

On the Ecology and Mechanism of Feeding Behavior in *Athene noctua plumipes*

纵纹腹小鸮 (*Athene noctua plumipes*) 的生态及捕食行为机理

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摘要 结合野外考察及部分室内实验,纵纹腹小鸮 (*Athene noctua plumipes*) 在陕西岐山县最适生境为有稀树、土台或沟壑的开阔田野。种群密度冬季 (1~2月) 0.4 对/10 hm², 夏季 (6月) 2.1 对/10 hm² 越冬期, 昼伏夜出, 主要捕食鼠类 (占 66.7%); 繁殖期, 昼夜活动, 主要捕食昆虫类 (占 62%~96.9%)。解剖学特征与陆栖捕食行为高度适应。体色拟态效果及无声飞行更为有利捕食过程。平均日食量 49.7 g。估计全年可捕鼠 238 只、昆虫 580 余只。还报道了小鸮自动情交配到后期换羽等一系列繁殖行为过程。

关键词 纵纹腹小鸮 (*Athene noctua plumipes*) 数量分布 繁殖 越冬生态 捕食行为机理 饲养管理 经济效益

Abstract On the bases of our field work supplemented by laboratory experimentation, the suitable habitats for the Little Owls (*Athene noctua plumipes*) in Qishan county, Shaanxi province are open countries with scattered trees, earth banks or crevices. The Little Owls activate at night during their wintering period when more rats (occupying 66.7% of the total prey) are taken, and activate in both day and night during their breeding period when more insects (occupying 62% to 96.9% of the total prey) are devoured. Their anatomical characteristics are well related to their habits. One Little Owl consumes 49.7 g of meat for one day in captive feeding, and would have devoured 238 rats and over 580 insects for one year in the field. The process of regeneration behaviors from mating to molting are described.

Key words *Athene noctua plumipes*, geographical distribution and population density, breeding, wintering ecology, mechanism of feeding behavior, rearing management, economic significance

All species of Strigiformes are generally called nocturnal raptors. There are 29 species of owls in China^[1]. Owing to traditional superstition, they are considered as inauspicious birds even till now. There are 4 subspecies of *Athene noctua* of which *A. n. plumipes* (the Little Owl) is widespread and resident eastward of 105°E and northward of the Yangtze River. but little has so far been known about them except for a short paper on their diet in Minqin, Gansu Province^[2]. We carried out field investigations on the

Little Owl from Jan., 1991 to Dec., 1993, in Qishan, Zhouzhi and Xi'an, Shaanxi Province. On the basis of our field work supplemented by laboratory experimentation, we have obtained much data on the geographical distribution and population density, breeding and wintering ecology, as well as feeding behavior and its mechanism, and have also made appraisals on their economic significance.

1 Geographical distribution and Population Density

The Little Owls are mostly distributed in foothills

near the forest, prairie, and hillside fields. The most suitable habitats in Qishan (34.4°E, 107.6°E) are found to be open countries with scattered trees, earth banks or crevices. Their population density differs in the period of wintering or breeding. Their average density is 0.4 pairs/10 hm² in winter (Jan. & Feb.), and 2.1 pairs/10 hm² in summer (June). The average distance between nests is 189 m, and the longest distance is less than 100 m. However, they are now rarely found in the open countries of Weinan, Meixian and Huxian counties of Shaanxi Province, Laishui and Yixian counties of Hebei Province.

2 Breeding and Wintering Ecology

The Little Owls were observed to be active in both day and night during their breeding period from the late March or early April to May or June. They were monogamous and showed a strong tendency of territoriality. Nests are built in holes in the earth bank (85.7%) or in the tree (14.3%) situated at 4.57 m (14 nests) above the ground. There is only one brood a year. Clutch size is usually 5~6, with an average 5.5 (5 nests). The female laid one or two eggs per day or in one day's interval. The eggs are white in colour with no speckles or dots. Six eggs average 15.5 ± 0.24 g in weight, and 34.5 ± 0.68 mm × 29.1 ± 0.25 mm in size. As to its ultrastructure, the eggshell consists of the spiracle, the palisade layer, the mammillary cone eggshell membranes and the basal cap. The calcific crystals of the inner surface of the eggshell are radiatively arranged from the mammillary in the form of a "flower". Fibres of shell membranes are fine and closely weaved as branches of a tree. The shell membranes are physiologically considered as protective screens. A "hatch patch" becomes very obvious on the abdomen of the female during the hatching of the eggs. The eggs are incubated by the female alone after the laying of the first egg. The hatching period lasts 26 to 28 days. The hatching rate is 92.7%, while the survival rate averages only 58.3%. The juveniles are fledged after 39 days, but they are seen to be with their parents from June to August after fledging. The result of the dispersion of the young birds facilitates the exchanging of gene pools between separate populations and gives rise to hybrid vigor. Molting of the pri-

maries succeeds from the 1st to the 10th during the late breeding period, and the molting of the tail feathers takes place during June to September while the young birds are still taken care by their parents.

3 Feeding Behavior and Its Mechanism

Annual and daily activity rhythms: the Little Owls are active at night during wintering, and extend their activities more and more near the daytime in the breeding period. Their daily activities are found to reach the peaks after sunset and before sunrise. Vocalization of parents and nestlings are different in sound spectrum.

In winter, the Little Owls are active at night, especially at dusk and dawn when they feed mainly on rats, which occupies 66.7% of the total amount of the food taken. Of the rats, *Cricetulus triton* is the commonest, occupying 25.6%. During the breeding period, on the contrary, more insects are taken ranging from 34.5% to 96.9% of the total amount of the prey consumed. The diet of the Little Owl is also greatly affected by the large-sized counterparts such as *Bubo bubo* competing for the same food (overlap index of trophic niche is 0.324). The former tends to prey on insects and small rats, while the latter prefers the large-sized or medium-sized rats.

The Little Owls are found to eat some fruits but not leaves or branches of plants which are often found in their stomachs. Their caeca are well-developed, measuring about 42.5 mm in length and occupying 25% of the body length. Hence, from an anatomical viewpoint, the Little Owls are well adapted for digesting the fibres of plants. They are also found to devour corpses instead of living bodies of their partners in the field or in rearing (such a feeding behavior should not be called cannibalism). Hence, it is incorrect to consider the Little Owls as "mother-eaten birds" or "inauspicious birds"^[3] that were believed in ancient China.

The process of feeding behavior of the Little Owls includes: at first locating the actual position of the prey; then approaching; attacking and eventually devouring the prey or preserving it in the nests of the owls. Feeding behavior often takes place on the ground by raising up the body and then crouching

down, wagging from left to right, of which movements especially with respect of the symmetrical positions of the ears are of benefit for detecting the sound source of the prey more precisely by creating time and tone differences. [4]

Their legs are relatively long. The feathers are very soft. The leading edges of the wings are frayed like tassels, and the barbules of the feathers are elongated, thus covering the feathers with fluffy coats, and providing an acoustical damping layer, so that sound and air turbulence are much minimized. The mimicry of body colouration (sandy brown) and the soundless flight further facilitate their feeding process.

4 Economic Significance and Rearing Management

In captive feeding, a Little Owl is found to consume 49.7 g of meat for one day [5]. On this basis an owl of this species would have consumed 18 141 g of meat for one year or 900 rats of 20 g in weight. The owl is thus estimated to save about 1.7 tons of grains from being consumed by rats. If seasonal influences are considered, one Little Owl would have devoured 238 rats, 5 small birds, 31 insectivora and 580 in-

sects, etc. Although they sometimes devoured some beneficial animals (such as *Sorex* spp.), it is considered insignificant as compared with the large amount of rats and insects. Hence, the Little Owls are beneficial birds, which are widely spread in the field especially near the human habitations. They are well worthy to be utilized as natural enemies of field rats and insects. They are now listed as Key Protected Species in China. Finally, we suggest that the most important tasks for protecting the Little Owls lie in protecting their breeding habitats, and carrying on active propaganda among the masses conserving the benefits of owls, and at the same time eradicating all the unfounded superstitions about the owls. All directors and scientists of the nature reserves in China should be adequately informed as to the importance of protection.

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