Brood movement and natal dispersal of hazel grouse Bonasa bonasia at Changbai Mountain, Jilin Province, China

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Brood movement and natal dispersal of hazel grouse *Bonasa bonasia* at Changbai Mountain were studied using radio telemetry in 1993-94. Most chicks hatched during late May to early June. Only hens accompanied three radio-tracked broods. After wandering for 30-35 days, broods 1 and 3 became relatively sedentary in second-growth forest, 1.6-1.7 km from their nests. Broods 1 and 3 disintegrated when chicks were 80 and 69 days old. Based on radio-tracking, it is suggested that the impetus for one brood's disintegration was that the hen left its brood. Female 2 lost her chicks about 20 days after hatching. The hens returned to their spring home ranges after brood dissolution. Three radio-marked chicks dispersed 4.8-5.7 km in mid-September. It is concluded that, in general, the hazel grouse is an active disperser in natural habitats.

Key words: Bonasa bonasia, brood movement, Changbai Mountain, hazel grouse, natal dispersal, People's Republic of China

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The hazel grouse *Bonasa bonasia* is widely distributed in northeastern China. Previous studies of the hazel grouse in China have not addressed brood movement and natal dispersal, as suitable research technology was not available (Zhao 1977, Zhu & Lu 1988, Gao & Zhu 1991). In addition very little data on natal dispersal are available for this species. This paper reports our radio-telemetry work on three broods and three chicks at Changbai Mountain.

Study area and methods

The study area was on the northern slope of the Changbai Mountain in northeastern China (45°N, 130°E). The annual mean temperature was 3.3°C, with an annual precipitation of 672 mm. At an altitude of about 700-800 m, the main forest type was an old deciduous-conifer mixed forest. The dominant conifer was Korean pine *Pinus kiraiensis*, and predominant deciduous trees were maples *Acer* spp., Manchurian ash *Fraxinus mandshurica*, limes *Tilia* spp., Japanese elm *Ulmus propinqua* and David's poplar *Populus davidiana*. Second-growth forest (50 years old), dominated by Asian white birch *Betula platyphylla* and David's poplar, occurred along the forest roads. The study covered two breeding seasons, 1993 and 1994, and was based on the results from three radio-tracked broods (Table 1).

The hazel grouse were captured in spring with walk-in traps and nets (Sun & Fang 1994) or at the

Table 1. Reproductive information of three radio-tracked hazel grouse broods at Changbai Mountain, China, in 1993-94.

Brood	Incubation period	Clutch size	No of chicks hatched	No of chicks surviving[a]
1	2-27 May 93	12	11	4
2	?-31 May 93	11	5	0
3	4-29 May 94	9	8	5

[a] Chicks that survived to brood disintegration.

nest. Female 3's two female chicks (4 and 5) were captured by nets on 25 July 1994. They weighed 310 g and 315 g, respectively. Bird 6, a male chick from an unknown brood, was captured on 3 September 1994, after his brood had disintegrated. Each was fitted with a necklace-type transmitter (Kenward 1987) that weighed about 12 g (3-3.8% of the bird's body weight).

Radio-tracked broods were located 1-3 times per day in 1993 and mostly 2-4 times per day in 1994. Daily movement was calculated as the distance travelled between consecutive evening locations. The home range size for a specified period was delineated using the minimum convex polygon method based on more than 25 locations.

Results

Brood movement

Most chicks hatched during late May to early June. Only hens were observed accompanying the three radio-tracked broods.

The broods moved gradually farther from their nest sites during the first 35 days of life (Fig. 1). Brood 1 moved farthest, 1.7 km from the nest site. After 35 days, it contained four chicks and stayed in a restricted area near some ginseng farms. Home ranges of brood 1 in July and August were 11.0 and 25.5 ha, respectively. Daily movement of brood 3 varied greatly during the first 21 days posthatching, averaging 178 ± 29.6 m. Brood 3 stayed in the home range of a radio-tracked male for several days, indicating that the male did not repel the brood. After 25 days, brood 3 was relatively sedentary, using a 10.1-14.5 ha area in second-growth forest. Female 2 lost her chicks about 20 days after hatching and returned to her spring home range. She occupied areas of 5.3 and 7.6 ha in July and August, respectively.

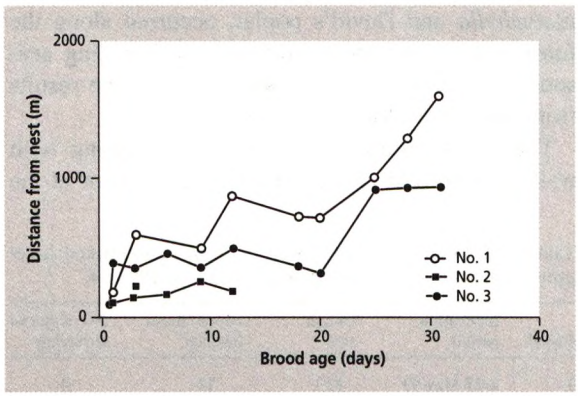

Figure 1. Distance of three hazel grouse broods from their nest sites during the period up to 35 days after hatching in the Changbai Mountain Area, China.

Brood dissolution

Brood 1 disintegrated when the chicks were 80 days of age. The hen moved back to her spring home range after brood disintegration. Female 3, together with her five chicks, left their July home range on 31 July and moved southward for about 700 m. During 1-3 August, the hen crossed the forest road five times, the first four times with her chicks. In the morning of 3 August, she crossed the road again and left her 67-day-old chicks, and the brood disintegrated (Fig. 2). Our previous radio-tracking data showed that hazel grouse seldom crossed roads that were more than 20 m wide. We suggest that hen 3 was trying to leave her chicks by repeatedly crossing the road and that disintegration of the brood was actively forced by the hen. Female 3 returned to her spring home range and was not located with chick 4 and 5 or seen with other chicks after 3 August.

Natal dispersal

Chicks 4 and 5 left the other three chicks one day after the brood disintegrated. However, they lived

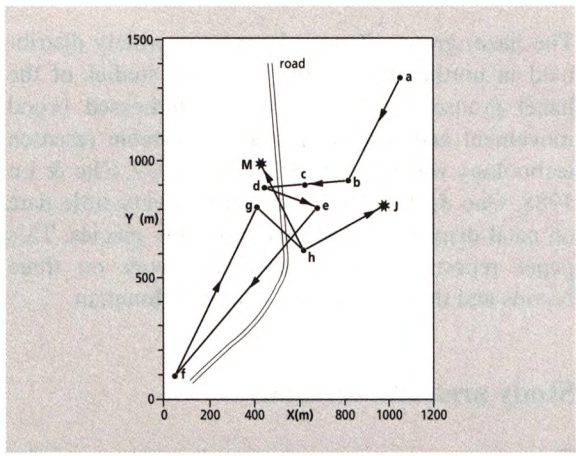

Figure 2. Movements of brood 3 prior to and during brood dissolution, 30 July-3 August 1994. The letters indicate the position on a) 30 July, b) 31 July, c) 1 August at 08.00 hrs, d) 1 August at 11.00 hrs, e) 1 August at 17.00 hrs, f) 2 August at 08.00 hrs, g) 2 August at 11.00 hrs, h) 2 August at 17.00 hrs. The asterisk at M gives the position of the female at 08.00 on 3 August, after brood dissolution, and the asterisk at J gives the position of the two radio-marked chicks at the same time.

together until winter. During 3 August to 12 September, their home range was only 150 m (the distance between home range centres) from their mother's, sometimes only 50 m apart, but separated by the road. On 13 September, chicks 4 and 5 left their home range, crossed the road, and moved 300 m into the old mixed deciduous forest. They remained there for one day, then crossed a river and moved 4.5 km farther into the old forest, where they established a new home range near a patch of young deciduous forest. Their total natal dispersal distance was 4.8 km. Bird 6 was often seen with another young grouse before being captured at its sand-bathing site. He dispersed southward for 2 km on 12-13 September, stayed for three days, and continued his southward journey for an additional 3.7 km, settling down on 21 September. His natal dispersal distance was 5.7 km.

Discussion

Male hazel grouse held territories in spring, but did not defend the broods, whereas the hens led the broods out of the spring territories, suggesting that the male's territory did not contain appropriate habitat for sustaining the chicks.

The hazel grouse broods wandered during 25-35 days posthatching. Godfrey (1975), studying brood movement of the ruffed grouse *Bonasa umbellus*, also found that the hen and brood wandered for about 10 days, then lived in a relatively stable area. This behaviour was also observed in other ruffed grouse studies (see Godfrey 1975). Gao & Zhu (1991) showed that the hazel grouse chicks fed primarily on animal food during the early period of the brood development, accounting for about 70% of the diet. The proportion of plant food increased as the chicks aged. We suggest that this wandering behaviour in the early brood developing period may be related to the food requirements of the chicks during the period when they eat mostly animal food. Within a given area, the availability of animal food was much more limited than plant foods.

We suggest that one hen left its brood, which was the impetus for brood disintegration. Gratson (1988) also suggested that the behaviour of Sharp-tailed Grouse *Tympanuchus phasianellus* hens was the impetus for disintegration of the brood.

Gaidar (1973), using marked and relocated birds as his study method, reported that hazel grouse dispersed only short distances. However, he did not trap outside the study area, so his results are biased because he missed long dispersers. Swenson (1991) radio-tracked two chicks in Sweden and also suggested that the hazel grouse was a poor disperser. Kämpfer-Lauenstein (1995) radio-tracked two chicks in old forest in Germany. We summarise the results of seven radio-tracked chicks in Table 2. Except for one female chick in Sweden, from a renesting hen, the females dispersed long distances, averaging 5.5 km (N = 3). One banded juvenile in Finland was reported to have been recovered 10 km from its site of banding by Kirikov (in Johnsgard 1983), but Swenson (1991) did not find recoveries farther than 3 km in his review of Finnish and Swedish banding records. Semenov-Tyan-Shanskii (1959) reported a natal dispersal of 5 km from the Ural Mountains. The hazel grouse is widely distributed in northern Eurasia, also suggesting that it is well able to disperse and expand its range.

We conclude that in general, the hazel grouse is an active disperser in natural habitats. Swenson's (1991) study area was situated in an intensively managed commercial forest in Sweden. We suggest that the limited dispersal he reported was influenced by the patchy distribution of suitable habitats and perhaps a low population density, resulting in many vacant habitats.

The chicks normally stayed in their brood ranges for 4-40 days (averaging of 23.5 days, N = 4, not

Table 2. Dispersal behaviour of hazel grouse chicks as determined by radio telemetry studies in China (this study), Germany (Kämpfer-Lauenstein 1995) and Sweden (Swenson 1991).

	China		Germany		Sweden	
No and sex of chicks	1 ♂	2 ♀	1 ♂	1 ♀	1 ♂	1 ♀
Date of:						
hatching	?	29.05	5.06	5.06	8.06	6.07
brood disintegration	?	3.08	21.08	26.08	8.09	19.09
leaving brood range	13.09	13.09	11.09	26.09	12.09	19.09
arrival at own home range	21.09	18.09	12.09	6.10	15.09	26.09
Dispersal distance (km)	5.7	4.8	0.85	6.8	1.4	0.22

including the chick from the renesting hen), and did not disperse until mid-September. What causes the chicks to leave their brood range? Perhaps the resumption of territoriality by adults in autumn may be one reason.

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