

STATUS OF BROWN BEARS IN KAMCHATKA, RUSSIAN FAR EAST

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Abstract: The Kamchatka Ecology and Nature Management Institute has been censusing brown bears (*Ursus arctos*) in the southern part of the Kamchatka peninsula (Russian Far East) since 1991. The censused area comprised 11,045 km² within the districts of Yelizovo, Ust' Bolsheretsk, Sobolevo, and Ust' Kamchatsk. We used an aerial total count method while flying in small fixed-wing planes during late spring (May–early Jun) to collect data on bear numbers, their distribution, den location, birth rate, and cub survival. A total of 1,051 bears was observed during 83 hours of overflight time during 1991, 1993, and 1994. Our yearly estimates of average bear densities in the southern part of Kamchatka (54,100 km² study area) ranged from 0.81 to 1.30 bears/10 km². Some areas had high bear density (>1.7 bears/10 km²) despite hunting pressure. Bear numbers declined (<0.8 bears/10 km²) near settlements along main roads. The main threat to brown bears in Kamchatka is poaching for bear parts by local residents. We recommend that aerial censuses be expanded and improved to more accurately estimate population status and trends. Alternate means of employment in ecotourism and outfitting should be developed for local residents to encourage their support of measures to sustain Kamchatka's brown bears.

Ursus 10:11–16

Key words: aerial census, brown bear, density, Kamchatka, Russia, *Ursus arctos*.

In 1991 the Kamchatka Ecology and Nature Management Institute initiated a study on the status and dynamics of the brown bear population in Kamchatka, Russian Far East. Prior to that time wildlife authorities in Kamchatka had insufficient data about brown bear populations to manage them, including estimates of the number and distribution of bears or knowledge of habitat use, recruitment, and survivorship. Ostroumov (1968) estimated Kamchatka's brown bear population to be 18,000 to 22,000 in the early 1960s. Dunishenko (1987) estimated a population of 12,000 to 14,000 bears in the late 1960s. According to an official report of Kosheev (1991) there were 8,000 to 10,000 bears in Kamchatka in 1986–90. These estimates described a downward trend in Kamchatka's brown bear population. In the late 1980s and early 1990s brown bears also faced increased poaching. Worsening economic conditions in Russia forced authorities and nature conservation agencies to pay less attention to brown bears. These developments increased the need for more accurate information on Kamchatka's brown bears. Consequently, we initiated this aerial survey to estimate the density of bears in this population.

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STUDY AREA

Kamchatka is a 1,200-km long peninsula in the Russian Far East bounded by the Sea of Okhotsk, the Bering Sea, and the Pacific Ocean. Its maximum width is 440 km, and area is 472,300 km². Brown bears occupy approximately 81.3% (384,200 km²) of the Kamchatka Peninsula, almost without fragmentation (Anon. 1995).

Our study was done in 84,600 km² of the southeast part of the peninsula, a mountainous area divided by broad river valleys with most peaks reaching 1,500 m of elevation (Fig. 1). The study area is a very active volcanic zone that includes >20 volcanoes (1,900–5,850 m elevation). The long coastline consists of steep banks, cliffs, and beaches. More than 95% of the human population and all major cities are along the coast. These centers of human activity are serviced by only 2 main roads, with a total length of approximately 1,000 km.

The vegetation cover on Kamchatka is very dense and mainly consists of pine (*Pinus pumila*) and alder bushes (*Alnus kamtschatika*) from the coast to 1,200–1,300 m above sea level, stone birch (*Betula ermanii*) forests on lower slopes to 700–800 m elevation, and willow (*Salix undensis*) and cottonwood (*Populus komarovii*) forests along drainages. The rugged terrain and lush vegetation provided high security cover for bears during the entire snowfree period. Approximately half the study area (46.7%) provided bears with a variety of foods (e.g., grasses, salmon [*Oncorhynchus* spp.], berries, and pine nuts), protection, and den sites (Table 1) (Revenko 1993). These high quality bear habitats have helped bears to maintain their number through a long history of bear–human relations. Moderate quality bear habitats (6.3% of the study area) lacked food diversity, good denning sites, and protection. There are many settlements and logging activity within this area. Low quality bear habitats on 47% of the study area provide limited food resources and had little protection for bears.

Two nature preserves comprise 14% of our study area: Kronotskiy State Preserve and South Kamchatka Sanctuary. Bear hunting has been prohibited within

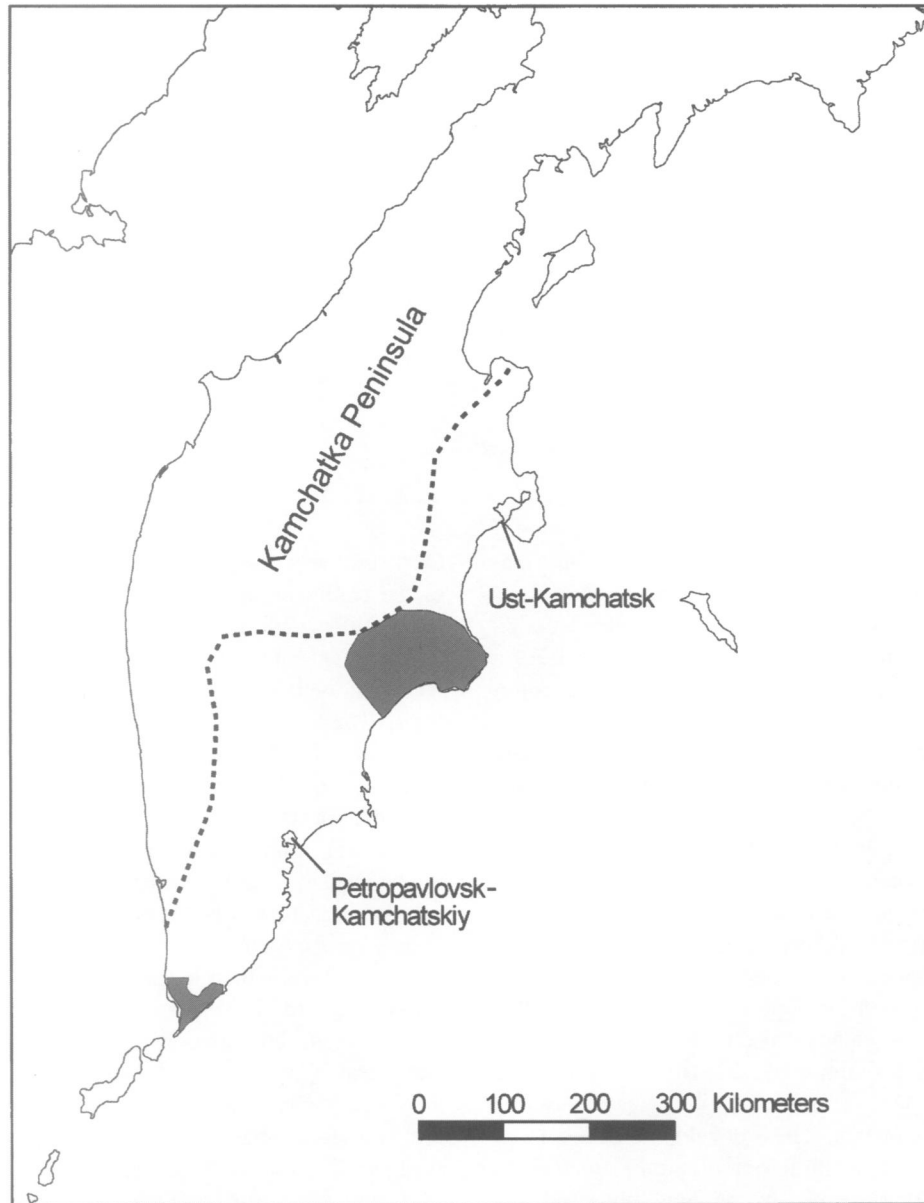


Fig. 1. The study area (within dotted line) for aerial surveys of brown bears in southeastern Kamchatka Peninsula, Russia, 1991. Shaded areas include bear preserves.

their borders for the last 20 and 10 years, respectively. Bear hunting is permitted in the rest of the study area.

METHODS

We conducted aerial strip counts of bears during the late spring of 1991, 1993, and 1994 to estimate bear density, distribution, and birth rate. Prior to these surveys

we spent 2 years studying bear activity in different parts of the study area and the effect of snow conditions on bear activity and our ability to detect activity. Due to the high visibility of bears and their tracks on snow, we chose early May to early June for aerial surveys. We tried to time our surveys to coincide with the 1–2 weeks during which most bears emerged from their dens while snow was still present. Weather permitting, we tried to

Table 1. Extent and quality of habitat types occupied by brown bears in Kamchatka, Russia (based on Anon. 1995).

Bear habitat quality, type	Area, x 1000 km ²	Percent
High quality		
Birch forest	64.2	16.7
Willow forest	15.0	3.9
Dwarf pine shrub	74.0	19.3
Alder shrub	26.0	6.8
Subtotal	179.2	46.7
Medium quality		
Larch forests	14.1	3.7
Spruce forests	2.2	0.6
Clearcuts, burns	7.7	2.0
Subtotal	24.0	6.3
Low quality		
Flat tundra and swamps	125.0	32.5
Mountain tundra	56.0	14.5
Subtotal	181.0	47.0
Total	384.2	100.0

time our surveys to occur when bears were most active. Our preliminary study revealed that to be 0700–1000 hours and 1700–2200 hours.

During 1991 we used a 10-passenger plane (AN-2) and an 18-passenger helicopter (MI-8) which were the standard vehicles for aerial surveys in Kamchatka until the early 1990s. In 1993 and 1994 we used a small fixed-wing Polish plane (3 passenger, Vilga-35) and a small helicopter (6 passenger, MI-2). In 1991 we surveyed the Yelizovo and Bol'sheretsk districts. We also surveyed the Ust'-Kamchatsk and Sobolevo districts during 1993 and 1994. Within districts we avoided open coastal flats with tundras and wide swamps and mountains higher than 1,500 m because brown bears do not use these areas in spring. We flew mostly over forests, shrub lands, and mountain tundra. We did not fly in a straight path but followed the major geographical features such as main rivers, ridges, and coastline.

We observed bears from aircraft during strip transect surveys; sightings were used to estimate the total numbers and density in each study area. The strip width was 1-km wide when observers could see the ground on both sides of aircraft, or 0.5-km wide when there was 1 observer or when the plane was flying along the coast. We flew 150 m above the ground at speeds of 140–160 km/hour. We maintained a distance of at least 5 km between transects to prevent counting bears twice. The area of the transect was calculated as the product of the transect width, the average flight speed, and flight time. The strip transect area comprised between 4.9% and 5.2% of the study area

during the 3 years of survey (Table 2). We recorded the following data on a portable tape recorder while flying: flight date, time of day, weather condition, percent snow cover, habitat type, and number of bears seen. For each adult bear we recorded size, color, activity, and number and age of any offspring. For the census we did not count bear tracks on snow as have previous researchers because it resulted in biases in extrapolation. We counted tracks of females with cubs and yearlings to estimate birth rate. The time spent conducting surveys for any year depended on the available funds for aircraft rental.

The density of bears in the study area was estimated as follows: density of bears = bears observed in transect/area of strip transect. I applied area-specific correction factors to account for the different sightability of bears under varying conditions of snow cover, terrain, weather, and time of the day. The factor represented an average of the sightability of bears over the yearly survey. To compute the average sightability we assumed that we observed 80% of the bears in birch forests on steep mountainous slopes, 90% in less broken terrain, and all bears on open snow covered surfaces on sunny days. We did not conduct aerial surveys during cloudy weather. To compare bear densities within the study area we divided the region into zones. Each zone represented a homogeneous landscape with respect to the quality of bear habitat and human occupation. The bear density for a zone was the mean number of bears observed/10 km² of transect flown within the zone. Lastly we asked residents about their attitudes toward bears to understand the main threats to bears from humans.

RESULTS

We observed a total of 1,051 bears during 83 hours of overflights during 1991, 1993, and 1994 (Table 2). Estimated density was 0.81 bears/10 km² in 1991, 1.30 bears/10 km² in 1993, and 1.13/10 km² bears in 1994. Most of these bears we observed either in mountainous terrain between 300 and 1,100 m elevation or in birch forests or alder shrubs along the Pacific coast. Very few bears were seen on open, low elevation areas. Fresh grasses along the coast or river banks appeared to attract bears beginning in late May. Most of the bears observed in June were feeding on fresh grasses along river banks. Some bears fed on remains of late salmon around Lake Kurilskoe or pine nuts. South Kamchatka Sanctuary, including the Lake Kurilskoe watershed, had the highest bear density in the study area. Bear density around Lake Kurilskoe in 1991 was 32.25 bears/10 km² of transect (Revenko 1993).

Table 2. Conditions under which aerial surveys were conducted on brown bears in Kamchatka, Russia, and estimates of their density.

Conditions	1991	1993	1994
Dates of surveys	14–28 May	4, 10–27 May	20–23 May, 3–6 Jun
Percent snowcover	75–90	90–100	85–100
Aircraft type	AN-2	Vilga-35, MI-8	Vilga-35, MI-2
Number of observers	2	2	1–2
Airspeed (km/hr)	145	150	150–160
Count time (hr)	23	28	32
Strip transect area (km ²)	3,335	4,150	3,505
Study area (km ²)	63,660	84,600	70,830
% area surveyed	5.2	4.9	4.9
Bears counted	224	467	360
Visibility correction factor	1.2	1.15	1.1
Estimated number of bears	5.131	10,948	8.002
Estimated density, /10 km ²	0.806	1.294	1.129

In 1993 density in the same area density was 5.45 bears/10 km² of transect. Mountainous coasts and remote ridges used for denning had relatively high number of bears (>1.7 bears/10 km² of transect, Fig. 2). Such zones overlapped with high quality bear habitats. Zones with moderate number of bears (0.8–1.7 bears/10 km² of airstrip) occurred in most of the study area. Zones with low bear density (<0.8 bears/10 km² of airstrip) occurred around major cities and along main roads.

We observed twice as many litters in the spring of 1993 ($n = 95$ litters) as we did in the spring of 1994 ($n = 44$ litters, Table 3). The proportion of litters with offspring of different ages was similar both years of observation. Cubs comprised the lowest proportion of litters over the 2-year period (mean = 17.3%), followed by 2-year olds (mean = 29.5%), and yearlings (mean = 53.2%). The mean number of cubs/maternal female bear was lower during both census years (e.g., 2.06 and 2.00) than the average of 2.24 cubs ($n = 86$ litters) recorded during ground observations in 1988–91 (Revenko 1991).

DISCUSSION

The use of smaller aircraft and a tape recorder to store data were improvements over the methods used by Kamchatka game managers since the 1960s. Accurate counts require access to appropriate aircraft and good visibility. The larger plane (AN-2) was unsatisfactory on both accounts, and its use was limited by lack of proper fuel. The small fixed-wing aircraft Vilga-35 (on skis) provided a better angle of view for observers on both sides of the aircraft. Its relatively slow air speed allowed observers more time to record data. However, the Vilga-35 could not be used after 22–23 May due to the warm weather, which made runways too soft for taking off and

landing. In addition, shortages of proper fuel in remote areas limited its usefulness. Under these conditions it was easier to fly small helicopters (MI-2), although the rental fee was twice that for the Vilga-35. Local airports supplied the helicopter with kerosene fuel, and it had no need for a runway.

The apparent increase in bear density between 1991 and 1993 and its decline in 1994 may reflect our methods, the changes in the status of the bear population, or both. The density estimate for the entire study area in 1991 (e.g., 0.81 bears/10 km²) was low despite an enormous concentration of bears around Lake Kurilskoe, where bears fed on the remains of a late salmon run. During 40 minutes of flight there, we observed 129 bears (Revenko 1993). We may have underestimated the visibility correction factor for our flight over Central Kamchatka on 10 June 1991. The snow cover in Central Kamchatka was fragmented in the mountains and lacking in elevations below 500 m. These conditions and our use of the larger aircraft (AN-2) made it difficult to observe bears, and the visibility correction factor for that part of the study area may have been too low. Despite these difficulties, the bear density we recorded around Lake Kurilskoe was probably the highest for Kamchatka and perhaps for Russia. Brown bear density was reported to be high but still less than Kamchatka in the north Far East of Russia (8 bears/10 km², Chernyavskiy et al. 1993), in the Altai Mountains (6 bears/10 km², Sobanskiy and Zavatskiy 1993), and along the shore of Lake Baikal (2.6 bears/10 km², Ustinov 1993).

The higher 1993 density (1.30 bears/10 km²) may have resulted from better visibility from the smaller aircraft and better timing. Our survey period of 15–18 May 1993 took place during the time of den emergence for many bears. We do not know if the 12.3% decline in the esti-

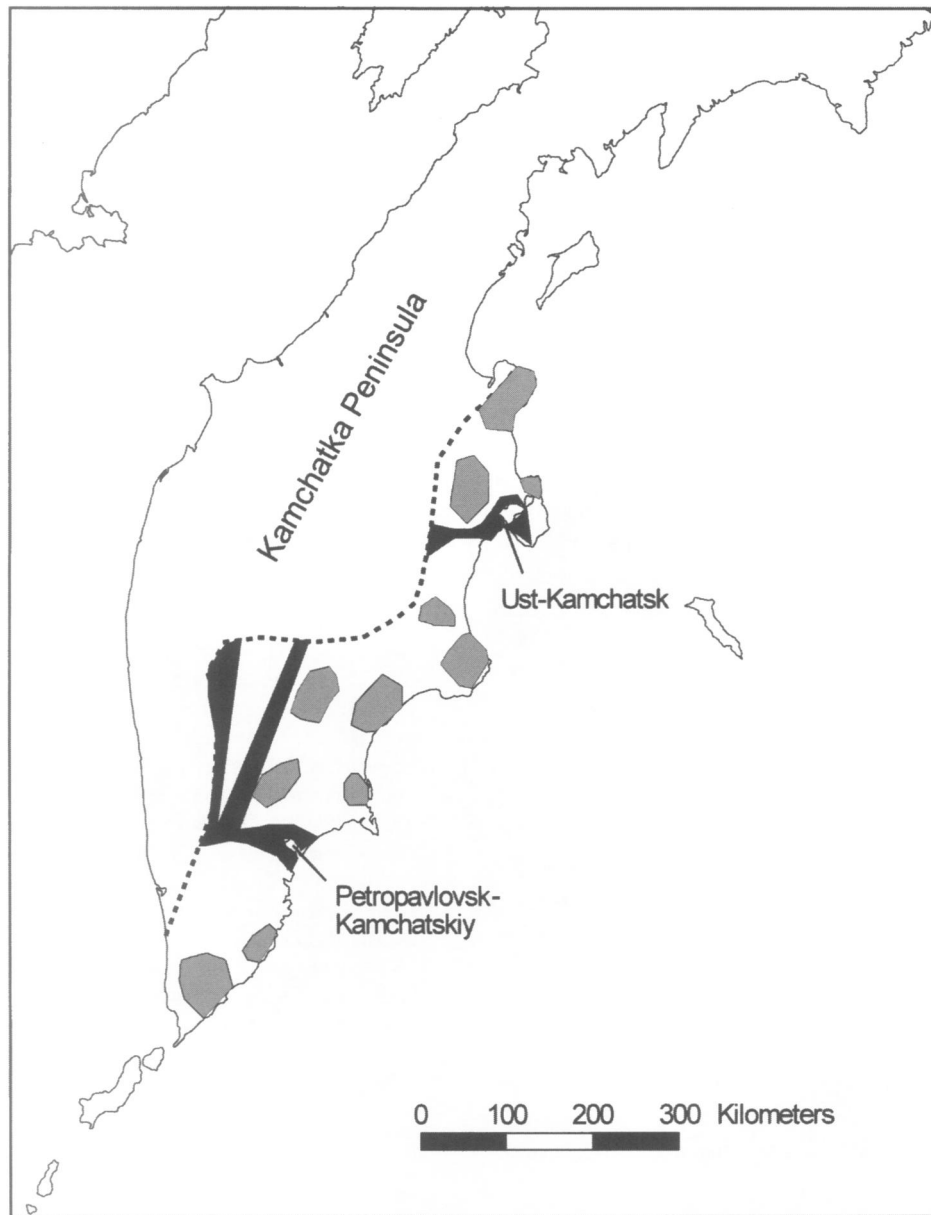


Fig. 2. Estimated relative brown bear density within study area, southeastern Kamchatka Peninsula, Russia, 1991–94. Dark shaded areas indicate low density; unshaded area, moderate density; and light shaded area, high density.

mates of bear density from 1993 to 1994 reflects our methods or the true population trend, although we suspect the latter. The economic hardships suffered in Russia since 1991 have increased, particularly in remote regions such as Kamchatka. Consequently, a lot of bears have been poached by the local people for subsistence purposes. However, heavy snow cover in 1994 may have delayed the emergence of bears from dens. We tried to compensate for this by starting our surveys later in the

east part of the study area (20–23 May) and northeast part (3–6 Jun). Late emergence may be one reason fewer litters were observed in 1994 than in 1993.

We recommend several steps to improve the accuracy of aerial counts. First, more flights are required to ensure that observers see the greatest number of bears when conditions are optimal. Second, a more accurate method of estimating visibility correction factors needs to be developed and tested. Third, we recommend that aerial sur-

Table 3. Composition of brown bear litters observed during aerial surveys in Kamchatka, Russia, 1993 and 1994.

Year	Age of offspring	Litters	(%)	N	\bar{x}
1993	cubs	17	(17.9)	35	2.06
	yearlings	51	(53.7)	111	2.18
	2-year-olds	27	(28.4)	59	2.19
	Subtotal	95	(100.0)	205	2.16
1994	cubs	7	(15.7)	14	2.00
	yearlings	23	(52.4)	44	1.91
	2-year-olds	14	(31.9)	26	1.86
	Subtotal	44	(100.0)	84	1.91
Total		139		289	2.08

veys be extended to cover the entire area occupied by bears in the Kamchatka Peninsula.

The main threat to brown bears in Kamchatka is illegal hunting for bear parts by local people, field workers, and military staff. Although on about half of the Kamchatka peninsula, brown bears have access to high quality habitat that is unfragmented and supports an estimated 8,000–10,000 bears, their future status is compromised by the worsening economic conditions that encourage local people to exploit them. Illegal kills are further encouraged by the lack of regulatory controls brought on by the lack of funding for enforcement agencies and the permanent demand for bear parts from Oriental countries with markets near Kamchatka. People have good access to remote bear areas in early spring. The concentration of bears around limited food sources and their high visibility against snow backgrounds makes them vulnerable to poachers. Due to the inability of authorities to enforce bear hunting regulations, reduction of poaching can best be achieved by modifying the conditions that promote it. We recommend authorities support private outfitter businesses and ecotourism as alternative ways to employ local people. Residents need to understand the link between

continued employment and a sustained bear population to be encouraged to reduce poaching.

LITERATURE CITED

- ANON. 1995. Materialy okhoteconomicheskogo obsledovaniya i mezhkhozayastvennogo ustroistva territorii Kamchatskoi oblasti. Vol. 1. Sibecocenter, Novosibirsk, Russia. Page 12. (In Russian.)
- CHERNYAVSKIY F.B., A.V. KRETCHMAR, AND M.A. KRETCHMAR. 1993. The north of the Far East. Pages 318–348 in M.A. Vaisfeld and I.E. Chestin, eds. Bears. Nauka, Moscow, Russia.
- DUNISHENKO, U.M. 1987. Rasprostranenie i Chislennost Burykh Medvedev Sibiriina Dal'nem Vostoke. Pages 45–56 in B.S. Yudin, ed. Bear ecology. Nauka, Novosibirsk, Russia. (In Russian.)
- KOSHEEV V.V. 1991. Sostoyanie resursov burogo medvedya i rekomendatsii po ikh ispol'zovaniyu v Kamchatskoi oblasti v sesone 1990/1991 godov. Rep. Kamchatka Nat. Use Dep. Pacific Geogr. Inst. Russian Acad. Sci. Petropavlovsk-Kamchatsky, Russia. 3pp. (In Russian.)
- OSTROUMOV, A.G. 1968. Aero-visual'ny uchet chislennosti burykh medvedei na Kamchatke i nekotorye resul'taty nablyudeniy za ikh povedeniem. Bull. Moskovskogo Obshchestva Ispytatelei Prirody 73:35–49. (In Russian.)
- REVENKO, I.A. 1991. Sovremennoe sostoyanie i cherty biologii burogo medvedya yuhznoi Kamchatki. Pages 56–61 in B.P. Zavatskiy and Y.G. Shevtsov, eds. Bears in U.S.S.R. Nauka, Novosibirsk, Russia. (In Russian.)
- . 1993. Kamchatka. Pages 380–403 in M.A. Vaisfeld and I.E. Chestin, eds. Bears. Nauka, Moscow, Russia.
- SOBANSKIY, G.G., AND B.P. ZAVATSKIY. 1993. The Altai and Sayans. Pages 214–249 in M.A. Vaisfeld and I.E. Chestin, eds. Bears. Nauka, Moscow, Russia.
- USTINOV, S.K. 1993. The Baikal region. Pages 275–301 in M.A. Vaisfeld and I.E. Chestin, eds. Bears. Nauka, Moscow, Russia.