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HOME RANGE, HABITAT USE AND NATAL DISPERSAL OF BLAKISTON'S FISH-OWLS

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Blakiston's Fish-owls (*Ketupa blakistoni*) occur in southeastern Russia (Amurland and Ussuriland, Sakhalin and southern Kuril Islands), northeastern China and northern Japan (northeastern Hokkaido) (Voous 1988, Brazil and Yamamoto 1989). Although this species was once widely distributed throughout Hokkaido, it now occurs very locally (Brazil and Yamamoto 1989) and the present population is estimated at 80–100 individuals (Brazil and Yamamoto 1989) and with no more than 20 breeding pairs (Clark and Mikkola 1989). This species is highly dependent on riparian forest (Burton 1973) and loss of suitable habitat could be contributing to its decline. However, there is no information available on the home range and habitat use of this species. Here, I report the results of a study aimed at describing the home range size, habitat use and dispersal behavior of young Blackiston's Fish-owls.

STUDY AREA AND METHODS

The study area (43°23′N, 143°20′E) was in the National Forest Agency and located on the upper Tokachi River in eastern Hokkaido, Japan. Approximately half of the study area consisted of a conifer forest plantation consisting of Sakhalin spruce (*Picea glehnii*), Japanese larch (*Larix leptolepis*) and eastern white pine (*Pinus strobus*). The other half included two types of natural forest. One consisted of mixed coniferous forest, mainly Yezo spruce (*Picea jezoensis*), Sakhalin fir (*Abies sachalinensis*) and broad-leaved tree species, such as Mongolian oak (*Quercus mongolica*), painted maple (*Acer mono*) and basswood (*Tilia japonica*) at higher elevations, and the other type consisted of broad-leaved forest dominated by Japanese poplar (*Populus maximowiczii*) and alder (*Alnus* spp.) which occurred along streams at lower elevations. Most of the ground cover was dwarf bamboo (*Sasa nipponica*).

Blakiston's Fish-owls were first observed breeding in the study area in 1986 and, thereafter, the same pair successfully fledged young four times from 1987–91 ($N = 9$ fledglings). Since 1985, the Environmental Agency of Japan supplemented the food supply of this pair by stocking a pond with fish to prevent possible starvation of the owls, especially in winter. This pond has become a major feeding area for the owls. In 1987, both adult owls and one of the two young born in 1986 were mist netted and individually color banded. Since 1987, all fledglings have also been color marked for individual identification.

To study movements, two young owls, one male and one female, raised in the study area were captured in mist nets near the stocked pond on 27 and 30 January 1992, respectively. Radio-transmitters were attached to the tail according to Kenward (1978), with some modifications. Radios were trimmed to fit the rectrix shaft and attached to the ventral surface with stainless-steel wire and epoxy glue. Antennas were 260 mm in length. They were fastened to the feather shaft using fishing trace wire, and the ties were sealed with epoxy resin.

Owls were tracked using Yaesu FT-290mkII receivers. When tracking, a car-mounted whip antenna was used to determine the general location of an owl. A more precise location was then determined using a three-element hand-held Yagi antenna. Bearings were taken from at least three different sites. If the resulting error polygons were larger than 1 ha, the location was not used. For each owl, locations were determined once in the daytime around noon and three or four times (with an interval of more than 2 hr) during the night. The minimum convex polygon method (MCP, Mohr 1947) was used to calculate home range sizes. Mean error distance of the directional bearings from the test transmitters was 46.8 m (SD = 29.0, range = 0–125, $N = 12$).

Habitat types in the study area were identified using topographic maps (Geographical Survey Institute) and timber-type maps (National Forest Agency) and categorized as: (1) mixed forest (evergreen coniferous and deciduous broad-leaved trees), (2) coniferous plantation (deciduous and evergreen), (3) young broad-leaved forest, (4) artificial (forest roads, houses and electric powerline right-of-ways) and (5) water area (streams and lake). The 13.3 km^2 study area was surrounded by mountain ridges so an aerial survey was also conducted to obtain dispersal data.

RESULTS AND DISCUSSION

One radio-tagged owl (90M) was a male that fledged from the nest in 1990. He stayed within his natal area for one yr, disappeared in late April 1991, and returned on 6 November 1991. He was captured and radio-tagged on 27 January 1992. After radio-tagging, he stayed within 400 m of the capture site for two d. He then traveled upstream 6.9 km and then returned to the capture site where he stayed for the next month. I calculated his home range to be 6.1 km^2 ($N = 11$ locations) during the month of February. After that, he disappeared. On 25

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Table 1. Compositions of the habitat components in the study area and home range, and of the actual habitat used by one female Blakiston's Fish-owl.

Vegetation Category	Study Area		Home Range		Radio Locations			
	Percent Coverage	Expected Numbers	Percent Coverage	Expected Numbers	Day	Night	Total	
	%	n	%	n	n			%
Mixed forest	60.4	66.7	70.0	79.7	29	55	84	77.1
Coniferous plantation	36	39.8	21.1	24.0	8	7	15	13.8
Young broad-leaved forest	0.8	0.9	2.5	2.7	5	5	10	9.1
Artificial	1.5	1.6	2.3	2.6	0	0	0	0
Water area	1.3	—	4.1	—	0	0	0	0
Total	100.0	109	100.0	109	42	67	109	100.0

June (3.5 mo later), the transmitter signal was found 18.7 km west of the capture site during an aerial search of the study area and the radio, which had fallen off, was recovered on 15 July in the same location. On 28 July, I found 90M roosting at the side of a stream 2.5 km from the point where the radio had been recovered. He was not located again after that.

The other owl (86F), a female that fledged from the nest in 1986, was radio-tagged on 30 January 1992. For two yr, she had remained within the natal nesting area before disappearing in March 1988. She returned to her natal area on 16 November 1988 and spent the next winter there, after which she again disappeared in March 1989 and was absent for two yr. Two mo after the disappearance of this owl's mother (this probably occurred sometime in October 1991), she returned to the natal area and mated with her father in December 1991. She laid two eggs in early March 1992 and incubated until early April, during which time she stayed in the nest almost continuously except for one or two short trips away from the nest (<200 m) for 2–20 min. In early April, she deserted the nest before the eggs hatched.

I did not radio-track 86F egg-laying and incubation periods but, from 30 January–19 May (when the radio fell off), I obtained 109 locations for this owl on 49 different days. Her total home range size was 4.1 km^2. During the prelaying period (from February–March), the home range was 0.3 km^2 (N = 20 locations). This area included the nest and the small area immediately around the nest. After the nest failed, the home range increased in size to 3.6 km^2 in April (N = 51 locations) but decreased again in May to 2.8 km^2 (N = 38 locations).

Use of the home range by 86F appeared to be affected by the location of water. Her most distant location was 462.5 m from water and it was only about one third of the way to the edge in the study area. Daytime roost sites averaged significantly farther from water ($\bar{x}$ = 139.29 m, SE = 18.36, N = 42 locations) than did nighttime roosts ($\bar{x}$ = 88.99 m, SE = 13.35, N = 67 locations; Mann-Whitney U-test, U = 1010.5, $P < 0.05$) indicating that she tended to hunt around streams and lakes at night.

The distribution of habitats also affected use of the home range by 86F. All telemetry locations were in the three forest types (mixed forest, conifer forest plantation and young broad-leaved forest), and she was never found using either the open water or artificial habitat categories. Because there was no significant difference in habitat use between day and night (χ^2 = 2.51, df = 2, $P > 0.05$), all locations were pooled when habitat use was compared to availability within the overall study area and home range (Table 1). Because the area of young broad-leaved forest was small (0.8% of whole study area), locations in this category were combined with locations in the mixed forest category. Owl 86F used mixed forest more often than expected based on its availability within the study area (two-tailed binomial test, $P < 0.01$) and within the home range ($P < 0.05$).

Because use of mixed forest was possibly related to the fact that a stream was located adjacent to the area of mixed forest in the home range, I compared the number of locations in mixed forest that were within 100 m of water (N = 58 locations) to the expected number of locations in mixed forest based on the availability of this habitat category (N = 41 locations) and found the difference in use to again be significant (two-tailed binomial test, $P < 0.01$). Therefore, I concluded that the owl selected both the stream and its surrounding mixed forest habitat.

In Hokkaido, heavy timber cutting from the late 1950s to early 70s has converted most native forests into conifer forest plantations. Obviously this caused a loss of habitat and thus reduced the number of Blakiston's Fish-owls in the area. The father-daughter mating observed in my study was probably inevitable due to the small size of the fish-owl population. A daughter returning to the parental home range after a long absence (22 mo) suggests that she could not find a potential mate nor adequate habitats elsewhere.

RESUMEN.—El tamaño de la pradera, uso de hábitat y el comportamiento de dispersión de *Ketupa balkistoni* fueron

estudiados en el norte este de Hokkaido, Japon en 1992. Este especie cría de febrero–mayo, durante el tiempo, dos individuales (macho y hembra) fueron observados por uso de radio-telemetro. Una hembra formo una pareja con su padre que había perdido su pareja tres meses antes. Su pradera calculado por el método mínimo convexa polígono (MCP) fue 0.3 km^2 antes de poner, poniendo y tiempos de incubación. Ella dejo el nido antes que los huevos salieron de cascarón. 3.6 km^2 en abril y bajo ha 2.8 km^2 en mayo. La pradera total medida durante el tiempo de observación fue 4.1 km^2. Ella prefería usar bosques mixtos con ríos. El macho joven se movía en un área amplia después que estaba marcado, y se fue del área de nacimiento.

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