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Ecology of some species of Owls in agricultural landscapes of the Altai region

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ABSTRACT

On agricultural landscapes of the Altai region the Strigidae are represented by 9 species. By distribution they may be divided into three groups: Migratory - 3 types (long-eared owl, short-eared owl, and scops-owl); Breeding and wintering in nesting areas - 5 species (eagle-owl, Ural owl, Great gray owl, pygmy owl, boreal owl); and Migratory and wintering, but not nesting - 1 species (snowy owl). The populations of most species are characterized by uneven spatial distribution of nesting areas, which is associated with significant anthropogenic transformation of the territory and the gravity of many species to unplowed areas. Three owl species under special protection listed in the Red Books of different levels are nesting in the study area. These are the eagle-owl, great grey owl, and pygmy owl. The eagle-owl population is still in relatively good condition. The populations of great grey owl and pygmy owl need further detailed study. The most significant limiting human-induced factors for owl populations in the Altai region are the death on birds-dangerous lines, selective logging, and dependence on cattle, agricultural ground fires, and commercial development of placer gold mine in the river and streams valleys.

Key words : *Altai region, Agricultural landscapes, Strigidae, Ecology, Distribution, Nesting, Nutrition, Limiting factors.*

Introduction

Plains and foothills of the Altai region are among the most developed Russian agricultural areas, and the agricultural landscapes make up their large part (Altai Territory. Atlas, 1978). At the same time, these areas are of key importance for the protection of many rare and declining birds species of Strigidae family (eagle owl, great gray owl, etc.), as there are sufficiently large breeding groups of these species (Vazhov, 2013; 2015). The mechanisms of resistance of birds populations to human impacts within agricultural landscapes, the nature of which is currently dramatically changing, are of interest. Today the direct destruction of bird habitats through plowing of natural areas almost does not occur, since the plowing maximum was reached back in the 1970s, and in recent decades considerable part of plowing land has been transferred to the fallow land and has partially recovered to secondary steppes. Nevertheless, the observation over the number of many owl species indicates that it is steadily declining since there are other understudied threats. On the other hand, the attention is drawn to preconditions of individual species synanthropization, particularly, the long-eared owl, which nests in agricultural landscapes on a massive scale. Therefore, the creation of a database on owls' ecology within the agricultural landscapes gradient has identified the research relevance.

The scope of research is the creation of a database on owls' ecology within the agricultural landscapes gradient of the Altai region.

The following tasks were completed to achieve the desired goal:

- Study of ecology and breeding biology features, identification of the number and nature of Strigidae nesting groups in agricultural landscapes;
- Identification of poorly surveyed habitats of owls within these landscapes;
- Monitoring of known nesting groups within the monitoring areas laid in 2005-2010;
- Assessment of the current state of Strigidae populations within agricultural landscapes;
- Study of stability mechanisms of populations and nesting groups, determination of viability of specific populations in modern conditions of human-induced impact;
- Development of protection strategies for Strigidae populations within agricultural landscapes of the Altai region.

The completion of tasks set allowed forming a new database on the ecology of some Strigidae species within the gradient of agricultural landscapes of the Altai region.

Methods

The studies were conducted between 2004 and 2015. The study area includes the northern and northwestern foothills of the Altai Mountains, Prealtai Plain and that part of the meadow-steppe and forest-steppe lowlands, which directly borders the foothills, as well as pine forests, Ob plateau, and the inundated forestlands of the right bank of the Ob (Upper Ob and Middle Ob forestlands). We do not consider the Taiga lowlands of Altai and Salair sharply differing by species composition and population of birds from the foothills and pine forests.

Formation of Strigidae ecology database under the influence of agricultural activities in the Altai region was performed by collecting the material in the course of field research and their subsequent cameral treatment (documentary fixation on the basis of photo and video shooting, entry into GIS and statistical analysis, including multivariate one using both parametric and non-parametric methods). Field works were carried out on the basis of generally accepted methods of owls learning (Guidelines: Methods for studying and protecting vermins, 1989; Bibby, Jones and Marsden, 1998).

Nesting areas (territories around nests protected by stationary pairs of birds) have emerged in the road and hiking trails in the nest-suitable habitats.

The following algorithm was used in identifying nests:

1. Systematic survey of a number of species-specific nesting habitats.
2. Localization of nesting territory.
3. Mapping the nesting center of the territory and its buffer (nesting area radius), on a map with the pre-made analysis of the nest-suitable habitats.
4. Research of a number of similar nest-suitable habitats outside the buffer until localization of the following nesting territory.

The expedition team has been moving on the car VAZ 21213. The nest-suitable habitats were examined using optics at stops every 200-400 m, as well as on radial hiking trails in order to detect nestings of hawks and corvids, occupied by owls or nestings of owls themselves sitting on perches. During the hiking trails the foot of the rocky outcrops and trees were also inspected to detect the residues of food and castings. In many cases rocky outcrops and slopes were examined simultaneously, both from above and from below by a group of two people, whose work was coordinated with the help of handheld radios. The inspection of small basins and valleys was performed from the dominant elevations during 0.5-1.5 hours. Binoculars 8×40, 8×45, 12×45, 20×50 and the telescope 20–50×60 were used thereby. The binocular with optical image stabilization "Canon" 8 × 25 IS was used for observations from a moving car. All the places of birds and their nests detection were attached to the coordinate system using personal satellite navigators Garmin Etrex, mapped and entered into the database ArcView GIS 3.2a ESRI, as well as to Web-GIS Wildlifemonitoring.ru.

The work focused on the identification of and search for nests of large birds of prey, which determine the distribution of many other birds of prey in the territory, and are the indicators of nutrition in the region, but all occurrences of owls were recorded. In areas surveyed in previous years, already identified nesting areas available in our database have been visited primarily, and the areas where the nesting of birds of prey is likely, but in previous years their nests have not been found have been inspected.

The following terms were used in characterizing the nests:

- "resident nest" is an active nest successful at the time of its study;
- "empty nest" is an active nest visited by birds, but without evidence of successful reproduction or with significantly dead offspring at the setting or brood time;
- "old nest" is an old nesting not visited by birds.

The nesting areas are equated to the occurrence of adult birds in pairs, displaying adult birds, males on long-term perches in the nesting season or repeated occurrences of single birds, showing concern to humans or predators. The used criteria for nesting sites conform to those adopted by the European Bird Census Council (Hagemeijer and Blair, 1997).

The birds' ecology was studied by conventional methods ((Guidelines: Methods for studying and protecting vermins, 1989; Bibby, Jones and Marsden, 1998). The distances between nests were measured in the GIS environment (ArcView GIS 3.2a ESRI or Web GIS Wildlifemonitoring.ru) accurate to 10 m. The density of the relief breakdown (km), rural population density (people/ km^2) and percentage of forest area (%) in areas of birds nesting was determined by relevant Atlas of the Altai Territory. (Altai Territory. Atlas, 1978). The inspection of nests to collect data on nesting and nutrition was performed only in cases where it did not pose visible to settings or broods.

One of the objectives of the research work was to monitor the known nesting groups of birds of prey at monitoring sites, laid by us back in 2005-2010 in Biysk, Altai, Soloneshensky, Petropavlovsk, Ust-Kalmansky, Krasnoschekovsky, Charyshsky, Shipunovsky, Kuryinsky, Zmeinogorsky and Loktevsky districts of the Altai Territory. The geographic information system Wildlifemonitoring.ru served as a basis for the establishment of a monitoring system.

Statistical data processing was performed using Microsoft Office Excel 2003, Statistica 6.0 and ArcView GIS 3.2a software packages. The parameters were checked for normal distribution using the Shapiro-Wilk, and Kolmogorov-Smirnov criteria. The reliability of mean differences was analyzed using parametric *t* - the Student's factor or Van der Waerden nonparametric rank X- factor, in some cases the univariate variance (ANOVA) and discriminant analysis was conducted using Statistica 6.0 program (Klecka, 1980).

Results and Discussion

Eagle owl *Bubo bubo* (Linnaeus, 1758)

Status: Eagle owl is one of the most typical and dispersed large birds of prey in the region, as indeed in the whole Altai-Sayan physiographic country (Karyakin, 2007). It is quite common for its size class in the study area. Nonmigratory species. It was included in the Red Book of the Russian Federation, Altai Territory, the Altai Republic, Annex 2 CITES, Annex 2 of the Berne Convention, the annex to the Agreement on Migratory Birds concluded between the Republic of Korea and Russia. Status in the IUCN Red List – Least Concern (IUCN. 2015).

Dispersion and abundance : Eagle owl is dispersed in northern Africa, the Arabian Peninsula and Eurasia - from the Atlantic coast to the valley of the upper Kolyma and the Pacific coast. To the north it is dispersed to 65-69th parallels, to the south - to the oceanic coast of Eurasia (Stepanyan, 1990). Currently, in the Altai Territory, at least 134 eagle owl nesting areas are known, the vast majority of which is located in pine forests on the Ob plateau (Fig. 1). In the study area 46 eagle owl nesting sites are known that makes 11.6-14.5% of the estimated population. The distance between the nearest adjacent active nests (n = 13) ranges from 1,350 to 7,350 m, with an average of 3,470.77 ± 1,775.91 m (median 3,020 m, As = 1.00; Ex = 0.66). The geographical distribution and habitat confinedness of the eagle owl nesting areas in the study area is very close to those of eagles, especially the steppe eagle, but the eagle owl is far more dispersed and inhabits both completely treeless and poorly dissected steppe areas, and the forest-steppe and even taiga lowlands (Vazhov, 2013; 2015).

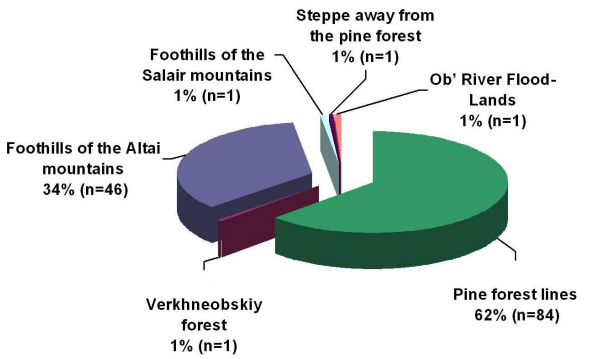

Fig. 1. The number of known nesting areas of eagle owl in different habitats of the Altai region

Nesting : In the Altai region the eagle owl, most probably, is the nonmigratory bird. In winter it was repeatedly noted by A.P. Kuchin (Kuchin, 2004) on the territory studied, and recently it was also observed in the winter in Tigireksky reserve (Bochkareva and Irisova, 2009).

On 29 owl nesting areas in the foothills of the Altai 39 nests were found, of which 38 are confined to rock outcrops, and one was in the spiraea bushes on the coastal slope of the river without rocks (I.E. Smelyanskiy, pers. comm). All nest represented a small cavity in the ground, most of them were located in niches at the foot of the riverside ledge rocks or rocky outcrops of hills slopes. The elevation of nests on the substrate ranges from 0 to 40 m, on average (n = 36) amounting to 4.22 ± 9.01 m (median = 0).

The number of nestlings in eagle owl broods in the Altai region was 1 - 3 (Fig. 2), on average 2.11 ± 0.60 (n = 9), and in the Altai foothills all broods contained two nestlings each, and in the pine forests – three nestlings each, two - two nestlings each, and one - one nestling each, on average 2.20 ± 0.84 (n = 5). In one of the nests in the foothills, except for two nestlings, the egg with dead embryos was found.

Nutrition : The nutrition of the eagle owl is very diverse. In the nest in the lower reaches of the Kuyacha River we have found the remains of three ordinary hamsters, two corncrakes, rooks, two root voles, and one common vole. In general, according to our observations in the study area on the perches and in the eagle owls nests the remains of zokor and voles dominate. On one of the perches near Novokalmanka village we found the remains of the hare and honey buzzard. All kinds of birds of prey inhabiting the study area, with the exception of a golden eagle, comprise the nutrition of the eagle owl. In his turn, the eagle owl also suffers from eagles, insofar as we recorded two cases of eradication of adult eagle owls by eagles in their nests.

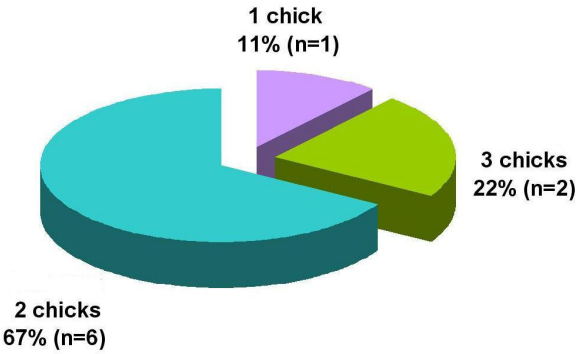

Fig. 2. The size of eagle owl broods in the Altai region

Limiting factors : Probably, the main limiting factors for the eagle owl population in the study area are the same as for the steppe eagle, but it is clearly less affected by the death on Birds-dangerous power lines than the eagles because it rarely uses them as perches. A very significant limiting factor may be the destruction of nesting and feeding stations (valleys and flood plains of small rivers) as a result of industrial development of placer gold mines, which in recent years is massive and takes menacing proportions in the Altai foothills. In general, the eagle owl is definitely less vulnerable than eagles and large falcons, as it is much wider dispersed.

Long-eared owl *Asio otus* (Linnaeus, 1758)

Status : The long-eared owl is a usual nesting migratory species in the region. Apparently, some birds are wintering. Status in the IUCN Red List – Least Concern (IUCN, 2015).

Dispersion and Abundance : The long-eared owl is dispersed in Eurasia, from the Atlantic to the Pacific coast, in the north - to the 60-66th parallels, in the south - to the south of the Mongolian Altai. Moreover, it nests in the north-western Africa and North America (Stepanyan, 1990). The stereotype of the nesting habitat of the long-eared owl is a mosaic of forest outliers and a variety of agricultural lands. Above all this owl prefers wood plantations near the fallow, pastures, hay crops and perennial crops; it tends less to pins among arable lands or on its margins, along the marshes and clearings or at the periphery. Such stations are well represented in the Altai foothills. The nests we found were on trees in old nestings of magpie (n = 9) and hooded crows (n = 1), as well as in an artificial nestbox intended for Ural owl (n = 1).

Nesting : The earliest occurrence of the long-eared owl was marked by us on February 28 in the vicinity of Kuyagan village. The earliest occupied nest (without setting) was found on April 2 in the forest belt near Platovo village. Given the lack of information in the literature on the dynamics of growth and development of the nestlings of this species in the study area, we consider it appropriate to give information on their morphometric characteristics in one of the nests (Table 1).

Table 1. The morphometric parameters of long-eared owl nestlings of one brood

Nestling	Date	Length, mm				Mass, g
		wing	tail	beak	tarsometatarsus	
1st	22.05	135	10	11.8	32.7	252
	26.05	170	25	11.9	32.8	290
	01.06	not found				
2nd	22.05	122	–	10.9	30.6	231
	26.05	145	10	11.1	32.0	235
	01.06	180	45	11.4	32.7	260

Limiting factors : The probable risk for long-eared owl populations in the region is a death from electric shock on the pillars of birds-dangerous power lines with a capacity of 6-10 kW, which are used by owls as perches. However, on the view of birds-dangerous power lines we found the remains of only one deceased long-eared owl. The density of dead owls of this species on the examined parts of the bird-dangerous power lines was 0.07 species per 10 km of power lines, which corresponds to the density of dead eagle owls and peregrine falcons. It is obvious that the population of long-eared owl much less suffers from death on power lines than other types of birds of prey. Another limiting factor is predation by larger birds, especially the eagle owl, eagles and peregrine falcon, widespread on nesting in the region. The remains of eaten long-eared owls were often seen by us in the nests and on perches of these species.

Ural owl *Strix uralensis* Pallas, 1771

Status: Ural owl is a nonmigratory, and possibly migratory common species nesting in the region. Status in the IUCN Red List – Least Concern (IUCN. 2015).

Dispersion and abundance : Ural owl is dispersed in Eurasia from Scandinavia and the lower Vistula Valley to the basin of the upper Kolyma River and the coast of the Sea of Japan (Stepanyan, 1990). In the forests of the Altai region it is a common breeding owl. In the study area we identified 21 nesting areas. Of these, 16 were found in riverine pine forest along the Biya River and its forest edges, three - in the forest-steppe lowlands (two of them - in the buffer zone of Tigireksky reserve and one near the Mayma village), and two - in the foothill forest steppe (one - between the Biya and Katun rivers, the another - between the Anouilh and Sandy rivers). The distance between the nearest adjacent active nests (n = 15) varies in a very wide range: from 870 to 8,190 m, with an average of 2,684 ± 2,270 m (median of 1,460 m, As = 1.28; Ex = 0,80).

Nesting : Ural owls with the signs of nesting behavior appear near their nests in late February. In the study area 8 natural nests were found, 7 of which were the old nestings of black kites and buzzards, six of them (86%) were located on the pines in the forest along the Biya, and one (14%) - on the birch in the pin among a pasture 1, 5 km from the edge of the forest. Only one of the natural nests found was in a half-cave at the turn of a pine trunk. Oviposition in Ural owl in the study area begins in early April. The nestlings start to leave the nest for the first time at the end of May. Thus, on May 22 under the nest of Ural owl in an old nesting of buzzard a fledgling was found, which on May 26 15 m appeared from the nest tree. The other two fledglings were in the nest. On June 1 a younger fledgling still was in the nest, while the senior fledgling sat on a branch near the nest. The fledglings begin to fly in the early - mid-June. The number of fledglings in known broods from natural nests is from 2 to 5.

The behavior of adult birds in natural nests is not very aggressive. On the view of the nests with chicks and fledglings, they were flying around the nest tree screaming, females often imitated attack, flying at 1-2 meters from the man, but did not stroke him.

For an in-depth study of the ecology and nesting biology of Ural owl in the forest on the Biya River we laid a platform on one of the parts of which, where currently is known the maximum of nests of this owl uniformly distributed through the woods in the hawk nestings, the special artificial nests are placed.

In the riverine forest along the Biya River there are almost no old trees big enough for Ural owl hollows due to selective logging, so most of the known nests of the owl are located in the hawk nestings, which implies the absence of such limiting factor as a lack of nesting fund. The latter was a decisive fac-

tor in choosing a model site for the study of Ural owl just in Biysk forests through its involvement in the artificial nests. In addition to studying the dependence of breeding success and population dynamics of Ural owl on the dynamics of small rodents population, its involvement in the artificial nests with their further monitoring will allow to answer several important questions: what would be the preference of the species in the possibility of the choice between an open nesting and the use of nestboxes; whether, and how, the basic parameters of the nesting (timing, efficiency and so forth.), as well as the behavior will change?

The nestboxes were made of boards, according to the scheme proposed by I.V. Karyakin and A.P. Levashkin (pers. comm.): height - 620-650 mm, bottom - 350 × 350 mm, entrance - 300 × 300 mm, a layer of sawdust around 10 cm was poured on the bottom. The boxes covered with varnish or a special wood preservative on the outside. The boxes were placed pointwise through the known nesting sites of Ural owl, and beyond - according to the scheme of potential sites distribution. All drawers were placed on the pines at a height of 5-11 m. In order to ensure the free reaching the interfering branches were cut down.

To study the dependence of breeding success and population dynamics of Ural owl on the dynamics of the number of its victims at the site in three hunting habitats of the owl (pine forest, the part of birch forest through the pinery and a grassy meadow on the edge), the accounting of the abundance of small mammals began using a 50-meter high hunting grooves with five cones (one in each habitat). The cones were filled with a 4% formaldehyde solution on a quarter of the height. The index numbers of small mammals, for up to 100 c/d was translated into one unit area of the habitat of 1 km^2.

The first check of nestboxes was performed on April 27 - May 1, 2010, the second - on May 22. One of the boxes was checked for the third time - on June 7, 2010. The audit determined the occupation of boxes by owls, if applicable, the number of eggs in settings and fledglings in broods was considered, the features of the behavior of adult birds was specified. Five nesting boxes (27.8%) were found occupied, of which one was placed on a known nesting site, where previously Ural owl bred in the nesting of a buzzard. The rest of the occupied boxes were placed on the potential areas where the owls were not previously observed. It should be mentioned that all known natural nests of Ural owl were empty at this site. Perhaps this is due to the low numbers of small rodents as the main food resource. This year, their total abundance in three hunting habitats of Ural owl was 7.3 species per 100 c/d (1,058.5 species / km^2), and in June 14.4 species per 100 c/d (2,088 species/ km^2). For comparison, the accounting data of the previous year (2009) in the same habitats may be mentioned. The relative abundance of small mammals in the summer in a pine forest was 26.6 species per 100 c/d, in the birch forest - 27.8 species per 100 c/d, in mixed grass meadow - 27.1 species per 100 c/d, and in the city dump - 118.1 species per 100 c/d.

Thus, Ural owls in the group, in which the open-nesting is dominated, quickly began to explore the nestboxes. The nestboxes placed on February 27 - March 7, were habitable in April. On one of the previously known sites the owls have passed from an open nest into the box, all the other well-known open nests were empty, as well as the nestboxes placed near them. However 4 nestboxes, which have been placed according to the scheme of distribution of potential sites where previously owls were observed, were habitable. It is possible that these were the owl moved from the known sites due to poor feeding conditions. The foregoing suggests that the Ural owl nesting in the hawk nestings, most likely is a forced adaptation in the absence of the natural hollows on the trees.

The level of aggressiveness of this group of owls comes under notice. If earlier Ural owls openly nesting in hawk nests, not always showed aggressiveness (33% of the attacks from the number of visited nests with the females came from them) and only imitated attacks, without striking, the Ural owls, occupying nestboxes, attacked the observers 3 times more often (100% of attacks from the number of visited nests from them females came therefrom) often striking. The pair attack of observers by a male and a female was first noted for Ural owl nesting in the nestboxes. Descriptions of such cases are extremely rare and are known for the territory of Ukraine and the Volga region, and in the latter case, the pair attack was observed in the region for the first time, and also for the pair that occupied a nestbox (I.V. Karyakin, pers. comm.)

The number of fledglings in known broods of nest boxes 2-4, on the average is 3.33 ± 0.89, which is normal for the species, despite the low number of basic food items this year. In the future we plan to

continue with the installation of artificial nests in other parts of the model site, followed by the study of breeding success and population dynamics of Ural owl on the dynamics of small rodents' population.

In the non-nesting period during regular (every 7-15 days) passage of 12-15 kilometer hiking routes, laid on the riverine forest and its edges, the dynamics of occurrence of Ural owl was traced (Fig. 3). The largest number of occurrences of the owl recorded in autumn was in early winter (October-November) and in the end of winter (March). In the middle of winter (December-January) the Ural owls almost never occur. They probably migrate to less snowy places where it is easier to forage.

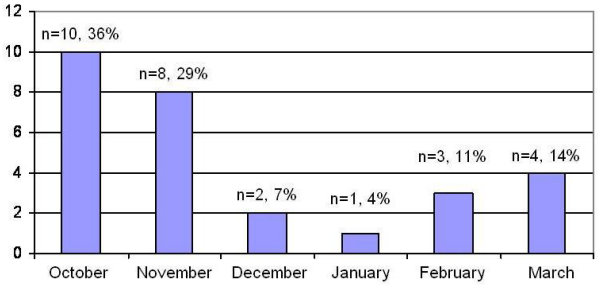

Fig. 3. The dynamics of the occurrence of the Ural owl in the forest through the Biya River in non-nesting period, n - the number of occurrences

Nutrition : The main food objects of Ural owl in the region, according to the contents of castings are common voles. In the food residues they were not marked because of the fact that the Ural owls swallow them whole. In addition, in the castings the fragments of beetles were marked in the period of their mass emergence (early-mid-May). The following animals were marked in food residues: voles, weasels, oriole, great spotted woodpecker, Oriental Turtle Dove, waxwing, corvids and small passerine birds.

Great grey owl *Strix nebulosa* J.R. Forster, 1772

Status. Great grey owl is a fairly rare non-migratory, and possibly migratory nesting species in the region. In the Altai region the Great grey owl is listed in the regional Red Book (The Red List of the Altai Territory. Rare and Endangered Species of Animals, 2006) in the category 4 - a rare poorly studied, sporadically distributed species. Status in the IUCN Red List – Least Concern (IUCN. 2015).

Dispersion and Abundance : The great gray owl is very common in northern Eurasia, and inhabits coniferous forests of various types. (Dementyev and Gladkov, 1951). According to the materials of the Red Book of the Altai Territory (The Red List of the Altai Territory. Rare and Endangered Species of Animals, 2006), the occurrence of the great grey owl is indicated on a Salair Ridge, in the foothills of the Altai in the floodplain of the Isha River, in the north of the Kulunda lowland; from 1998 to 2004. in the nesting season it was observed in Priobsky forests in the vicinity of Akutiha, Bobrovka, Rasskaziha villages where the nesting has been supposed. Also, in October-November 2000-2001 single units of these species were observed in clusters of Ural owl along the Chui path between Srostki and Mayma villages. According to A.G. Inozemtsev the only inhabited nest was found in May 2004 on the edge of the forest at the Novosibirsk reservoir near Dresvyanka village (The Red List of the Altai Territory. Rare and Endangered Species of Animals, 2006).

For eight years of field research (2004-2011) in the Altai region we met the great gray owl only once on November 12, 2004 in the riverine forest along the Biya River near Lesnoye village. However, in 2012 we found just four nesting sites, two of which were confirmed by the findings of inhabited nests, and two - by the occurrence of anxious adult birds in the nesting season. On August 6, 2012 I.V. Karyakin has found another nesting area of the great grey owl on the Altai Territory: an adult bird with a brood of two fledglings was met in Kornilovsky forest (I.V. Karyakin, pers. comm.). The sharp increase in the number of owls in the nesting period in 2012 can be attributed to favorable trophic conditions in the region. Thus, according to the account of small mammals (the main food resource) their abundance in the pine forest along the Biya River in the summer (July-August) 2012 amounted to 93.2 species per 100 cone days (13514 species/km^2) (A.V. Makarov, pers. comm). Probably on the background of the peak number of rodents the invasion of the species occurs. New emerging nesting areas are likely to cease to exist during the small mammal population depression.

Nesting : The first nesting area was found in April 13 in the riverine forest along the Biya River around Biysk city. The female had heavily hatched the clutch in the old (as we know it since 2006) nesting of a black kite, situated on a pine tree in the middle

of the trunk at the base of the lateral branches in 14 m from the ground. On April 15 the female continued to hatch, not reacting to the approach of observers to the nesting tree. The male was not observes.

When visiting the nest on May 13 the female was still there, and flew from the nest with a man climbed up to it. The two chicks of 1-3 days of age and two eggs, in one of each the hatching occurred, were found in the nest. During the inspection of the nest the female was sitting on a branch of the nesting tree breeding in two meters from the explorer, then flew to a nearby tree. Two carcasses of gray voles were in the nest. The appeared male has located on a tree 20 meters away from the nest. Both adult birds become restless - clicked their beaks. After the observers departed 10 m from the nesting tree, the female immediately returned to the nest.

At the following visit to the nest on June 4 the female was there, and flew only when climbing up to it. The two fledglings that began to hiss with human appearance were in the nest. The female twice imitated attacks, and after the male appeared, she attacked the observer, striking his head with the claws. Upon next visit on June 12 the nest was empty. One chick was sitting 10 meters from the nest in the branches of a nearby tree, and the second was on the ground 50 meters away from the nesting tree. Upon banding the chick the female flew less than 10 meters away from the observer, clicked beak, and anxiously cried.

The second nesting area was identified on April 24 in the Troitsky region near the Tyumen village. The nesting, previously belonged to hawk was located in the birch copses on the border of the Upper Ob forest on the birch in the upper third of the stem at the base of the lateral branches 15 meters from the ground. The female has been hatching. The male stayed near the nest, allowing observers to approach on 20 m. Upon the second visit on May 22 the female was closely sitting in the nest. The male was not observes.

The third probable nesting area of the great grey owl was discovered on May 1 in Biysk forest near Usyatskoe village. The adult bird was in the area of old-growth pine forest. We could not find the inhabited nest, but two empty nestings of hawk birds were found here. The fourth probable nesting area was identified on July 16 in the depth of the Upper Ob forest on the border of Bolsherechensky reserve in wet mixed pine and aspen forest. The adult bird was met. The nest was not found due to the difficult section of the nesting habitat.

Other species

In addition to the four described species of owl in the study area we noted the short-eared owl, Scops owl, pygmy owls and boreal and snowy owl. We have not succeeded to discover the nests of these species.

Asio flammeus (Pontoppidan, 1763) – is a short-eared owl, probably usual in nesting, but little studied. Single birds and pairs, displaying clear signs of territoriality, were often observed by us in the nesting season throughout the region. According to A.L. Ebel (Ebel, 2015), on June 20, 2012 in the floodplain of the Ob in Barnaul a nest with 5 chicks, with a junior one of 2-3 days of age was found; on July 10, 2012 here, but on another nesting site the two bad flying fledglings were met; on May 11, 2014 in Rubtsovsk area near Tishinka village in the wet meadow, overgrown with reeds, a nest of a marsh owl with a clutch of 6 eggs was found. Earlier, on February 28, 2011 a short-eared owl was seen by us in Kuyagan village, Altai region.

Otus scops (Linnaeus, 1758) – scops owl. Apparently, it is the usual nesting species in the study area. In May and June, we observed the vocalizing birds practically throughout the region. On the Babyrgan Mountain and at its foot we always had to hear the voices of the scops in the nesting time, from which we must conclude that there is quite a large nesting micropopulation. On July 12, 2011, at the Kolyvanskoye Lake in a niche between the rocks, A.L. Ebel (Ebel, 2015) found a nest with three chicks, less than a week prior to flight; according to the same author in the first half of the summer of 2013 and 2014 in Klyukvenniy village the display was noted.

Glaucidium passerinum (Linnaeus, 1758) – pygmy owl. During the period of research in the study area we have twice observed vocalization of these owls: On May 23, 2009 and on June 27, 2010 at the steppe lowlands of the middle course of the Kuyacha River. The huntsman S.N. Baidukov (pers. comm.) has also noted the display of the pigmy owl in Kisluhinsky reserve.

Aegolius funereus (Linnaeus, 1758) – boreal owl. At the beginning of July 2015, two young species (this year fledgings) were observed in rarefied felling of a pine forest near Smolenskoe village. in 2003-2004 the inhabited nests in the hollows of black woodpecker and boreal owls broods were found in tape

pine forests of the Altai Territory. (I.V. Karyakin, pers.comm.). On November 27, 2011 and on January 5, 2015 this species was also found in the arboretum of Barnaul in the same place, and it was observed by I.A. Belyaev; On April 20, 2014 near Klyukvenniy village , the display of the boreal owl in a Birch outlier was noted (Ebel, 2015).

Bubo scandiacus Linnaeus, 1758 – snowy owl. In the Altai region it is found only in the autumn and winter migrations, according to numerous reports from A.P. Kuchin (Kuchin, 2004), A.L. Ebel (Ebel, 2015), and A.V. Gribkov (pers.comm.), and also from the other researchers, including us.

Conclusion

These observations lead to the following conclusions. On agricultural landscapes of the Altai region the Strigidae are represented by 9 species. By distribution they may be divided into three groups:

- Migratory - 3 types (long-eared owl, short-eared owl, scops-owl).
- Breeding and wintering in nesting areas (maybe nonmigratory) - 5 species (eagle-owl, Ural owl, Great gray owl, pygmy owl, boreal owl).
- Migratory and wintering, but not nesting - 1 specie (snowy owl).

The nesting of pygmy owl in the study area still remains disputable, but given the fact of display of this specie, it is very likely and is virtually certain.

The populations of most species are characterized by uneven spatial distribution of nesting areas, which is associated with significant anthropogenic transformation of the territory and the gravity of many species to unplowed areas.

3 owl species under special protection listed in the Red Books of different levels are nesting in the study area. These are the eagle-owl, great grey owl, and pygmy owl. The eagle-owl population is still in relatively good condition. The populations of great grey owl and pygmy owl need further detailed study. The available data are insufficient to adequately assess them. The most significant limiting human-induced factors for owl populations in the Altai region are the death on birds-dangerous lines, selective logging, dependence on cattle (lack of grazing pressure), agricultural ground fires, and commercial development of placer gold mine in the river and streams valleys.

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