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THE CURRENT STATUS OF FORMOSAN BLACK BEAR IN TAIWAN

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Abstract: Due to recently increasing game exploitation and habitat fragmentation, the existence of Formosan black bear (*Selenarctos thibetanus formosanus*) was thought to be endangered. To assess the current status of this species, aboriginal hunters, forestry workers and game store owners were interviewed and 6 field surveys were also conducted. The results showed that this species was distributed mostly in mountains where the elevation is higher than 1,500 m; whereas in winter it could be seen in low elevation from 500 to 1,000 m. From 1985-88, 32 - 60 bears were sighted by the forestry workers in 22 locations. Most bears were found in Lala Mountain Reserve, Yushan National Park and Snow Mountain Area. In addition, from our surveys some bears were found in Tawu Mountain Reserve.

At present, this species can fetch a price of between \$727 US and \$7,274 US ($\bar{x} = \$2,713$ US, $N = 13$) in the local market. This price is approximately 1/2 the annual income of an aboriginal hunter. Besides, over half of the aboriginal hunters ($N = 97$) were willing to catch the animal regardless of its fierceness. This species is widely favored by game store owners; about 91 bears were sold in game stores between 1985-88.

A decreasing bear population was reported by most of the game store owners, aboriginal hunters and forestry workers, as a result of unlimited hunting. To cope with the current crisis, the Council of Agriculture legally declared in January 1989 that the Formosan black bear is a threatened and protected species and a reserve to protect the Formosan black bear is now being planned.

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Formosan black bear was once common in Taiwan (Kuo 1986). It was found in mountains between 100 to 2,000 m elevation all over the Island. Kano (1930) reported that bear could be found in the Coastal Mountain Range near Taitung and in Lion's Head Mountain in Miaoli where the elevation of most of the areas are within 100 to 1,000 m. McCullough (1974) proposed that bears were still present in many mountain areas in Taiwan, including the Coastal Mountain Range. However, their numbers were greatly reduced. Lin and Lin (1983) reported that after 40 years of human activity, many mammals, including bear, were forced to move to higher elevations (from 600-2,700 m in 1940 to 1,500-3,500 m in 1980). Except for these few reports on bears, there has been no study or information about the current status of bear in Taiwan. The objectives of this study supported by the Council of Agriculture were to learn the current distribution of Formosan black bear and human threats to the species. It is hoped that the outcome of the study will accelerate the establishment of reserves and other government actions to save the species.

METHODS

This study of the status of Formosan black bear has been carried out since 1985. Game store owners, aboriginal hunters and forestry workers were interviewed. Each survey was conducted by 2-5 interviewers, 2-3 times per month. Direct interview and mail questionnaires were used to obtain the information from game stores ($N = 78$) on annual average trade, price, and utilization of bear. Ninety-seven hunters from 59 aboriginal villages were interviewed to learn the population trend of bear and the economic impact of hunting. Forestry worker surveys were carried out by sending questionnaires to workers in 69 work stations in all 13 national forest districts. The

questionnaires asked for the number of bear sightings, and the elevation and forest type where they occurred. In addition, 6 field trips were made to areas where bears were thought to be present to verify their presence.

The opinions of the 3 groups of people on the status of bear and 14 other mammalian species were summarized. The degree of endangerment was expressed by an index ranging from 200 to -200. This index was calculated by weighting (2 for population in great danger, 1 for population in danger, -1 for no threat to the population and -2 for an increasing population) the proportion of responses about the population change of those mammals. For example, 80% of all the people interviewed agreed that a given species is in great danger and 20% responded that the same species is in danger. Then, the index of that species is 180 ($2 \times 80 + 1 \times 20$). The number of bear sightings in the field was recorded. The maximum number was the total number of bear sightings with the assumption that individual bears were observed only once. To avoid possible repeated counts of the same individual, the minimum number of bears was estimated by assigning a different probability to each sighting to calculate the expected number of bears sighted. Due to lack of previous information about replication, I used equal chance for the estimate with and without replication to calculate the expected number of bears sighted.

DISTRIBUTION OF BEARS IN TAIWAN

The sighting reports by forestry workers revealed that, during the past 3 years, bears were seen in the major mountain areas of the Island except in the Coastal Mountain Range (Fig. 1). However, the sighting frequency was very low, about a 0.064% chance that a worker would sight a bear or bears in the field on 1 day. There were 26 sightings with an estimated minimum of 32 bears to a

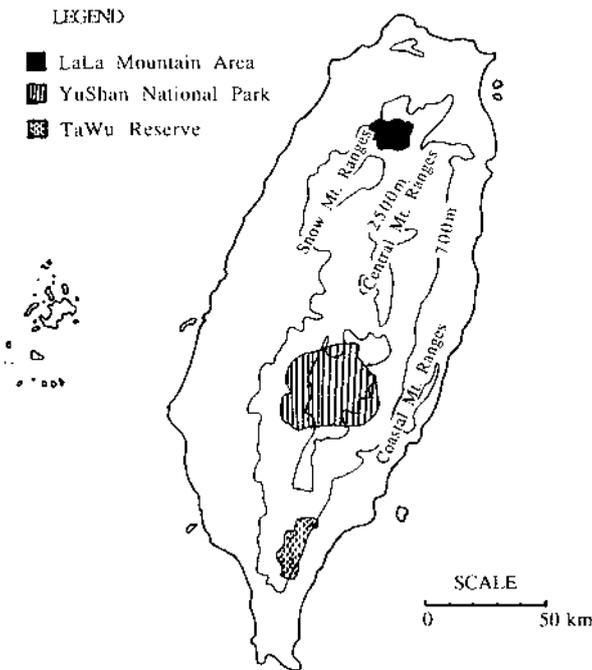


Fig. 1. Major mountain ranges and reserves in Taiwan.

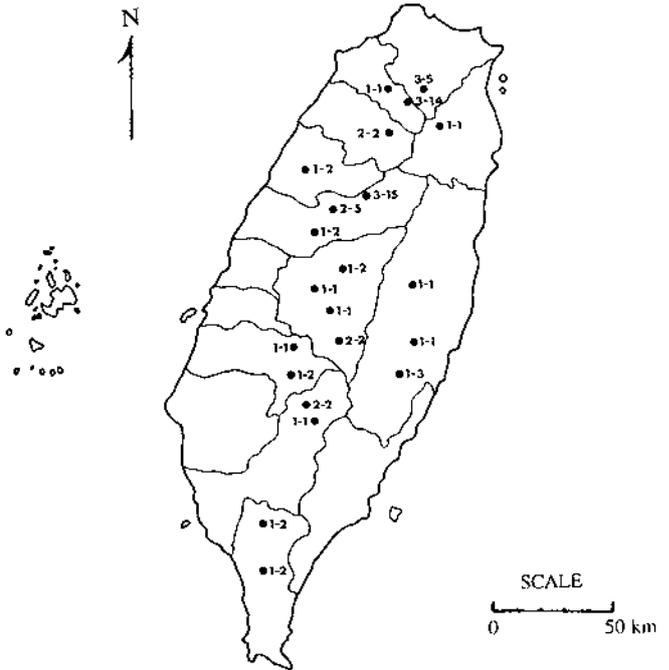


Fig. 2. Bear sightings by forestry workers at different field stations (number at each dot represents the minimum and maximum number of bears).

maximum of 68 bears during these 3 years (Fig. 2). Judging from the distribution of bear sightings by forestry workers, bears were distributed Island-wide along the Central Mountain Range and Snow Mountain Range. Three places within these 2 ranges were good spots to see bears frequently. They were Lala Mountain Area where the highest concentration of bears is so far known to occur (8-21 bears), Snow Mountain Area, (6-22 bears), and the Yu Shan National Park in central Taiwan (5-6 bears).

According to the same sighting reports, the estimated number of bears in the southern part of Taiwan is low (2-4 bears). However, from our own field survey in southern Taiwan, bear signs and tracks were found in 6 different locations around the Payu Lake and its surrounding area in the Tawu Reserve. It indicated that bears were very active in this area. Besides, from the aboriginal records, at least 5 bears were captured in this area in 1988.

According to the records, the elevation of sites where forestry workers saw bears ranged from 1,200 to 3,000 m (Table 1). This range is similar to Lin and Lin's (1983) estimate (1,500-3,500 m). However, bears seemed to be concentrated within an elevation range of 1,500 to 2,000 m (6 out of 9 sightings). That bears could be found in coniferous and mixed forest and plantations suggested that bears are not limited to a specific elevational forest type. According to our field surveys and interviews with

aborigines, bears were also found in orchards and corn fields between 500 and 1,000 m. Perhaps it is easier to get food in these areas than in the other areas with higher elevation.

Table 1. Number of bear sightings by forestry workers between June, 1987 to May, 1988.

Region	Forest station	Number of sightings		Forest type	Sighting elevation(m)
North	Neiwan	1	2	Coniferous	2,700
Central	Puli	1	1	Coniferous	2,000
	Puli	1	1	Plantation	1,200-1,700
	Anma Shan	1	2	Coniferous	-
	Tahsueh Shan	2	5	-	-
Southern	Jenlun	1	2	Mixed	2,800-3,000
	Tienchih	1	2	Mixed	1,800
	Tienchih	1	1	Mixed	1,800
	Kaoshu	1	1	Coniferous	1,500
	Kaoshu	1	1	-	1,500-2,000
Eastern	Juisui	1	1	-	-
	Juisui	1	1	-	-
	Mukua	1	1	Plantation	1,800-2,000
Total		14	21		

UTILIZATION OF BEAR AND ITS ECONOMIC VALUE

Bears have been utilized in Taiwan in many ways. Gall bladders and bones are used as traditional medicines. Meat is sold in the market. Paws, especially the front paws, are considered a delicacy in restaurants. Hides though not as important as other parts are occasionally used for decoration.

Apart from the consumptive use, young bears are sold as pets and adult bears are sometimes kept in cages and placed in front of shops or stores to attract tourists and potential customers.

Nearly every part of the bear is valuable (Table 2). The whole animal, depending on its size and weight, could be sold for \$727 US for a very small one to \$7,274 US for a very large one with the average price of \$2,713 US ($N = 13$). Parts thought to have medical value such as gall bladders or parts considered delicacies such as paws have a high demand in the market and sell for a proportionally higher price. The average price for a gall bladder was \$831 US ($N = 7$) with a range from \$363 US to \$1,454 US according to its weight. The average price for a paw was \$243 US ($N = 8$) with a range from \$181 US to \$363 US. Bear meat, though not considered a delicacy, was sold for \$34 US/kg due to its rarity. It was one of the most expensive meats found in the market. Finally, hides though not in great demand could be sold for \$305 US.

CURRENT THREAT

The low sighting rate by forestry workers probably indicated a low bear population now surviving on the Island. Furthermore, the average price of bear (whole

Table 2. Price of various items of bear sold in game stores in 1988.

	<i>N</i>	Average price (\$US) ^a	SD	Range
Whole animal	13	2,713	186.2	727-7,272
Skin	5	305	153	181-545
Meat (per kg)	6	34	9	24-48
Gall bladder	7	831	404	363-1,454
Paw	8	243	73	181-363

^a Price converted from NT dollars with exchange rate = 1 (US): 27.5 (NT)

animal) is \$2,713 US, and the average annual income in Taiwan in 1987 was about \$4,630 US, which is equivalent to the price of 2 bears sold in the market. Such a high profit would probably lure the aboriginal hunters to poach, regardless of the bear's perceived fierceness by many aborigines. Over half of the aboriginal hunters ($N = 97$) we interviewed were willing to catch this species.

From 1985 to 1988, at least 10 stores sold bears. The total number of bears sold in game stores was 91 in 3 years, and more than half of them (51) were sold in the 1987-88 season. Compared with the low sighting rate, this harvest represents an alarming loss of bears.

From the opinion survey on population trend, all 3 professional groups (48 store owners, 97 aboriginal hunters and 327 forestry workers) indicated that the bear population was decreasing. All of the forestry workers indicated a decrease in the bear population, 95% of aboriginal hunters indicated either a decrease or extinction locally of the species, and more than half of the game store owners thought that the bear no longer existed in the wild.

If we compare the status of the Formosan black bear with that of other species (Table 3), bears were consid-

Table 3. Wildlife population changes of 15 species estimated by 3 professional groups.

Scientific name	Game store owners		Aboriginal hunters		Forestry workers	
	index ^a	rank	index	rank	index	rank
<i>Muntiacus reevesi micrurus</i>	63	8	53.8	3	98.4	8
<i>Lepus sinensis</i>	9	14	13.6	11	70.7	11
<i>Paguma larvata taivana</i>	28	11	27.0	7	96.4	9
<i>Capricornis crispus swinhoei</i>	67	7	57.3	2	109.7	6
<i>Sus scrofa taivanus</i>	24	12	28.2	6	66.5	13
<i>Mococa cyclopsis</i>	19	13	-2.5	13	28.0	15
<i>Melogale moschata subaurantiaca</i>	38	10	26.4	8	52.4	14
<i>Herpestes urva</i>	53	9	14.6	10	96.3	10
<i>Manis pentadactyla pentadactyla</i>	137	4	50.6	4	120.8	4
<i>Viverricula indica pallida</i>	132	5	0.0	12	117.4	5
<i>Mustela sibirica davidiana</i>	128	6	-17.8	14	100.3	7
<i>Cervus unicolor swinhoei</i>	146	3	62.1	1	129.3	3
<i>Felis bengalensis chinensis</i>	173	2	21.1	9	159.5	1
<i>Selenarctos thibetanus</i>	177	1	41.3	5	152.6	2
<i>Petaurista sp.</i>		15	-19.9	15	60.9	12

^a Order of the population change index is from large to small

ered the most threatened species by game store owners, the second most threatened species after the Chinese leopard cat (*Felis bengalensis chinensis*) by forestry workers, and a less threatened species than sambar (*Cervus unicolor swinhoei*), serow (*Capricornis crispus swinhoei*), muntjac (*Muntiacus reevesi micrurus*) and pangolin (*Manis pentadactyla pentadactyla*) by aboriginal hunters. There was some discrepancy in rating, based on their own experience. However, they all agreed that the Formosan black bear was one of the species whose population had declined severely.

FUTURE HOPE

The Council of Agriculture (COA), the major governmental agency in charge of wildlife conservation in Taiwan, declared Formosan black bear to be a threatened and protected species under the Cultural and Natural Heritage Act on 30 January 1989.

In February 1989 I-LAN County government announced that every protected species listed in the Cultural and Natural Heritage Act, including bear, if kept or fed as

a pet by people, should be registered with the government.

In the meantime, Lala Mountain Nature Reserve, which was formerly established to protect natural resources, as well as other areas are now considered by the COA as special reserves for the Formosan black bear.

A long term research project on bear biology and management in areas where bears could be found is now being planned.

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