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Establishment of Management Plan by Sighting Reports of Asiatic Black Bears (*Ursus thibetanus*): A Case Study in Oze National Park, Central Japan

Yukihiko Hashimoto and Tomohito Anrui

Additional information is available at the end of the chapter

Abstract

In order to make efficient plans for wildlife management, we propose here how to establish the plan for the bear management using sighting reports of Oze National Park (Oze NP), Central Japan. A total of 574 sighting reports gathered from 2004 to 2009 in Oze NP were analyzed. Firstly, analyzing 36 of 236 dangerous bear responses to visitors revealed that bears in Oze NP were not habituated to visitors or their foods. This suggests that all efforts could be put into preventing from making "nuisance bears" in Oze NP. Secondly, in order to determine proper assignation of staffs, the pattern of bear occurrences was analyzed. Bears occurred more frequently in August and relatively frequently in June. Thus, the larger number of staffs should be assigned these months. Core areas were determined by the 50% karnel. Since core area was smaller in August, a few staffs should stand by at Yamanohana area. In June, the number of sighting and core area was larger only in early periods; thus, one staff should stand by at Todengoya and another at Yamanohana area in early June.

Keywords: Asiatic black bear, management plan, Oze National Park, sighting information, *Ursus thibetanus*

1. Introduction

National parks should be managed in a fine balance between wildlife conservation and human activity. Over the decades, conflicts between bears and visitors occurred frequently in some natural parks in Japan [1]. Since staffs and budgets are limited, efficient management plans have to be made. Bear occurrences depend on topology, food availability, vegetation,

bear physiology, and human activity [2]. If it is possible to detect bear occurrence pattern, intensive management action can be planned where and when bears occurred frequently.

In this chapter, using our cases in Oze National Park (Oze NP), we propose how to establish the plan for the bear management using sighting reports. This method we used can be applied in most national park, because sighting reports are not only collected easily and economically but also supposed to have already collected in most national parks.

Two hikers each are injured in the Ozegahara in 1999 and in 2004. Both of these incidents occurred at same spot (**Figure 1**) and about 8 o'clock in the morning in early June. Thus, these incidents may have similar background, and it should be revealed to discuss a proper bear management plan in Oze NP.

Firstly, we will discuss whether the bears in Oze NP are habituated or not. If bears habituated to human or artificial food, these bears are called "nuisance bear," and the risk of conflict between bear and human will be higher [2]. Since prompt action is essential to manage habituated bear, at least one trained staff must be ready at any time in months bears frequently occur. As a result, the larger number of trained staffs is needed than for nonhabituated bears. Thus, firstly the presence of nuisance bear must be detected. In Oze NP, food habit study of the Asiatic black bear revealed that the bears do not use artificial food at all [3]. Besides these studies, we analyzed reactions of bears when they noticed visitors and evaluated the presence of nuisance bear.

Secondly, by analyzing pattern of occurrence of the bears, we discuss on proper staff assignment. In order to decide assignment of staffs, the area where bears frequently occur needs to be determined. Although bears occur anywhere in Oze NP, frequently sighted sites were limited and
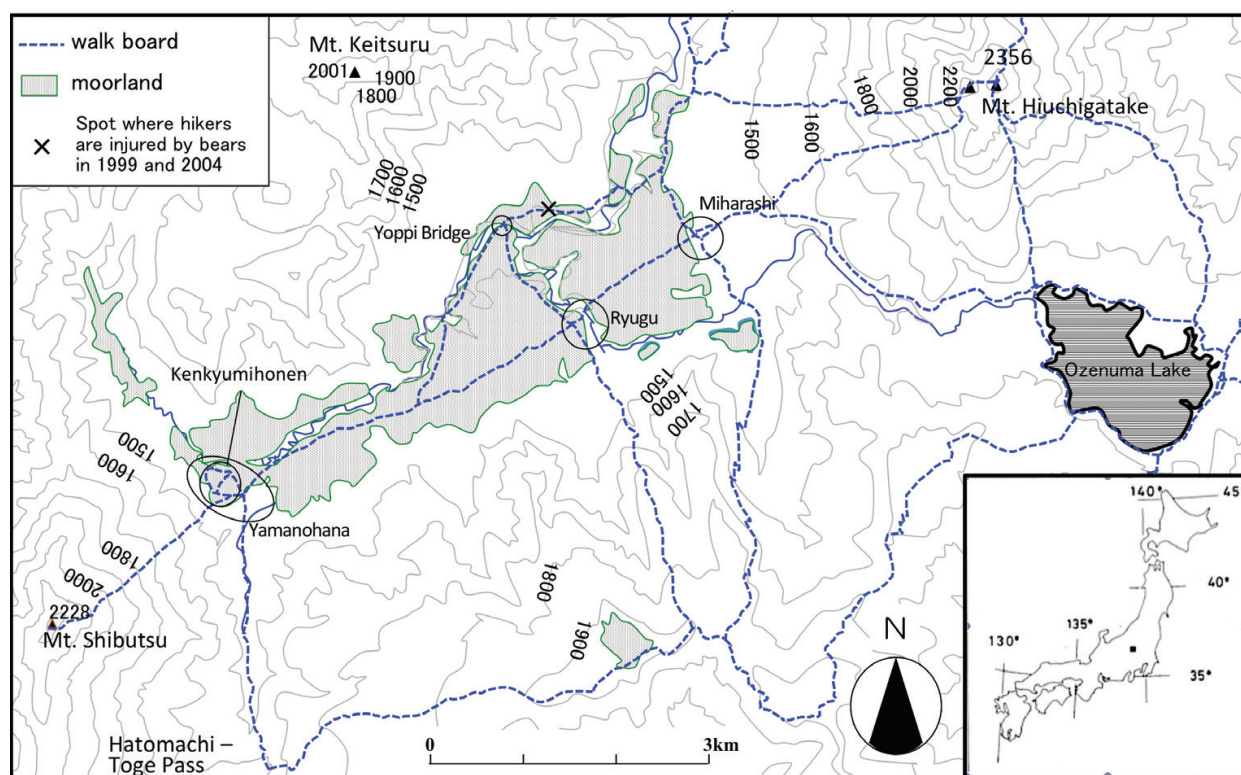

Figure 1. Study area.

change seasonally. In Oze NP, since no road which vehicles can drive was built, staffs have to arrive on foot at the site where bear management is needed. For prompt action, staffs should choose a place to stand by at with good access of the site. Accordingly, we determined areas where bears are prone to occur frequently by analyzing sighting reports and proposed yearly staff assignment.

2. Study area

This study was conducted in the Ozegahara, Ozenuma Lake and surrounding area of Oze NP (**Figure 1**). Ozegahara is the largest area of moorland in Honshu or the South of Japan, measuring 6 km from northeast to southwest and 2 km from northwest to southeast, with a total area of 7.6 km^2 located at an elevation of 1400 m. Ozenuma Lake is 1.8 km^2 at 1665 m elevation. The area receives heavy winter snow, with mean annual precipitation of 1972.5 mm and a mean maximum snow depth of 342 mm. January is the coldest month, with a mean monthly temperature of −6.5°C, and August is the warmest, with a mean temperature of 17.5°C, according to climate data measured from April 2006 to March 2010 at the Yamanohana Meteorological Station (elevation 1405 m).

Ozegahara consists of fen and marsh, with a raised central bog and transition moorland (valley bogs) in peripheral areas [4–7]. The raised bogs are dominated by *Sphagnum* spp. and cranberry *Vaccinium oxycoccos*. The fens and marshes are dominated by several types of reed communities, and *Phragmites* and *Moliniopsis japonica* communities tend to dominate the transition moorland. Riparian forest extends along streams and rivers in the moorland and provides cover and a corridor for wildlife. Several forest types occur in the area, with
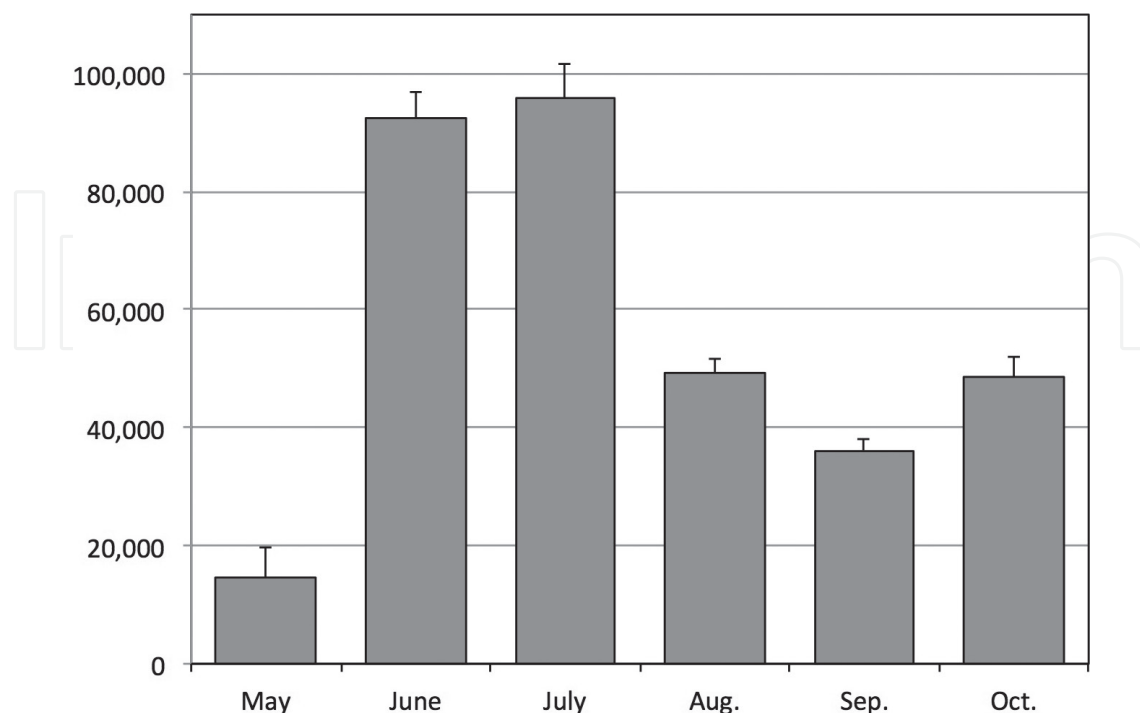

Figure 2. The number of people visit in Oze National Park each month. The number of hikers is from unpublished data provided by the Ministry of the Environment, Japan.
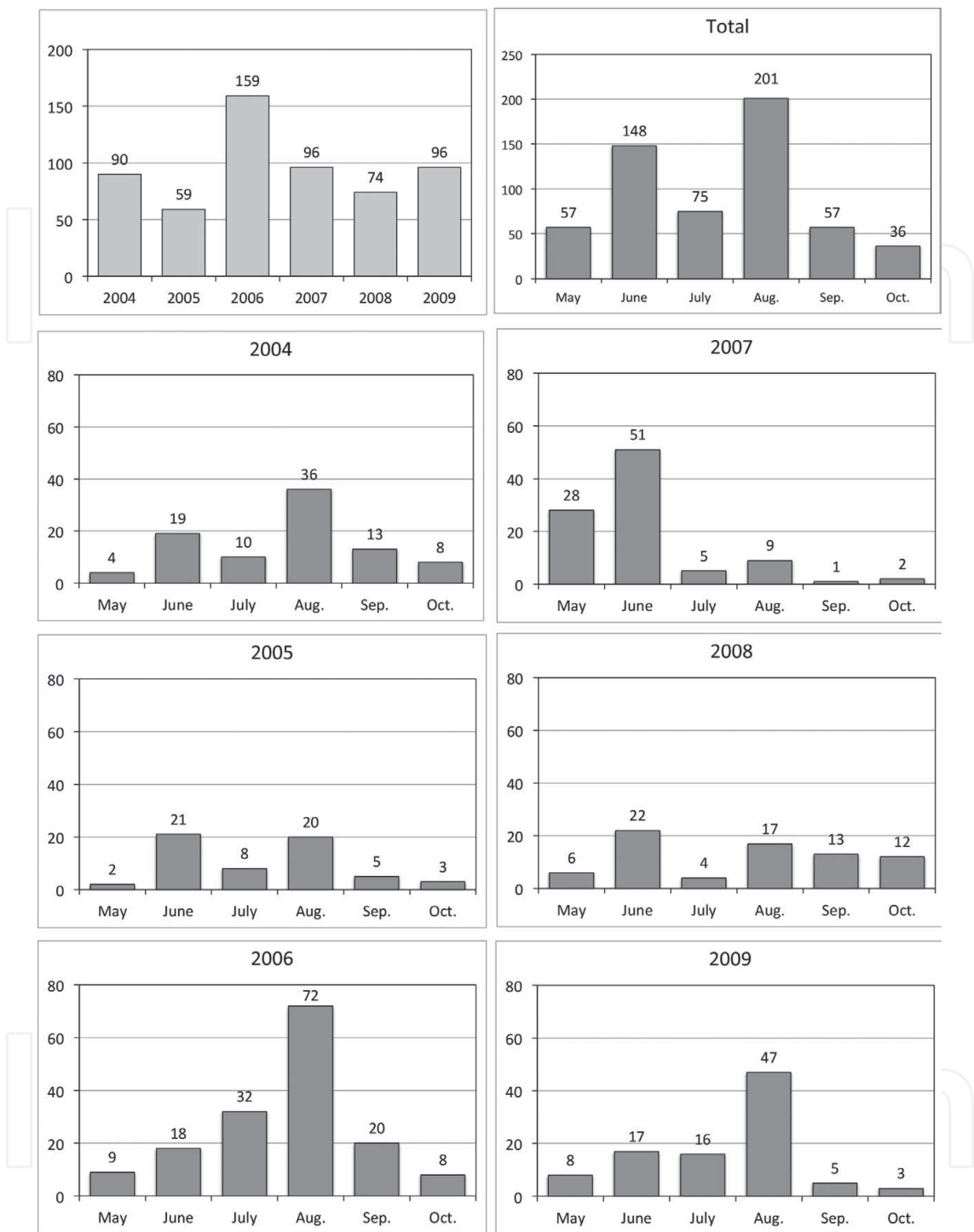
Figure 3. The number of yearly and monthly sighting reports from 2004 to 2009. The number of bear-sighting information is from unpublished data provided by the Oze Preservation Foundation.

the dominant species being *Ulmus davidiana var. japonica*, *Betula ermanii*, *Larix kaempferi*, *Salix bakko*, *Aesculus turbinata*, and *Pterocarya rhoifolia* [5, 6, 8]. The surrounding mountains are high enough to have a timberline and support alpine communities such as *Pinus pumila* scrub. The mountain slopes in the subalpine zone consist of *Abies mariesii* at high elevations and beech (*Fagus crenata*) forests in the foothills (1400–1600 m in elevation) [6, 8].

The Oze area is celebrated as the "origin of nature conservation in Japan." A dam construction project was undertaken in 1919, but local residents and plant ecologists opposed its construction from the outset, and the plan was finally aborted in 1996. This was the first development project to be halted for nature conservation in Japan. The Oze area has been protected since then and is one of the most famous national parks in Japan, with about 300,000 visitors annually. Blooming skunk cabbages are one of the main attractions for visitors to Oze NP. Many hikers visit in late May to the middle of June to enjoy the scenery of skunk cabbages flushing (Ministry of the Environment of Japan published data; **Figure 2**).

Ozegahara and Ozenuma Lake are designated as special protection areas within the Oze NP and are registered as special Japanese natural treasures and as important international wetlands with the Ramsar Convention. Visitors are restricted to boardwalks to prevent damage to the habitat. Asiatic black bears in the Oze area were hunted by local people until the 1970s; however, they have been subsequently strictly protected by several laws. The park includes 16 lodges, and garbage and waste are managed to prevent environmental damage. Hikers frequently sight Asiatic black bears eating grasses on the moors in June following snowmelt and eating spadices of skunk cabbages from June to August (Oze Preservation Foundation unpublished data; **Figure 3**).

3. Methods

We used data of 574 sighting reports gathered from 2004 to 2009 in Oze NP (**Figure 3**, **Table 1**). Using a questionnaire form, we gathered information about (1) the behavior of bears, (2) the place where bears are frequently sighted, and (3) the month when they are sighted. We interpreted frequent sighting as higher possibility of occurrence of conflicts between bears and visitors. Analyzing reaction of sighted bears, the nature of the bears in Oze NP was decided. Fixed kernel method is used to detecting where the bears are frequently sighted.

Data was collected by interviews and questionnaires. We made the inquiry form and asked witness, including hikers, volunteers, and staffs of visitor centers and hiking lodges to fill the form, and when witnesses come to visitor centers, staffs interviewed them according to the questionnaire. The questionnaire asked about the place where bear was, time, distance to bear, characteristics of bears (size, number, and body feature such as the presence of white patch on the chest), countermeasure of hikers, and bear reaction against witness for each sighting.

To distinguish whether bears are habituated or not, bear reactions were reviewed. We excluded reports when distances between bears and witnesses were longer than 30 m, because even if a bear noticed hikers at a large distance, the bear may not show any behavior. Cases were excluded if reactions of bears were not documented and if possibility that bear did not notice witness was high. If the bear did not show any avoiding behaviors, sneak to hiker, or threaten hiker, we determined it as a problematic response.

If bears occurred and would not move away from the place where distance from wooden board was less than 30 m, and even if they noticed hikers, bear management staffs close the trail and try to make the bears learn to avoid humans by chasing away or using firecrackers. The cases with such management actions were included in the problematic response.

Year	Problematic response				Normal behavior	Total
	Dangerous reaction (Mother and cub)	Chased away	Closing trail	Subtotal		
2004	5 (1)	1		7	23	30
2005	0	0		0	19	19
2006	1	11	1	13	74	87
2007	3	4		7	22	29
2008	2	0		2	21	23
2009	4 (1)	2		7	41	48
Total	15 (2)	18	1	36	200	236

Table 1. The numbers of sighting reports of problematic response gathered from 2004 to 2009 in Oze National Park.

The core area, where bears frequently occur, was determined by 50% kernel of bear-sighting points of relevant period.

All statistics and calculating core areas were performed using R-3.4.1 [9]. Core areas were drawn using QGIS 2.14.

4. Results

4.1. Bear habituation

The numbers of bear-sighting information for analyzing bear habituation were 30 in 2004, 19 in 2005, 87 in 2006, 29 in 2007, 23 in 2008, and 48 in 2009 (**Table 1**). And, the numbers of problematic responses were 7 in 2004, 0 in 2005, 13 in 2006, 7 in 2007, 2 in 2008, and 7 in 2009 (**Table 1**). Among problematic responses, two cases were associated with mother bear accompanied with a cub each in 2004 and in 2009.

4.2. Bear occurrence pattern

4.2.1. Yearly and monthly variation

The number of occurrence of the bears was 95.7 ± 14.0 (from 59 in 2005 to 159 in 2006, **Figure 3**). The number of sighted bears was significantly larger in August than those in May, September, and October (two-way ANOVA, year $F = 1.247$, $p = 0.317$; month $F = 0.005$, $p < 0.05$; Tukey HSD, $p < 0.05$) and marginally larger than those in July (p = 0.073). The number of sighted bears was slightly larger in June, when injury incidents occurred, than other months except for August (**Figure 3**), but it was not significant ($p = 0.14 \sim 0.55$). The number of sighted bears in August varied yearly; for example, the number was 72 in 2006 but was only 9 in 2007 (Tukey HSD, p < 0.05, **Figure 3**).
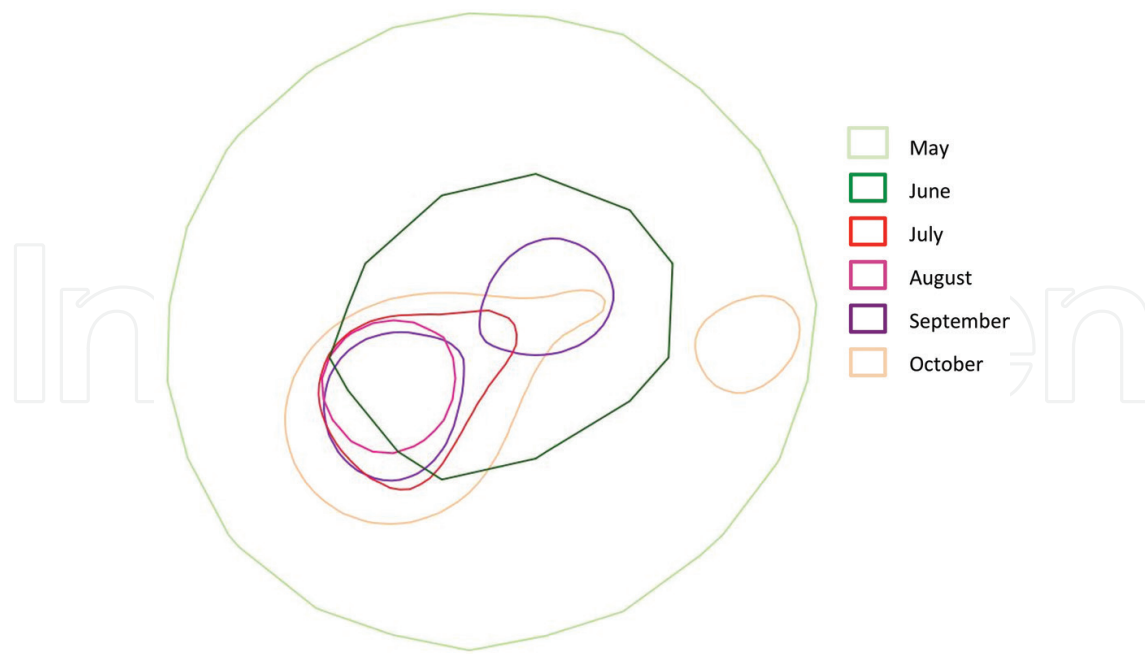
Figure 4. Monthly core areas of bear sighting in Oze NP. The core area, where bears frequently occur, was determined by 50% kernel of bear-sighting points.

4.2.2. Core area of occurrence

The core area, where the sightings were concentrated, of each month was shown in **Figure 4**. The core area was largest in May, became smaller with the month until August. Those in September and October enlarged and had two core areas.
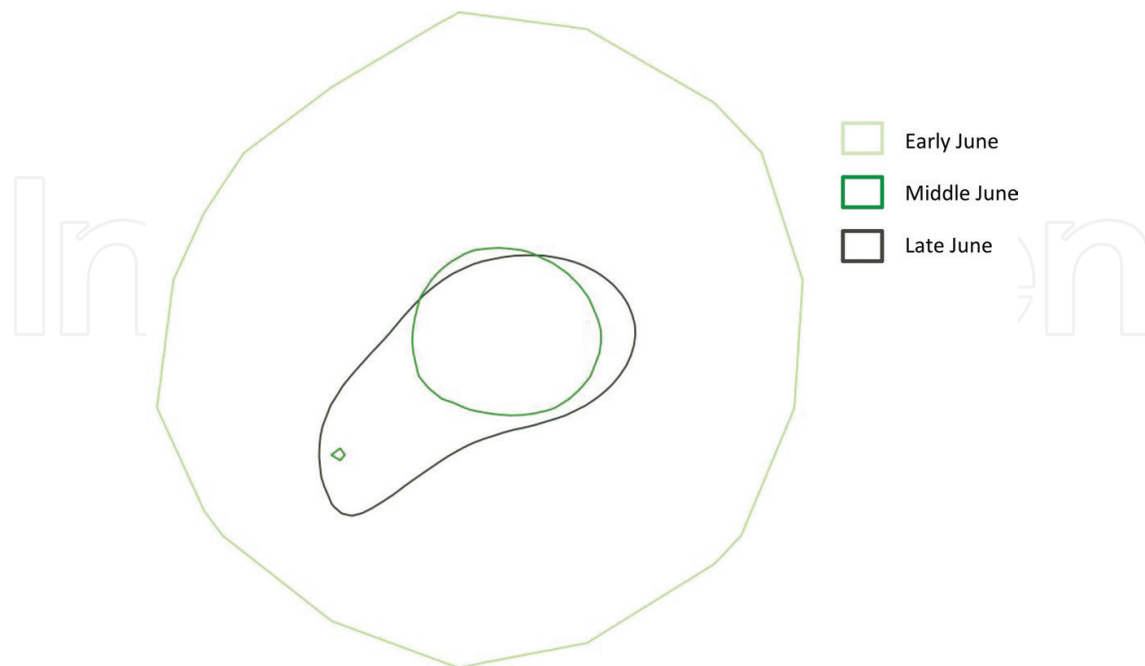

Figure 5. Core area of early, middle, and late June in Oze NP. The core area, where bears frequently occur, was determined by 50% kernel of bear-sighting points.

Human injury incidents occurred in early June. In order to examine the background of the incidents, we separated data of June into early (1st to 10th), middle (11th to 20th), and late (21st to 30th). The number of sighting reports was large in early June and decreased in middle and late June (**Figure 4**). The core area was largest in early June and become smaller in middle and late June (**Figure 5**).

5. Discussion

5.1. Nuisance bear

We found that most of the Asiatic black bears in Oze NP did not habituate to human or artificial foods [3]. But some bears persist of some natural foods near the area where visitors are active.

In 2004, a male bear occurred frequently around Yamanohana area where three hiking lodges and the visitor center are aggregated. This male was live captured and radio collared before released at about 10 km remote site. In 2007, this male bear occurred around Yamanohana and Ryugu areas in Ozegahara (**Figure 1**). This male bear caused all seven cases of problematic response in 2007. Since the bear was radio collared in 2004, we could monitor it and treated it quickly before it came near to the hiking lodge or walk board in 2007.

In 2006, two subadult bears frequently occurred around Yamanohana area in August. All 11 cases of chasing in 2006 were against these bears. They persisted community of skunk cabbage and ate anthotaxy of skunk cabbage exclusively [3]. Although they did not show avoidance of behavior to humans, they did not show any behavior trying to approach humans or artificial foods.

Similarly in 2009, one subadult bear frequently occurred around Yamanohana area in August. Both cases of chasing in 2009 were against this bear. Other situations were also similar to those in 2005.

These results indicates that bears in Oze NP were not habituated to artificial foods, but some of them, usually younger bears, do not mind humans, and if artificial foods were available for them, they would easily habituate. And, we found that such bears could be managed relatively easily if it was radio collared.

But once a bear is habituated, risks for visitors and thus efforts to prevent bear-human conflicts will significantly increase. All staffs engaging habituated bears must be well trained, but such human resource is difficult to secure in Japan. Thus, the most important management action in Oze NP is to prevent making habituated bears. Visitor education not to feed bears by lecture, leaflet, and notice of information calling for attention is the most important action.

5.2. Proper staff assignment

Visitor education should be conducted throughout open season as a routine action mainly by a bear management staff. Added to this, staffs should stand by in months where bears frequently occur.

Bear sighting occurred most frequently in August. Thus, the increase of the number of staffs in this month should be discussed. Mean bear occurrence in August was more than once a day (33.5 ± 8.5). Thus, at least two bear management staffs are needed. Since the core area was small in August (**Figure 4**), staffs may stand by at a single site in or near the core area. From these points, two staffs should stand by at Yamanohana area in August.

Since injury incidents occurred in June and the number of sighting reports was larger although not significant, staff assignment should be discussed. The incidents occurred in early June; the number of siting reports was larger (**Figure 3**), and core area was larger than those of middle and late (**Figure 4**). Thus, increase of staffs in early June should be discussed separately to middle and late June. Since core area was large in early June, the larger area has to be covered. Thus, staffs should stand by each other at separate sites in the core area. From these points, one staff should stand by at Todengoya and another at Yamanohana area in early June. Since the numbers of sighting reports are smaller in middle and late June, additional staffs are not essential, but if needed, added staffs should stand by at Todengoya.

6. Conclusion

We found that the Asiatic black bears in Oze NP did not habituate to humans or artificial foods. This suggests that all efforts could be put into preventing from making "nuisance bears" in Oze NP. Relatively small number of staffs may cover the whole area of the national park. But if bears habituate, not only more possibility of injury accidents which may occur will be higher, but also the cost for bear management will be much higher resulting in employment of a larger number of trained bear management staffs. Daily action of visitor education with bear management staffs is the most important management action. If human injured incidence did not occur in a long period, attentions tend to be neglected. Headquarters of national parks should keep these in mind at any time.

Of cause, these points are similar to other natural parks. Both staffs and visitors of national parks should understand that feeding wildlife, especially carnivorous large animals, results in considerable increase in not only the risks but also financial burdens.

Acknowledgements

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