Biological sciences

UDC 598.2

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BIOLOGICAL FEATURES AND PROTECTION OF THE SPARROW HAWK ON THE TERRITORY OF PRYDNISTROVSKE POKUTTIA

Summary. *Within the boundaries of the Prydnistrovske Pokuttia, the sparrow hawk remains a rare species during the nesting period, the density of which varies from 0.24 ind./km^2 (tree plantations near settlements) to 1.35 ind./km2 (isolated forests). The total livestock of the local population ranges from 170 birds in winter up to 400 birds during the nesting period. In the nesting period it feeds on 10 species of birds and animals, in the autumn-migratory period it feeds on 20 species, and in the winter period it feeds on 14 species, mainly small rowan birds. The population of the sparrow hawk is largely influenced by such anthropogenic factors as death from pesticides, the effect of a short circuit on power lines and the elimination of young birds as a result of collisions with vehicles on roads.*

Key words: *nesting, ecological niche, biotopes, ornithophages, trophic.*

Experimental procedure. Species identification of birds of prey was carried out in accordance with the guide "Birds of Ukraine" by I.V. Marisova and V.S.

Talposh [16]. The spatial dynamics of the population of the sparrow hawk were determined according to the method of A.P. Kuzyakin [3]. Bird counts were made by the route method. The width of the transect in the settlement in the arrays of individual buildings was 60 m, among new buildings - 80 m, in the field within sight up to 100 m.

In general, we made counting routes in certain small stations suitable for the life of a sparrow hawk. 10 routes were laid: with a length of 12 to 18 km. The average length of routes was 14.6±1.4 km. Such length of the route gave us quite an attractive selection. During the study, the total length of the routes covered is 1800 km. The elapsed time is 900 hours.

Methods of direct observation were used while studying nesting biology. The height of the nest in the tree is determined by the rule of regular triangles, for this a meter stick and a measuring tape are used.

Nest parameters are measured with a ruler with an accuracy of 1 cm. A ladder was used to examine the nest (following safety rules) [8]. In addition, the eggs were measured, too. According to M.E. Nikiforov's [18; 22] recommendations and others we can distinguish the following types of eggs: shortened-ellipsoid, ellipsoid, rounded, elongated-ellipsoid, teardrop-shaped, shortened teardrop-shaped, pear-shaped.

Egg parameters are measured with a caliper with an accuracy of 0.01 mm. For laying eggs, we used R. Myand's methodic [19].

Statistical parameters are carried out according to the Derkach's method [6; 7].

Data Analysis and Discussion.

*Status of species***.** Rare species.

Number of species. According to our calculations, in the zone of hornbeam-oak forests in the nesting and pre-nesting period, we found 100 individuals of the sparrow hawk (50 pairs of birds), which corresponds to a density of 0.7 ind./km^2. During the breeding and autumn migration period, the total number within the

forest plantations is about 210 birds, which corresponds to a density of 1.2 ind./km^2. In winter, we observe a decrease in the number to 75 individuals, which corresponds to a density of 0.5 ind./km^2. The decrease in density in winter is explained by climatic conditions and the factor of the movement of the sparrow hawks closer to settlements [38]. Within the isolated forests among the fields during the nesting period, we observe 20 birds, which, in terms of the area of these stations, is 0.6 ind./km^2. The relatively high density is explained by the ecotone effect. In autumn, within the isolated forests, we noted an average number of 45 individuals over the years of our study, which corresponds to a density of 1.35 ind./km^2. In winter, no more than 10 people were found within the isolated forests, which corresponds to a density of 0.3 ind./km^2. Within the tree plantations of settlements, we observe 40 individuals (20 pairs), which corresponds to a density of 0.24 ind./km^2. In autumn, the number is 80 birds or 0.48 ind./km^2. But in winter, due to the additional migration of hawks from forest plantations, it is 120 birds, which corresponds to 0.96 ind./km^2. If we analyze the forest belts and their dependence on the sparrow hawk, we see that here during the nesting period we noticed 60 individuals or 30 pairs, which corresponds to a density of 0.6 ind./km^2. During the breeding season, the average number increases to 100 birds, which is 1 ind./km^2. In winter, the number decreases and corresponds to 0.3 ind./km^2, that corresponds to the status of a rare species. That is, in the study area we can notice 220 individuals or 110 pairs. During the breeding time and autumn migration periods, the number of the sparrow hawk, due to the complete breeding of offspring, is about 400 birds. In winter, we can track no more than 200 birds. In the winter period, population density only increases near settlements, where small passerine birds gather at this time. A tendency emerges, based on the area of the territory, that the sparrow hawk in generally is a rare species, except for some years, when in autumn during the migration period, the density within the forest stands exceeded 1 ind./km^2.

Biotope of birds. In the nesting period, it occupies blind areas where human access is low. Ritual mating behavior falls on the second half of March. The sparrow hawk sometimes occupies other bird's nests, but more often builds them itself. The process of renovating or building a nest starts at the end of March – the beginning of April. In total, we found 21 nests of the sparrow hawk. Most of them were found in the hornbeam-oak forests of the Dniester Canyon, and we found 2 nests (9.5%) each of them in the railway forest belts and isolated forests. The detailed distribution of the hawk populations according to stations is shown in table 1.

Table 1

Distribution of nests of the sparrow hawk

Station name	Qty nests	Part %	tree species on which nests were found	Number of nests per types of trees
Forest belts	2	9.52	Norway spruce	2
Isolated forests on the territory of the fields	2	9.52	common birch	2
Mid-seasonthe woods	7	33.34	common oak European ash hornbeam	2 3 2
Ripe forests	5	23.81	common oak field maple	3 2
Poles	5	23.81	Tatar maple linden heart cherry forest	2 2 1
Total:	**21**	**100**	**9**	**21**

Source: author's property

From the data obtained, it can be seen that most of the nests of the sparrow hawk were found in mid-ripening forests – 7 items, which is 33.3%, five nests (23.8%) were found in mature forests and poles, two more settlements were noticed in isolated forests (9.5%).

Choosing trees for nesting. At the time of nesting, the sparrow hawk selects eight species of trees for settlement. Common oak (Quercus robur L.) - 5 cases (23.7%) and common hornbeam (Carpinus betulus L.) – 3 cases (14.2%). Other types of trees are less common. The sweet cherry tree (Prunus avium L.) is

inhabited less - 1 nest (4.8%). As for the location of nests, the sparrow hawk mostly prefers areas at the base of the tree crown in places where large side branches are devided into many parts. Taking into the consideration the nests we found, 14 nests (66.7%) were located in the center of the crown, 5 nests (23.8%) were located along the edges of the side branches, and only 2 nests (9.5%) were located in the apical branches. The average nest height is 10.02±0.45 m.

The nest. The hawk mainly has 2 nests on the same nesting territory, which it uses alternately. The nest material is tree branches, dry roots and stems, animal hair, feathers, and clay. Analyzing the nests (table 2) we see that 18 nests were built independently, and 3 previously belonged to the jay.

Table 2

Morphometric indicators of the nests of the sparrow hawk, n=15

Socket options	M±m	Lim min-max	σ	CV, %
Nest height, cm	24.5±2.4	20 - 26	3.2	13.08
Nest width, cm	43.52±2.76	37 - 49.5	3.9	11.35
Tray depth, cm	7.35±1.06	5 - 10.5	1.6	14.32
Tray width, cm	18.42±1.78	15 – 26	1.88	10.21

Source: author's property

These nests are predominantly cup-shaped. The parameters of the nests are shown in table 2 and coincide with the data of scientific sources [4; 7; 31; 34]. The process of egg laying begins in the second half of April. Clutch size ranges from 3 to 5 eggs. The colour of eggs is light green background with slight brown mottling. Predominantly all eggs are of ellipsoid shape - 80.7% of all eggs, and the rest of them are shortened ellipsoidal - 19.3%. The female incubates eggs for 34-35 days. The parameters of eggs of clutches (n=49) are shown in table 3.

Table 3

Morphological characteristics of the eggs of the sparrow hawk, n=49

Egg parameters	M±m	Lim min-max	σ	CV, %
Long axis of the egg, mm	38.9±1.08	38.5 - 41.5	1.12	2.9
Short axis of the egg, mm	30.5±0.78	29.6 - 32.1	0.86	2.8
Roundness index, %	78.22±0.94	76.54 - 79.37	1.81	2.3
Egg volume, mm3	23654±614	22488 – 29213	680	2.4

Source: author's property

According to all indicators, the coefficient of variation of the parameters does not exceed 3%, which indicates their low variability and reliability of measurements. The chicks stay in the nest for about 45 days, then the parents feed the fledglings for some time. Only after this, young individuals switch to independent nutrition.

Etiological features. The sparrow hawk is a territorial species and occupies well-defined limits at the time of nesting. It secures the territory of the corresponding ecosystem and retains it for itself for several years, therefore, at the beginning of the nesting period, there are some conflicts with representatives of their own species which are trying to occupy some parts of their territory. The sparrow hawk forms permanent pairs that are bounded to certain biotopes. At the beginning of nesting, the couple of birds already shows increased aggressiveness, letting them know about their territory with a loud cry. In addition, the peculiarities of eating behavior is that the sparrow hawk, like a bird of prey, hunts from an ambush. During hunting, the hawk is quite maneuverable, as it has relatively short wings, which it easily uses to move within the forests and occasionally in open landscapes. A feature of reproductive behavior is that they occupy two nests side by side in shifts during several seasons. The male creates the outer perimeter of security activity, and the female creates the inner one. Another feature is that at the end of April they form a full clutch of 3-5 eggs, which the female begins to incubate. During the period of incubation the sparrow hawks most often show their aggression against any big species of birds. Conflicts are reflected in table 4.

Table 4

Distribution of birds in conflict with the sparrow hawk

No.	Specific name	Number of conflicts	Part, %
1	Common raven	8	20
2	Hooded crow	12	30
3	Eurasian magpie	8	20
4	Common buzzard	4	10
5	Eurasian hobby	4	10

6	Red-footed falcon	4	10
	Total: 6 types	**40**	**100**

Source: author's property

The main percentage of conflicts falls on raven birds – common raven, black gray, Eurasian magpie (70%). These birds can be a real danger to eggs and chicks, so a pair of the sparrow hawks attack these species with a preventive purpose [35]. When breeding chicks, the ethological feature is that only the female feeds the chicks, that is, she bites and distributes food, and the male only brings her killed animals. In the breeding season, the conflict of the sparrow hawks decreases, and they do not attack individuals of large bird species unnecessarily. In winter, sparrow hawks do small migrations to settlements, as there are more rowan birds gathering there and because the transformed landscapes make it easier for them to find food.

Food. Analyzing the remains of animals that feed on the sparrow hawks, we see that a certain seasonal dynamics can be traced in its diet. That is, at different times of the year, this type of the sparrow hawk has different food priorities. Thus, in the pre-nesting and nesting periods, the sparrow hawk killed mainly 10 species of birds, and the following birds as European robin (Erithacus rubecula L.), common linnet (Acanthis cannabina L.) and garden warbler (Sylvia communis L.) play a significant role in the diet. The proportion of other bird species is much lower. Only the female feeds the chicks, the male brings the food [30]. If a female bird dies, the brood dies because the male does not know how to feed them [30]. Nestlings are mainly fed with small rowan birds (fig. 1).

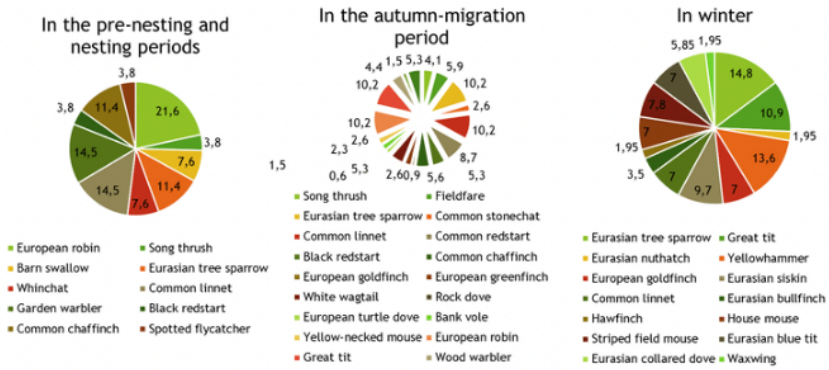

Fig. 1. Trophic relationships of the sparrow hawk on the territory of research

Source: author's property

During the autumn migration period, nutritional priorities change somewhat. There are already 20 species of homoiothermic vertebrates in the diet of the sparrow hawk (fig. 1). These are four species of mouse-like rodents, but their share in the sparrow hawk's menu is insignificant. The main feeding species in autumn are the Eurasian tree sparrow (Passer montanus L.), the great tit (Parus major L.), and the European robin. When analyzing the trophism of the sparrow hawk in winter, we see the presence of 14 species of vertebrates in the diet of the hawk (12 types are birds, and 2 types are mammals): the house mouse (Mus musculus L.) and the striped field mouse (Apodemus agrarius L.). More often, three species of rowan birds fall are the food of the sparrow hawks in winter: Eurasian tree sparrow, yellowhammer (Emberiza citrinella L.), great tit. Other species of birds that are in the diet might be found less frequently. Although, in winter, the sparrow hawk hunts for migrant species from the north, such as: Eurasian siskin (Spinus spinus L.), Eurasian bullfinch (Pyrrhula pyrrhula L.) and waxwing (Bombycilla garrulus L.). So, there is a tendency in the feeding habits of the sparrow hawk to the predominance of small rowan birds in the diet.

Phenological features. The hawk belongs to a nomadic species that makes small migrations in search of food [36], especially in winter. In autumn and winter, the sparrow hawk makes migrations to places where a larger number of rowan birds is concentrated. The sparrow hawk is a hemerophobic species that is

difficult to adapt to new conditions [34], although in winter and autumn migration period the bird often appears near settlements where it is aggressively met by mountain ash birds. In spring, a hawk is clearly bounded to certain areas, where it breeds and feeds.

Protection of the sparrow hawks. We analyzed the remains of dead sparrow hawks which we have found and based on that we created the list of actions which we need to do to preserve the local population of the sparrow hawk in the ecosystems of Prydnistrovske Pokuttia. The following conservation measures should be taken:

– Preserve older hornbeam-oak forests in the zone "Dniester Landscape Park named after Sergii Didich" where sparrow hawks are most likely to settle;

– Carry out educational work among schoolchildren on the inadmissibility of destroying nests and scaring away adult birds in nesting biotopes;

– Rational use of pesticides in the cultivation of fields and forests, replacing insecticides with pheromone traps as far as possible, which will protect sparrow hawks from poisoning [37];

– Actively cooperate with hunters, explaining to them the inadmissibility of shooting birds of prey;

– Regularly debunk the myth that local residents think about the harmfulness of the sparrow hawk, explaining to them the true aspects of the biology of this species;

– Power and electric companies should regularly check the tension of the wires on high-voltage power lines, which will protect birds of prey from short circuits due to wires snagging on the edges of the wings.

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