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Efficiency of Harp Trap for Capturing Bats in Boreal Broad-Leaved Forest in Japan

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Abstract

We attempted to catch bats by using harps trap in boreal broad-leaved forest of Japan and examined its capture efficiency compared to that of mist net. We caught 81 individuals of 4 bat species by harp traps in 16 nights and 42 individuals of 5 species by mist nets in 12 nights. The capture efficiency of harp traps (number of bats caught / night / trap) was almost the same as that of mist nets. We concluded that harp trap is an effective tool for research of Japanese bats.

Key words: Bats, Capture method, Harp trap, Japanese broad-leaved forest.

Introduction

About 1000 species of bats inhabit various environments from torrid zones to sub-arctic zones of the world (Kunz and Racey 1998). Out of them, 35 bat species are distributed in Japan, and they account for 1/3 of Japanese mammal fauna (Abe *et al.* 1995). However, the ecological study of Japanese bats has not developed as speedy as in Europe and North America. One of the reasons is difference in methods for capturing bats. Mist net is commonly used to capture bats by Japanese researchers (e.g. Funakoshi and Uchida 1981, Funakoshi *et al.* 1999, Kawai 2000). The capture efficiency of mist net seems to be low, because bats often detect mist nets by echolocation calls. Moreover, mist net gives bats a lot of stress and risk of injury to their bodies when they are removed from the net. Other Japanese researchers have used funnel trap (Bat Research Group of Centennial Woods Fan Club 2001), although the use of this trap is limited to the entrance of the bat's roost. On the other hand, in Europe and North America, harp trap is commonly used for survey of bat fauna and habitat use along with mist net (e.g. Kunz and Kurta 1988, Palmeirim and Rodrigues 1993, Krusic et al. 1996, Sedgeley and O'Dnnell 1996). It was suggested as benefits of harp traps that bats do not entwine the trap and researchers can collect them with perfect ease (Jones and Mcleish 1999). In this study, we attempted to use harp trap in Japanese boreal broad-leaved forest and examined its capture efficiency.

Method

We made harp traps of 1 meter high and 2 meters width, referring Tuttle (1974). The trap consists of two rectangular steel frames held 5cm apart at the tops. Fishing lines (diameter: 0.15mm) were stringed from upper hem of outer frame to lower hem at intervals of 5cm. Springs were attached at the lower end of each fishing line to produce tension. The fishing lines stringed to each frame were tied alternately at the top of the outer frames. We attached arched reinforcing bars to prevent outer frames from contortion. A bag made of plastic sheet of 1mm thickness was attached under the outer frames. The size of the bag was 30cm × 200cm and 30cm in depth. Plates made of aluminum were attached to the edges of the bag to prevent bats from escaping after falling into it (Fig 1).

We attempted to catch bats by using harp traps for 16 nights and mist nets for 12 nights from May to September in 1998 and 1999 at Tomakomai Experimental Forest of Hokkaido University (142° 43′ N, 141° 36′ E). We set two harp traps and two 300cm×540cm mist nets after sunset for 5 hours above a stream and a path in the forest. We checked the traps at 15 minutes intervals. When bats were captured, we identified species, sex, age and breeding condition, and measured forearm length and body weight. Then we attached an Aluminum numbered band on their forearm and released them. Capture license number was 534 and 847 from Environment Agency of Japan.

Results

Eighty-one individuals of 4 bat species (*Myotis ikonnikovi*, *Myotis macrodactylus*, *Murina leucogaster* and *Murina ussuriensis*) were captured with harp traps and 42 individuals of 5 bat species with mist net (adding *Rhinolophus ferrumequinum* to the former 4 species; Table 1). The average number of males and females of *M.macrodactylus* captured with harp traps per night was significantly greater than that of mist nets (Mann-Whitney U-test $p<0.05$ $U=46.5$, 39.0; Fig 2). However, there were no significant differences of capture efficiency between harp traps and mist nets in other species at each sex

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(for 3 species: U<90.0 n.s.; Fig 2). There was a significant difference in composition of captured bat species between harp traps and mist nets (chi-square test, $\chi 2$=315.680, p<0.0001; Fig 3).

Discussion

Our study demonstrates that harp traps are suitable for the investigation of bats in Japanese boreal broad-leafed forest. Capture efficiency of harp traps was almost the same as that of mist nets, although capture efficiency of harp traps for *M.macrodactylus* was higher. It may be because *M.macrodactylus* could not detect harp traps using echolocation call rather than mist nets. However, we could take out captured bats from harp traps smoothly, because bats were not tangled among the strings like as in mist nets. Therefore, we could decrease the stresses-due-to-capture of bats by using harp traps. On the other hand, disadvantages of harp traps for researching bats became clear. Harp traps used in this study were too heavy and could not be folded and taken into pieces, therefore carrying and setting the traps needed much labor. The catching area of harp traps (2 m^2) was smaller than that of mist nets (16.2 m^2). Because harp traps were set at low height from the ground, they could not cover the whole space of a path in the forest. Therefore, bats could fly freely through the space above the traps. These problems would be solved by minimizing their weight and by downsizing the traps when contained.

Species composition of captured bats was different between harp traps and mist nets. Capture efficiency for each species may be different with type of trap. It is necessary to pay attention to this bias in bat species composition when using these traps.

Table 1. Number of bats captured with mist net and harp trap

	Mi		Ml		Mm		Mu		Rf		total	
	f	m	f	m	f	m	f	m	f	m	f	m
mist net (12nights)	8	2	11	4	2	1	6	6	2	0	29	13
harp trap (16nights)	2	1	7	5	26	36	3	1	0	0	38	43

f: female, m: male
Mi: *Myotis ikonnikovi*, Ml: *Murina leucogaster*, Mm: *Myotis macrodactylus*,
Mu: *Murina ussuriensis*, Rf: *Rhinolophus ferrumequinum*

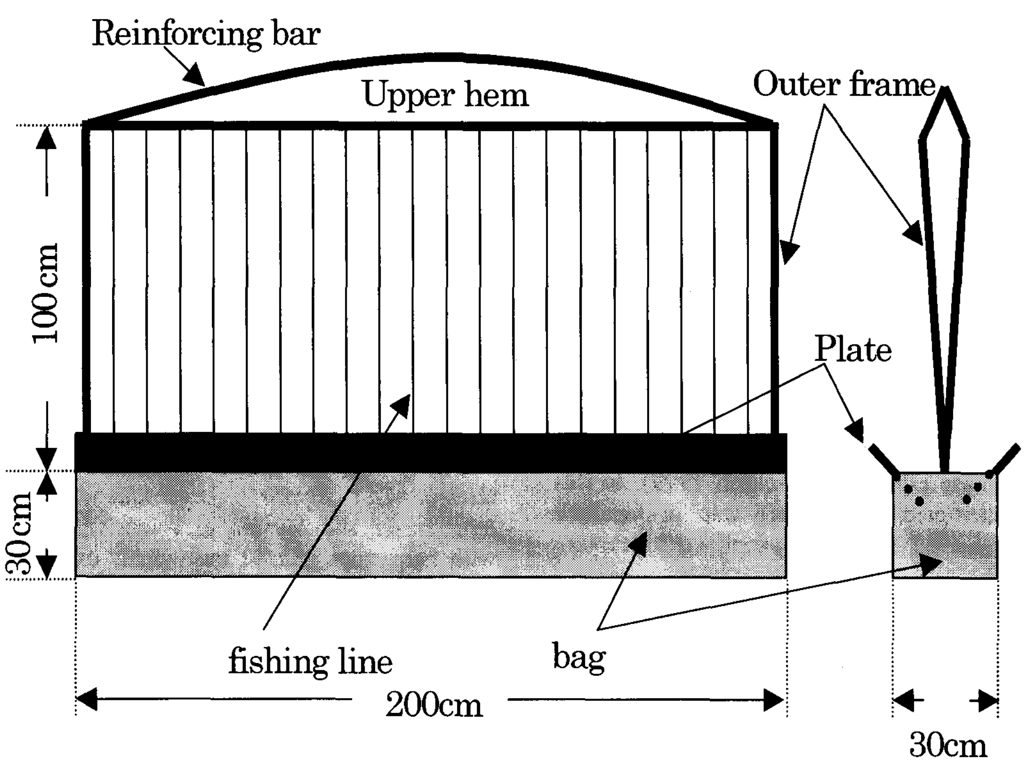

Fig. 1. Sketch of harp trap of squarely view (1) and profile view (2).

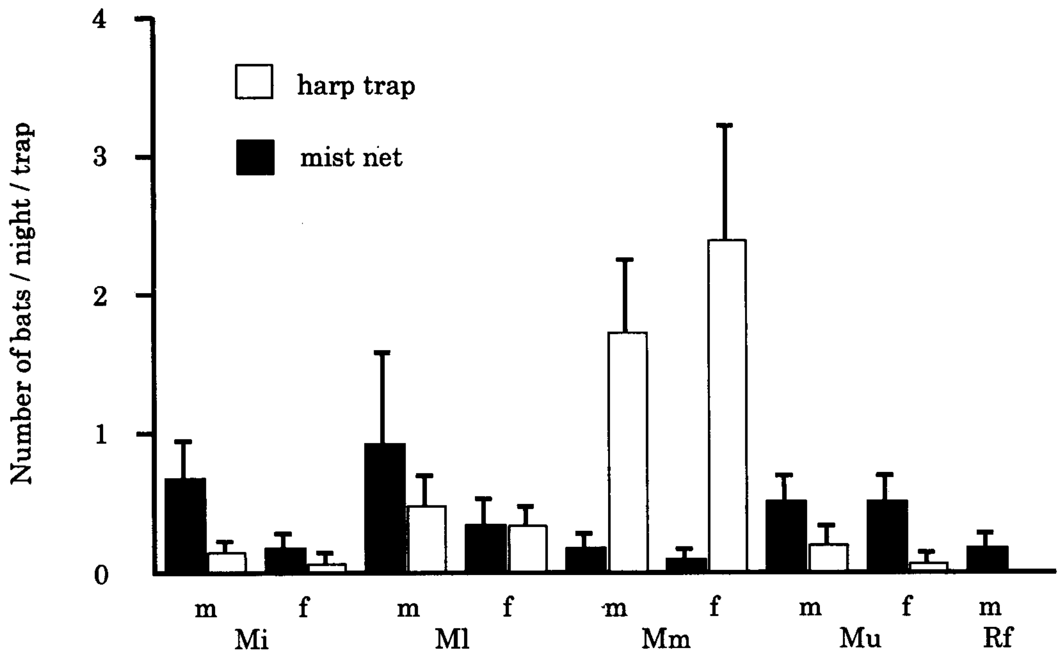

Fig. 2. Average number of captured bats per 1 night by harp traps and mist nets. Error bar meaning $\pm SE$. m: male, f: female, Mi: *Myotis ikonnikovi*, Ml: *Murina leucogaster*, Mm: *Myotis macrodactylus*, Mu: *Murina ussuriensis*, Rf: *Rhinolophus ferrumequinum*

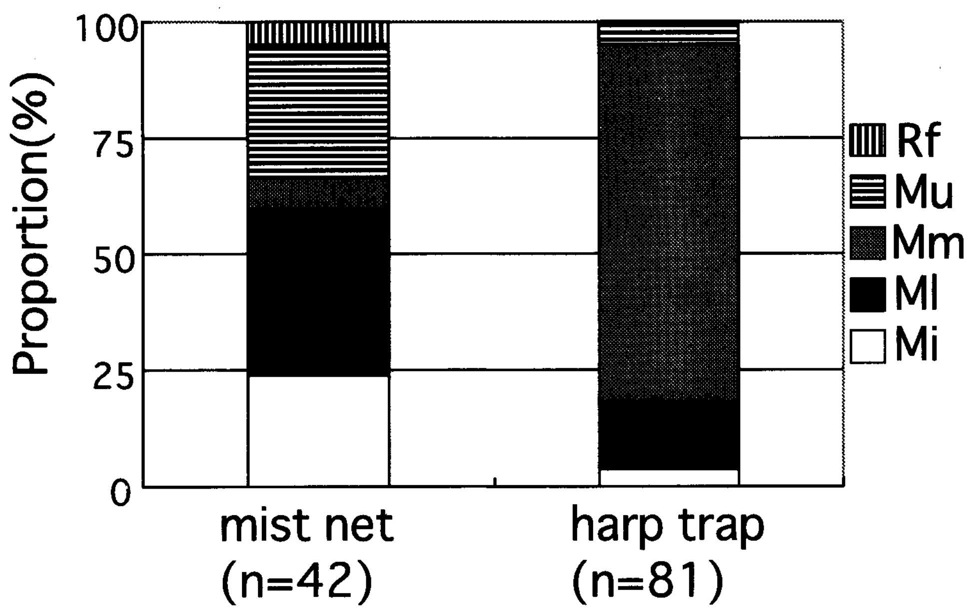

Fig. 3. Proportion of bat species captured by harp traps and mist nets.

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