these parks. An international appeal to the Italian Parliament for the quick resolution of bureaucratic problems and obstacles would be extremely useful.
2. Poaching instances could be resolved in two different ways: a) including the most vulnerable bear ranges within the parks (where no hunting is admitted by Italian law), and b) strongly increasing the cultural appeal for bear survival with educational programs. A similar project to (b) is planned but needs to be further developed. The cost could be covered by approximately 200 million It. Lires (US\$120,000) per year for at least three years.
3. In the bear distribution range (approximately 5,000km²), we need to reduce the level of product-oriented forest management, modifying this with more natural forest management or replanting native trees (especially *Fagus sylvatica* and *Quercus cerris*), employing the marginal, unproductive areas in wood production.
4. In the protected areas, strict control of ski lift and road development is needed. This may be applied by future park agencies, but outside of Abruzzo NP, no signs of support for this control exist today.
5. A research program encompassing the entire bear range (not only Abruzzo NP as is the present situation) could be very important in assessing ecological needs in different areas, especially for those bears living in marginal situations. Assessment of feeding resources, movements, chances for population development, and related information could be gathered by a radio-telemetry project with an annual budget of approximately 150 million It. Lires (US\$90,000) for at least five years.
6. The bear would benefit from replanting fruit trees and caring for those already existing in the recently instituted National and regional parks. Replanting 3,000 trees per year over five years would require approximately 500 million It. Lires (US\$300,000).
7. A campaign to stimulate adoption of the bear as a regional symbol could be useful. The cost would be approximately 200 million It. Lires (US\$120,000).

Status and management of the brown bear in Italy (Trentino)

Fabio Osti

Historic range and current distribution

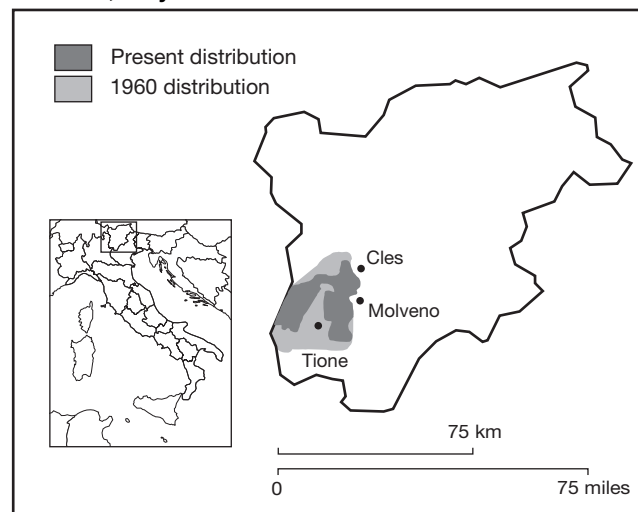
Bears were once widely distributed throughout the forested zones of Italy, extending southwards into Sicily (Figure 6.1). By 1500, they had been exterminated from most of the country. The historical regression suffered by the alpine bear population, undoubtedly due to the actions of man (illegal hunting, deforestation, habitat degradation, etc.), is clearly illustrated by the present day location of the last remaining bears in Trentino.

Today, the brown bear is found in Italy in three separate localities: Abruzzo NP and surrounding areas in the Apennine mountains, a small area in the province of Trentino in the northeastern part of the Brenta Mountains, and in the area of Tarvisio in the border region between Italy and Austria.

In Trentino, potential bear habitat extends only 1,500km² in the Adamello and Brenta mountains (Figure 6.10). The present bear distribution area is divided into the following categories, according to quantitative order of data collected:

1. Area with continuous presence of bears (primary area) encompassing a total of 240km². It includes classical feeding areas, reproduction areas (83.4 % of all cubs were found in this area in the last decade) and winter refuges. The denning area covers roughly 100km² and includes the northeastern portion of the Brenta Mountains and the Campa-Tovel Mountains in Adamello-Brenta Natural Park. Data from this area represent 91% of all bear signs collected from 1987 to 1991, and 81% of indicators of bear presence between 1982–1986.

Figure 6.10. Brown bear (*Ursus arctos*) distribution in Trentino, Italy.



2. Area only periodically used in summer by bears (secondary area) covering a range of about 500km². This area includes Valle di Sole (Mezzana-Vermiglio and Malè-Dimaro), Val delle Seghe (Molveno), Valle d'Ambies (San Lorenzo in Banale), Val Algone, and Val Manez. The information collected in these localities represents 7% of all data collected from 1987 to 1991. Only one female bear with two cubs has been observed in this area in the last 10 years.
3. Area only occasionally used by bears for feeding or as a result of human induced displacements, especially during summer months (transitional area). At present, this area includes Val di Rumo, Val di Bresimo, and some localities of Valle di Ledro e Giudicarie. The Adamello-Presanella Mountains (Val Genova, Val Breguzzo, Val di Fumo) have appeared abandoned by bears since 1985. This area, that encompassed about 690km² in the years 1982–1986, includes at present less than 100km².

Status

In Trentino, the brown bear population in the last 10 years has been estimated at around 10 individuals. Data collected indicate a decrease in the bear population.

Legal status

The brown bear in Italy has been completely protected by law since 1939. The Trentino population is centered mainly in the Adamello-Brenta Natural Park (established in 1967 but operating only since 1988). In a legislative move aimed at introducing proactive measures to safeguard bears, programs were established to provide immediate and total compensation for damage done by bears to beehives and livestock. Also, harmless defense measures were taken (the application of which is charged almost entirely to the provincial administration) to avoid possible damage done by bears.

Three restocking experiments have taken place in Trentino. The first two, in 1959–60 and in 1969, were unsuccessful because the bears were either recaptured or killed. The last experiment, in the spring of 1974, entailed the release of two bears on the eastern slope of the Brenta Mountain range. One of these animals survived until 1978.

Population threats

In addition to its small size, the alpine bear population has a low reproductive capacity, and in the last two years of this research, the indices of cub presence are non-existent.

The last confirmed case of a human-caused wild bear mortality occurred in 1971 (Daldoss 1972). Bears are presently tolerated by local hunters and farmers.

Habitat threats

Bear habitats are situated between the altitude of 500 and 1,500m. Cultivated lands and orchards are found at lower elevations (under 700m). The majority of the vegetation consists of broad leaved forests of oak (*Quercus pubescens*), and beech (*Fagus sylvatica*), progressively mixed with pine (*Pinus sylvestris*), fir (*Abies alba*) and spruce (*Picea abies*). Around 1,200–1,300m marks the beginning the pure coniferous forest with fir (*Abies alba*) and spruce (*Picea abies*) dominant. At the upper elevations, the vegetation consists of an alpine forest of larch (*Larix decidua*) and mountain pine (*Pinus mugo*). The understory is composed mainly of *Sorbus* sp., *Prunus* sp., *Sambucus* sp., *Vaccinium* sp., and *Rhamnus* sp. Forests are frequently interspersed with alpine pastures where cattle graze during the summer. There are alpine grasslands above 2,000m.

The main threat to the bear in Trentino is habitat loss and disturbance caused by increasing human presence. In particular, the population is being squeezed into smaller and smaller areas. The principal threats to the Trentino brown bear population include: the fragmentation and deterioration of habitat due to exploitation of the forests for wood products, the increased construction of forest roads in the core area allowing motor vehicle access to critical bear habitat, and the reduced size of the population and its genetic isolation.

Management

Species monitoring: Monitoring techniques are based on indirect signs of bear presence (tracks, feces, bear sightings, moved stones, etc.). They are aimed at determining geographical distribution and population size, and at monitoring the effect of human management on bears. The monitoring of sample trails, a method applied since 1980, consists of the collection of all brown bear presence indicators on monthly monitored transects. Some valleys in bear range are monitored by a sample trail. Electronic methods for automatic monitoring were tested in 1989 by the Park and Forest Service. An automatic station consisting of a video camera with a weight scale were installed near the only feeding area existing in the Park. All the data are recorded on a normal video cassette, allowing recognition of individual bears and giving details on the presence of animals, their favorite hours of presence, and seasonal differences in weight. Another automatic monitoring system is presently being studied. This system consists of a small video camera with a battery and radio

component, placed near where bears usually travel, to transmit images directly to a central office.

Habitat management: In general, tall beech forests are exploited by selective cutting in a rotation of 10–15 years. As tractors have replaced horses almost entirely, forest roads must be built. Increased accessibility to the forest means additional disturbance of bear habitat and easy access by motor vehicles for the purposes of hunting, poaching, and tourism. The main part of the forest inhabited by bears is state property, and for this reason it is possible to implement a management plan aimed at bear conservation. In the last two years, the Adamello-Brenta Natural Park promoted a project to actively protect traditional bear habitat. This exclusively naturalistic project of safeguarding the park, even if not yet approved by the Provincial Committee of Parks Management, shows a commitment to avoid the extension of the forest road network, limit the extraction of timber in the bears' core survival zone, and forbid construction or excavation in these areas. The Natural Park administration has financed alternative solutions in response to the demand brought forward by the local people who are the legitimate proprietors of the territory.

Human-bear interactions

In Trentino, bears live in an environment which is heavily utilized by people. However, because of the low density of the bear population, man and bears rarely come into conflict. Conflict has occurred in cases of predation on livestock, honey theft and hive destruction, and damage to crops and fruit trees. The protection of crops and orchards by electric fences has been in force in Trentino bear range since 1978.

Specific conservation recommendations

Bear conservation requirements in Trentino demand that all bear areas are the object of a management plan integrating legal protection measures and active management programs.

Habitat management

Forest policy measures specifically aimed at maintenance of the integrity of large forest complexes include:

1. Conservation or recovery of mixed broad-leaved forest, structural heterogeneity and a rich understory;
2. Upgrading of some forests by planting species useful for the bear.
3. Control of vehicles and persons entering the forest on existing trails and roads, and prohibiting construction of new forest roads.

4. Financial compensation for loss of income due to restraints imposed on forestry.
5. Forestry activities should be restricted in most of the core area, and development of tourism infrastructure should be curtailed.

Genetic evaluation and population restocking

We also advocate restocking (release of 5–10 individuals, presumably of Slovene and Croat origin) to increase the genetic variability and to contribute to a demographically stable and viable bear population. Analysis of the historical information available suggests that about 200 years of isolation (equal to about 20 generations) is not enough to bring about a significant genetic divergence. This hypothesis could be scientifically tested in a short time since three laboratories (in Germany, France, and Italy) are currently carrying out genetic analyses on various populations of European bears (including those in Adamello-Brenta Natural Park and Abruzzo NP). A restocking program must be coordinated with a conservation education project aimed at people living in or near bear range.

Status and management of the brown bear in Norway

Ole Jakob Sørensen, Jon E. Swenson, and Tor Kvam

Historic range, current distribution and status

Originally, and even into the 1800s, the brown bear occurred throughout Norway, including the larger islands (Collett 1911–12). As late as the mid-1800s, there were an estimated 2–3,000 bears in the country, and they occurred in all provinces (Elgmork 1979a, 1988; Swenson *et al.* 1994a). After 1850, the population declined rapidly, about 3.2% per year based on bounty records (Swenson *et al.* 1994a). This decline was due to very intense hunting as a part of the official policy to exterminate bears and other carnivores. The purpose was to increase populations of other game species, a philosophy that was encouraged by zoologists of that time. During the period of national bounties, (1846–1930), 8,291 bears were bountied in Norway. The policy was successful, and by the 1920s, the bear was functionally extinct in almost all of Norway (Swenson *et al.* 1994a). One isolated population in southern Norway survived until the 1980s (Elgmork 1994). The distribution of bears around 1900, based on bounties paid, is shown in Figure 6.11. The decline of the Norwegian bear population is described in more detail in Swenson *et al.* (1994a).

Today, bears are only found in a few areas next to the borders with Sweden, Russia, and Finland (Figure 6.12). The bear population in Sweden is large (over 600) and

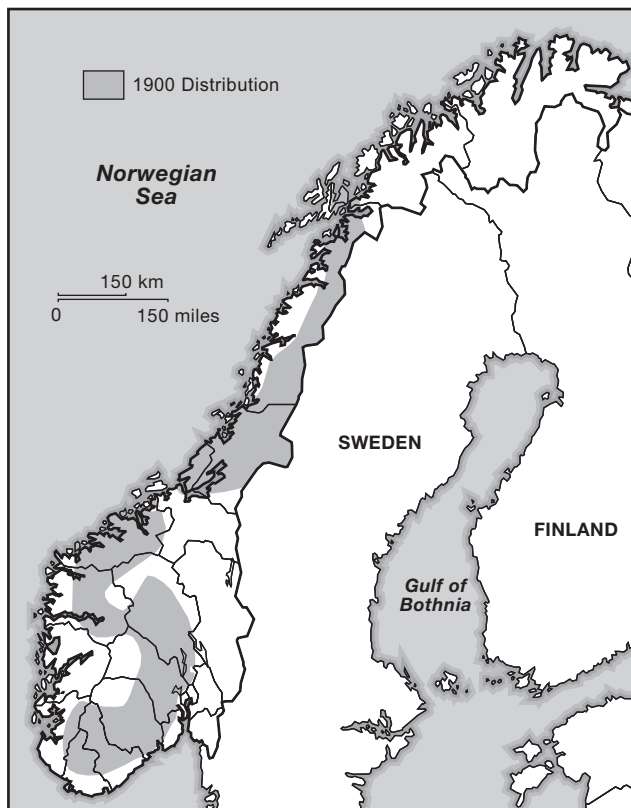


Figure 6.11. Distribution of brown bears (*Ursus arctos*) in Norway (c. 1900) based on records of bounties paid.

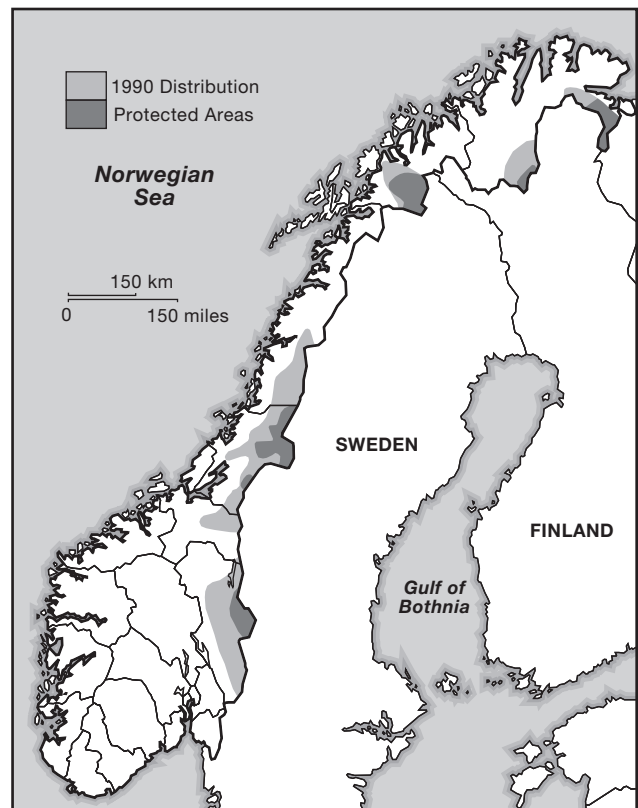


Figure 6.12. Distribution of brown bears (*Ursus arctos*) in Norway (c. 1990).

expanding (Swenson *et al.* 1994a, b). There are, at any time, probably only 10–20 bears in Norway, excluding the northernmost province of Finnmark, and these must be considered to be emigrants from Sweden (Swenson *et al.* 1994a). Together, the Scandinavian population is 650–700 bears (Swenson *et al.* 1994a).

The Pasvik Valley, on the northeastern tip of Norway, was recolonized from Russia and Finland (Wikan 1970). There are an additional 5–30 bears in eastern Finnmark that have a portion of their home ranges on the Norwegian side of the border (Sørensen *et al.* 1990 a, b; Bergstrøm *et al.* 1993), and belong to a common Russian-Finnish-Norwegian population that might number 400–500 bears (Makarova 1987; Nyholm 1985; Bergstrøm *et al.* 1993). At any given time, there is probably an average of 20–25 bears inside Norway, although this will vary by season and year. Previous estimates of the number of bears in Norway were considerably higher (Myrberget 1969, 1978; Elgmork and Mysterud 1977; Heggberget and Myrberget 1979; Kolstad *et al.* 1984, 1986; Kvam *et al.* 1990; Sørensen *et al.* 1990a, b). They were based on reports from the public, and overestimated the true numbers to varying degrees (Sørensen *et al.* 1990 a, b; Swenson *et al.* 1994a). The estimates given for each year by Sørensen *et al.* (1990 a, b) might have been more realistic, yet still overly optimistic, estimates.

Legal status and management

A national bounty, administered at the local level, was implemented in 1733. Administration was moved to the national level in 1845. This bounty was removed in 1930, but local bounties could be paid until 1972, when bears received total protection throughout the country. A local protection that began in the late 1930s may have prolonged the survival of the now-extinct Vassfaret population in southern Norway (Elgmork 1978, 1994). In retrospect, we realize that bears were protected several decades after the Norwegian part of the Scandinavian bear population was already functionally extinct.

According to the Norwegian Wildlife Act of 1981, all species of huntable wildlife are protected unless it is decided that the species and population can be hunted. A main purpose of this act is to ensure long-term viability of Norwegian wildlife populations. This is in accordance with the Norwegian ratification of the Bern Convention. With regards to the bear and other large carnivores, another aim of the act is to keep depredation of livestock, especially sheep and domestic reindeer, at reasonable and acceptable levels. Therefore, national authorities can give permission to kill depredating bears. Local pressure to issue a kill permit often begins when 10–20 sheep have been documented to be killed by a bear. Since protection

was enacted in 1972, 33 bears have been shot, at an average of 1.6 per year. Nineteen bears have been shot with official permits and 11 bears have been shot legally by livestock owners protecting their stock, or by big-game hunters who have felt threatened. We are now convinced that even the legal kill is above a sustainable level, based on the amount of bears considered to be “Norwegian”, and that the apparent small increase in bear numbers is due to increased immigration from neighbouring countries (Swenson *et al.* 1994a). Hunting permits in Norway are given only because viability is ensured by the common population with Sweden, Finland, and Russia.

According to regulations laid down by the Ministry of Environment, a livestock owner can be compensated for livestock killed by the lynx (*Lynx lynx*), wolf (*Canis lupus*), wolverine (*Gulo gulo*), and golden eagle (*Aquila chrysaetos*) (DN 1993a). Compensation is about US\$150 for a lamb and US\$400 for a ewe. Additional compensation for extra herding, fodder, etc. is also common. Losses due to bear predation have increased gradually over the past 20 years, but vary a lot from year to year. In 1992 and 1993, approximately 2,000 sheep were compensated as bear-killed. This represents about 0.08% of the sheep on open range. Less than 1% of the sheep owners apply for compensation due to bear predation, but the losses can be substantial for individual sheep owners. In 1993 one owner in Lierne, North-Trøndelag lost 28% of his total stock and 25% of his ewes were confirmed killed by bears (Kvam *et al.* 1994).

Livestock owners are generally satisfied with the level of compensation that is given, which represents a value up to 100%–200% of mean sale price for the slaughtered sheep. Livestock owners may feel that they have not been compensated for enough animals, though. Bear attacks in sheep flocks are unacceptable to the owners for several reasons: 1) based on old tradition, the farmers believe that this should not be tolerated, 2) such attacks might greatly disturb planned breeding, and 3) such attacks cause much more work regarding herding and the bureaucracy involved in documenting losses and claiming compensation.

The Norwegian Ministry of Environment and the earlier Directorate for Wildlife and Freshwater Fish started a research project in 1980 to estimate populations and devise a monitoring system to document occurrences of bears, wolves, and wolverines, as well as to document the loss of domestic animals killed by protected carnivores (Sørensen *et al.* 1984). The resulting system is now used in every province of Norway and, as a part of the compensation system, biologists are working at the local level with specially trained contact persons in every municipality to inspect animals claimed to be killed by carnivores. Permits to hunt bears are given by the Directorate for Nature Management, which can transfer the authority for execution of the kill permit to the County Governor’s Environmental Authorities at the province level.

Approximately US\$1 million is used yearly by the Directorate for Nature Management for the Government’s “Carnivore Management Strategies”. This money is used to pay for extra herding, and for the costs associated with delaying the release of sheep into pastures or taking them home earlier than normal.

In June, 1992 the Norwegian Parliament enacted a new policy for the management of large predators (Ministry of Environment 1992; DN 1993b). An important component of this policy was the establishment of five administrative core areas. Within these boundaries, bears will be allowed to establish reproducing populations, with a goal of maintaining viable Scandinavian and Fennoscandian/Russian bear populations. The management procedures and boundaries for these areas were approved in 1994 following public review (Ministry of Environment 1994).

Population and habitat threats

There is no question that the bear was nearly exterminated in Norway due to heavy hunting pressure. The greatest hindrance to a recolonization of Norwegian habitats is the killing of bears that kill sheep. After large predators were eliminated from most of Norway, sheep owners began to allow their sheep to graze almost completely unattended on open range in mountainous and forested areas. There are now over 2.2 million sheep on open and forested ranges in summer throughout Norway. This form of sheep management is successful where there are no large predators. Thus, the problem of re-establishing the bear in Norway is obvious. Norwegian government policy has been to maintain the settlement of rural areas. The policy is intimately linked to agriculture policies with the result that sheep farming is encouraged and financially subsidized (Øksnesutvalget 1974; Landbruksdept 1975, 1976, 1993; Alstadheimutvalget 1991). People in rural communities are generally opposed to re-establishment of the bear in their areas and see it as a threat to the social structure of rural communities.

Although illegal killing of bears most likely occurs, we do not think it is a major factor preventing re-establishment of reproducing females on the Norwegian side of the border. However, threats of illegal killing are often used in the current debate over bear management in Norway. This is even being encouraged by some local politicians, especially from the political parties that traditionally represent farmers.

We have not been able to identify important habitat threats to the re-establishment of bears in Norway. However, the widespread distribution of recreational cabins combined with road construction and urbanization in some valleys may have reduced habitat and may hinder dispersal (Elgmork 1978, 1983). Also, clearcutting in mountain forests might have a negative impact locally on

the use of habitat, at least until adequate cover becomes established, normally at tree heights of 5–7m.

Public education needs

Norwegians generally want to maintain the brown bear in Norway. This is evident from the government policy referred to above and in an interview study where 80% of those questioned were in favor of having bears in Norway (Dahle 1987). However, the mass media tends to focus on the negative aspects of bears, especially sheep depredation (Frafjord 1988). The media often portrays this as a conflict between the powerful government and the weak, vulnerable individual. In addition, many Norwegians are afraid of bears (perhaps because of old stories). Public education about bears and the consequences of different management strategies is needed especially in the proposed core areas. This education should be focused at all social levels in the local communities—from kindergarten and primary schools through adult organizations. Even more specialized information should be focused on local politicians, farmers and hunters. Moose and grouse hunters may come into difficult situations with bears, and at least three bears have been shot in Norway because of this. Some of the potential dangers are real, but knowledge about how to handle such situations might prevent unnecessary killings.

Conservation recommendations

The brown bear has legal protection, and Norway uses a considerable amount of money to re-establish reproducing bear populations based on immigration from Sweden, Finland, and Russia. We feel that the present management practices are generally good.

In our opinion, a “rapid” re-establishment of bears has so far been delayed mostly by the legal killing of bears that prey on sheep. We believe it is important that Norwegian Wildlife authorities continue to focus intensively on that problem. The bear-sheep conflict has sociological aspects that should receive much more attention. For example, the authorities should actively inform people in core areas about goals for bear management, and what effects these goals will have for the future of the local community. We feel that people living locally must know approximately what numbers of bears a core area will be likely to have, or at least a goal for numbers of reproductive females in an area. Of course, this number must be revised as research results become available. Most importantly though, is that political policies should ensure farmers that they will receive help to establish new farm practices that conflict less with bears. This is already beginning in one of the five bear areas, but it should be stressed to people that it is not the bear that will make rural living impossible.

Status and management of the brown bear in Poland

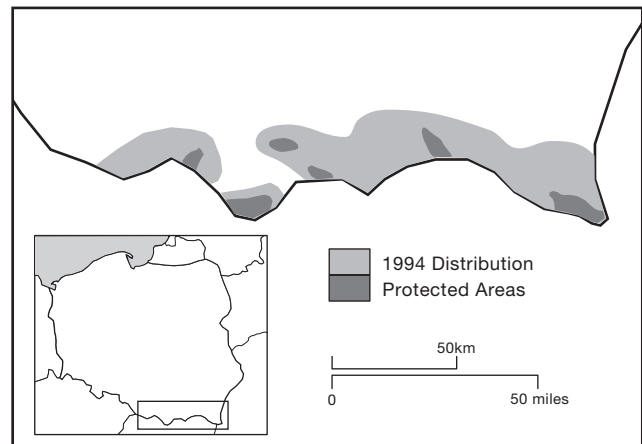
Witold Frackowiak, Roman Gula, and Kajetan Perzanowski

Historic range and current distribution

The earliest records on the occurrence of brown bears in Poland are from the 12th century (Kiersnowski 1990). At that time, bears were present throughout the entire country. The extension of hunting rights from royalty to the whole of gentry (the permit for bear hunting was formerly regarded as the king’s special favour) and significant changes in habitat, especially the fragmentation of forested areas, caused considerable shrinkage of the bear’s range in Poland. By the 18th century, brown bears had practically disappeared from the majority of Polish lands. At the beginning of 19th century, permanent refuges of brown bears in Poland were limited to the Carpathians, Bialowieska Forest, Lodzka Forest, and the part of Kielce Province (Jakubiec and Buchalczyk 1987). Outside the Carpathians, bears last disappeared from the Bialowieska Forest, where the last records of bear presence are known from 1873–78 (Karpinski 1949; Jakubiec and Buchalczyk 1987). At the beginning of the 20th century, bear range was limited to the Carpathians.

In the Carpathians, bears were hunted on a permanent basis, and in some parts of that range (i.e. Beskid Zywiecki) they were even treated as pests (Burzynski 1931; Augustynowicz 1939; Jakubiec and Buchalczyk 1987). The last individual in Beskid Slaski (the western Carpathians) was observed in 1918 (Jakubiec and Buchalczyk 1987). In 1937, there was a successful attempt to reintroduce bears into Bialowieska Forest (Karpinski 1947; Jakubiec and Buchalczyk 1987). These reintroduced bears were present there until 1947 (in 1946 five bears were recorded), but in 1947 bear tracks were seen only once

Figure 6.13. The distribution of brown bears (*Ursus arctos*) in Poland in 1994 based on official data of State Forest Administration and National Parks.



(Karpinski 1947; Jakubiec and Buchalczyk 1987). After World War II, numbers of bears in Poland were estimated at 10–14 individuals (Buchalczyk 1980). That number remained quite stable until 1960, when it began an increase to 70 animals in 1982 (Jakubiec and Buchalczyk 1987). The fastest growth of bear populations after World War II took place in the Bieszczady Mountains. This population grew from less than 10 animals in early 1950s (Grodzinski 1957; Ogonowski 1958) to about 60 individuals at present. This region became virtually depopulated as a result of the war, the density of the human population dropped from about 32/km² in 1937, to 1–2/km² by the end of the 1940s. Since the 1950s, the number of permanent inhabitants has slowly increased, and at present (not taking into account larger townships located at the edge of mountains like Lesko and Ustrzyki Dolne) it is reaching the level of about 10 people/km². Along the state-border zone, which is most strongly affected by the resettlement of local people, the density of human population is the lowest in the country at about 5/km².

Currently, the range of the brown bear is limited to the Carpathians in the southeastern part of the country. Bears occur in three provinces: Krosno, Nowy Sacz, and Bielsko-Biala, within a range of about 7,000km². The estimated distribution, based on data from Regional Forestry Offices and National Parks is given in Figure 6.13. The total population size is currently estimated at 80–90 individuals (according to the official data from the Forestry Department and National Parks).

Although the presence of bears is occasional along the entire Carpathian Range, there are five regions where bears are observed frequently (Table 6.8, Figure 6.13).

The Bieszczady Region

The eastern part of Polish Carpathians is the mainstay of Polish bears where females with cubs are observed on a regular basis. This area has an estimated total population

of 50 individuals. The area is mountainous, spanning about 2,000km² with elevations up to 1,350m. The majority of the area is covered by a natural beech-fir (*Fagus sylvatica*, *Abies alba*) forest, supplemented by areas of former farmlands afforested mostly with spruce. The area above the timberline (1,100m) is covered by subalpine pastures. The Bieszczady Mountains are relatively sparsely populated (about 10 inhabitants/km²) compared to the rest of the country (120 inhabitants/km²). The Bieszczady area is a popular tourist area. In particular Bieszczady NP attracts thousands of visitors annually, mainly hikers.

Beskid Niski

The lowest range in the Polish Carpathians (highest elevations just over 900m) is mostly mixed mountain beech-fir forest, and has low human densities. The region remains quite undeveloped and free of tourists, with an economy based on logging and small-scale agriculture. In 1995, a new national park (Magurski NP) will be established on 200km². Bears exist there in small numbers and are probably mostly resident animals.

Beskid Sadecki, Gorce Mountains, and Pieniny Mountains

These three neighbouring mountain ranges are situated to the west of Beskid Niski. The highest peaks exceed 1,300m and dominant tree species are the Carpathian beech forest in Beskid Sadecki and spruce stands in Gorce. The density of human population is relatively high compared to Bieszczady and Beskid Niski, due mostly to easier access from larger cities. Bear density is slightly higher compared to Beskid Niski, but much lower than in Bieszczady and Tatras.

Tatras

This area is the highest part of Carpathians with peaks reaching 2,500m and a well developed alpine zone. The

Table 6.8. Basic parameters of brown bear range in Poland, human pressure, and potential threats.

| Main refuges | Total area (km ²) | Max. altitude (m) | Forested area (%) | Fragmentation of the forest* | Area of national parks (km ²) | Human density/ km ² * | Capacity of hotels/ km ² * | Estimated number of bears | Major threats |
|--|-------------------------------|-------------------|-------------------|------------------------------|---|----------------------------------|---------------------------------------|---------------------------|----------------------------------|
| Beskid Zywiecki, Beskid Wysoki | 1,100 | 1,725 | 40 | high | 17 | 80 | 1.4 | 7 | habitat fragmentation tourism |
| Tatra Mountains | 290 | 2,499 | 46 | low | 210 | 132 | 59 | 14 | tourism |
| Beskid Sadecki, Gorce Mountains, Pieniny Mountains | 1,570 | 1,310 | 40 | high | 89 | 89 | 20 | 8 | habitat fragmentation tourism |
| Beskid Niski | 2,100 | 997 | 40 | low | 200 | 28 | 1.9 | 8 | logging |
| Bieszczady Mountains | 2,000 | 1,346 | 52 | low | 270 | 15 | 1.5 | 50 | logging poaching tourism |

* After Jakubiec, 1993 mod.

forest is mostly spruce stands artificially introduced by the end of 19th century. Most of the area is protected by Polish and Slovakian national parks, but due to extremely high numbers of tourists visiting both parks and their vicinity, the degree of human pressure and human-related disturbance is very high. Bears have been present in Tatras on a permanent basis and their numbers remain quite stable, including one to two females with cubs observed every year on the Polish side of the range.

Beskid Zywiecki and Wysoki

The highest elevation exceeds 1,700m but only few peaks have well developed sub-alpine and dwarf-pine zones. The composition of forests varies from artificially planted spruce stands to small remains of original mountain beech-fir forest. The density of bears is moderate for the Polish Carpathians and females with cubs are observed within the zone close to the Polish-Slovak border.

In 1994, a single bear was noticed in the Sudeten Mountains, but apparently that case was exceptional. In the near future no reintroductions of brown bears are planned in other parts of Poland. The only possible sites where such a project could possibly succeed are forested areas of considerable size such as the Sudeten Mountains and Bialowieska Forest. In either case, any program of reintroduction should be preceded by the estimation of habitat capacity and careful evaluation of potential bear-human conflicts.

Legal status

A royal bill, which limited permits for bear hunting to only a few selected aristocrats during the seventeenth century, was the first officially enacted law concerning bear management in Poland (Kiersnowski 1990). A few centuries later, the law was disregarded more and more frequently, and even with severe financial penalties for illegal bear hunting, these animals were extirpated in many regions of Poland. In the Carpathians, bears were hunted in considerable numbers until World War II (Burzynski 1931). The first legal protection for bears as a game species was introduced in 1927 by decree of the President of Poland, which prohibited killing females with cubs, and introduced the possibility of closing the hunting season in some areas of Poland (Dziennik Ustaw R.P. 1927). A further modification to the decree occurred in 1932, changing the status of bears to a fully protected species did not prevent sporadic harvest (Kiersnowski 1990). After World War II, full legal protection of the species was initiated in 1952 (Dziennik Ustaw R.P. 1952). The brown bear is listed in the Polish Red Data Book of Animals as rare with a high chance of extinction (Polish Red Data Book of Animals 1992).

Population threats

Poaching: Since 1945, at least ten cases of bear poaching were reported (Podobinski 196; Parusel 1985; Jakubiec and Buchalczyk 1987; Jakubiec 1990a; Kiersnowski 1990). Due to poor economic conditions, poaching has become more intensive, particularly towards ungulates. The most common poaching device, the neck snare, creates a real danger for bears. The last registered case of bear poaching took place in November 1994, in Bieszczady, where a six-year-old male was captured in a neck snare that was probably set for a deer. Additionally, there were a few cases of illegal bear hunts organized for various officials before 1989.

Nuisance bears: Individual bears known to damage human property are shot under authority of permits issued by the Ministry of Forestry. Since 1945 four such permits have been issued (Lenkowa 1966; Olszewski 1971; Jakubiec and Buchalczyk 1987; Jakubiec 1990a). One bear was shot because of attacking a hunter (Parusel 1985). One bear was accidentally run over by a bus (Bunsch 1967). In 1991 in Tatras, a female with three cubs, known to have fed at a garbage dump near a mountain shelter, was captured and transferred to the Wroclaw Zoo where she died a short time later (Tatra NP). According to the most recent information, the cubs remained in captivity.

However damage done by bears (about US\$6,000 annually – see text below) are not economically significant. However, bears with no fear of humans are a serious problem. This is especially true in Tatras, with its high tourist traffic, lack of educational programs, and available garbage for wildlife. There is a need for nuisance bear control and public education in this area.

Habitat threats

Regional development: The quickly growing economy may cause significant changes in local areas where small-scale farming is now giving way to more intensive development. Bieszczady and Beskid Niski, which still remain basically undeveloped, may be threatened in this way. In these regions, considerable amounts of farmland (former parts of bankrupted state farms) are up for sale, and the future of these areas is uncertain. The most probable development scenario is the purchase of small plots by many owners, which may only worsen habitat conditions and lead to further habitat fragmentation. Local development planning has not included consideration of the habitat needs of large predators.

Tourism: The majority of the Carpathians is a popular recreation area throughout the year. A rapidly developing economy increases tourist business, with associated

consequences such as increasing number of visitors (disturbance), and development of infrastructure like hotels, mountain shelters, and skiing stations. Particularly threatened are areas in the vicinity of national parks (Figure 6.13).

Timber harvest: Harvest is very intensive throughout the Carpathian range and is only limited in national parks to some extent. Although clearcuts are not permitted in the mountains, harvest of timber is the direct cause of: a) changes in the structure of tree-stands, b) decrease in the age of the forest, and c) lowered biodiversity. Additionally, the construction of forest roads make access easier for people, and logging activities increase disturbance.

Management

The Department of Forestry, currently part of the Ministry of Environmental Protection, Forestry and Natural Resources (MEPFNR), is responsible for the management of protected species and for issuing licences for nuisance bear control. MEPFNR is also obliged to compensate all damages done by bears to human property, i.e. to livestock, crops, beehives etc. The value of the damage is estimated by a committee that includes representatives of local administration and forestry. Compensation is paid from the state budget. Except for compensation, there are no other bear management practices.

Human-bear interactions

Since the range of brown bears in Poland overlaps with some areas of high human density (Table 6.8), bears sometimes cause damage to livestock (sheep and cattle), beehives, and, less frequently, to crops. The list of bear-related damages for the last five years is given in Table 6.9. The average annual value of bear-related damages is estimated at about US\$6,400 (Bobek *et al.* 1993).

Since World War II, there have been no documented human deaths caused by bear attacks. In regions with high human presence (i.e. Tatras), there has been a slight increase

Table 6.9. The numbers of livestock killed and beehives destroyed by brown bears in Poland between 1987–1991 (after Bobek *et al.* 1993 mod.).

| Year | 1987 | 1988 | 1989 | 1990 | 1991 | Total |
|----------|------|------|------|------|------|-------|
| Beehives | 49 | 42 | 98 | 140 | 56 | 385 |
| Sheep | 41 | 101 | 115 | 32 | 77 | 366 |
| Cattle | 27 | 15 | 21 | 16 | 4 | 80 |
| Pigs | 2 | 0 | 3 | 0 | 0 | 5 |
| Goats | 2 | 1 | 0 | 1 | 5 | 9 |
| Horses | 2 | 0 | 0 | 1 | 0 | 3 |

in numbers of bears habituated to people. Such bears feed on garbage next to mountain shelters and are not afraid of people they encounter on mountain trails (Tatra NP data).

Public education needs

1. The education of special interest groups such as:
 - a. Hunters and foresters can help to monitor the bear populations because of their high chance of observing bears in the wild and may be able to provide first-hand information about bears. If they are properly briefed, their data might be much more valuable. They should also be aware of the conservation needs of bear populations, because these people can directly contribute to the protection of bear refuges, dens etc. There is also an urgent need to properly educate hunters so they will not mistake bears for wild boars (*Sus scrofa*), especially when hunting in corn or oat fields.
 - b. Tourists should be educated about responsible behavior in bear country in order to avoid unnecessary disturbance of animals and minimize the risk of bear attacks. This is most important in national parks.
 - c. Farmers need access to information about their legal rights regarding claims of bear damage, and should be educated about proactive forms of protecting crops and livestock from bears.
2. Creation of greater public bear awareness through the media by providing information regarding the status of the species, potential threats, and protection to ensure the further existence of the species in Poland. Programs should be extended to schools to disseminate basic information concerning bears and emphasize the problem of their protection.

Specific conservation recommendations

1. **Population monitoring**
 - a. Monitoring the minimal population size by annual counts of females with cubs. Additionally, records of litter size may provide indications about the reproductive status of the population. Spatial distribution of females and cubs should indicate locations of main refuges.

Duration: annual

Extent: entire range

Primary methods: 1) Selection of credible foresters and park rangers; 2) Preparation of questionnaires; 3) Distribution of survey forms by mail; 4) Evaluation of data.

Estimated budget: US\$10,000 per year.

- b. Spatial distribution of the population survey by questionnaires directed to Forest Districts, national parks, and hunting clubs (such data actually exist since foresters, hunters, and park rangers are obliged to perform annual counts of game species).
Duration: every second or third year
Extent: all of potential bear range
Primary methods: 1) Preparation of questionnaires; 2) distribution of forms by mail; 3) evaluation of data.
Estimated budget: US\$10,000 per year.
- c. Evaluating trends in the reproductive status of females using age of first pregnancy, breeding interval, litter size, and mortality of cubs.
Duration: ten years
Extent: sampling area
Primary methods: 1) Capturing and radio monitoring of 10 females; 2) monitoring of winter dens (access to cubs): every year; 3) result: the model of population dynamics.
Estimated budget: US\$200,000 (entire project)
- e. The size of individual home range and movements.
Duration: 3 years
Extent: sampling area
Primary methods: 1) Capturing of 6 individuals; 2) radiotracking; 3) data evaluation.
Estimated budget: US\$40,000 (entire project)

3. The implementation of guidelines to achieve viable bear populations for local development, tourism, and timber harvest.

Guidelines should be based on models of population trends, habitat changes, and habitat and food requirements of brown bears. The first areas to introduce and test such guidelines should be national parks and biosphere reserves, and further extension should be negotiated for landscape parks, State Forest Districts and hunting grounds. Because bears in Poland belong to the much larger Carpathian population, the existence of the species in Poland depends directly on the status of bears in Slovakia, Ukraine, and Romania. Therefore, cooperation and coordination with these countries is absolutely essential to any conservation effort.

2) Habitat monitoring

- a. Food habits: the composition of natural diet based on scat analysis.
Duration: five years
Extent: throughout all main habitats
Primary methods: 1) Annual collection of scat samples; 2) analysis in laboratory; 3) evaluation of data.
Estimated budget: US\$30,000 (entire project)
- b. Annual and spatial variation in the productivity of main food items.
Duration: 10 years
Extent: sampling areas
Primary methods: 1) Annual monitoring of preferred fruits/nuts; 2) estimates of potential food supply in particular years; 3) data evaluation
Estimated budget: US\$50,000 (entire project)
- c. Habitat size and trend of changes based on the analysis of forest and vegetation maps (GIS). Suitability of potential habitats using analyses of: food supply, cover, fragmentation and corridors, existing and potential disturbance by agriculture, logging, tourism, human settlements, roads, and local development.
Duration: every five years
Extent: entire range
Estimated budget: US\$75,000 (entire project)
- d. Habitat use and preferences.
Duration: 3 years
Extent: sampling area
Primary methods: 1) Capturing of 12 individuals; 2) radiotracking; 3) data evaluation.
Estimated budget: US\$60,000 (entire project)

Status and management of the brown bear in Romania

Ovidiu Ionescu

Historic range, current distribution and status

The brown bear is the largest predator in Romania. Its range is directly connected to the large forests that cover the Carpathian mountains. Historically, a great number of bears occupied the forests that covered Romania. However, in 1940, a population of only about 1,000 bears was estimated. After World War II, human pressures caused the numbers of bears to decrease. In 1950, a population evaluation showed 860 individuals. From 1950, bear numbers increased as a reflection of various management measures which had been taken (Table 6.10). The greatest number was reached in 1988 when the

| Table 6.10. The increase of bear range and population in Romania. | | |
|--|---------------------|-------------|
| Forest land (km²) | Bear numbers | Year |
| 21,000 | 2,000 | 1955 |
| 26,000 | 3,000 | 1960 |
| 29,000 | 3,800 | 1965 |
| 30,000 | 4,200 | 1970 |
| 31,000 | 3,850 | 1975 |
| 35,000 | 6,000 | 1980 |
| 36,000 | 6,000 | 1985 |
| 38,000 | 7,400 | 1990 |
| 38,500 | 6,600 | 1993 |

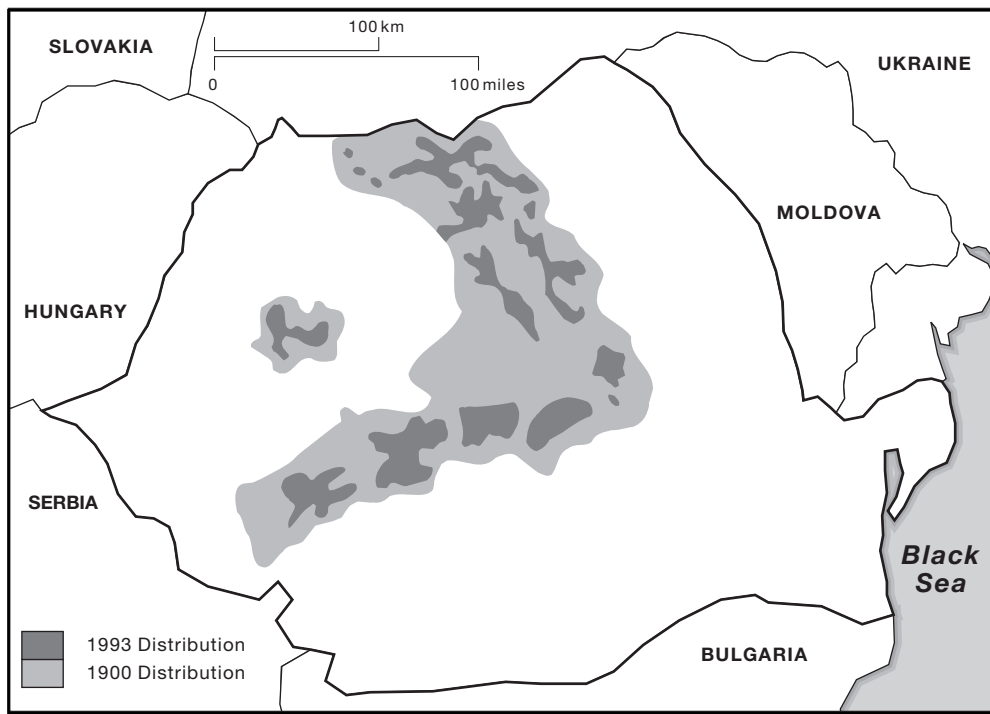


Figure 6.14. Present distribution of the brown bear (*Ursus arctos*) in Romania, 1993.

population was estimated to number 7,780 individuals. The latest evaluation of the bears in the spring of 1993 showed that 6,600 are present in 585 hunting areas with a forest surface greater than 38,500km² (Figure 6.14).

Aggressive stance of a mid-sized male brown bear (*Ursus arctos*), Romania.



Peter Weber

Management

The increasing number of bears created a need to establish a scientific basis for bear management in Romania. To accomplish this, it was necessary to establish areas that offered good conditions for bears, and that supported optimum numbers of bears within each hunting area. Researchers from the Forest Research and Management Institute Wildlife Laboratory created a key to define the suitability of an area for bear habitat. This key contained three categories of factors: a) abiotic factors such as altitude, relief, snow pack, and water; b) biotic and managerial factors like forest size, age class, species, thickness, utilization of browse by game, presence of orchards, and supplementary food; and c) human activity such as grazing, pesticides, forest harvest, and public attitude.

The analysis of hunting areas was done in collaboration with specialists involved in game management from forest units and hunting associations. The result was that 426 hunting areas comprising 31,000km² were selected as good bear habitat. It was possible to take measures to encourage bear populations because forest and game management in Romania were carried out in concert. The fruits of forest trees and shrubs play an important role in the bear's diet. The decision of silviculturists to maintain the natural composition of the forest offered a good basis for the diet of the bear. Also, the management of herbivorous prey species (red deer, roe deer, and wild boar) for increased populations assured that more food would be available for bears. In 1960, when populations were estimated, roe deer numbered 85,000, red deer 14,000, and wild boar 16,000.



Two brown bears (*Ursus arctos*) in Romania, probably three-year-old brothers.

Peter Weber

At the same time, wolf populations were estimated at 3,100 individuals. Wolves are the only predators that can coexist and sometimes prey on bears, but in that period wolves were considered a pest and were destroyed by all means. In 1988 when the bear population was the largest it had been since World War II (7,780), the herbivore population was 177,000 roe deer, 42,000 red deer, and 44,000 wild boar, while the wolves numbered only 1,900. Increases in livestock and expansion of the grazing system have given bears more opportunities to attack domestic animals, especially when livestock is not supervised while grazing in the forest.

Adequate cover is also important to bear survival. Bears prefer young, thick forests during the summer, and generally den in hilly areas during winter. Silviculturalists have taken special measures to protect areas in which dens are known to exist. Other measures aimed at protection have included: 1) barring gypsies from keeping bears in captivity (1960); 2) reduction of poaching; 3) limiting the harvest to those bears who greatly damage livestock; 4) permitting hunting only with a special license between March 15 and May 15, and between September 1 and December 31, to protect females with cubs; and 4) supplementary food which was made available in the spring and autumn between 1973–1975.

Repopulation of bear habitat has been attempted by capturing cubs at three, four, or five months old, and releasing them in the wild at about 16 months of age. This program began in 1974 with 42 cubs, and continued with 43 cubs in 1975, 42 in 1976, 29 in 1977, and 36 in 1978. It was not a great success. During the period in which the cubs stayed in captivity, they became conditioned to human

food and presence. Better results were obtained by repopulation with adults. However, when the density of bears increased, they occupied all suitable habitats and even some which were not considered suitable.

Human-bear interactions

Even as bear population density has decreased, the range has consistently increased. Beginning in 1978, as a result of protection measures, the total bear population exceeded the number considered to be optimum and spread out of its core range. This large density of bears created conflicts with farmers. Because every adult bear has its own territory, those individuals which are weaker are pushed to the edges of the range, and are obliged to find food in improper places. Overpopulation created great concentrations of bears and great damages to orchards. Young bears and females with cubs appeared near towns and obtained food from garbage. Others attacked farms at the edges of mountain villages trying to take domestic animals. Also, herds grazing in alpine meadows, mountain forests, bee gardens, and agricultural fields sustained some damages from bears. Compensation for these depredations are paid by a state insurance system and by the owners of hunting rights.

These large concentrations, which occurred in autumn and at the feeding stations, favored the spread of parasites in the bear population. Analyses of 323 bears between 1990 and 1993 revealed that 15% were infested with *Trichinella spiralis*. Other parasites present included *Toxascaris transfuga*, and the very rare *Dicrocoelium lanceolatum*.

Table 6.11. Brown bear populations in Romania by district.

| District | Hunting areas | Optimum population | Actual population | Annual harvest |
|---------------------|---------------|--------------------|-------------------|----------------|
| Alba-Iulia | 30 | 104 | 121 | 2 |
| Arad | 4 | - | 14 | - |
| Bacau | 20 | 185 | 192 | 12 |
| Baia Mare | 46 | 257 | 335 | 12 |
| Bistrita Nasaud | 31 | 235 | 257 | 14 |
| Brasov | 43 | 306 | 329 | 6 |
| Buzau | 17 | 280 | 342 | 4 |
| Cluj | 11 | 100 | 101 | 2 |
| Deva | 39 | 285 | 397 | 17 |
| Drobeta Tr. Severin | 6 | 20 | 37 | - |
| Focsani | 24 | 222 | 436 | 26 |
| Miercurea Ciuc | 48 | 425 | 794 | 62 |
| Oradea | 6 | 10 | 37 | - |
| Piatra Neamt | 29 | 215 | 166 | 2 |
| Pitesti | 22 | 265 | 335 | 12 |
| Ploiesti | 19 | 190 | 296 | 16 |
| Resita | 26 | 145 | 184 | 1 |
| Rimnicu Vilcea | 22 | 235 | 223 | 6 |
| Satu Mare | 4 | 15 | 14 | - |
| Sfintu Gheorghe | 29 | 400 | 600 | 55 |
| Sibiu | 33 | 155 | 234 | 6 |
| Suceava | 48 | 404 | 266 | - |
| Tirgoviste | 3 | 20 | 43 | - |
| Tirgu Jiu | 15 | 145 | 158 | 4 |
| Tirgu Mures | 40 | 250 | 425 | 40 |
| Zalau | 1 | - | 1 | - |
| Total | 616 | 4,868 | 6,337 | 299 |

Table 6.12. Brown bear population and harvest numbers in Romania by year.

| Year | Population | Harvest | Year | Population | Harvest |
|------|------------|---------|------|------------|---------|
| 1940 | 1,000 | 38 | 1973 | 3,690 | 177 |
| 1950 | 860 | - | 1974 | 3,761 | 203 |
| 1952 | 1,500 | - | 1975 | 3,834 | 65 |
| 1953 | 1,650 | - | 1976 | 4,269 | 89 |
| 1954 | 2,000 | 40 | 1977 | 4,609 | 58 |
| 1955 | 2,400 | 40 | 1978 | 5,204 | 84 |
| 1956 | 2,500 | 45 | 1979 | 5,681 | 42 |
| 1957 | 3,060 | 51 | 1980 | 6,014 | 66 |
| 1958 | 3,065 | 49 | 1981 | 6,260 | 53 |
| 1959 | 3,079 | 84 | 1982 | 6,342 | 36 |
| 1960 | 3,300 | 24 | 1983 | 6,534 | 74 |
| 1961 | 3,400 | 50 | 1984 | 6,713 | 59 |
| 1962 | 3,510 | 43 | 1985 | 6,837 | 68 |
| 1963 | 3,596 | 84 | 1986 | 6,974 | 70 |
| 1964 | 3,783 | 36 | 1987 | 7,253 | 51 |
| 1965 | 4,014 | 98 | 1988 | 7,780 | 63 |
| 1966 | 4,014 | 109 | 1989 | 7,770 | 131 |
| 1967 | 4,260 | 140 | 1990 | 7,422 | 164 |
| 1968 | 4,600 | 67 | 1991 | 6,880 | 288 |
| 1969 | 4,700 | 275 | 1992 | 6,653 | 299 |
| 1970 | 4,205 | 122 | 1993 | 6,337 | - |
| 1971 | 3,962 | 187 | | | |

Conservation recommendations

After comparing the actual population numbers with optimum population numbers (Table 6.11), we know that the hunting of bears can and must be allowed in certain districts. These districts include Maramures, Mures, Harghita, Covasna, Bacau, Buzau, Prahova, Brasov, Arges, Sibiu, and Hunedoara.

If hunting helps to manage bear populations at the existing level, then hunting and bear existence in Romania are indeed compatible.

Status and management of the brown bear in Russia

See Chapter 7, Brown Bear Conservation Action Plan for Asia, pages 136–143.

Status and management of the brown bear in Slovakia

Pavel Hell and Slavomír Find'ó

Introduction

This report provides basic information on the brown bear population in the former Czech and Slovak Federal Republic (CSFR). The brown bear in Bohemia became extinct in the last century, therefore we describe only the situation in the Slovak Republic where the number of this species is higher than at any time in the past 100 years.

Historic range and current distribution

In the 17th century, the brown bear became a rare species in Bohemia. In the 19th century according to Kokeš (ex Hell and Sládek 1974), only seven bears were shot by hunters. The last brown bear to be shot in Bohemia was shot in 1856. This specimen inhabited Švarcenberg forests and had been living there for 15 years as a lone animal. According to Čabart (ex Hell and Sládek 1974), traces of the last Bohemian bear were found on February 24, 1864. Later on, this bear was killed by a poacher near the Volary village. In Moravia and Silesia the bear had been decimated, and around the 1600s, the last refuge became the Hrubý Jeseník Mountains. However, in the 18th century the bear became a rare species in this refuge and the last specimen was killed in 1790. The last bear in the Bohemian-Moravian highland (hunting area Předín) was killed in 1717. In the Moravian-Silesian Beskydy Mountains, the bear survived almost 100 years longer. The rest of the bear population in this region was exterminated between 1876 and 1887 near the villages Roznov, Morávka, and Ostravice. The last

surviving bear in the Ostravice hunting area was recorded in 1908.

In Slovakia, the bear became extinct at the end of the 19th century only in the Bratislava district (Ortvay ex Hell and Sládek 1974). According to Matlekovits (ex Hell and Sládek 1974), from 1885–1894 no bears were hunted in the following districts: Tekov, Komárno, Hont, and Novohrad. In the same period, the annual harvest of bears by district were as follows: Nitra 1, Trenčín 4, Orava 4, Turiec 3, Liptov 10, Zvolen 7, Gemer-Malohont 4, Spiš 4, Zemplín 1, Abov-Turňa 2, and Užhorod 4 (including part of the so-called “forested Carpathians” of the Ruthenia-Ukraine). From 1885–1894 the mean annual harvest in Slovakia was approximately 42 individuals (Hell and Sládek 1974). At the beginning of this century, the bear in Slovakia was still abundant (Pazlavský ex Hell and Sládek 1974). However, by World War I, only 120 bears survived in Slovakia.

This rapid decrease in bear numbers was caused by persecution, aimed at eliminating damage to beehives and domestic animals, as well as by sport hunting pressure. For example, in 1901 the Count Andrásy’s forest personnel in Gemer forests estimated bear numbers at 46 individuals. Of these, the mean annual harvest was 20 individuals, and 11 were once killed in a day! On the other hand, the feudal owners of large properties attempted to maintain their bear populations, so as not to lose the gentlemen’s amusement. In 1905 near the Pol’ana Mountains, Habsburg Prince Frederick liberated two males and four females imported from Transylvania to reinforce native bear populations. Unfortunately, the fate of these animals is unknown. In the Javorina hunting ground (The High Tatras), Prince Christian Kraft Hohenlohe-Oehringen provided supplementary food for bears to maintain and increase their numbers.

In spite of decimated numbers, bears were intensively hunted after World War I. Annual harvests between 1927–1929 were 19, 12, and 11 bears respectively. In 1928, bear numbers were estimated to be only 30–40 individuals (Hell and Sládek 1974) and in 1932, estimates decreased to 20 individuals. According to other authors this number was underestimated by at least 50%. Since 1933, the bear has become a protected species throughout the year, although this regulation is applied only to hunters and not to land owners.

Due to this protection, the numbers of bear in Slovakia rebounded and many parts of the previous range have been re-established. According to Turček (ex Hell and Sládek 1974), in Slovakia after World War II, there were 50–80 bears, and by 1953 this number had increased to 200 (Feriancová ex Hell and Sládek 1974). Between 1966 and 1968, Škultéty and Randík (ex Hell and Sládek 1974) estimated bear numbers at 320 individuals. The core area of bear distribution is in the central part of the Western Carpathians (Figure 6.15). At that time in Eastern Slovakia,

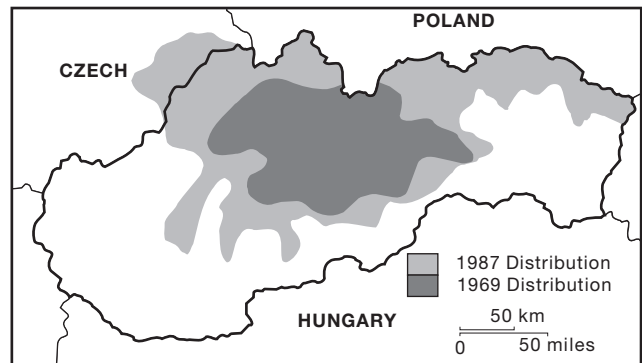


Figure 6.15. Distribution of the brown bear (*Ursus arctos*) in the western Carpathians, Slovakia, 1969 and 1987.

the bear did not occur, therefore the Western Carpathian population became isolated from the eastern population situated in Sub-Carpathian Ukraine and the Transylvanian Alps in Romania.

The present distribution of bears in Slovakia is given in Figure 6.15. The range covers the major part of the Western Carpathians with the exception of the southernmost and westernmost parts. At present the Slovak bear population is not isolated from its eastern counterpart as it was 20 years ago. A connection of the Slovak, Ukrainian, and Romanian populations has been recently recorded. The occurrence of bears in eastern Slovakia has been more frequent in recent years, further demonstrating the conjunction of populations, including a small one in Poland.

Status

The number of bears in the Slovak Carpathians has increased rapidly in the second part of the 20th century. According to official hunting statistics, in 1969 there were about 381 bears in Slovakia (Anon. 1969). By 1992 this number had increased to 954 individuals. This number is probably overestimated due to duplications in counting. Wildlife experts estimate about 25% fewer, or 700 bears. We notice that the population is still increasing although the bear is intensively hunted in Slovakia. Problems associated with this rapid increase will be discussed later. The optimal number of bears in Slovakia is considered to be 450 individuals.

As a result of the growing population in Slovakia, the number of bears in the neighboring northern part of the Western Carpathians in Poland had increased to 90 animals (Jakubiec 1987), but has recently decreased to 70 bears due to increased hunting in Slovakia (Jakubiec pers. comm.).

The total territory of bears in the former CSFR, including the transitionally inhabited zones, covers 13,000km², of which the core area covers 10,000km². Assuming a total population of 700–900 bears, the mean population density is 0.54–0.69 (core area) or 0.70–0.90 (total range) individuals per 10km².

Legal status

In the past, the bear had no legal protection in the territory of the former CSFR. On the contrary, bounties were paid for hunting to prevent damage to livestock, beehives, oats, and fruit trees, as well as to prevent direct conflicts with humans. Bears were also hunted for their skin, meat, fat, and bile to which curative effects had been attributed. According to Hošek (ex Hell and Sládek 1974), the bear was considered one of the most harmful species in Bohemia. The bounty for killing a bear in the 18th century varied within individual estates at around 7 gold coins, the same sum being paid for fur.

According to Josephine's hunting order (1738), bears could be killed by any person using any means. A similar allowance was made in the Provincial hunting law (1883) for Slovakia, which continued with certain changes until the enactment of the State hunting law No. 225 in 1947. This law, and the later Law No. 23 of 1962 designates the bear as protected "harmful game", with the state paying compensation for all damages caused to beehives and domestic animals. The poisoning of any animals is forbidden in both republics, further reducing the mortality pressure on the bear. In the Decree of the Slovak National Council No. 125:1965 on the protection of wildlife, the bear is designated a strictly protected species. The penalty for its illegal killing in 1972 in Slovakia was 15,000 Crowns with the possibility of a change in the base penalty by 100 to 300%. In the Czech Republic, the penalty is 40,000 Crowns. In the Red Book of Endangered Species of Plants and Animals of the Czechoslovak Republic, the brown bear is listed as a rare species.

Population threats

At present the greatest pressure on the bear population is due to intensive hunting. Illegal shooting of bears has been very rare but may increase in the future in response to a decreased standard of living, increased unemployment, and an increased crime rate. Occasionally, bears are killed by accident or in self-defense (e.g. at night or in twilight, mistaken as a wild boar). Because damage caused by bears to beehives and livestock is compensated, there is no reason for wilful and illegal killing of bears by injured parties. Sometimes bears are killed by trains, but accidents with other vehicles have not been registered.

Habitat threats

Bears are found most frequently in fir-beech, spruce-beech-fir, and spruce forests at altitudes between 700 and 1,250m. Bears also seek acorns, beech nuts, field crops, and other foods in beech-oak forests at lower elevations.

The best territories for bears are large and continuous forest areas. The construction of forest roads and skidding lines, as well as various human habitations can bring bears and people into conflict. Forests cover 40% of total territory of Slovakia and this percentage has stayed stable due to reforestation. This trend will probably continue. The construction of highways in mountainous areas has been limited due to lack of finances.

The construction of weekend houses and hotels, which can lead to habituated bears, has been limited. The constructions of skidding trails has similarly declined, but the network that remains creates two problems for bears. First, the roads allow access for people picking forest fruits, especially raspberries, bilberries and cowberries. Even in the most remote places of the Carpathians, this access can significantly decrease the food base of the bear. Increasing unemployment and great interest of buyers may continue to spur this activity.

Bear habitat quality has been gradually worsening, and this process will certainly accelerate after the end of the present recession and the new economic development that will follow. Information concerning relationships between bears and other wildlife species is not available.

Management

Although the bear in Slovakia is a protected game species throughout the year, the increase in numbers and resulting damage to agriculture necessitated hunting beginning in 1962. In the beginning, the optimum harvest number was estimated to equal 5% of the total population, but soon it appeared that from the increase of bears in the Slovak Carpathians that the population was substantially higher. Bear numbers increased very quickly, making it necessary to increase the target harvest percentage.

During the first three years of the hunting period, an average of 3.67 bears were taken annually, but by the 1989–1991 period, the average had increased to 60.67, a 16.5-fold increase. The total number of bears hunted in Slovakia between 1962 and 1991 was an unbelievable 806. The addition of illegal and accidental kills would further increase the total human-caused bear mortality rate.

Large numbers of bears are hunted by foreigners who pay a fee that helps compensate people for damages caused by bears. A smaller number of bears are hunted by native hunters paying a lower fee. Only a small part of the total harvest is comprised of control shooting of dangerous and problem habituated bears. In spring, the use of animal or plant baits to attract and shoot bears is common. Recently molasses feed has been popular, especially in the areas with high occurrences of problem bears. With the exception of problem bears, hunting is limited to the borders of the range.

In the past, trophy hunting for large, old males affected the age and sex structure of the population. Therefore, hunting of bears larger than 150kg has been strongly limited and recently completely forbidden. The approval of bear hunting plans for individual hunting grounds and specification as to weight allowed is carried out by the Professional Commission of the Ministry of Agriculture, which issues special permits for hunting based on an agreement with the Ministry of Environment.

These regulations have affected both sex and age ratios. Hell and Sabadoš (in press) report an increase in sex ratios of bears harvested from 0.30 between 1980–1982 to 0.93 between 1989–1991. Mean weight of hunted bears decreased from 142.5kg during the years 1980–1982 to 101.8kg during the years 1989–1991. The representation of harvested individuals with the front foot wider than 15cm decreased from 35.2% during the years 1980–1982, to 12.9% during the years 1989–1991. The average annual harvest during the years 1980–1991 per 100km² of the bear area was 0.48 individuals.

The harvest regulations should continue to allow an increase in the percentage of older, large males and females in the population. The greatest problem is still the determination of the optimum sustainable harvest number. Up to now, game surveys have been carried out by forest administrations and forest enterprises through the mediation of the State Forests but also directly on individual hunting grounds through the mediation of state administration. Therefore, in our opinion it results in numerous duplications. With the present reprivatization of a large part of the forests, it will be even more complicated. The success of encouraging hunters and foresters to measure and note bear sign, which will be helpful in eliminating the duplicate counting of individuals, is not guaranteed.

Human-bear interactions

In the Slovak Carpathians, bears prey on livestock, especially on sheep in mountain meadows. They attack sheep mainly at night in the sheep-folds. The lack of preventive measures, such as guard dogs, convenient alarms and scare devices, and carelessness of shepherds contributes to the problem. Electric fences have been used successfully, but the mobile nature of sheep herding limits their application. Depredation of cattle occurs very rarely and is more frequent on the Polish side (Jakubiec 1987). Bears damage beehives, as they are often placed in the middle of bear habitat. Electric fences have been used successfully, but this equipment is expensive and requires regular checking that amateur bee farmers cannot afford. Damages to domestic animals and beehives reach 0.75–1.0 million Slovak Crowns (US\$20,500–27,000) annually.

Bears also damage fruit trees (breaking off branches), especially plum trees, and crops of oats

(*Avena* spp.). This damage is not significant and is not compensated.

Part of the bear population occurring in tourist areas is partially habituated to human garbage, and this often causes conflicts. This is a nuisance exacerbated by local inhabitants, cottage owners, and tourists who attract bears with various delicacies. Garbage containers are not closed properly or are not taken away frequently enough to prevent access by bears.

Nearly every year, individual cases of direct confrontations between bears and humans occur (Hell and Bevilaqua 1988), sometimes involving serious injuries to people, but more often the death of the bear. These conflicts occur mostly with hunters, beekeepers, people picking forest fruits, foresters, and tourists. Surprisingly, no person has been killed by a bear during this century in the Slovak Carpathians.

Damage caused by bears to ungulate game is tolerable and substantially lower than that caused by wolf and lynx. However, hunters often complain of the presence and activity of bears during the red deer rut.

Public education needs

Slovak citizens generally accept the presence of bears and therefore special educational activities from this point of view are not necessary at present. Most complaints come from private apiarists, and to a lesser degree from shepherds employed mostly by agricultural cooperatives. This problem will become more serious after reprivatization of forest and agriculture land. If the state does not compensate for damage caused by bears due to lack of finances, the situation for the bear will rapidly worsen. A more intensive educational program will be needed to prevent damage by bears, as well as to teach forest visitors about appropriate behavior in bear territory.

Specific conservation recommendations

1. Improving the population monitoring used for management so that favorable numbers, sex ratios, and age structures can be maintained.
2. Killing only problematic, habituated individuals.
3. With the privatization of hunting grounds, it will be necessary to increase the state supervision of the management of bear populations.
4. Limiting the hunting of bears near the borders of their range.
5. Cooperating closely with Polish authorities and possibly also with Ukraine (Sub-Carpathian Ukraine) in conservation and management of bears.
6. Ensuring further compensation for damages caused by bears.

7. Supporting the introduction of complex biological and technical damage control measures.
8. Improving the management of habitats and important food sources for bears, designating certain localities rich in forest fruits inaccessible to the public.
9. Publishing information for visitors in bear areas, giving guidelines on appropriate behaviour on close range encounters.
10. Continuing scientific studies of bears in the Western Carpathians (including radio tracking etc.), and supporting it with both ideological and financial support of international conservation organizations.

Status and management of the brown bear in eastern and western Cantabria, Spain

Anthony P. Clevenger and Francisco J. Purroy (eastern)
 Javier Naves Cienfuegos and Carlos Nores Quesada (western)

Historic range

Brown bears were once found throughout the entire Iberian Peninsula. Their presence was documented as far south as Andalusia in the 14th century (Alfonso XI 1976). During the 16th century bears disappeared from the southern third of the Iberian Peninsula, while in the 17th century they were only found in the northern half of the country. A break between the Cantabrian and Pyrenean bear ranges took place between the 17th and 18th centuries (Nores 1988; Nores and Naves 1993). In the north, the last bears

in the Basque Country were killed in Altamira and Urgoiti (Alava) around 1830 (Nores 1988).

At the beginning of the 19th century brown bears were found in just the Pyrenees and Cantabrian Mountains, occurring over 8,000 and 14,000km² respectively. At the beginning of the 20th century the western and eastern limits of the Pyrenean population were nearly the same as in the previous century; the southern limit receded towards the mountains, so that the Spanish occupied area shrank considerably. The population decrease was less severe in the Cantabrian Mountains, as bears lived in an area of about 9,200km².

Cantabrian bear distribution during the mid-1800s is compared with the present range in Figure 6.16. The earliest demographic information on the bear population in the five Cantabrian provinces was obtained from the geographic studies conducted by Madoz (1843) between 1833 and 1843. The data are not complete, as some villages historically associated with bear activity and folklore did not record bears as part of the local fauna for some reason. Nonetheless, the data do provide a general outline of the bear range during the middle part of the last century.

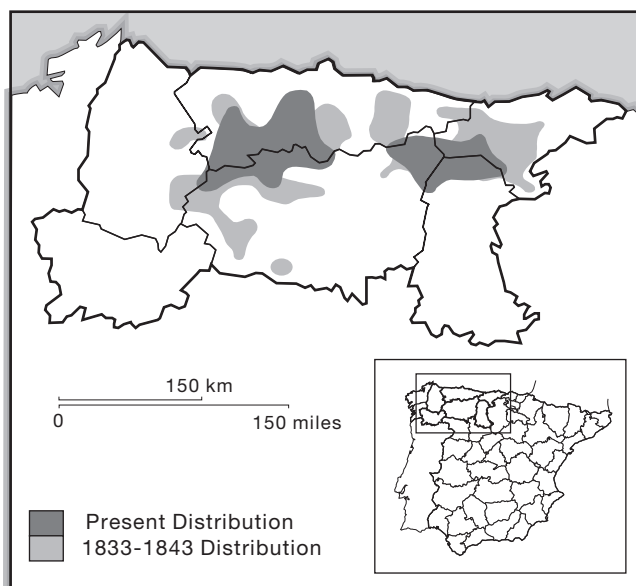
The range area reduction which took place during the 19th century corresponded with a decline in bear numbers. The Asturian bear population went from 400 bears during the first decade of the 1800s to slightly more than 100 bears in the 1900s, before hunting bounties were removed (Nores 1993). The consequence of this reduction in brown bear range and number has resulted in the present isolation of the Pyrenean population and the near extinction of their presence on the Spanish slope (Caussimont *et al.* 1993; Alonso and Toldra 1993).

Reductions in range during the last 150 years are most notable in two broad geographical areas: 1) eastern Asturias and southern Cantabria, and 2) southwestern Leon. Loss of habitat and continued uncontrolled hunting of bears are factors that best explain shrinking bear range during this period. The industrialization of the Cantabrian coast and its accompanying rise in human population beginning in the 1920s resulted in the cutting of nearby lowland deciduous forests. At the same time, exploitation for coal turned into large-scale operations in Asturias, with many of the mines being situated in the core of the bears' range. In southern Leon, as in the northern provinces, hunting and frequent use of strychnine and other poisons to reduce livestock damage by predators were the factors generally responsible for the bears' disappearance.

The current brown bear distribution in Spain occupies about 45% of that existing at the beginning of the century. In the Cantabrian Mountains in northern Spain, bears disappeared from the eastern part of Asturias and most of Cantabria between 1930 and 1950, producing the separation of the two groups which presently remains.

This population represents one of the last strongholds of Eurasian brown bears in southern Europe and is one of

Figure 6.16. Historic (Madoz 1843) and present brown bear (*Ursus arctos*) distribution in the Cantabrian Mountains, Spain.



the largest of the four remnant populations surviving there. The population is divided and distributed over an area of approximately 5,500km² with both subpopulations roughly equal in area (Clevenger *et al.* 1987; Servheen 1990; Clevenger and Purroy 1991a). The Eastern and Western nuclei are separated by approximately 50km of mountainous terrain. Many large and small coal mining operations occupy the northern portion of the uninhabited area between the groups, while the southern part is characterized by open, low-shrub vegetation of heath (*Erica* spp.) and Spanish broom (*Cytisus*, *Genista* spp.). The Cantabrian population was believed to have separated at the beginning of this century (Nores 1988), and today it is unlikely that any interchange between the two occurs. Throughout their distribution, bears and their habitat are threatened as illegal hunting continues and development fragments their range.

Legal Status

Bear hunting has been encouraged by countrymen and rewarded by the government of Spain since early times. Bounties were awarded for bear hunting as early as the 16th century. During the first decade of the 19th century, 60 bears were hunted annually in Asturias. Harvests decreased to one third of this total seven decades later. In some municipalities, more than three bears were killed/100km²/year (Nores 1993).

The exact date when bear persecution stopped is unknown, but at the end of the 19th century rewards for killing bears did not exist. Although livestock owners were responsible for local extinction of the species, during the second half of the 20th century sport hunters demanded the implementation of a closed season. This pressure prompted certain restrictive measures to be taken. Hunting was prohibited in the Cantabria province in 1949, and in 1952 the prohibition spread all over Spanish territory, lasting for a period of five years. Since 1955, the creation of the National Hunting Reserve System has helped reduce illegal bear hunting within the western bear area in the Cantabrian Mountains.

Comprehensive protection for the brown bear in Spain came after the national government passed a “temporary” law in 1967, which prohibited the hunting or harassment of bears, only two years after the last bear was legally killed. This law was intended to curtail hunting until a decision could be made concerning the population status and measures could be taken to insure the species’ continued survival. Nevertheless, in 1968, with limited economic compensation for the damages caused by bears and opposition to the new protective measures, 11 bears were killed by poachers in Asturias (Notario 1970).

Several years later, the Protected Species law was passed by the Spanish government on October 5, 1973,

and the brown bear formally became a protected species. The new law prohibited hunting, trapping, possessing, and commercially exploiting the animal, and fines were established for anyone violating the law. In 1980, the Protected Species law was adapted to the new government and constitution (post-dictatorship), and the brown bear was placed on the “strictly protected” species list (Real Decreto 3181/1980).

The passing of the Conservation of Natural Spaces and Wild Flora and Fauna law on March 27, 1989 required all Autonomous Communities to begin taking action and implementing measures to conserve endangered species (including the Cantabrian Brown Bear) and their habitat. Since 1989, governments from the four Autonomous Communities within the Cantabrian bear range (Asturias, Cantabria, Castile-Leon, and Galicia) approved special decrees for the conservation of the brown bear which included their respective recovery plans. The objectives of the four recovery plans are the same, and their conservation actions vary slightly among the different Autonomous Communities. The following types of actions are found in the four recovery plans: direct protection, habitat conservation, socio-economic considerations, research and monitoring, public education, and cross-community cooperation.

The National Catalogue of Threatened Species was established by the Royal Decree 439/1990, dated 30 March, 1990. In this Catalogue, the Spanish brown bear was considered a species “in danger of extinction”.

Eastern Cantabrian subpopulation

Current distribution

The Eastern nucleus, (Figure 6.16) is found within four provinces (Asturias, Cantabria, Leon, and Palencia) representing three separate Autonomous Communities (Asturias, Cantabria, and Castile-Leon). The range extends from Campoo de Suso (Cantabria) in the east to Valdeteja (Leon) in the west. North-south boundaries are defined by the Asturian mountains of Ponga and the pine plantations of Rio Camba (Leon).

The bear population is found primarily in the provinces of Leon and Palencia. Two basic core areas exist, one in the Fuentes Carrionas National Hunting Reserve (NHR) (Palencia) located in the upper Pisuerga River (La Pernia, Los Redondos, Castillera, and Sierra del Brezo) and another in the Riano NHR (Burón, Casasuertes, Hormas, Lechada, and Barniedo). A travel corridor between both areas runs from the hardwood forests of Lebanza and Resoba passing along upper part of the Carrion River (Cardano de Arriba, Valdenievas, and Valcerezco) and connects with the upper Valponguero valley along the southeastern edge of the Riano NHR.

In Cantabria, bears most commonly occur in the headwaters of the Deva River situated between Cosgaya and Salvaron Pass. The Remona Pass and Pineda-Sierras Albas divide are the most commonly travelled passes connecting with the Valdeon valley (Leon) and La Pernia (Palencia), respectively. On the northwestern edge of this nucleus, bears are found in the Asturian Sierra de Carangas and Cordal de Ponga.

Status

In the last 30 years, eight population estimates have been published for Eastern Cantabrian brown bears (Table 6.13). Most studies relied heavily on questionnaires and interviews with NHR game wardens and local people living in the bears' range. In 1986, a survey was conducted to clarify two questions regarding Eastern nucleus demographics. The survey sought to determine whether the 1962–1983 population estimate data (see pre-1986 estimates in Table 6.13) represented the actual population trend (increasing), and whether Spain's Protected Species Law of 1973, which legally protected the bear, had been effective in at least maintaining their numbers and preventing any further decline of the population (Clevenger and Purroy 1991a). The population trend index indicated that overall, bears had decreased in numbers in the Cantabrian Mountains during the last 13 years, as both Eastern and Western nuclei had negative trend indices. According to the game wardens interviewed who were working in the Eastern nucleus, the causes for the bears' decline was primarily attributed to illegal hunting and high human activity in the bears' range.

Thus, the Eastern Cantabrian population appears to be in a continuous and steady decline, however slight it may be, despite the protection afforded to brown bears in each of the three Autonomous Communities. The most recent population estimates put the Eastern nucleus at approximately 12–16 bears (Clevenger and Purroy 1991a). This figure was based on the estimated number of breeding

females in the nuclei (Servheen 1989) and was supported by other field data (Clevenger *et al.* 1992a). In the future, the mountain system separating Leon and Palencia provinces would most likely be the part of the nucleus to show a decline in bear numbers that would result in the division of the subpopulation.

Population threats

The greatest threat to the Cantabrian bear's survival is from illegal hunting throughout its entire range (Brana *et al.* 1979; Garzon *et al.* 1980; Clevenger and Purroy 1991a,b). In the Eastern nucleus during the last 11 years, five bears are known to have died from human-related causes, including three males, one female, and one of unknown sex. Strychnine poisoning caused the death of an old female in 1982, a 7-year old male in 1984, and an old (≥ 20 -years old) male in 1990. Two bears were shot by poachers in 1987 and 1988; one was a nine year old male, while age and sex of the others was unknown.

Unlike the Western nucleus, bears run little risk of being trapped in snares, as this type of activity is not commonly carried out in the Eastern part of their range. The most common cause of death is by accidental or intentional shooting during large game drives, and poisoning from strychnine-laced baits set out by livestock owners for wolves (*Canis lupus*). Livestock predation by bears in the Eastern nucleus is insignificant (Clevenger and Purroy 1991b) and the few losses annually caused by bears are compensated quickly and effectively by the respective Autonomous Communities. However, the delayed government reimbursements made to farmers who have lost livestock to wolf predation or have had hayfields uprooted by wild boars (*Sus scrofa*) force them to take the law into their own hands. This activity is threatening to the bear's survival in the Eastern nucleus and the entire Cantabrian range.

Cantabrian bears are also being killed by and for trophy hunters in search of this rare Spanish carnivore. There is evidence indicating that organized poachers operate in the Cantabrian Mountains and take clients out on furtive hunts in areas outside of the NHRs. Similarly, some mountain people actively engage in poaching bears and selling their hides or heads to interested parties, all of whom are willing to pay high prices for the illegally taken material.

Within the Fuentes Carrionas NHR there are several "controlled" hunting reserves which are leased by the village councils to private hunting groups. Game wardens from the NHR's do not have jurisdiction in the private reserves as the private groups hire their own wardens to carry out this function. Often the private wardens are absent or consent to illegal hunting in the reserves, and reports of bear poaching and harassment within them are common.

Table 6.13. Population estimates for the brown bear (*Ursus arctos*) in the eastern nucleus of the Cantabrian Mountains, Spain.

| Author(s) | Estimate |
|-----------------------------|----------|
| Notario 1964 | 16 |
| Notario 1970 | 10 |
| Brana <i>et al.</i> 1979 | 12 |
| Garzon <i>et al.</i> 1980 | 16 |
| Notario 1980 | 17 |
| Campo <i>et al.</i> 1984(a) | 35 |
| Campo <i>et al.</i> 1984(b) | 39 |
| Clevenger and Purroy 1991a | 14 |
| (a) 1982 estimate. | |
| (b) 1983 estimate. | |

Habitat threats

Studies investigating bear-habitat relationships in the Cantabrian Mountains have only been carried out in the Eastern nucleus (Clevenger 1990; Clevenger *et al.* 1992b). Cantabrian bears prefer native beech (*Fagus sylvaticus*) and oak (*Quercus* spp.) forests, and have a greater tendency to use habitat situated further from villages and roadways than would be expected by chance. The high level of human presence and the fragmented nature of bear habitat in the Eastern nucleus is of important concern as concerted efforts will need to be made to protect and restore critical travel corridors to avoid extinction.

During the last 50 years, many large-scale reservoirs (30–70km²) have been constructed in the Cantabrian Mountains and in core areas of the bears' range. Although they are situated in open lowland habitats rarely used by bears, some reservoirs may act as barriers to bear movements, requiring that they travel around the barriers and contact suboptimal habitats which will make them more vulnerable to human persecution or harassment. Road building and construction associated with reservoirs is believed to affect bear movements and behavior although it has not been documented in this population (Mattson *et al.* 1987; McLellan and Shackleton 1988). Presently, in the Eastern nucleus there are six large-scale reservoirs located within the brown bears' range. Another was scheduled to be constructed in the Palencian valley of Vidrieros in 1994. However, due to public opposition and the negative impact it would have had on the Eastern bear population it was abandoned by the Spanish government for the time being. The construction of the Vidrieros dam, situated on an important travel corridor between two core areas within the Eastern nucleus, would likely have further fragmented the bears' habitat, degraded habitat quality, and begun isolating the two main areas of bear activity.

At the moment there are tentative plans to build a winter ski resort in the Riano NHR. The resort will be privately owned and operated, but will need the authorization of the Castile-Leon Autonomous Community before the project is approved and construction begins. The location of the proposed ski area in the Naranco and Lechada valleys is not optimal bear habitat, consisting mainly of subalpine grazing lands. However, the area is of critical importance because it is also a travel corridor between the Leon and Palencia core areas. Bears frequent the area mostly during summer and travel through it practically year-round. As many as three bears have been observed in the Naranco Valley recently, all of which used the area for breeding activities (Clevenger *et al.* 1992a). Development in the Naranco-Lechada valleys will similarly erode the quality of bear habitat in the Eastern nucleus, as noted above, and will only result in expediting the extinction of this sector of the Cantabrian population.

Road construction is still a problem within the Eastern bears' range. Plans are being made to build a road connecting the villages of Corniero and Liegos within the Riano NHR. Both villages and the intervening area are located outside of the core bear area, but still receive a substantial amount of use, especially during autumn when bears frequently travel south to hard mast-producing areas like Pardomino Valley. Until now, the low human activity in this region facilitated bear travel between areas. The proposed road will most likely affect bear movements. Forest road construction is a serious problem in the Fuentes Carrionas NHR and the other core area of the Eastern nucleus. Road-building is spontaneous, is carried out with little regard for the local bear population, and is condoned by government resource agency officials.

Management

Management and conservation measures to conserve the Cantabrian brown bear population are part of the respective Autonomous Communities bear recovery plans. Five principal areas of management and conservation activity are described:

1. Application of legal measures which will guarantee the conservation of the bear's most important habitats;
2. Development of a forest management plan which will increase and conserve the amount of native deciduous forests;
3. Minimize the effects of forest roads and vehicles within the bear's habitat;
4. Regulate forms of tourism and recreation in bear areas that may affect their well-being;
5. Manage hunting activities in bear range so that their impacts will be minimum.

Each Autonomous Community is responsible for applying the measures and making sure that they are strictly adhered to. In the Eastern nucleus, only two of the five activities have been enacted. Several forest roads that entered into areas of critical bear habitat in the Riano NHR were closed (gated) to vehicular traffic. These measures were actually adopted in 1987, prior to the brown bear becoming a legally protected species in the Castile-Leon Autonomous Community and its recovery plan being prepared. There have been few, if any, road closures since official protection of the species. Nowhere else in the Eastern nucleus have forest roads been closed to protect important bear habitat.

Since 1990, the Autonomous Communities of Castile-Leon and Cantabria have begun to manage wild boar hunts so that they do not occur in valleys which are reported to be "important bear areas." These hunts begin in autumn and usually last through winter. No effort has been made to determine or monitor the effects of wild boar

hunting on the local bear population. The remaining three principal conservation activities (legal measures, forest management, and tourism management) have not been put into effect anywhere within the Eastern nucleus as of the time of the preparation of this report.

Human-bear interactions

Human interactions with bears in the Eastern nucleus are limited to agricultural damage: these are relatively few each year and are compensated quickly by the respective Autonomous Communities. In the Eastern nucleus, there are an average of 5–10 agricultural damage incidents per year, costing the governments on average some 50,000–250,000 pesetas (US\$400–1,800) annually. Attacks on livestock are the most common type of damage by bears, while attacks on beehives are less frequent (Clevenger and Purroy 1991b).

Public education needs

Educating the public about the plight of the Cantabrian brown bear population in the Eastern nucleus currently consists of: (1) presentations given to grammar school children living in the bear's range, and (2) educational efforts through brown bear interpretation centers. The Autonomous Communities administer the two public education programs. Local conservation groups are also active in making the public aware of the bears' situation through local campaigns which include audiovisual presentations and talks given by various people involved in bear conservation at the local, state, and national level. The public education program run by the Autonomous Communities needs to contact the adult population living in the bear's range, in addition to local school children and passing tourists at whom it is directing attention at the moment. Public talks should be organized in all county seats and important villages within bear range during the course of the year.

Specific conservation recommendations

1. Efforts should be made to include all of the Eastern Cantabrian bear range within the National Hunting Reserve system, or another type of public (natural reserve, regional park, etc.) or privately administered reserve. The objective of the reserves would be to provide protection for the bear by having trained personnel to effectively warden the area as well as prohibit or limit the amount of hunting activity occurring there. This could be accomplished by either buying the "open hunting" lands (*cotos libres*) belonging

to municipalities which border the Reserves, or by obtaining the lease on the "controlled hunting" (*caza controlada*) lands situated inside the NHRs when the multi-year lease on each expires. Areas to be targeted in this effort include: (a) Leon province: Prioro, Morgovejo, Valderrueda, Besande, Cremenés, Lois, Pardomino, and Rezero; (b) Palencia province: all controlled hunting areas within the Fuentes Carrionas NHR, Branosera, Barruello, and Sierra del Brezo.

2. Travel corridors need to be protected and restored within the Eastern Cantabrian bear range, and between the two isolated Cantabrian nuclei. Measures that may help to accomplish this objective include the following activities in the Eastern corridor areas: reforestation, road closures, reduced number of livestock and human activity, and renting upland pastures and woodlands in corridor areas. Areas to be targeted include: Lechada-Naranco valleys with Alto Carrion, Valpenguero with Valdenievas-Vidrieros, and Pardomino with Valdeburon via Primajas, Cornierno, Rezero, and Lois.
3. Reduce the forest road network in the Eastern Cantabrian bear range by closing or gating roads to unnecessary vehicle traffic.
4. Expedite the payment process for farmers affected by agricultural damages caused by wild boars and wolves in the bears' range. Start efforts to reduce the number of wild boars as they are direct competitors with brown bears for hard mast prior to denning.
5. Maintain long-term population trend monitoring work in the Eastern Cantabrian bear range (US\$5,000/year).
6. A supplemental feeding program should be planned and developed to guarantee the availability of food resources during years of hard mast failures or low food abundance (US\$5–7,000/year).
7. Develop a public education program designed to inform the people living in bear range about the situation of the species, its plight, and what efforts are being implemented to save the population from extinction (US\$25,000 /year).

Western Cantabrian subpopulation

Current distribution

The western Cantabrian population (Figure 6.16) covers an area of 2,600km² within three different Autonomous Communities: Galicia (65km²), Castilla and Leon (700km²) and Asturias (1,835km²) (Campo *et al.* 1984; Naves and Palomero 1993a). Within the western group, bears experience some range constrictions. The most important range constriction occurs near the Leitariegos mountain pass (Asturias/Leon), where a narrow 10km wide area joins the two subpopulations.

In Asturias during the last decade, there have been two cases of colonization of places where bears had not occurred in the 19th century (Marquinez *et al.* 1986; Nores 1988). Both colonizations took place after the 1950s, when the reduction of livestock activities improved the habitat for bears. Recently in the north of León, females with cubs have been observed. On the other hand, during the last decades, a considerable portion of the southeastern section of this population has suffered a population loss (Notario 1980) which is still taking place.

The wide-ranging nature of this species causes some cases of sporadic presence out of the limits of the distribution areas described before, even in far away places and those which are not considered as adequate bear habitat. Some places in the western and southern areas of this population are the most probable places where future range expansions might occur if conservation measures are properly enacted.

Status

Currently, the population estimate is around 50–65 bears (Palomero *et al.* 1993), taking into account that 10% of a healthy bear population is made up of females with cubs (Servheen 1989).

Population threats

One of the main short-term problems facing conservation of the Cantabrian brown bear is the difficulty in producing offspring to counterbalance losses due to poaching. If we also consider the small size of the Cantabrian populations, their future is quite uncertain. If we assume that demographic parameters of the Cantabrian bears are similar to those of North American populations, and therefore require similar minimum numbers for the continuance of populations (e.g. 70–90 bears in the case of the Grizzly Bear Recovery Plan of lower 48 United States) (Shaffer 1984; Knight and Eberhardt 1985; Allendorf *et al.* 1986), the present situation in the Cantabrian Mountains can be considered critical.

The isolation of the two populations of bears is particularly problematic. The recovery of a corridor between the populations allowing bear interchange would help overcome the threat of extinction in each population (Marquinez *et al.* 1986). Although methodologies have differed, recent studies describe a reduction in the number of adult females and a decrease in total population, apparently related to illegal hunting. In recent years 21 bears were killed in the western population, and it is probable that 12 more incidents occurred. The mortality rate included all age and sex classes (Palomero *et al.* 1993). Other authors report that from 1979 to 1981, 20–25 bears

were killed by poachers in the Cantabrian Mountains (Brana *et al.* 1982).

Illegal shooting with no specific purpose accounted for 54.5% of non-natural deaths of bears in the western population. In some cases, bears were also killed during the legal hunting seasons of other game species. Although no bear offspring mortalities have been reported during hunting drives for wild boar (*Sus scrofa*) in winter, bear appearances during these drives are common. This type of hunting is traditional in the Cantabrian Mountains and is frequently carried out within the territory of the western bear population. In each hunting drive, two or even three areas can be covered with a frequency of about 23 hunting drives every 100km²/year (Consejería De Medio Ambiente y Urbanismo 1992). This type of hunting, which generally takes place during autumn or winter, appears to be on the increase within bear areas.

Snares, steel traps, and strychnine poisoning cause 36.4% of human-caused bear mortality. The number of dead bears due to poisoning may be underestimated, as it is often difficult to find the carcasses. This cause of death seems to be consistent with management problems for other species in the Cantabrian Mountains.

Over the last few decades, wild boar (Telleria and Saez-Royela 1985) and wolf (*Canis lupus*) (Blanco *et al.* 1992) have spread throughout the country, causing serious damages to local agriculture and farming. Because of the low economic compensation for damages caused by those species and the problems derived from their management, the use of illegal, non-selective means (snares, traps, and poisoned baits) has increased and contributes considerably to bear mortality (Naves and Palomero 1989; Purroy 1991; Garcia-Gaona in press).

In the western bear population, damage caused by wolves average about 800 head of livestock per year, with an economic value approaching 20 million Spanish pesetas (US\$140,000 (Garcia-Gaona *et al.* 1990)). Only the regional governments of Galicia and Asturias pay full compensation for damages caused by wolves in bear areas. In Castille-Leon, damages caused by wolves are only paid in National Hunting Reserves. Hunters also consider the wolf as a competitor for their game species. In the case of wild boar, the situation is quite similar. Damage to crops and cultivated grasslands within the bear distribution area approach 3,600 claims every year, with an economic value of about 60 million Spanish pesetas (US\$420,000). These depredations, which are only paid in the National Hunting Reserves, are a source of disagreement.

Habitat threats

The range of the brown bear in the Cantabrian Mountains has been impacted by the presence of humans. In the area occupied by the western bear population, there are 19.4

permanently inhabited human settlements per 100km², with a total number of 12,948 inhabitants (12.1 inhabitants/km²) (Reques 1993). The main economic activity in the bear area is raising livestock (35 animals/km²), primarily cattle. Apart from this activity, there are others which may be locally important such as: mining, tourism and sporting (hunting included), agriculture, public works (reservoirs, highways, and roads), and timber harvest.

At present, the high level of human impact in bear territory results from land-use changes in response to several socio-economic factors. Traditional farming and agriculture are in decline, and the subsequent demographic changes (aging of the local population and exodus of the young adult population) have opened up some areas for a new stage of economic development. New human activities including tourism, reforestation with foreign species, timber harvest, and reservoir and hydroelectric power station development are having a high impact on the region's bear habitat.

Studies of human geography in the Cantabrian Mountains have shown that the western bear population is surrounded by a higher level of human presence than is the eastern population (Reques *op. cit.*). However, the western bear population has practically three times more bears than the eastern Cantabrian population (Campo *et al.* 1984; Palomero *et al.* 1993).

A clear example of this high level of human-bear coexistence can be seen in the reproduction area of Proaza. Here, forests account for 20% of the area (Indurot 1993), density of permanent human inhabitants is 28.6/100km², and the density of paved roads is 34 km/100km² (Reques

op. cit.). Nevertheless, from 1982 to 1991, 7 family groups were observed (Naves and Palomero 1993a). Low rates of natural mortality among bear cubs (survival during the first year of life is 70.6%), the large mean litter size (2.24), and the interbirth interval (some two year intervals were observed) (Palomero *et al.* *in press a*) indicate that despite this high level of human activity and road density, bears are still thriving.

Availability of different kinds of dried fruits during autumn and winter seems to explain some of these demographic characteristics (Palomero *et al.* *op. cit.*). Studies of habitat quality for the brown bear give evidence that abundant food resources are situated in very few scattered places (Marquinez *et al.* *in press*). Chestnuts (*Castanea sativa*), which have the greatest trophic value during the whole year, cover only 0.3% of the study area. Historic human activities have reduced the forest cover to 30% of the total surface of the western area (Indurot 1993). Purroy and Clevenger (1991) also emphasize the importance of deciduous forests for bears.

Human activity has also caused the alteration or destruction of other necessary bear habitats. Shelter and denning sites have been abandoned by bears due to the loss of understory cover (Naves and Palomero 1993b). The loss seems to be related to human-caused fires. Today, adequate shelter and den sites are found in no more than 17% of the total western bear area (Naves and Ruano 1993).

In the patchy landscape of the western part of the Cantabrian Mountains, human pressures along corridors between high quality habitats or between subpopulations



Brown bear (*Ursus arctos*) and cub in Somiedo Natural Park, 1995.

J.C. Blanco

are becoming critical. The most important examples are again the Leitariegos Pass, which is being developed by mining and tourism interests, and the area separating the western and eastern Cantabrian populations, which is home to a great number of human activities including highways, roads, railways, ski resorts, and mines. A mountain highway crosses the central part of the Cantabrian Divide from north to south, but the existence of tunnels leaves about 7km available for movements between the two populations.

Management

The approval of the Spanish Catalogue of Threatened Species in 1990 did not modify the classification of the brown bear as a species in danger of extinction, but it added a new administrative characteristic as well as more active conservation via the Recovery Plans. These schemes were approved subsequently in Cantabria (Act 34/1989 dated 18 May, 1989), Castille-Leon (Act 108/1990 dated 21 June, 1990), Asturias (Act 13/1991 dated 24 January, 1991), and Galicia (Act 149/1992 dated 5 June, 1992).

The contents of the four Plans are similar, reflecting the frequent movement of the bears from one Autonomous Community to another. This similarity was the product of several meetings and working groups. The International Workshop on the Conservation of the Bear in Europe, which took place in Covadonga (Asturias) in May, 1988, enabled Recommendation 10 to be passed by the Permanent

Committee of the Congress on Conservation of Wildlife and Natural Environment in Europe (Berna Convention) (Council of Europe 1989).

The Recovery Plans seek to increase bear numbers, ensure stable distribution, foster contact between both populations in the Cantabrian Mountains, and bolster the demographic integrity of the whole. The need to join both populations and the plan for a demographic increase require that the Plans include potential range. In the case of the western population, no future expansion areas were considered in the schemes, and in the case of Castille-Leon, no contact among the Cantabrian bear groups was assumed.

The Recovery Plans provide an opportunity to call for the increase of Protected Natural Areas and to carry out environmental impact assessments in the bear area for projects not mentioned in national legislation (Royal Act dated 28 June, 1986). Assessments of small scale human activities are needed to determine whether they may, when combined, cause negative impacts to bear habitat.

Assessments of administrative and management performance and follow-through are included in the Plans. The Plan Coordinator must follow a program drawn up annually or biannually specifying the projects to be carried out during this period, the mechanisms for public participation, and the incorporation pertinent scientific findings. The Recovery Plans themselves should be submitted to a thorough periodic review process. The Recovery Plans have been in existence only a short time, making it difficult to assess their efficacy. Nevertheless, a first review of their implementation would probably not



Human presence in bear habitat is so important that sometimes dens are close to villages, as in Somiedo Natural Park.

J. Navas

give us an extremely positive assessment (Palomero *et al.* 1993b).

Though some of the measures taken have shown positive results (regarding compensations for agricultural damages and the increase in wardens), no progress has occurred in other management aspects. Environmental Impact Assessments (EIA) have not limited human activities in bear areas, and no plan of conservation activities has been agreed upon up to now. Mechanisms for technical input or public participation in the Plans have not been in use. The present participation of non-governmental organizations in the conservation of the bear and its habitat makes it necessary to establish mechanisms to coordinate or exchange information.

Support for the implementation of the Plans is being sought from a variety of sources. The European Community recently approved of a project for the "Conservation and Recovery of the Brown Bear in the Cantabrian Mountains", which was signed by the four Autonomous Communities and by the Institute for the Conservation of Nature ICONA (Spanish Ministry of Agriculture). This may be an important achievement. The project represents a general investment of 1,100 million pesetas (US\$7.6 million) for projects carried out with the two Cantabrian populations from September 1992 to December 1995. Habitat protection and measures against poaching constitute more than 60% of the planned investments. There are great differences among the Autonomous Communities regarding criteria used to decide on the use of funds for each stated aim. The lack of coordination among the administrations limits the awareness of authorities responsible for bear conservation in rural areas. In some cases, these investments have actually degraded bear habitat.

One of the most important mechanisms in the conservation of brown bear habitat is the creation of Protected Natural Areas. At present, only 13.5% of the land over which the western population is distributed is in Protected Natural Areas. The first protected area was the Natural Reserve of Muniellos, created in 1982. After its enlargement in 1988, it now covers an area of 59.7km². In 1988, the Natural Park of Somiedo was created, encompassing an area of 292km². One of the most important reasons for its creation was the existence of the outstanding nuclei of brown bears therein.

The national law for the Conservation of Natural Areas and Wildlife has introduced important changes in the management of protected areas. As a consequence of this law, regional legislations soon followed: the regional Law dated 5 April, 1991 regarding the Protection of Natural Areas in Asturias, and the regional Law dated 10 May, 1991 passed in Castille-Leon. Estimations of expected Protected Natural Areas may represent 57% of the present range of the brown bear in this western population. There are no performance terms for these Protected Areas and

financial support for their operation has not been defined up to now. All plans should be considered with certain care.

Human-bear interactions

Hunting is surely the oldest means of interaction between bears and humans. Documents dated from the 14th century indicate that, unlike some other European countries, the most important hunting activity of the Spanish nobility was bear hunting. At the end of the 19th century the so-called *oseros* or bear hunters, were well known for the heroic feats they inherited from their ancestors. Legend still surrounds bear hunting and hunters in the Cantabrian Mountains.

The tradition of bear hunting in southwestern Europe may explain the limited aggressiveness presently shown by bears toward humans. Bears that avoided human contact could have a longer life span and those characteristics would then be selected for in the population. Hunting may have also influenced the increase in nocturnal and forest-based activity. There have been no recent cases of bear attacks on humans and now it may be considered nearly impossible.

Currently, the most direct human-bear contact, apart from hunting which is now illegal, involves the damages caused by bears in the livestock and farm industry. Garcia-Gaona *et al.* (1993) studied 1,076 claims of compensation for damages due to the Cantabrian brown bears in the western population during the period 1973–1990. They found that 96.1% of them were from Asturias, 3.5% from Castille-Leon, and only 0.4% from Galicia. The claims referred mainly to horses (28.2%), and then to crops or fruit trees (21.7%), cattle (20.7%), beehives (11.8%), goats (10.5%), and sheep (7.2%). The estimated value of these claims, in the western population, approaches five million Spanish pesetas (US\$35,000) each year.

Regardless of the total value of damages caused by bears, problems with the system of compensation increase the hostile attitude of the local people towards the bear, and as a result, difficulties for bear conservation arise. Nearly all the researchers who have addressed this issue agree that compensation for damages has a positive influence in the Cantabrian Mountains (Campo *et al.* 1984 and 1986; Clevenger and Purroy 1988; Campo 1989; Purroy 1991; Garcia-Gaona 1993; Garcia-Gaona *et al.* in press).

The Recovery Plans for the brown bear state that compensations should be processed quickly, with generous damage appraisals and extra compensation calculated from a percentage of the base payment. This aim is, at present, achieved by a simple reporting procedure followed by the injured party. Then a payment is made over one or two months, damaged assessments are continuously updated, and up to an additional 20% of the base



Cantabrian brown bear skull trophies obtained by illegal hunting in 1986.

J. Naves

compensation may be paid out, depending on the Autonomous Community involved.

At present, therefore, the main reason for poaching is not out of revenge for a bad compensation policy. It seems rather, that the leading causes are the excitement experienced from illegal hunting, or the accidental taking of bears when snares, traps, or poisons are used to hunt other animals. The economic gains from trading in skulls and skins, and the “pride” felt in owning an illegal and uncommon trophy may also contribute to bear poaching.

The Law on Conservation of Natural Areas and Wildlife refers to the killing of species “in danger of extinction” as a very grave action, and the legal value of each specimen is estimated that between 10 to 50 million pesetas (US\$70,000–\$350,000). The Brown Bear Recovery Plans require the application of the highest estimated appraisal. During current revisions to the Penal Code, there has been some support for making the killing of endangered species a criminal offense.

Public education needs

Several generic campaigns have been organized to encourage public support for measures protecting the brown bear. Other programs have been limited to school presentations. These first campaigns have been successful in the cities, but have received less approval from farmers. While continuing with these general educational campaigns, specific campaigns should address specific problems or social sectors. These programs may have the following aims:

1. To encourage public disapproval of poaching, as illegal hunting is one of the most important problems facing the Cantabrian brown bear’s survival. Poaching is not justifiable given the small economic scale of damage by bears.
2. To foster specific programs addressing the administration of agriculture, farming, and public works activities in bear habitats, or activities concerning bear conservation (justice, civil guard, and protected areas).
3. To carry out campaigns addressing hunters to reduce the risks connected with legal hunting by introducing selective hunting techniques, and to isolate poachers from the broader hunting community.
4. To foster programs for environmental education that may be continuously carried out at schools, especially in towns and villages which are near bear areas.
5. To foster natural resource development which is compatible with bear conservation strategies so policies are not restrictive.

Specific conservation recommendations

The following recommendations on conservation concern the application and development of the Brown Bear Recovery Plans now in force, the enforcement of the Protected Areas in the different Autonomous Communities, and the implementation of current programs. Considering some conservation objectives for this decade, we can conceive two levels of priority divided in two different periods of time.

First Period (1993–1995)

Enforcement of the present Brown Bear Conservation Plans, paying special attention to:

1. Operation of mechanisms for technical and public participation;
2. Strict application of the measures mentioned in the Recovery Plans regarding environmental impact assessment;
3. Preparation of annual or biannual actions to organize and distribute the project's economic and other existing resources.

In Protected Areas, the priorities are as follows:

1. Formal declaration of Natural Parks in the Narcea area (including the Natural Reserve of Cueto de Arbás, Asturias) and Ancares de León (Castille-Leon), and of the Special Action Plans for Leitariegos and Huerna passes. These aims depend upon the following activities: (a) public information and communication in the local areas involved; (b) preparation of documents and regional research programs concurrent to their legal declaration; (c) guarantee the necessary funds for administration, conservation, and restoration activities for the five years following the declaration.
2. Guarantee the operation of the present Protected Areas (the Natural Reserve in Muniellos and the Natural Park in Somiedo, both of which are in Asturias).

Revision of the Recovery Plans (at least in Asturias and Castille-Leon). Further technical studies and documentation need to be considered for future plans to overcome present deficiencies, including:

1. Increased cooperation with other administrations that carry out activities in the bear area, especially those in charge of Protected Natural Areas and forest management.
2. Specification of technical and methodological criteria to identify high quality habitat areas: shelter and denning sites, feeding areas, forests, corridors, reproductive nuclei, and any other potential use areas.
3. Specifications to assess the environmental impact of human activities, and methods outlined to control these activities.
4. Increased conservation activities may also increase restrictions on some human activities. Therefore, it is necessary to specify measures for social and economic development of small communities consistent with the proposed aims. Implementation of agricultural insurance programs, compensating losses due to wild animals, and encouraging forest preservation projects with local benefits may be workable measures.
5. Specification of priority criteria and increased funding for each of the proposed aims.

Second Period (1996–2000)

1. Implementation of the new Conservation Plans for the brown bear.
2. Establishment of the Protected Areas and Special Action Areas approved during the first period.
3. Preparation of a new revision of the Plans and declaration of the other potential Protected Areas.

Economic Consideration: Before calculating the cost of these conservation measures, some previous considerations shall have to be mentioned:

1. Considering the high levels of human development in the bear area, where the ownership is largely private or community-based, substantial economic investments will be necessary to prevent problems and to compensate local people. Therefore, it is essential to ask for financial support from sources other than the Autonomous Communities. This may take many years before implementation can be achieved.
2. Habitat conservation measures, especially those referring to the Protected Natural Areas, influence not only the brown bear but the conservation of natural resources and wildlife in general in the Cantabrian Mountains.
3. Consideration of economic costs associated with Protected Natural Areas is based on experience with the Natural Park in Somiedo, with adaptations in accordance with the difference in land area, population, and problems involved. General substructure costs are excluded.
4. The necessary financial support for the priorities outlined in the First Period (1993–1995) is about 1,554.1 million pesetas (US\$10.7 million). Previous estimations of necessary funding have been lower. It is urgent to either find some extra financial support or to redistribute currently available resources.
5. The necessary funds for the Second Period (1996–2000) are about 6,690.4 million pesetas (US\$46.0 million). Depending upon the size of the Autonomous Community, between one and three administrative experts would be needed to implement these measures and manage the Recovery Plans. In the Protected Nature Areas, an increase to one gamekeeper every 20km² and the addition of three administrative experts for the management of each area is proposed. For Leitariegos and Huerna passes, one expert and two gamekeepers each are thought to be necessary for the implementation of the Special Plans.

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Status and management of the brown bear in Sweden

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Historic range, current distribution, and status

The brown bear originally occurred throughout Sweden, but it disappeared before 1700 in the southernmost parts of the country. The estimated distribution around 1800 is presented in Figure 6.17, based on the verbal description in Lönnberg (1929). The rapid decline of the Swedish bear population during the last half of the 1800s is illustrated by hunting statistics. In 1905, the Royal Swedish Academy of Sciences declared that it was a “matter of honor for our country that this interesting animal be protected from complete extinction” (Lönnberg 1929). The distribution of bears at this time was mapped by Ekman (1910, Figure 6.17). By 1900, bears were only being shot in the three

northernmost provinces. The bear population was probably at its lowest level, perhaps about 130 bears, around 1930 (Swenson *et al.* 1995).

Since then, the bear population in Sweden has increased both in size and distribution. The number of bears in the country has been estimated on four occasions: 294 in 1942 (Selander and Fries 1943); 350–450 in 1966 (Haglund 1968); 400–600 in 1975–76 (Bjärvall 1980); and about 620 (300–900) in 1991 (Swenson *et al.* 1994b). The 1991 population estimate was revised in 1994 to 670 bears (Swenson *et al.* 1995), and about 1,000 bears (800–1,300) in the spring of 1996 (Swenson and Sandegren unpubl.) This suggests a rapid increase during the past 50 years. The approximate present distribution, based on records of hunter-killed bears and observations, is presented in Figure 6.18. Thus, brown bear distribution in Sweden has expanded to that reminiscent of the mid-1800s, based on Lönnberg’s (1929) descriptions.

Today, female bears are mostly confined to four areas in Sweden. These “female core areas” probably represent remnant populations that survived the population

Figure 6.17. Approximate distribution of the brown bear (*Ursus arctos*) in Sweden around 1800 (from Lönnberg 1929) and around 1900 (Ekman 1910).



Figure 6.18. Present distribution of the brown bear (*Ursus arctos*) in Sweden, 1993 (Swenson *et al.* unpubl. data).



bottleneck at the turn of the century (Swenson *et al.* 1994b). Population expansion is occurring from these four areas, and most bears found outside of them are males (Swenson *et al.* 1994a). We have not identified any factors that will limit the present distribution or population size. We predict that the population and the distributional range will continue to increase, and that the population will number well over 1,000 bears in the year 2000.

The brown bears of Sweden belong to two different mitochondrial DNA lineages (Taberlet *et al.* 1995). The bears in the southern-most female core area (200–300) are most closely related to bears in Spain and France, and are the largest and most secure population in this lineage. The bears in the other three female core areas number 600–1000 and are most closely related to the bears in Russia. Although the border between these two mitochondrial DNA lineages is quite sharp (Taberlet *et al.* 1995), preliminary data suggest that there is no correspondingly sharp border in nuclear DNA, indicating extensive gene flow between these two mitochondrial DNA lineages (unpubl. data).

Legal status

National bounties were paid for bears killed in Sweden starting in 1647. Originally, the bounty was rather low, but local governments could augment it. In 1864, the national bounty was increased about 10 times to 50 riksdaler banco (Lönnberg 1929), which roughly equaled the value of a cow. In addition, the skin and meat were valuable; a skin was worth about as much as the bounty at this time (Zetterberg 1951). Economic incentives, plus the general improvement in weapons and transportation, were important factors in the near extermination of bears in Sweden (Lönnberg 1929).

A motion was made in the national Parliament in 1889 to remove bounties on bears. It failed, but the bear received successively more protection after that. Bounties were removed nationwide in 1893. The Royal Swedish Academy of Sciences recommended protection for bears in 1905. Bears were protected in national parks in 1909, the general permission for everyone to kill bears regardless of land ownership was removed in 1912, and the bear was protected from hunting on Crown lands in 1913. As further protection seemed necessary to save the bear from extinction, all economic incentives to kill bears were removed in 1927, when dead bears became Crown property (Lönnberg 1929).

After this, the bear population began to increase. In 1943, fall hunting was allowed in two areas, one in central Sweden and one in northern Sweden. There has been a fall hunting season every year since 1943, and areas open to hunting have been gradually expanded.

Habitat and population threats

Presently, no habitat threats to the brown bear have been identified in Sweden. Population increases have occurred along with a period of rapid increases in the density of forest roads and intensification of forest management, including practices such as clearcutting, thinning treatments, deciduous tree control, ditching, and even-aged stand management. Brown bears use areas close to villages and heavily traveled paved highways less than expected, both in denning and non-denning periods, but this effect is not necessarily true for other roads (Swenson *et al.* 1996a). However, during this period of bear population increase, the human population density has declined drastically in rural areas of central and northern Sweden, as has the number of domestic livestock. Concurrently, moose numbers have increased dramatically.

Based on the previously described history of the brown bear in Sweden, the only obvious negative factor for the population is overexploitation. Additionally, changes in the perceived trends of the population during the past 30 years are highly correlated with harvest rates (Swenson and Sandegren in press). Although poaching does occur, it does not appear to be a major problem on a national level, given the bear population increase in spite of a relatively high legal hunter kill (see below). However, poaching appears to be a problem locally, especially in areas of the north where domestic reindeer are raised.

Management

The national policy regarding bears calls for allowing the population to increase in size and naturally recolonize previous habitats. Artificial translocation will not be allowed. Continued hunting regulated by quotas will be allowed. A management plan is being prepared and will probably be implemented in 1997.

No habitat management for bears occurs in Sweden, nor does any seem necessary at this time. The State has compensated livestock owners for economic losses in the past when bears killed domestic animals, although this program was terminated in 1995. However, bears were only responsible for 5% of the value of livestock losses to predators in 1992, which totaled SEK 22 million, or roughly US\$3.8 million.

The brown bear has been hunted as a game animal during a fall hunting season since 1943. In 1981, this was changed to a quota system, where quotas were decided by the Swedish Environmental Protection Agency after discussions with provincial governments and provincial offices of the Swedish Hunters' Association. This system was modified in 1992 when female subquotas were added

Table 6.14. Type of hunting season and harvest of brown bears in Sweden, 1981–1995.

| Year | Season type | Total quota | Female subquota | Number killed |
|------|---------------------------------|-------------|-----------------|---------------|
| 1981 | Total quota | 33 | - | 16 |
| 1982 | Total quota | 38 | - | 21 |
| 1983 | Total quota | 39 | - | 34 |
| 1984 | Total quota | 39 | - | 27 |
| 1985 | Total quota | 35 | - | 27 |
| 1986 | Total quota | 40 | - | 35 |
| 1987 | Total quota | 50 | - | 41 |
| 1988 | Total quota | 52 | - | 46 |
| 1989 | Total quota | 67 | - | 49 |
| 1990 | Total quota | 67 | - | 42 |
| 1991 | Total quota | 50 | - | 45 |
| 1992 | Total quota and female subquota | 50 | 16 | 34 |
| 1993 | Total quota and female subquota | 50 | 16 | 34 |
| 1994 | Total quota and female subquota | 50 | 16 | 29 |
| 1995 | Total quota and female subquota | 50 | 16 | 35 |

to the quota system, and the quotas were set according to subpopulation size based on the results of a national population estimate (Swenson *et al.* 1994b). Young-of-the-year and females with cubs are protected from hunting. All hunters with rifles approved for big game hunting and with hunting rights in the area may shoot bears. After shooting, the hunter must report his kill and provide a tooth along with other samples and information to the bear research project.

During the 53 years from 1943 to 1995, 1,289 bears have been harvested legally and the population has increased rapidly. This suggests that the population can sustain a legal harvest rate of about 7.0% per year. Recent calculations based on observed reproductive and mortality rates of radio-marked bears suggests that the sustainable harvest rate is even higher than 10% (unpubl. data). The national harvest of bears during 1981–1995, when quotas were in effect, is summarized in Table 6.14.

Public education needs

The brown bear enjoys a relatively high degree of support among the Swedish public (Norling *et al.* 1981), and hunters appreciate it as a valuable big game animal. During this century, bears have not caused any known deaths or serious injury to humans, except for a reported death caused by a wounded bear in 1902. Seven people were injured by bears between 1976–1995, five by wounded bears. Even so, the bears in Scandinavia are among the least aggressive brown bears in the world (Swenson *et al.*

1996b). Education is important to maintain this support as the population continues to increase.

Specific conservation recommendations

Although the situation for the brown bear in Sweden is very good, we see two problems. One is poaching, primarily in reindeer herding areas in the north. The second is the possibility that support for bears may decrease as the bear population increases. This increase will undoubtedly bring more bears to populated areas, and they may begin to kill more livestock. Conflict will occur, especially now that livestock owners no longer receive compensation for their losses.

Data needed by management agencies, and answers to scientific questions about natal dispersal and colonization, are being provided by a joint Scandinavian Bear Research Project funded primarily by the Swedish Environmental Protection Agency, the Swedish Hunters' Association, the Norwegian Directorate for Nature Management, the Norwegian Institute for Nature Research, and WWF-Sweden. This project began in 1984, and in 1996 over 70 brown bears had functioning radio transmitters in two study areas.

Status and management of the brown bear in the former Yugoslavia

Djuro Huber

Bosnia and Hercegovina

Historic range and current distribution

The total area of what is now the Republic of Bosnia and Hercegovina (BiH) (51,804km²) was historically brown bear range. The lowland parts south of the Sava river along the Croatian border were the first to become settled, deforested, agriculturalized or urbanized, and thus lost as bear habitat. This process probably was completed before the end of the last century. There are no documents on brown bear distribution in 1800 and 1900. Figure 6.19 includes an estimate of former range based on human population distribution and increase, and on topography. Because of poor older data, no access to recent bear managers, and no way to estimate the current damage to bear populations, the data on current distribution in Figure 6.19 is in part provisional.

Most forests survived in mountainous regions and this is where the bears may be found today. Roughly 10,000km² (20%) of BiH is bear range, including approximately 46% of 21,830km² of BiH forests. Brown bear habitat in BiH is in the middle part of the Dinara Mountains, the mountain range that runs parallel to the Adriatic Sea coast from

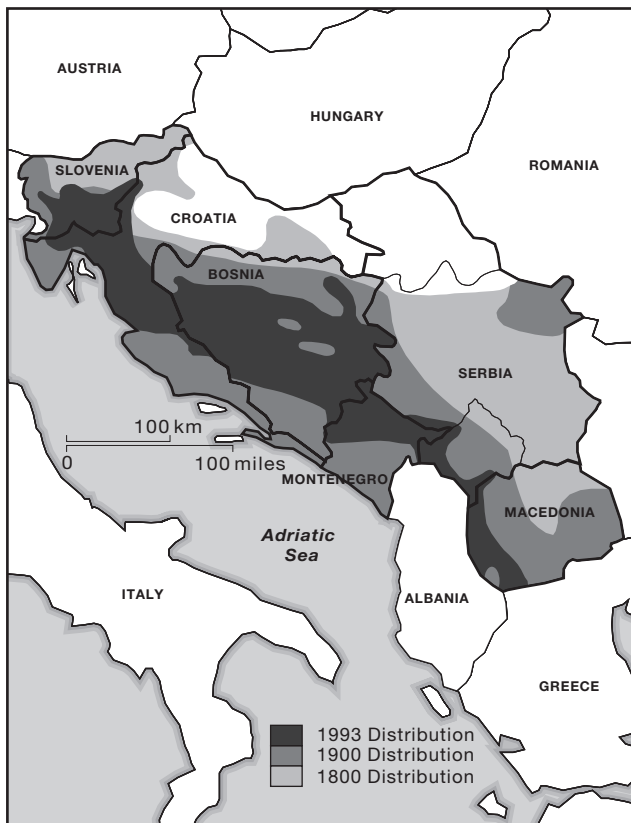


Figure 6.19. Estimated historic and present distribution of the brown bear (*Ursus arctos*) in the former Yugoslavia (Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia, and Slovenia).

northwest to southeast, extending from Slovenia through Croatia, Bosnia and Herzegovina, Montenegro, Macedonia, and Albania to Greece (Pindus Mts.). One of the core bear areas is around Bugojno. The topography of the bear habitat has partial karst features and the forest covers about 70% of the habitat.

Status

An estimated population of 1,195 brown bears exists in BiH (Huber and Moric 1989). They are connected with bears in Croatia on the northwest, and with bears in Montenegro and Serbia on the southeast. There are large marginal habitat areas where bears are not always present. Population estimates by systemized counts of bears visiting permanent bait stations are done only by some hunting organizations.

Legal status

Bears in BiH are classified as a game species with specially regulated hunting quotas, except outside of designated

areas. In 1992, the entire country entered into a devastating war. All bear areas were affected by major war operations.

According to the SSC criteria (Mace *et al.* 1992) brown bears in BiH may be listed in the “Vulnerable” category, though this can only be resolved after the country recovers from the war.

In the bear areas in BiH, bears are hunted during a hunting season (1 October to 15 May). Outside of this, area bears are not protected unless the local hunters have a local management plan.

Population threats

The main source of mortality is hunting which took 83 of a total 85 bears in 1987 (Huber and Moric 1989). The mortality due to the recent war can not be estimated. However, there is some evidence that mortalities occurred because of these circumstances. A rescued brown bear cub was brought to Zagreb (Croatia) in April 1992 after his mother and a sibling were killed by war operations.

Habitat threats

Forest exploitation and extension of forest roads have decreased the habitat carrying capacity. The forest has also been exploited by gatherers of other products (mushrooms, berries, medical plants, etc.). The recent war is by far the major habitat threat: areas up to 400km² were intentionally burned around Bugojno by the Serbs as a means to help them occupy the area (Huber 1993).

Management

In BiH, bear hunting was conducted during the season (1 October–15 May) from elevated stands over exposed baits at night. Bears were managed by hunting reserves, the forestry service, and hunting clubs. Due to the changes after the end of socialism in 1990, most organizations were in the process of privatization and the number of bear managing units was unclear. The only clear case was the “Koprivnica” hunting reserve near Bugojno, the former hunting area of the late president Josip Broz Tito. After Tito’s death the reserve operated commercially, killing up to 30 bears per year, mostly catering to foreign hunters. In the “Koprivnica” hunting reserve the bear feeding program was particularly intensive: at 12 feeding stations 175,000kg of corn and 375,000kg of animal remains were delivered yearly. The rise of the local bear population from 12 in the 1960s to 138 in 1987 resulted in increased bear concentrations around feeding sites and tree damage.

Around 1984 bears started to peel the bark from trees and to feed on sapwood. In four years at least 4,916 trees were damaged (Huber and Moric 1989). A supplementary feeding program to reduce tree damage was initiated in 1989, but the war stopped the program, as well as the documentation of the results.

With the onset of war all management practices ended, including the feeding program. Consequently, the bears were approaching human settlements in search of food and were often killed (Huber 1993).

Human-bear interactions

In 1987, 1,164 cases of bear damage in BiH were recorded: 560 on domestic animals (99% cattle), 372 on fields, 209 in orchards, and 23 on beehives (Huber and Moric 1989). Also in 1987, one child was killed by bear that was later proven to be rabid.

Public education needs

This might be important only after the country sufficiently recovers from the war.

Specific conservation recommendations

Until the devastation from the war ends, no other conservation measures may be discussed. The international community should be more involved in rebuilding from the war, not only for the people's sake but to save rare European wildlife (including bears) and their habitats.

Croatia

Historic range and current distribution

With exception of the islands in the Adriatic sea, the total area of today's Republic of Croatia was historically brown bear range. The lowland parts of northern Croatia were first to become settled and thereby lost as a bear habitat. This process began probably over a thousand years ago and was completed for the most part more than 200 years ago. Most forests survived in mountainous regions and this is where the bears may be found today. Except for man-made and natural forest openings and the mountain peaks above timberline, no nonforested areas are considered bear habitat.

An estimate of former distribution (Figure 6.19) is based on increasing human populations, topography, frequency of bear names in geographic features, and limited information from the beginning of this century.

There are no documents on brown bear distribution in 1800 and 1900.

Roughly 9,800km² (17%) of Croatia is currently bear range, including approximately 34% of 19,800km² of the Republic's forests. The extent of bear distribution in southeast Croatia is questionable. Due to the recent occupation of about half of bear habitat during five years of war, little recent data is available. The northern part of Croatian bear range has been used by bears with increased frequency in the last decade. If management increases result in tolerance of bears here, it may become regular bear range.

All brown bear habitat in Croatia is within the Dinara Mountains which parallel the Adriatic Sea coast, running from northwest to southeast, and extending from Slovenia through Croatia, Bosnia and Hercegovina, Montenegro, Macedonia, and Albania to Greece (Pindus Mts.). Elevations in the Croatian part of the Dinara Mountains range from 0 to 1,912m above sea level. The area is politically divided into Lika and Gorski kotar regions with Plitvice Lakes and Risnjak National Parks, respectively, as bear core areas.

The topography of the bear habitat has typical karst features and various depressions without surface drainage. Limestone bedrock is covered by shallow soils; the mountain peaks and steep slopes (>60 degrees) are formed of bare rocks. Forest covers about 70% of habitat and is dominated by a mixture of beech (*Fagus sylvatica*), fir (*Abies alba*), spruce (*Picea abies*), and other tree species varying in composition with elevation and exposure.

Status

An estimated population of 400 brown bears lives in Croatia (Huber and Moric 1989). They are connected with the bears in Slovenia to the northwest and to bears in Bosnia and Hercegovina on the east. The highest concentrations (about 1 bear/10km²) are in Gorski kotar and central Lika around Plitvice Lakes National Park. In other areas densities are much lower (down to 1 bear/45km²), and there are marginal areas where bears are not always present. Occasional reports of bear sightings from previously unoccupied areas were the most frequent in the last decade. For example, in June, 1993 two bears were reported (one was found dead) in Krka National Park near Sibenik at the Adriatic Sea coast where bears have not been present for at least 50 years. Population estimates in Gorski kotar are made each spring by systemized counts of bears visiting permanent bait stations (Frkovic *et al.* 1987). In other areas, estimates of population size are based on much weaker grounds. However, indices show that the population grew approximately four times from 1946 till about 1980 when it stabilized at present numbers (Frkovic *et al.* 1987).

Legal status

Bears in Croatia are classified as a game species and are subject to specially regulated hunting quotas. The importance of Croatian brown bears in Europe has increased in the last four years as a source for reintroductions to other countries. According to the IUCN Red List criteria (Mace *et al.* 1992), brown bears in Croatia are listed in the “Vulnerable” category. Because of restricted access to scientists in the aftermath of the war, no recent data from the area are available.

During two years after World War II (1946–47) brown bears in Croatia were totally protected to help them recover from the low numbers after the war. From 1947 to 1965 a two month hunting season for bears (Nov. and Dec.) was allowed. However, no legal harvest occurred until 1955, and during the next ten years averaged only one bear/year. The total mortality in this period was 63 (3.0 per year), of which 40% (N=25) bears died from poisoned baits set for wolves (Frkovic *et al.* 1987). In 1966, the bear hunting season was extended to 7.5 months, and in 1976 it became nine months.

Population threats

Accurate data on overall bear mortality are available only for the Gorski kotar region where a total of 281 bear deaths were recorded during 1946–1985 (Frkovic *et al.* 1987). An additional 163 bears were removed from the population during 1986–1992. Comparison of these two sets of data reveals some important trends. The increase of the total mortality rate from 7.0 to 23.2 per year is highly significant (Chi-square = 9.74, $P < 0.01$). The main source of mortality has been hunting, legal and illegal. During 1946–1985, 205 bears were hunted (mean = 5.1; range = 0 to 19). In the period 1986 through 1992 hunting mortality increased to 16.0 annually (total = 112; range = 14 to 20). The illegal kill remained similar in both periods: 17.6% and 15.2%, respectively (Chi-square = 0.15, difference not significant).

Poisoning, which accounted for 26 (9%) of total deaths causes in the 1946–1985 period, is no longer a mortality factor. The last poisoned bear was recorded in 1972. The number of bears killed by vehicle collisions was 31 in each analyzed period but the percentage due to vehicle collisions has significantly increased from 11% in 1946–1985 to 19% in 1986–1992 (Chi-square = 4.83, $P < 0.05$). From 1986–1992 eight bears were removed from the population alive: two exported for reintroduction in Austria, and six were rescued as orphaned cubs and were placed in zoos. In the sex ratio of dead bears, the share of females significantly increased from 23.0% in 1946–1985 to 35.2% in 1986–1992 (Chi-square = 6.22, $P < 0.02$). Distribution of bear mortalities over the year and the share of bear age classes

didn't change in the last seven years compared to older data presented by Frkovic *et al.* (1987).

Habitat threats

Forests are commercially utilized outside of Risnjak and Plitvice NPs. Within the National Parks only so-called “sanitary and corrective” logging is officially allowed. Timber harvest is done by selective cutting and by occasional circular (<100m in diameter) clearcuts. Reforestation is usually done by planting only spruce seedlings (Dokus *et al.* 1992). After 1960 log hauling became mechanized. Forests began to be opened by truck roads, and since 1950 the total length of forest roads has increased 31 times: from 3.0 to 11.8m/ha on average. The forest road network is continuing to increase (Krpán 1992). Presently a new modern highway is under construction from Karlovac to Rijeka that runs through the middle of Gorski kotar.

Increasing tree mortality in Croatia has been noticed since the 1980s and has been attributed to environmental pollution. The area of Gorski kotar within Croatia, has been the most severely affected (15% of all trees damaged), and the Lika area was in second place (12.6–15% of all trees damaged). Among tree species, fir was the most vulnerable; almost 80% exhibited visible damage (Prpic 1992).

Management

Bears in Croatia are hunted from 1 September through 31 May. Shooting is performed exclusively from elevated stands over exposed baits on moonlit nights. The hunter pays a fee proportional to the trophy value of the harvested bear. The yearly harvest quota is calculated not to exceed 10% of the estimated population size. In 1986 and 1987, 29 and 19 bears respectively were reported killed by hunting in all of Croatia. For the last five years, we estimate that 20 to 30 bears are hunter-killed annually.

Bears are managed by forest enterprises in over 80% of the habitat, and by hunting clubs in the remaining areas. The hunting club may manage bears if their hunting ground is >70km². That is insufficient because the range of any sex/age class of bear is much larger (Huber and Roth 1986). A new hunting law (of 1994) will regulate the management of hunting areas through a leasing/renting system. Direct bear management includes feeding of bears at bait stations with animal carrion and corn year-round. Feeding is most intense during the hunting season when it is used to bring in bears to feeding areas used by hunters. Some feeding stations occasionally use truckloads of general garbage. Bears also visit local garbage dumps

which are usually unfenced and unguarded (Huber 1991, 1992).

Human-bear interactions

The last complete survey of bear damage in Croatia was done by Huber and Moric (1989) in 1987 when a total of 247 cases of bear damage were recorded. Among 13 domestic animals killed by bears, eight were cattle and three were sheep. The main crops damaged were oats (N=107) and corn (N=94). The only fruits taken by bears were plums (N=23). The organization that manages bears in the area is responsible to pay damage compensation. Where bears are not managed, no one is responsible for compensations.

In the last 50 years in Croatia there has been only one recorded case of fatal attack by a bear on a man, which occurred in March, 1988 at Plitvice Lakes NP.

Public education needs

A questionnaire (Moric and Huber 1989) showed that a reasonable positive attitude towards bears and wolves (*Canis lupus*) is proportional to actual knowledge about animal biology, behavior, and habitat needs. Persons that know more about these species are more positively oriented toward them. The amount of damage suffered from bears contributes to a negative attitude. People that share the habitat with bears show less fear of them compared to people from urban areas and from countries with no bears (Moric and Huber 1989). Public education in areas where the bear population could expand would be the most powerful means of increasing total bear range in Croatia.

Specific conservation recommendations

After reaching present numbers, the brown bear population in Croatia seems to be stable and is slightly increasing in range. Part of the reason for occupying new areas may be due to the recent war. The occurrence of two bears in the Krka NP is probably related to the war in Bosnia and Hercegovina, which was 45km away by air. To facilitate an increase in bear range, the acceptability of bears by local people must be ensured by a dependable source of funds for the compensation of bear damages. Hunting pressure seems to be balanced with natural reproduction, although the effect of a 3.3 fold increase of annual known mortality in the period 1986–1992 in Gorski kotar might be a cause of concern.

There are several threats and corresponding conservation needs for the future of bear populations in Croatia:

1. A medium-term threat is the increasing disturbance of bear habitat due to new forest roads, other forestry operations, and, in particular, the construction of a new highway through Gorski kotar. The highway itself has a potential to fragment bear and other wildlife populations if proposed mitigation measures are not fully implemented. The overall disturbance in habitat interferes with natural life cycle of bears, but also contributes to 19% of known bear mortality through traffic kills which have significantly increased in the period 1986–1992. At least two tunnels (about 300m each) and 10 viaducts (total length about 3,000m) should be built at strategic places along the new highway through Gorski kotar. The cost of these mitigations would be around US\$50 million. Several bear crossings should be built over the existing railroad to decrease the number of bears killed by trains. No new forest roads should be build in bear habitat.
2. Another medium-term threat might arise if bear management became increasingly localized. Animals with wide-ranging movements like bears should be managed uniformly on a landscape level within their entire habitat. The new hunting law should reflect this need.
3. A long-term threat is habitat deterioration due to exploitation, spruce monocultures, and increasing tree mortality. The natural composition of forests should be maintained by modifying the logging quotas and methods, and by adequate replanting. Forest mortality should be controlled by international agreement and cooperation.
4. The most important long-term threat is garbage conditioning of bears, which, over generations, changes their natural feeding and living habits and makes them less shy and more tolerant of sharing space with humans. Bear feeding stations should not increase in numbers and amount of food delivered. Only standard bear food such as corn and carrion should be used. No garbage should be available to bears. All garbage dumps should be eliminated from forest areas and fenced against bears. The proper rearrangement of dumps in Gorski kotar would cost at least US\$1 million.

We conclude that brown bears do survive in the forests of the high mountains of Croatia, not because this habitat is the best suited for their needs, but because these areas are the least affected by man. However, continuous gradual changes in this region are shrinking its size and deteriorating its suitability for bears. We propose a certain level of protection of the entire habitat (e.g. a Biosphere Reserve), as well as strict protection of critical places for bear denning, resting, and feeding where all human related activities should be excluded.

Study and monitoring of all threats to brown bears should be continued and intensified. An approximate

budget of US\$18,000 per year would be needed for this monitoring.

Macedonia

Historic range and current distribution

All of Macedonia (25,713km²) was historically brown bear range. The lowlands around the country's capital, Skopje, were the first to become settled and thus lost as bear habitat. This process probably was completed before the end of the last century. Most forests survived in mountainous regions and this is where bears may be found today.

There are no documents on brown bear distribution in 1800 and 1900. Figure 6.19 is an estimate based on human population increase and topography. The connection with the bear population in Bulgaria was probably lost in the last century. Because of poor data on current distribution, occasionally used bear ranges might be larger and/or different than shown in Figure 6.19.

Roughly 820km² of Macedonia is bear range, including approximately 10% of the country's forests. Most of the bear range in Macedonia is along its western borders with Kosovo, Albania, and Greece. Brown bear habitat is in the southeastern end of the Dinara Mountains, the mountain range running parallel to the Adriatic Sea coast from northwest to southeast. The topography of bear habitat has partial karst features. A mostly deciduous forest covers about 70% of the bear habitat.

Status

An estimated population of 90 brown bears lives in Macedonia. The population estimate is not scientifically based. The population is connected with the bears in Kosovo, Albania, and Greece.

Legal status

Bears in Macedonia have been classified as a game species only since 1988. According to the IUCN Red List criteria (Mace *et al.* 1992) bears may be listed in the "Vulnerable" category.

Bears are hunted during the hunting season (1 October to 1 January) which was established in 1988. Before that there were no rules or limitations on bear hunting.

Population threats

In 1987, only eight bear deaths were recorded, and all of these were from hunting (Huber and Moric 1989). Actual

mortality was no doubt higher. There is no information regarding how and if the present law is enforced.

Habitat threats

No specific information is available. The political disturbances and consequent economic crises are likely to negatively impact bear habitat and the population itself.

Management

In Macedonia there is no specific bear management or hunting methods in use.

Human-bear interactions

In 1987, 131 cases of bear damage in Macedonia were recorded: 66 on domestic animals, 15 on fields, and 50 in orchards (all cherry trees). Twenty wooden telephone poles were reported damaged by bears (Huber and Moric 1989).

Public education needs

It would be very important to start an intensive public education campaign.

Specific conservation recommendations

Not enough data are available for specific recommendations. Obviously the present laws should be enforced, damage done by bears should be compensated, their habitat should receive some sort of protection, and the human population should be educated about the international value of bears.

Montenegro and Serbia (with Kosovo)

Historic range and current distribution

Montenegro and Serbia (with Kosovo) have called themselves the Yugoslav Federation since 1991. The total area of these countries (13,812 and 88,361km² respectively) has historically been brown bear range. The lowland northern province of Vojvodina was the first to become settled and thereby lost as bear habitat. This process was probably completed before the end of last century. Most of the forests survived in mountainous regions and this is where the bears may be found today.

There are no documents on brown bear distribution in 1800 and 1900. Figure 6.19 is an estimate of historic range based on the increase of human population and topography. The connection with bear population in Romania was probably lost in the last century, although there were some more recent data on bear observations in northern Serbia. Because of poor, older data, no access to recent bear managers, and no way to estimate the current damage on bear populations due to political instability, data on current distribution in Figure 6.19 is partly provisional. In particular, judgement of occasionally and continually used bear ranges in Montenegro contains certain levels of guessing.

Roughly 500km² in Montenegro and 1,670km² in Serbia are bear range, including approximately 518km² and 1,624km² of the countries' forests. Most of the bear range in Serbia is within the province of Kosovo. Brown bear habitat exists in the southeast part of the Dinara Mountains, the mountain range that runs parallel to the Adriatic Sea coast from northwest to southeast. The topography of the bear habitat has partial karst features, and forest covers about 70% of the habitat.

Status

An estimated population of 250 brown bears lives in Montenegro and 180 in Serbia (100 of the latter in Kosovo) (Huber and Moric, 1989). The population estimates are not scientifically based. This population is connected with the bears in Bosnia and Hercegovina, Albania, and Macedonia.

Legal status

Bears in Montenegro and Serbia are classified as a game species with specially regulated hunting quotas, except outside of designated areas. According to the IUCN Red List criteria (Mace *et al.* 1992) brown bears may be listed in the "Vulnerable" category. Due to political disturbances it was not possible to obtain any recent data.

Bears are hunted during the hunting season (1 October to 30 April). In Serbia (mostly Kosovo) hunting is done from elevated blinds over bait, while in Montenegro bears are hunted when encountered during chases and ground hunts.

Population threats

Out of a total known bear mortality of 26 in Montenegro and 25 in Serbia in 1987, only 11 and 8 respectively were legally hunted (Huber and Moric 1989). The political disturbances and consequent economic crises are likely to

reduce the enforcement of laws that protect bears and other wildlife.

Habitat threats

No specific information is available. The political disturbances and consequent economic crises are likely to have negative impacts upon bear habitat and the population itself.

Management

In Serbia the organizations that managed bears were also feeding them at permanent stations where hunting was done during the season from elevated stands over exposed baits. In Montenegro no specific bear management or hunting methods are in use.

Human-bear interactions

In 1987, 23 cases of bear damage in Montenegro were recorded: 20 involving domestic animals and 23 involving beehives. In the same year in Serbia, 124 cases were recorded: 49 on domestic animals, 55 on fields, 17 in orchards, and three on beehives (Huber and Moric 1989).

Public education needs

This will be important only after the political and economic situations are more stable.

Specific conservation recommendations

Before the political instability and devastating war in neighboring countries can be recovered from, no other conservation measures may be discussed. The international community should be more involved in this recovery, not only to help people but also to save rare European wildlife (including bears) and their habitats.

Slovenia

Djuro Huber and Miha Adamic

Historic range and current distribution

All of today's Republic of Slovenia (20,251km²) was historically brown bear range. The lowland parts of central Slovenia were the first to become settled and thereby lost as bear habitat. This process began probably over a

thousand years ago and was completed for the most part more than 200 years ago.

There are no documents on brown bear distribution in 1800 and 1900. Figure 6.19 shows the estimated historic range of brown bears in Slovenia. Following Austrian hunting legislation from the 18th century, the brown bear was nearly exterminated by the mid-19th century in most of Slovenian territory. A small stock persisted in the forests on large private estates in Kočevje, Planina, and Javornik-Snenik in the Dinarics. But despite low densities of bears in the Dinarics in the 19th century, individual bears penetrated into the Alps, where they were persecuted and regularly killed. According to the earlier data on the presence of brown bears outside of the core area, it is evident that the northern corridor used to be the most important emigration route for bears from the Dinarics into the Alps. Its use was reduced in the mid-20th century. Although the reasons are unknown, we speculate that the construction of the motorway Ljubljana-Zagreb after 1960, as well as elevated quotas of yearly bear harvest in Kočevje since 1966, might have suppressed northern corridor functioning. The northern corridor has recently become reactivated.

Most forests survived in mountainous regions and this is where bears may be found today. About 5,500km² (27%) of Slovenia is currently considered bear range, including approximately 54% of the country's forests (10.2km²). In 1966, 3,000km² of Slovenia was bear range. Brown bear habitat in Slovenia is at the very northwestern end of the Dinara Mountains, the mountain range running parallel to the Adriatic Sea coast from northwest to southeast, extending from Slovenia through Croatia, Bosnia and Herzegovina, Montenegro, Macedonia, and Albania to Greece (Pindus Mts.). The main bear areas are Notranjska and Kočevje where bears are intensively managed by year-round supplementary feeding (Adamic 1987). The topography of the bear habitat has partial karst features, and forest covers about 70% of the habitat.

The importance of Slovenian, together with Croatian brown bears in Europe has increased in the mid-1990s as a source for reintroductions to other countries. The northern part of bear range in Slovenia has been used by bears with increased frequency in the last decade. If the political decision is to tolerate bears here, it may become regular bear range. The projection of range in the year 2000 is hoped not to be beyond the current continually occupied range. If management is close to optimum, most of today's occasionally used range may become continually occupied.

The Slovenian population is connected to that of Croatia on the southeast. The connection with the Alps in northern Italy and southern Austria has been practically blocked by habitat interruption and numerous physical obstacles (mostly highways). There are marginal areas where bears are not always present. Population estimates

are made each spring by systemized counts of bears visiting permanent bait stations.

Status

After centuries of unlimited hunting, brown bears in Slovenia reached low numbers of 30 to 40 animals at the beginning of this century. After World War II their numbers rose, and since 1966 bears in Slovenia are considered a game species.

The calculated size of the population of brown bear in Slovenia, derived from the results of 1995 and 1996 censuses, performed on nationwide level is 350–450 individuals. Although there is an average density of bears within the core area, calculated at 0.6–0.8 bears/10km², pronounced differences occur among regions inside the core range. Densities reached a maximum of 1.3 bears/10km² in the area of Kočevje in southcentral Slovenia, but the minimum density was 0.3 bears/10km² in the newly occupied western and northwestern part of the range.

Legal status

Bears in Slovenia are classified as a game species with specially regulated hunting quotas. The hunting season lasts from 1 October until 30 April, and on average 43 bears are harvested annually (Kr'c 1988). The importance of Slovenian, together with Croatian, brown bears in Europe has increased in the last four years as a source for reintroductions to other countries. According to the IUCN Red List criteria (Mace *et al.* 1992) brown bears in Slovenia may be listed in the "Vulnerable" category.

Population threats

The main source of mortality is hunting which increased from 33 annually in the period 1965–69 to 45 in 1980–1984 (Adamic 1990). Regularly controlled harvest accounted for 80% of all extracted bears between 1991–1996, which represents the key mortality factor for brown bears in Slovenia. An average of 37 bears have been harvested annually in this period. Traffic kills account for 9% of all extractions, and are the second most important mortality factor. On the highway section between Vrhnika and Postojna (about 30km), five bears attempting to cross the highway were hit by vehicles in 1992 alone.

Habitat threats

Forest exploitation and extension of forest roads are decreasing habitat carrying capacity. The forest is also

exploited by gatherers of other products (mushrooms, berries, medical plants, etc.).

The impacts of accelerated highway construction in Slovenia result in broad levels of environmental destruction. Fragmentation of habitats and its long-term impact upon wildlife populations are among the most serious consequences, and large mammals with big home ranges, e.g. the brown bear, are among the most affected. Fragmentation effects upon populations are far more serious than just wildlife-vehicle collisions. Great efforts have thus been invested to study the permeability of the corridors, connecting the core bear area in the Dinarics with the Alps and Alpine bear population occupying habitats on the border of Slovenia, Italy and Austria. Some bear friendly modifications have been made, which provide bear underpasses, planned fencing of critical sections, additional electric fencing, and the building of two ursiducts (bridges for bears in areas of frequent bear-vehicle collisions).

Management

Bears in Slovenia are hunted during the season (1 October–30 April) exclusively from elevated stands over exposed baits on moonlit nights. The hunter pays a fee proportional to the trophy value of the harvested bear. The yearly harvest quota is on average calculated at the level of 15% of the estimated population size. Female bear reproduction interval is usually two years.

Bears are managed by professional organizations in the designated areas (Notranjska and Kocevje). There, they are fed with carrion and corn year-round at permanent feeding stations that are spread at least one every 60km². Outside of these areas they have no protection. In the period 1970–86 a total of 80 sightings outside of bear range were recorded and 21 bears (20 males and one female) were killed (Adamic 1990).

Due to the population expansion in the period 1966–1995, a new conservation strategy had to be enacted, including: 1) Stating fixed size and spatial distribution of yearly harvest quotas for brown bear; 2) Yearly censusing of the bear population on statewide level; 3) Functional extension of core management area; 4) Compensation of damages to human property with State funds; 5) Central registration of bear mortality, and; 6) Accounting for the bear presence in any extended spatial planning activities (e.g. the construction of highway network).

Human-bear interactions

In 1987 only one case of sheep depredation by a bear was recorded (Huber and Moric 1989). Also in 1987 one woman was killed by a bear while picking mushrooms.

Since that period only four cases of aggressive behavior towards humans have been recorded, all which involved female bears accompanied by cubs. The last case took place in April 1996 near Velike Lašče. Accelerated expansion of brown bears into the Slovenian Alps during 1967–1995 resulted in rising predation upon free-pastured sheep on alpine pastures. In the area of Tolmin in northwestern Slovenia, more than 60 cases of bear predation upon sheep were recorded between 1992–1996. Repeated predation and fear from local people, which has been supported by local press, was the reason that the Ministry of Agriculture and Forestry decided to issue permits to extract several problem bears in the mentioned period.

Public education needs

Education of the public living on the margins of bear areas would be the single most powerful means to increase total bear range in Slovenia.

Specific conservation recommendations

The brown bear population in Slovenia seems to be stable and its range is increasing. To facilitate the increase of bear range, the acceptability of bears by local people must be assured by a dependable source of funds for compensation of bear damage. Hunting pressure seems to be balanced with natural reproduction, although the effect of 27% increase of annual known mortality in the last 10 years might become visible in the coming period.

There are several threats and corresponding conservation needs for the future of bear populations in Slovenia:

1. A medium-term threat is the increased disturbance and obstacles in bear habitat due to the opening of new forest roads, other forestry operations, and by old and new highways and railroads. Traffic on roads and railways significantly contributes to bear mortality. Bear crossings should be built over existing roads and railroads. This would also facilitate the spread of bears towards Alps. No new forest roads should be build in the bear habitat. Many current roads should be closed to increase habitat security.
2. Garbage and human-related food conditioning of bears is probably the most important long-term threat. Over generations, the changes in natural feeding and behavioral patterns will make them less shy and increase conflicts with humans. Bear feeding stations should not increase in number or amount of food delivered. Only standard bear food should be used there. No garbage should be available to bears. Garbage dumps should be moved out of forested areas and fenced against bears.

Gradual changes in bear range are deteriorating its suitability for bears. A certain level of international protection of the entire habitat (e.g. a Biosphere Reserve) is proposed, as well as strict protection of critical habitat for bear denning, resting, and feeding where all human related activities should be excluded. The establishment of continuous low-density bear populations outside of today's

official range is possible and desirable. The cost of such management, including the payment of all bear damage compensations, would be in the range of US\$30,000 per year.

Study and monitoring of all threats to brown bears should be continued and intensified. An approximate budget of US\$12,000 per year would be needed for this.