Territorial Protection Maintenance of the Wildlife Species Listed in the Red Data Book of the Nizhny Novgorod Region

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Abstract. The paper summarizes the results of the analysis of the territorial protection maintenance of the wildlife species listed in the Red Data Book of the Nizhny Novgorod region. To assess the current state of territorial protection of rare wildlife species the database containing 3599 facts of registrations of the rare wildlife species on approved and projected protected areas of the Nizhny Novgorod region was compiled by the authors. In addition, authors have offered to recognize 5 levels of the protection maintenance: full, good, satisfactory, poor, and absent. Authors have evaluated the scale of changes in the rare wildlife species providing with territorial protection in the XX-XXI centuries as well. The territorial protection maintenance of the rare wildlife species in the Nizhny Novgorod region has grown significantly over the past 40 years. In 2001, the rare wildlife species listed in the Red Data Book of the Nizhny Novgorod region were known to inhabit only 195 protected areas. Now the rare species of animals, plants, fungi and lichens are protected in 227 approved protected areas, and 92 territories are projected for the protected areas establishing. In general, the territorial protection of rare species listed in the regional Red Data Book seems to be satisfactory, but need the significant improvement. It is necessary to create additional protected areas along with continued searching of rare species habitats.

1. Introduction

The global problem of conservation of biological diversity is largely solved at the regional level. Approaches and principles for conserving regional and local diversity are actively discussed [1, 2, 3]. The Nizhny Novgorod region (76.6 sq. km) located in the center of the Russian plain is repeatedly considered as a model region for the implementation of projects for the study and conservation of biological diversity. The model of regional strategy for biodiversity conservation in the Nizhny Novgorod region developed in 1997-1999 under the Global Environment Facility (GEF) project "Biodiversity Conservation in the Russian Federation" was the most significant [4]. It was shown that the main limiting factor for the majority of rare wildlife species in the region is the human impact on habitats. Therefore, protected areas play a leading role in the biodiversity conservation. Territorial protection is the most important condition for the survival of most wildlife species listed in the regional Red Data Book [5]. This approach was actively developed by scientists from different regions of Russia [6-14].

Currently, 411 protected areas have been established in the Nizhny Novgorod region. In addition, 147 sites are projected as protected areas. The total area of existing and projected protected areas together with buffered zones is 8350 sq. km (11% of the area of the region). Developing the regional network of protected areas, the principles and approaches of the pan-European ecological network were taken into account as well [15].

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The analysis of territorial protection of animals, plants, fungi and lichens listed in the Red Data Book of the Nizhny Novgorod region was conducted in 2019. The complete lists of rare wildlife species found in approved and projected protected areas were loaded in the database. In total, the database includes 3599 pieces of information. To estimate the level of the protection maintenance 5 degrees have offered to recognize (table. 1).

**Table 1.** Scale of assessment of levels of territorial protection of rare species of living organisms

| Level of the territorial protection | Description                                                                 | The need to expand territorial protection          |
|-----------------------------------|------------------------------------------------------------------------------|---------------------------------------------------|
| Full (sufficient)                 | All species habitats are protected, the probability of identifying new habitats is minimal | absent                                             |
| Good                              | The most part of the species habitats (including all the most important) are protected | It is advisable to increase the level of territorial protection (by 10-20%) |
| Satisfactory                      | Significant part of the species habitats (including all the most important) are protected | It is necessary to increase providing the protection for the revealed species habitats or the regional populations by 25-50%. |
| Poor                              | Some habitats are protected                                                  | It is necessary to increase the level of territorial protection by more than 50% |
| Absent                            | Species is not registered (found) on the protected areas                     | It is necessary to establish protected areas to conserve the known species habitats or search remained habitats and establish protected areas |

2. Results and Discussion

2.1. Current state of territorial protection of rare wildlife species

The current level of territorial protection of different systematic groups and categories of the status of rare wildlife species, obtained as a result of the analysis, is shown in Fig. 1 and Table 2. Figure 1 shows the level of territorial protection according to the Kingdom of living organisms. Table 2 contains information according the smaller taxonomy groups (classes, divisions) of organisms.

Full (sufficient) level of territorial protection is considered for only 5 species of plants: Isoetes lacustris L. and I. echinospora Durieu, Asplenium viride Huds., Stipa lessingiana Trin. & Rupr. and Nymphoides peltata (S. G. Gmel.) End. All known habitats of these species are located on approved protected areas; the probability to found new habitats of these plants is almost zero.

The share of species having “good” status of territorial protection is highest among algae, mosses, fungi and lichens (Table 2). The most number of these species is rather poor studied in the region and recorded in the protected areas only. The probability of finding new habitats of such species, including outside protected areas is extremely high. The share of the most studied vertebrates and plants having “good” status of territorial protection is less than 20% (Table 2). This share is even lower for insects and is absent for fish and lampreys (Table 2).

The share of rare species with “satisfactory” status of territorial protection is highest for most groups of wildlife species and ranges from one-quarter for birds, amphibians and reptiles to half for lichen species (Table 2).
Species with “poor” status of protection are absent among algae and lichens. Their share is insignificant for mosses and fungi. The share of rare vertebrate and plant species with such status comprises about one-third (Table 2).

A number of wildlife species listed in the Red Data Book of the Nizhny Novgorod region are absent in the protected areas. Most of these species are either classified as extinct in the regional Red Data Book or belong to other categories, but reliable records in the region have not known for several decades (probably disappeared in the region). The share of species that are not provided with territorial protection is especially high for fishes and lampreys (Table 2), i.e. for the taxa with the highest number of extinct species. It is also significant figure for insects (Table 2), many species of which were recorded once in the region in the early XX century.

2.2. Changes in the rare wildlife species providing with territorial protection

In the XX century, the protection of biodiversity was not a top priority to establish protected areas. Hunting reserves had a significant share of the protected areas in the region comprising more than half until the early 1990s. Unfortunately, they did not solve the problem of the rare wildlife species conservation. The regional system of protected areas grew and developed rapidly during the 1990s. By the early 2000s, the number of protected areas had more than doubled. The share of of protected areas that ensure the ecosystem and biodiversity protection has reached almost 70%.

The first analysis of the rare wildlife species providing with territorial protection in the Nizhny Novgorod region was conducted by us in 2001 [5]. In the XXI century, the level of territorial protection of rare species has generally increased (Fig. 2), while the number and square of protected areas in the region have changed slightly. Currently, rare species of animals, plants, fungi and lichens listed in the Red Data Book of the Nizhny Novgorod region are protected within 227 approved and 92 projected protected areas. In 2001, rare species were known to inhabit only 195 protected areas [5].
Table 2. The level of territorial protection of wildlife species listed in the Red Data Book of the Nizhny Novgorod region according to taxonomy groups.

| Taxonomy group of organisms | Number of species listed in the Red Data Book of the Nizhny Novgorod region | Share of total number of rare species ( % ) having territorial protection at the level as follows: |
|-----------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------|
|                             |                                                                          | Sufficient | Good | Satisfactory | Poor | Absent |
| Mammals                     | 31                                                                       | 0.0         | 22.6 | 32.3         | 29.0 | 16.1   |
| Birds                       | 75                                                                       | 0.0         | 21.3 | 26.7         | 40.0 | 12.0   |
| Amphibians and reptiles     | 4                                                                        | 0.0         | 50.0 | 25.0         | 25.0 | 0.0    |
| Fish and lampreys           | 17                                                                       | 0.0         | 0.0  | 0.0          | 23.5 | 76.5   |
| All vertebrates             | 127                                                                      | 0.0         | 19.7 | 24.4         | 34.6 | 21.3   |
| Insects                     | 146                                                                      | 0.0         | 16.4 | 34.3         | 20.6 | 28.8   |
| Other invertebrates         | 14                                                                       | 0.0         | 57.1 | 28.6         | 7.1  | 7.1    |
| Plants                      | 180                                                                      | 2.8         | 17.2 | 38.9         | 27.8 | 13.3   |
| Mosses                      | 28                                                                       | 0.0         | 53.6 | 35.7         | 3.6  | 7.1    |
| Algae                       | 3                                                                        | 0.0         | 66.7 | 33.3         | 0.0  | 0.0    |
| Fungi                       | 50                                                                       | 0.0         | 34.0 | 46.0         | 6.0  | 14.0   |
| Lichens                     | 16                                                                       | 0.0         | 43.8 | 50.0         | 0.0  | 6.3    |
| All rare wildlife species   | 484                                                                      | 0.8         | 19.4 | 29.8         | 11.4 | 38.6   |

The territorial protection providing for terrestrial vertebrates has decreased over the past decades (Fig. 2). This is due to two factors: a) the high level of territorial protection having achieved by the 2000 has allowed a number of species to recover and begin to settle outside the protected areas; b) the degree of study of rare bird species has significantly increased – in recent years, a large number of previously unknown habitats outside the protected areas have been found. In addition, it is impossible to ignore the consequences of positive trends in the population number of rare species (for example, White-Tailed Eagle – Haliaeetus albicilla L.) in Northern Eurasia as a whole.

The principal improvement in the degree of territorial protection of rare insect and, especially, fungi species is clearly expressed (Fig. 2). It was caused by the purposeful searching of many species in the protected areas of the region.

The changes in the territorial protection of plants is ambiguous. On the one hand, the share of plant species with the “good” level of protection has significantly decreased, on the other hand, the share of species with the “absent” level has decreased as well (Fig. 2). These changes are also explained by the progress in the study of plants in the region: many previously unknown habitats of rare species were found both within the boundaries of protected areas and beyond.

The territorial protection providing for rare wildlife species has generally improved: the share of species with “good” and “satisfactory” levels has increased, and the share of species with “absent” level of protection has significantly decreased (Fig. 2).

As our experience shows, monitoring studies and a detailed inventory of the flora and fauna of protected areas allow us to identify a large number of rare species that were not noted during the previous surveys. Therefore, the real role of protected areas in the conservation of rare wildlife species seems to be significantly higher than the current estimation shows.
Figure 2. Changes in the level of rare wildlife species territorial protection in the Nizhny Novgorod region

3. Conclusion
The territorial protection providing for rare wildlife species of living organisms in the Nizhny Novgorod region has grown significantly over the past 40 years.

In general, the territorial protection of rare species listed in the regional Red Data Book is considered to be satisfactory, but need significant improvement.

And approving the projected (reserved) protected areas should be very important in improving the territorial protection of rare species.

It is necessary to establish additional protected areas, especially for the conservation of species that currently have the “absent” level of territorial protection, as well as the search for new habitats of rare wildlife species.

The degree of study of the biota of many protected areas in the region is insufficient, and searching for rare species should be continued in protected areas.
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