

DOES HUNTING AFFECT THE BEHAVIOR OF BROWN BEARS IN EURASIA?

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Abstract: Literature from Eurasia was reviewed for information to test the hypothesis that hunting of brown bears (*Ursus arctos*) makes them more wary of humans. The results were not rigorous enough to test the hypothesis scientifically. However, the common impressions were that bears are more wary of humans where they are hunted than where they are protected and that bears remained wary in several low-density populations that had been protected for a long time. In spite of this, bears in several increasing populations that were hunted became less wary. Use of human-derived food was involved when wariness toward humans was lost and appeared to be a more important factor influencing wariness than hunting. I tentatively conclude that accessible human-derived foods for bears must be controlled to maintain the bears' wariness toward people. When this has been done, hunting may contribute to increasing bears' wariness. This subject requires that more research and scientific experiments be conducted, because people are more willing to accept wary bears.

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Dood et al. (1986) reviewed the very limited information from North America and concluded that grizzly bears (the same species as the brown bear) became less wary of humans when they were not hunted. There was actually little empirical evidence of this, but they did cite data from Herrero (1985) showing that the human injury rate due to grizzly bears in North America was greater in national parks than outside of them. To examine this question further, I reviewed literature on the situation in Eurasia, which was not considered by Dood et al. (1986), and can be considered a sort of replicate. Although this literature review was not exhaustive, the literature I found should not be biased one way or the other. I consider the conclusion of Dood et al. (1986) to be a working hypothesis.

Throughout this literature review, I encountered statements about bears becoming more or less wary of people or references to other behavioral attributes that had changed. The authors have explained the purported changes in behavior as a consequence of a change in other circumstances such as hunting pressure or food availability. However, these changes were never quantified. This poses 3 severe limitations to the interpretation of the results: (1) definitions of behavioral terms, such as wariness, are not provided and most likely vary from author to author, (2) only short-term changes in behavior (i.e., learned responses of individuals) could be identified, and (3) the lack of quantification makes a rigorous scientific analysis impossible. However, as many of the authors were working independently, their impressions and conclusions are worthy of compilation.

BEAR BEHAVIOR IN AREAS WITH AND WITHOUT HUNTING

Vaisfeld and Pazhetnov (1992) reported that bears were more wary, avoiding people and their signs, in areas in European Russia with considerable hunting pressure. In the reserves or their vicinities, where there was no or less intensive hunting, the number of bear-human encounters was higher as bears were much less wary of people. However, a complicating factor was human foods. Vaisfeld and Pazhetnov (1992) also reported that the problem of bears obtaining food from people, becoming more habituated, and losing fear, which often ended in human injury and death of the bear, was becoming more common in Russia, particularly in the reserves. Unfortunately, they provided no information about human use in and outside the reserves. Nyholm and Nyholm (1992) noticed a similar trend with Finland's increasing bear population, stating that the behavior of bears in areas where they are not hunted had become more and more reckless. I only found one reference indicating that bears in reserves, with no hunting, were exceptionally wary of and not aggressive toward people. Kaletskaya (1979, cited in I.E. Chestin, 1993, Brown bear-human conflicts in Russia, report to Interagency Grizzly Bear Committee, Missoula, Montana) reported this for bears in the Darvinskii Reserve (480 km²) in Yaroslavl Oblast' in central European Russia. However, Chestin (unpublished, 1993) refuted her results, showing that the rate of attack by bears was relatively high in this reserve.

The bears in Slovenia are hunted only at specific bear feeding sites. They are wary of people and rarely take

garbage or slaughter remains near people (P. Kaczensky, Wildbiologische Gesellschaft München, Linderhof, Germany, personal communication, 1997). Bears from the same population are protected in Austria and more often visit roe deer (*Capreolus capreolus*) feeding stations and eat human-derived foods near human habitation (Wildbiologische Gesellschaft München 1997, P. Kaczensky, Wildbiologische Gesellschaft München, Linderhof, Germany, personal communication, 1997).

In Asia, the reports were similar. In the southern regions of the Russian Far East, Yudin (1993) concluded that long-term protection of bears in the state reserves and reduced hunting pressure during the last years had changed bear behavior toward people. It became more common to see bears at short distances, and bears broke into hunters' cabins and guard huts more frequently. In Tuva in south-central Siberia, Zyryanov et al. (1993) recorded an increasing trend in bear aggressiveness, with 5 people killed in 22 conflicts during 1971–90, more than previously. They concluded that in areas with well-developed bear hunting, aggressive animals were harvested first because they were easier to find. However, in general, bear hunting in the region was not popular. Suvorov (1991) also reported that bears had lost their fear of people and had become dangerous for people in reserves in Middle Siberia. Again, mass tourism and food from people compounded the problem. Chernikin (1985, cited in Chestin unpublished, 1993) stated that brown bear aggressiveness toward people was greater inside the Barguzin Reserve (2,480 km²) in Irkutsk Oblast', south-central Siberia, where they had not experienced hunting, than outside the reserve. Sobanskii and Zavatskii (1993) found that bears were more wary in places where encounters with people were more frequent in the northeastern part of the Altai Mountains in Central Asia; they looked around and sniffed the air more often (not quantified). Bears with no fear of nor aggression toward humans were frequently met along the shores of Lake Ayan in the northern basin of the River Yenisei, where few people live, but some aggressive bears were found near slaughter sites of semidomestic reindeer (*Rangifer tarandus*), where they obtained meat remnants (Suvorov 1991).

Chestin (unpublished, 1993) conducted the only quantitative analysis of brown bear behavior toward people. He found that brown bear aggressiveness in Russia, measured as attacks on people and accounting for bear density, was statistically significantly and inversely related to human density. He did not specifically include hunting as a variable, but it is reasonable to assume that hunting pressure is higher where human density is higher, although the relationship is not necessarily linear.

Changes in Bear Behavior with the Onset of Hunting

Bishop Peder Claussøn Friis described in 1599 how bears in Norway became more fearful of people in the 1560's, when hunters began to use rifles (match-lock black powder muzzleloaders) for bear hunting. After this happened, bears began to run far and fast from the scent of men and became much more wary (Storm 1881). Bears were reported to be common at this time (Storm 1881) and 300 years later (Swenson et al. 1995).

Zheleznov (1993) reported that bears became more nocturnal (not quantified) in northeastern Siberia in the mid-1970's. This coincided with the start of the use of helicopters for bear hunting.

Changes in Bear Behavior with the Cessation of Hunting

Suvorov (1991) reported that bears in an area on the west shore of Lake Baikal showed less fear of man and began feeding diurnally only 2 years after the area was proclaimed a reserve and bears were protected. Such a change was noticed only 3 years after the Baikal State Game Management Area, where many foreigners hunted bears, was converted to a national park. Without naming reserves, he stated that bears in reserves in this area often obtain human-derived food resulting from tourism, which again confounded the results. In Norway's Pasvik Valley, bears have become increasingly bold and come nearer human habitation and take human-derived foods more now than previously. Bears have been increasing in numbers since they were protected in 1972 (Wikan 1996). The population increase may be a confounding variable here.

Loss of Wariness in Hunted Populations that are Increasing in Number

Wesslén (1940), the first photographer to photograph Scandinavian bears in the wild, described his efforts to photograph bears in the Swedish mountains in the 1930's, when the bear population was at its lowest following an intensive eradication attempt (Swenson et al. 1995). He reported that these bears were extremely shy and difficult to approach; it was even difficult to get them to come to baits. Today, the bear population in Sweden is perhaps 6 times greater than in the 1930's, but it has been hunted since 1943. In spite of this hunting, the bears in this much larger population do not appear to be as shy and are now more willing to come to baits than those described by Wesslén (1940). In fact, bears that have lost their fear of man and that come close to human habitation to eat food are becoming an increasing problem in

Sweden (Sandegren and Swenson 1997). This suggests that either (1) bears were very wary after the population had declined 90% over about 80 years (Swenson et al. 1995), but less wary after 50 years of 5.5% annual harvest, on average, (Swenson et al. 1994), (2) a greater number of bears were available to cause problems after the population had increased greatly, or (3) a combination of these factors is involved.

Similar experiences have been reported from Slovakia (Hell and Findó 1999) and Romania (Ionescu 1999). There, despite continued hunting, the populations increased, as did reports of bears encountering humans, eating garbage, and causing other problems. However, the amount of available garbage also has increased with the increasing standard of living (P. Kaczynsky, Wildbiologische Gesellschaft München, Linderhof, Germany, personal communication, 1997). Zyryanov (1991) and Khlebnikov (1991) agreed that in Sayan, Russian Asia, the numbers of bears increased after the hunting season was restricted so that harvest was only about 1% of the estimated population. The bears became less wary of man and caused more problems, such as breaking into huts and killing livestock.

Unhunted, but Wary, Bear Populations

Bears do not necessarily lose their fear of man when they are protected. The bear was protected in Spain in 1973, but bears in the 2 remnant populations there do not appear to have lost their wariness of man; however, poaching does continue (Clevenger and Purroy 1991). The same situation is seen for remnant populations in Italy, protected in 1922 and 1939 (Boscagli 1999, Osti 1999), in France, partially protected from hunting in 1955–58 and totally protected in 1972 (Camarra 1999), and the now extinct remnant population in southern Norway, protected in 1971 (Elgmork 1979). All of these were low-density and static or decreasing populations.

HUMAN DISTURBANCE AND ACTIVITY PATTERNS OF BEARS

Activity patterns of European brown bears have been studied in the Italian Alps, Croatia, Spain, northern Sweden, and in central Sweden–southeastern Norway (Roth 1983, Roth and Huber 1986, Bjärvall and Sandegren 1987, Clevenger et al. 1990, Wabakken and Maartmann 1994). In all cases, the major pattern was one of crepuscular or nocturnal activity. In all of these areas, bears have been persecuted by man for centuries, and in Italy and Spain, only small, remnant populations remain. Roth (1983) reviewed the North American studies and concluded that North American brown bears were

more diurnal than European brown bears. One reason might be the much longer period of persecution in Europe, which may have resulted in a selective killing of diurnal bears over long periods.

In the northeastern part of the Altai Mountains in Central Asia, Sobanskii and Zavatskii (1993) found that bears in areas where they were not being disturbed by people were active throughout the day. Bears apparently became more nocturnal in northeastern Siberia when hunters started using helicopters (Zheleznov 1993).

TENTATIVE CONCLUSIONS

It was impossible to rigorously test the hypothesis based on a review of subjective impressions and unquantified statements. Although we have much to learn about the mechanisms of wary behavior in brown bears, there seems to be a few general patterns.

Access to Food.— The accessibility of food near humans confounded many of these studies. Bear access to human food was always associated with a relatively rapid loss of wariness to humans. Thus, the reported loss of wariness with protection and increasing populations was probably more due to the availability of human-derived foods. Bears that are expanding into areas where bears have been gone for a long time often find food near human dwellings because people have not needed to bear-proof these food sources. The availability of human-derived food apparently caused bears to lose their wariness, even when hunted.

Hunted Bears.— When human-derived food was not a confounding variable, the authors indicated that bears were more wary where they were hunted. Also, the initiation of hunting with rifles or helicopters changed the wariness of bears rapidly. Hunters may selectively remove bolder individuals, but it is difficult to imagine that this has a genetic effect unless a large proportion of the population is removed. The differences inside and outside the Russian reserves suggest that the effect is learned rather than genetic, because gene flow in brown bear populations occurs over areas much larger than Russian reserves (Craighead et al. 1995). The rapid changes in behavior that were reported also suggest learning as the most important behavior-modifying mechanism. Young brown bears remain with their mother for more than a year, which allows them ample time to learn from their mothers how to react to humans.

Previously Hunted Bears.— Brown bears in previously hunted populations appeared to be wary of humans for a long time without hunting if they did not associate humans with food, such as in the ranges of the small, static, or decreasing remnant European populations.

There, use of human-derived foods by bears is not a management problem (Elgmork 1979, Boscagli 1999, Camarra 1999, Osti 1999).

The results of this review partly support the hypothesis proposed by Dood et al. (1986). Both Dood et al. (1986) and Greer (1976) used increased wariness as a justification to continue hunting of the grizzly bear in Montana. However, it appears that the subject is more complicated than they proposed and that managing garbage and other food sources in the vicinity of people is probably even more important than hunting in maintaining wariness. This is the most difficult aspect of brown bear management in North America (Herrero 1985), and this statement also applies to Eurasia. The literature suggests that the accessibility of human-derived foods to bears must be controlled to maintain the bears' wariness toward people. When this has been done, hunting may contribute to increasing bears' wariness.

These conclusions are similar to conclusions about North American brown bears. Grizzly bears were more habituated to humans, and more aggressive encounters occurred in Glacier National Park, Montana, where hunting is forbidden, than in nearby areas, where hunting was allowed for grizzly and American black bears (*Ursus americanus*), ungulates, and birds (Jope 1985, McLellan and Shackleton 1989, Mace and Waller 1996). McCullough (1982) argued that, although conditioning to food was an important factor in loss of wariness in bears, it was not the only factor. He considered habituation due to lack of negative conditioning, especially hunting, to be an important additional factor. Although Herrero (1985:206) stated that "death isn't an instructor—it is an eliminator", McCullough (1982:30) concluded that "the role of learning in producing wildness in bears and concomitant avoidance of humans should not be underestimated." Thus, the observed trends in North America are similar to those in Eurasia, but the factors are not well documented in North America either.

Should we use increased wariness of bears as a justification for bear hunting? The bears in the areas most populated by humans are often the most endangered, whereas those in large, secure populations are often in areas less populated by humans. As bear populations are sensitive to overharvest (Knight and Eberhardt 1985, Miller 1990, Swenson and Sandegren 1996, Sæther et al. 1998, Tufto et al. 1999), one cannot justify harvesting endangered populations to make them more wary of humans. Also, starting to hunt a protected, food-conditioned population may be problematic, resulting in an initially high kill of unwary, habituated bears (McCullough 1982). Large populations usually can sus-

tain a limited harvest (Miller 1990). Maintaining wariness could be used as one reason to hunt bears, but if the population is large and can sustain exploitation, one does not need this reason. In any case, it is important to keep human-derived food unavailable to bears. If this is done effectively, it will probably contribute more to solving the problem of unwary bears than hunting, although that in itself will probably not totally solve the problem.

This review raises more questions than it answers. It is obvious that more research is needed in this area, especially because people are more willing to accept wary bears. What we really need is innovative and ethically acceptable experiments that quantify wariness and reveal its causes.

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LITERATURE CITED

- BJÄRVALL, A., AND F. SANDEGREN. 1987. Early experiences with the first radio-marked brown bears in Sweden. *International Conference on Bear Research and Management* 7:9–12.
- BOSCAGLI, G. 1999. Status and management of the brown bear in Central Italy (Abruzzo). Pages 81–84 in C. Servheen, S. Herrero, and B. Peyton, compilers. *Bears, status survey and conservation action plan*. IUCN/SSC Bear and Polar Bear Specialist Groups, World Conservation Union, Morges, Switzerland and Cambridge, United Kingdom.
- CAMARRA, J.J. 1999. Status and management of the brown bear in France. Pages 68–72 in C. Servheen, S. Herrero, and B. Peyton, compilers. *Bears, status survey and conservation action plan*. IUCN/SSC Bear and Polar Bear Specialist Groups, World Conservation Union, Morges, Switzerland and Cambridge, United Kingdom.
- CLEVENGER, A.P., AND F.J. PURROY. 1991. *Ecología del oso pardo en España*. Monografías del Musio Nacional de Ciencias Naturales, Madrid. (In Spanish with English summary.)
- , ———, AND M.R. PELTON. 1990. Movement and activity patterns of a European brown bear in the Cantabrian Mountains, Spain. *International Conference on Bear Research and Management* 8:205–211.
- CRAIGHEAD, L., D. PAETKAU, H.V. REYNOLDS III, E.R. VYSE, AND C. STROBECK. 1995. Microsatellite analysis of paternity and reproduction in Arctic grizzly bears. *Journal of Heredity* 86:255–261.
- DOOD, A.R., R.D. BRANNON, AND R.D. MACE. 1986. Final programmatic environmental impact statement; the grizzly bear in northwestern Montana. Montana Department of Fish, Wildlife and Parks, Helena, Montana, USA.
- ELGMORK, K. 1979. *Bjørn i naturen*. Gyldendal Norsk Forlag, Oslo, Norway. (In Norwegian.)
- GREER, K.R. 1976. Managing Montana's grizzlies for the

- grizzlies! International Conference on Bear Research and Management 3:177–189.
- HELL, P., AND S. FINDÓ. 1999. Status and management of the brown bear in Slovakia. Pages 96–100 in C. Servheen, S. Herrero, and B. Peyton, compilers. Bears, status survey and conservation action plan. IUCN/SSC Bear and Polar Bear Specialist Groups, World Conservation Union, Morges, Switzerland and Cambridge, United Kingdom.
- HERRERO, S. 1985. Bear attacks, their causes and avoidance. Winchester Press, Piscataway, New Jersey, USA.
- IONESCU, O. 1999. The status and management of the brown bear in Romania. Pages 93–96 in C. Servheen, S. Herrero, and B. Peyton, compilers. Bears, status survey and conservation action plan. IUCN/SSC Bear and Polar Bear Specialist Groups, World Conservation Union, Morges, Switzerland and Cambridge, United Kingdom.
- JOPE, K.L. 1985. Implications of grizzly bear habitation to hikers. Wildlife Society Bulletin 13:32–37.
- KHLEBNIKOV, A.I. 1991. Reaktsiya burogo medvedya na izmeneniya ekologicheskikh uslovii v Zapadnom Cayane. Pages 181–185 in V.V. Volkovintser, editor. Medvedi v SSSR, Izdatel'stvo Nauka, Novosibirsk, Russia. (In Russian.)
- KNIGHT, R. R., AND L. L. EBERHARDT. 1985. Population dynamics of Yellowstone grizzly bears. Ecology 66:323–334.
- MACE, R.D., AND J.S. WALLER. 1996. Grizzly bear distribution and human conflicts within Jewel Basin Hiking Area, Swan Mountains, Montana. Wildlife Society Bulletin 24:461–467.
- MCCULLOUGH, D.R. 1982. Behavior, bears, and humans. Wildlife Society Bulletin 10:27–33.
- MCLELLAN, B.N., AND D.M. SHACKLETON. 1989. Immediate reactions of grizzly bears to human activities. Wildlife Society Bulletin 17:269–274.
- MILLER, S.D. 1990. Population management of bears in North America. International Conference on Bear Research and Management 8:357–373.
- NYHOLM, E.S., AND K.E. NYHOLM. 1992. Distribution of brown bear in Finland years 1978–1990. Pages 3–13 in F. Bourlière, president of the scientific committee. Management and restoration of small and relictual bears populations. Museum d'Historie Naturelle, Grenoble, France.
- OSTI, F. 1999. Status and management of the brown bear in Italy (Trentino). Pages 84–86 in C. Servheen, S. Herrero, and B. Peyton, compilers. Bears, status survey and conservation action plan. IUCN/SSC Bear and Polar Bear Specialist Groups, World Conservation Union, Morges, Switzerland and Cambridge, United Kingdom.
- ROTH, H.U. 1983. Diel activity of a remnant population of European brown bears. International Conference on Bear Research and Management 5:223–229.
- , AND D. HUBER. 1986. Diel activity of brown bears in Plitvice Lakes National Park, Yugoslavia. International Conference on Bear Research and Management 6:177–229.
- SANDEGREN, F., AND S. SWENSON. 1997. Björnen—viltet, ekologin och människan. Svenska Jägareförbundet, Uppsala, Sweden. (In Swedish.)
- SÆTHER, B.E., S. ENGEN, J.E. SWENSON, Ø. BAKKE, AND F. SANDEGREN. 1998. Assessing the viability of Scandinavian brown bear, *Ursus arctos*, populations: the effects of uncertain parameter estimates. Oikos 83:403–416.
- SERVHEEN, C. 1990. The status and conservation of the bears of the world. International Conference on Bear Research and Management 8; Monograph Series 2.
- SOBANSKII, G.G. AND B.P. ZAVATSKII. 1993. The Altai and Sayan. Pages 214–249 in M.A. Vaisfeld and I.E. Chestin, editors. Bears: brown bear, polar bear, Asian black bear; distribution, ecology, use and protection. Nauka, Moscow, Russia. (In Russian with English summary.)
- STORM, G. 1881. Samlede skrifter av Peder Claussøn Friis. A.U. Brøgger, Kristiania (Oslo). (In Danish.)
- SUVOROV, A.P. 1991. Ob elementakh sinantrolizma v rovedenii burykh medvedei Srednei Sibiri. Pages 149–154 in V.V. Volkovintser, editor. Medvedi v SSSR, Izdatel'stvo Nauka, Novosibirsk, Russia. (In Russian.)
- SWENSON, J.E., AND F. SANDEGREN. 1996. Sustainable brown bear harvest in Sweden estimated from hunter-provided information. Journal of Wildlife Research 1:228–231.
- , ———, A. BJÄRVALL, A. SÖDERBERG, P. WABAKKEN, AND R. FRANZÉN. 1994. Size, trend, distribution and conservation of the brown bear *Ursus arctos* population in Sweden. Biological Conservation 70:9–17.
- , P. WABAKKEN, F. SANDEGREN, A. BJÄRVALL, R. FRANZÉN, AND A. SÖDERBERG. 1995. The near extinction and recovery of brown bears in Scandinavia in relation to the bear management policies of Norway and Sweden. Wildlife Biology 1:11–25.
- TUFTO, J., B.E. SÆTHER, S. ENGEN, J.E. SWENSON, AND F. SANDEGREN. 1999. Harvesting strategies for conserving minimum viable populations based on World Conservation Union criteria: brown bears in Norway. Proceedings of the Royal Society of London B 266:961–967.
- VAISFIELD, M.A., AND V.S. PAZHETNOV. 1992. Bear-human conflicts in developed landscapes of European Russia. Pages 332–337 in F. Bourlière, president of the scientific committee. Management and restoration of small and relictual bears populations. Museum d'Historie Naturelle, Grenoble, France.
- WABAKKEN, P., AND E. MAARTMANN. 1994. Final report from the brown bear-domestic sheep project in Hedmark County 1990–93. Norwegian Institute for Nature Research, Trondheim, Forskningsrapport 58. (In Norwegian with English summary.)
- WESSLÉN, S. 1940. På lapplandsfjällen bland björnar. P.A. Norstedt & Söners Förlag, Stockholm, Sweden. (In Swedish.)
- WIKAN, S. 1996. Björnens år, villmark og rovvilt i Pasvik. Chr. Schibsteds Forlag, Oslo, Norway. (In Norwegian.)
- WILDBIOLOGISCHE GESELLSCHAFT MÜNCHEN. 1997. Managementplan für Braunbären in Österreich. Wildbiologische Gesellschaft München e.V., Linderhof, Germany. (In German.)
- YUDIN, V.G. 1993. The south of the Far East. Pages 348–380 in M.A. Vaisfeld and I.E. Chestin, editors. Bears: brown bear, polar bear, Asian black bear; distribution, ecology,

use and protection. Nauka, Moscow, Russia. (In Russian with English summary.)

ZHELEZNOV, N.K. 1993. Dynamics of human-caused pressure, bear number and behavioural patterns in marginal north-east Russia. Pages 77–85 in I.E. Chestin and S.M. Uspensky, editors. Bears of Russia and adjacent countries—state of populations. Volume 1. Proceedings of the sixth conference of specialists studying bears. Moscow, Russia. (In Russian with English summary.)

ZYRYANOV, A.N. 1991. Biotopicheskoe razmeshchenie i

povedinie burogo medvedya v Sayanakh. Pages 171–180 in V.V. Volkovintser, editor. Medvedi v SSSR, Izdatel'stvo Nauka, Novosibirsk, Russia. (In Russian.)

———, M.R. SMIRNOV, AND A.V. BRILLIANTOV. 1993. Peculiarities in brown bear distribution and behaviour in Middle Siberia. Pages 93–102 in I.E. Chestin and S.M. Uspensky, editors. Bears of Russia and adjacent countries—state of populations. Volume 1. Proceedings of the sixth conference of specialists studying bears. Moscow, Russia. (In Russian with English summary.)