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GREAT GREY OWL *STRIX NEBULOSA* (STRIGIFORMES, STRIGIDAE) BREEDING AND REPRODUCTION IN POLISSKIY NATURE RESERVE, UKRAINE

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Great Grey Owl, *Strix nebulosa* (Strigiformes, Strigidae), Breeding and Reproduction in Polisskiy Nature Reserve, Ukraine. Kuzmenko, Yu. — A Great Grey Owl population on the territory of Polisskiy Nature Reserve (Olevsk and Ovruch District, Zhytomyr Region, Ukraine) was investigated in 2006–2008, 2013–2016. The main breeding locations were mesotrophic mires, where the lack of Birds of Prey nests made owls to breed on artificial constructions. Reproductive indexes of mean clutch size were similar to such indexes achieved in 1985–1996, and indexes of mean number of fledglings on active nest and breeding success decreased reliably.

Key words: Great Grey Owl, breeding habitats, breeding, reproduction, clutch size, breeding success, Polisskiy Nature Reserve.

The Great Grey Owl (*Strix nebulosa* Forster, 1772) is a relatively new breeding species in Ukraine that has appeared as a result of resettlement, most likely, from the territory of Belarus (Gorban, Bumar, 2003) due to population fluctuation and its overall increasing (iucnredlist.org). As a rare species it is listed in the Red Data Book of Ukraine (2009). Breeding was firstly recorded in 1985 on the north of Zhytomyr Region on the territory of the Polisskiy Nature Reserve (Yaremchenko, Sheigas, 1991). During the subsequent years a resettlement of the species on the territory of the forest nature zone was recorded (Red Data Book..., 2009). The current breeding range of the species covers the territory from the north-east of Volyn Region, northern parts of Rivne and Zhytomyr Regions to the north-west of Kyiv Region (Domashevskiy, Boumar, 2009). Abundance of the Great Grey Owl is estimated at 60–110 nesting pairs in Ukraine (Ławicki et al., 2013).

On the territory of Polisskiy Nature Reserve the study of Great Grey Owl breeding and reproduction was one of the priority directions of annual monitoring in the framework of the program of Nature Chronicle. The main results of that works were published earlier: dynamics of abundance, clutch size and brood size, reproduction success during 1985–1996 (Zhyla, 1997), as well as reproduction peculiarities during the abundance increasing period (Gorban, Boumar, 2003).

Material and methods

Study of breeding biology of the Great Grey Owl was conducted during 2006–2008 and 2013–2016. In order to estimate breeding density the absolute surveys were made on the territory of Selezivka forestry (80 km² were covered). As a result 19 breeding sites were examined, among them 16 sites were located on the territory of Polisskiy Nature Reserve and its protection zone and 3 ones were situated in vicinities within Olevsk and Ovruch Districts of Zhytomyr Region. Totally 20 nests were found and 27 breeding cases were monitored.

Repetitive cases of breeding in the same nests were considered as one case. The search for the nests was performed by checking the nests of birds of prey, wild bee's hives and artificial nests. Dimensions of hive roofs were 55–140 x 50–90 cm. Artificial nests were platforms constructed of 45 x 50 cm width and 14 cm high boards. In total 23 artificial nests were located in winter 2007–2008.

Reproduction was studied during the checking of the found nests. We examined the nests 2–4 times per season to determine their content. The date of first egg laying was determined by the method of counting. We considered 29 days as the length of the incubation period (Mikkola, 1983). We made measurements of 45 eggs of the Great Grey Owl directly in the nests and one egg was taken from the collection of the Museum of Nature of the Polisskiy Nature Reserve.

Results and discussion

Breeding density of the Great Grey Owl in the Polisskiy Nature Reserve during research period was 3.4 pairs per 100 km² of a forest area.

Breeding areas of Great Grey Owl were located in high-stem forests of various types, which are surrounded by open sedge bogs, most often in birch-pine buckthorn-molinia waterlogged forests (table 1). Underbrushes, mainly from alder buckthorn, were not dense on most nest sites (65.0 %), less either dense — 25.0 % or totally absent (10.0 %). Plantings were 50–100 years old; mean age was 73.7 ± 3.2 years. The closeness of the tree crowns was 0.6–0.9; mean was 0.73 ± 0.02 .

Owls use for breeding the nests made by Common Buzzard (*Buteo buteo* Linnaeus, 1758) and artificial platforms — 40.0 % both, as well as hive roofs — 20.0 %, located in the depths of forest in 15–200 m (mean — 111.84 ± 14.47 m) from open places: most often transition mires (65.0 %), less frequent waterlogged floodplains of small rivers and old felling — 10.0 %, oligotrophic marshes, melioration systems and fire bridges — 5.0 %.

The distance to settlements was 1–6 km, on the average — 2.5 ± 0.32 km. One nest was located at a distance of 900 m from the regional significance road. The rest of the roads lying near the nests were rarely used and were located at a distance 30–250 m for ground roads, 380–900 m for covered roads.

Nesting trees were pine (90.0 %) and birch (10.0 %). Nests were located mainly in the lower (90.0 %) and less in the middle (10.0 %) parts of the crown. The height of the location of the nests ranged from 4 to 16 m, an average of 11.23 ± 0.73 m (table 2).

Nests are built mostly from the branches of the pine (90 %), as well as birch and aspen. Bottom of nest is covered with thin branches of pine, birch and aspen. There are usually owl feathers on the bottom of the nest. Size (cm) of the nests made from the

Table 1. Habitat distribution of nests of Great Grey Owl

Habitat	Relative number of nests, %
Birch and pine forest	60.0
Birch and pine buckthorn-molinia waterlogged forest	35.0
Birch and pine buckthorn-blueberry	25.0
Pine forest	35.0
Pine buckthorn-molinia waterlogged forest	15.0
Pine buckthorn-green moss-blueberry forest	20.0
Pine and birch forest	5.0
Total, n = 20	100

Table 2. Location high of different types of nest of the Great Grey Owl

Type of nest	n	Limits, m	Mean, m
Nests from branches	8	4–16	11.47 ± 1.55
Artificial nests	8	10–14	12.29 ± 0.56
Hives	4	5–9	7.33 ± 1.20

branches: diameter (n = 6) is 50–90 cm, height of the nest (n = 6) is 30–90 cm, diameter of the bottom (n = 4) is 22–35 cm, depth of the nest (n = 4) is 4.5–6 cm. The pad on the hive roofs was absent, females laid the eggs on the bare decks or it was covered with roofing material or birch bark, as well as on the remains of Black Stork (*Ciconia nigra* Linnaeus, 1758) nest. In the part of artificial nests the pad eventually disappeared, but the owls laid eggs on the bare boards.

The sedentary behavior of the species is evidenced by the facts of attachment to the breeding areas and nests. During the research period among 19 breeding sites four nests were occupied for two consecutive years and birds in three cases did not leave the territory even after the previous unsuccessful breeding. Two breeding areas have been marked for two years with a one-year break.

Great Grey Owls are present on the nesting sites throughout the year. There were three observation of the Great Grey Owl during winter period: 12th Dec 2007, 10th Jan 2008, and 21st Jan 2008. The calling in the nesting areas begins in the middle of February and lasts to the middle April (Kuzmenko, 2014). The beginning of the egg-laying is stretched (table 3).

The earliest egg-laying was started on March 27, 2008 and on March 27, 2014, the latest on April 30, 2013: average is April 12 ± 2.6 days (n = 17).

The clutch included from 2 to 4 eggs (table 4). Average long-term size of clutch in the Polisskiy Nature Reserve is less than observed in Northern Europe (Mikkola, 1983) and similar to registered in Belarus (Tishechkin et al., 1997; Abramchuk, 2009).

Between the date of first egg laying and the size of the clutch a significant negative strong correlation was found ($r = -0.67$, $n = 13$), thus the regularity was confirmed that large clutches are laid earlier (fig. 1).

The discrepancy between the start of egg-laying is also observed during one season. In 2008, among 5 nests controlled, the beginning of the breeding of 4 pairs was synchronous — they bred in the 10-day period, the divergence of the fifth pair and the first was 21 days.

The sizes of eggs (n = 45) fluctuated within: 47.1–55.8 x 40.0–44.6 mm, on the average 51.97 ± 0.29 x 42.37 ± 0.17 mm, max — 55.8 x 42.2 and 51.5 x 44.6 mm, min — 47.1 x 40.3 and 55.7 x 40.0 mm. There were recorded from 1 to 2 nestlings (table 4).

The average long-term size of clutch in the Polisskiy Nature Reserve is the smallest among marked in Europe (Mikkola, 1983; Tishechkin et al., 1997; Abramchuk, 2009).

Comparing the average clutch size and brood size and the same data collected during 1985–1996 (Zhylya, 1997), we found out that the average clutch

Table 3. First date of egg-laying

Period	Percentage
March 20–31	17.6
April 1–9	23.5
April 10–19	35.4
April 20–30	23.5
Total, n = 17	100

Table 4. Clutch and brood size of Great Grey Owl

Parameters	Number of eggs and nestlings				
	0	1	2	3	4
Nests with clutches (n = 15)	–	–	4	6	5
Nests with fledglings (n = 23)	14	5	4	–	–

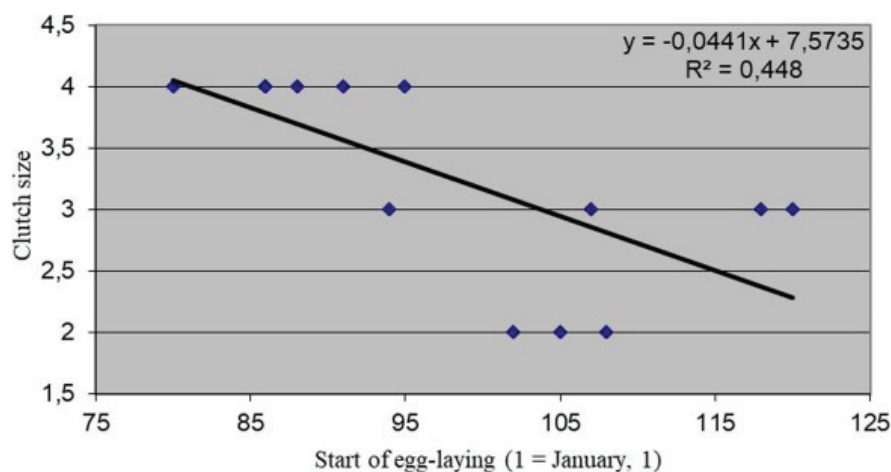


Fig.1. Correlation between clutch size and start of egg-laying.

size and the average number of fledglings per successful nest did not change (the difference was not statistically verified at $\alpha = 0.05$), and the average number of fledglings per active nest and the reproduction success have reliably decreased (table 5).

Productivity of reproduction during research period was low:

- 3 nests were examined in 2006 and 2007: no one owlet was raised;
- in 2008 only 4 owlets left 5 nests;
- in 2013 from 3 nests only 2 fledglings were raised;
- in 2014 there were 4 nests and 2 chicks;
- in 2015 there was only 1 fledgling and 3 nests were found.

The high total mortality rate was noted — 82.6 %. Partial and complete destruction of the nest contents was detected in 17 nests, among them 11 were completely wasted and the death of eggs and chicks in other nests was partial.

The causes of egg death were:

- Leaving of the whole clutch by owls (2 cases, 5 eggs);
- Disappearance of the whole clutch or all small chicks (5 cases, 13 eggs);
- Dropping of the nest with eggs by strong wind.

The causes of partial death were:

- Disappearance of 1–2 eggs or chicks (4 cases)
- One egg with formed chicks slipped out of the hive roof
- Two eggs were unfertilized (wind eggs)
- One egg was addled
- Disappearance of chicks in embryonic feathers (3 cases, 6 ind.) and in mesoptyl (1 case, 1 ind.). There was also one case of 2 chicks' death from the food shortage at the age of 13 and 15 days.

Table 5. Reproductive indexes of the Great Grey Owl

Period	Clutch size		Fledglings / active nest		Fledglings / successful nest	Breeding success
	Lim	M ± m (n)	Lim	M ± m (n)	M ± m (n)	
1985–1996 ¹	2–4	3.33 ± 0.22 (12)	0–3	1.15 ± 0.25 (13)	1.50 ± 0.22 (10)	37.50 ± 7.1 (12)
2006–2015	2–4	3.07 ± 0.21 (15)	0–2	0.56 ± 0.16 (23)	1.44 ± 0.18 (9)	17.39 ± 5.3 (15)

¹ S. M. Zhyla, 1997.

The conditions for breeding of the Great Grey Owl in northern Ukraine are likely to be less favorable than in northern Europe. A high percentage of unsuccessful breeding attempts on the territory of Polisskiy Nature Reserve were observed in the period with a low number of voles, which was the main prey species for Great Grey Owls in Europe (Mikkola, 1983). During the period of research in the diet of the Great Grey Owl on the territory of the Polisskiy Nature Reserve there was a high proportion of secondary and substitute species of prey — shrews and birds (Kuzmenko, Mishta, 2014, Kuzmenko et al., 2015), which could not provide the survival of chicks.

Conclusions

1. In the Polisskiy Nature Reserve the Great Grey Owl breeds in the pine-birch and pine forests, in a band width of up to 200 m from open areas, most often mesotrophic swamps.
2. Due to lack of natural nesting places, owls often breed on artificial floorboards from boards (wild bee's hive, artificial nests) (60.0 %).
3. The laying period is overstretched and lasts a little more than a month, starting on the average on April, 12.
4. The average indexes of clutch size and brood size by the data we collected during the period 2006–2015 was similar to the same data obtained in 1985–1996. The average number of fledglings per active nest and the reproduction success significantly increased and were statistically confirmed.
5. During the research period breeding conditions in the region were not convenient, the years with low and average productivity and high general mortality were prevalent.

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