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*Predation by birds of prey on Tetraonidae populations at Vladimir
Station near Moscow, U.S.S.R.*

Among factors which influence the population dynamics of Tetraonidae predation by birds of prey seems to have rather a specific significance. Due to exaggeration of its effect, birds of prey seriously suffered from hunters and game keepers in many countries.

One of the main aims of our study at the Vladimir station (about 200 km to the east of Moscow) in 1963-1965 was a quantitative estimation of the pressure of predatory birds upon game bird populations. The influence was characterized by an index of predatory pressure (or index of predation). This means the percentage of individuals taken by all predators out of the total number of their potential victims within the area under consideration during a definite period of time.

In order to calculate the index of predatory pressure (X_A)

exercised by a predatory species "A" upon the population of a prey species "a" we collected the following data:

(1) The total number of predatory birds of species "A" (N^A) which inhabit the area under consideration. For this purpose the number of breeding pairs was counted and mapped.

(2) The average number of individuals of prey species "a" taken by each predator "A" (P_a^A) within a definite period (usually the breeding season). In order to set reliable data on the composition and number of prey of various species of birds of prey, we made continuous observations from hides built in trees close to occupied nests. We collected samples of the prey brought to the nests for further laboratory examinations.

(3) The total number of individuals of the prey species "A" (n_a) within the study area.

With the help of these data, the index of predatory pressure (X_a^A) for predator "A" and prey "a" has been calculated by the formula:

$$X_a^A = \frac{N^A \cdot P_a^A}{n_a} \cdot 100\%$$

The entire population of birds of prey within the Vladimir station (210 sq. km, including 152 sq. km of forests) consisted of 6 species. Their total number fluctuated from 32 breeding pairs in 1965 (15.2 pairs per 100 sq. km) to 40 pairs in 1964 (19.0 pairs per 100 sq. km). They included Buzzard (*Buteo buteo*, from 17 to 23 pairs), Sparrow-Hawk (*Accipiter nisus* 4-6 pairs), Honey Buzzard (*Pernis apivorus*, 0-5 pairs), Black Kite (*Milvus migrans*, 2-3 pairs), Kestrel (*Falco tinnunculus*, 1-4 pairs), and Goshawk (*Accipiter gentilis*, 2 pairs).

The populations of 3 species of Tetraonidae were rather large: 2900-3000 individuals (adults and young) in June. It included 1200-1400 Hazel Grouse (*Tetrastes bonasia*) 1000-1200 Black Grouse (*Lyrurus tetrix*) and 500-600 Capercaillies (*Tetrao urogallus*).

Only goshawks and buzzards fed on game birds. Each breeding season (June-July) the two pairs of goshawks took 110-140 individuals of Tetraonidae mostly young: 50-70 Hazel Grouse, about 20 Black Grouse and about 10 Capercaillies (the remaining ones unidentified). So the goshawk's index of predation on the Tetraonidae population fluctuated from 3.7 per cent (1965) to 4.5 per cent. (1964) of the total number of Tetraonidae present. It was 4.2-5.2 per cent. for Hazel Grouse, 1.6-2.1 per cent. for Black Grouse and 1.4-2.0 per cent. for Capercaillies. All buzzards in June-July took only 20-70 individuals of Tetraonidae mostly young of Hazel Grouse. The buzzard's index of predatory pressure upon Tetraonidae depended obviously on the density of rodent populations. It was 0.7 per cent. of the total number of Tetraonidae in 1963 (coordinating with highest level of rodent population) and 1.9-2.3 percent. in 1964

A HUGE URBAN POPULATION OF BIRDS OF PREY IN DELHI, INDIA

(PRELIMINARY NOTE)

The abundance of birds of prey in the capital of India is extraordinarily impressive. As a first step towards studying it, an estimate of their population in Delhi was made during two breeding seasons (December–May) by means of direct mapping of every occupied nest or nesting territory within sample areas. There were 20 samples (from 0.15 up to 5.10 sq. km) in 1967/68 and 26 samples (from 0.60 up to 4.40 sq. km) in 1968/69. The data from the latter season are more reliable, since the entire area of the capital was evenly covered by the samples.

During 1968/69 breeding season 715 nesting territories including 679 occupied nests were registered and mapped within 37 sq. km of the sample area. So the average population density of predatory birds was 19.3 pairs per 1 sq. km. Hence, it follows that about 150 sq. km of Delhi area is inhabited by 2,900 or roughly 3,000 nesting pairs of birds of prey! The most abundant is the Black or Pariah Kite *Milvus migrans*—about 83% of the total number. The average density of the Kite population is 16.1 breeding pairs per 1 sq. km and their total number is about 2,400 pairs.

The population of large vultures (mainly *Gyps bengalensis*) is much smaller, about 400 breeding pairs or an average of 2.7 pairs per 1 sq. km. Almost all of them nest in the northwestern part of Old Delhi (mostly in mango gardens) and on the eastern edge of the city along Yamuna river.

The population of the Egyptian Vulture *Neophron percnopterus* is smaller again, less than 100 pairs or 0.5 pairs per 1 sq. km. Their territories are distributed all over the Delhi area with a preference for old ruins and temples.

Other predators (*Elanus caeruleus*, *Pernis ptilorhynchus*, *Accipiter badius* etc.) are rare, solitary pairs being found occasionally in thick gardens or parks.

It was found that the density of predators in different districts of Delhi varied greatly, from 0.5–2 pairs per 1 sq. km in building development on the southern edge of the city, up to 60–100 pairs per 1 sq. km in some areas in Old Delhi.

Study of the variation showed that there is a marked decline in the number of predatory birds from northern to southern areas of the city. The majority are concentrated within Old Delhi and the northern strip of New Delhi, areas densely inhabited by people and covered with tall trees, and which contain some slaughter houses and also meat and fish shops. There the density of birds of prey averages about 42 breeding pairs per 1 sq. km. In the green, respectable, clean and relatively less populated central part of New Delhi the density is only about 17 pairs per 1 sq. km, while in recently built-up areas of the southern third of the city which are scarcely covered with trees, the density is not more than 3 pairs per 1 sq. km.

The abundance of predatory birds in Delhi is probably due to (a) the amount of available food—garbage, carcasses of animals on rubbish heaps (including those killed by traffic), a tremendous number of small birds and palm squirrels etc.; (b) the number of trees in parks, gardens and along the streets; and (c)—perhaps the most important—the traditional good-will of Indians to all living beings, including birds of prey.

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