



## A REVIEW OF THERIOLOGICAL RESEARCH IN THE POLISSIA IN THE XIX–XXI CENTURIES

Inessa Bolotina<sup>1</sup> , Alexandr Savarin<sup>2</sup> 

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theriological research, theriologists, mammal fauna, Polissia

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### Affiliations

<sup>1</sup> ‘Green’ Network Partnership (Turov, Belarus), <sup>2</sup> Gomel F. Skorina State University (Gomel, Belarus)

### Correspondence

I. M. Bolotina; 2 Berezetskaya Street, Turov, 247980 Belarus;  
Email: zelpra@gmail.com;  
orcid: 0000-0002-4988-2134

### Abstract

The history of theriological research in the territory of Polissia from the 19th century to the present is considered (authors, works, and contributions to the study of the mammal fauna of the region). A review of the most significant publications on the theriofauna of the Polissia region is presented. The material is considered in chronological order, in four sections: ‘The period before systematic collecting’ (from the 19th century to 1920), ‘The period of field expeditionary research’ (1920–1940), ‘The resumption of theriological research at a new level’ (1945–1970), ‘Period of detailed stationary studies’ (1971–2000), ‘Modern stage of research’ (from 2001 to the present). A list of the most famous researchers of Polissia is given in accordance with the proposed periodization. The authors conclude that the number of studies and publications for the analysed period is connected, first, with state projects for the economic development of this territory (the construction of the Brest–Moscow railway at the end of the 19th century, large-scale land reclamation of Polissia throughout almost the entire 20th century). The key role of A. V. Fedyushin and I. N. Serzhanin for the development of theriological research is noted. The role of nature reserves created in the Chernobyl territory in the study of the mammal fauna of this region is discussed. The complete list of Polissia mammals including 80 species is given. It is concluded that the Polissia theriofauna has not been fully studied (insectivorans, bats, and rodents). The theriological studies in various parts of the Polissia region were carried out unevenly: from single visits and local expeditions to stationary and long-term monitoring studies. The insufficient level of theriological monitoring and, as a result, the lack of proper analysis of changes in mammal assemblages are indicated. The existing scientific collections, where specimens of mammals from Polissia are stored, are not catalogued into a single database and are difficult to study. In Belarus, theriologists are divided and do not have a common platform for the exchange of information and experience. The positive experience of Ukrainian colleagues in the creation and maintenance of the long-term activity of the Theriological School is presented.

### Cite as

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## Огляд теріологічних досліджень у Поліссі у ХІХ–ХХІ століттях

Інесса Болотіна, Аляксандр Саварин

Резюме. Розглянуто історію теріологічних досліджень на території Полісся з ХІХ ст. до теперішнього часу (автори, роботи, внесок у вивчення теріофауни регіону). Зроблено огляд найбільш значущих публікацій з теріофауни Поліського регіону. Матеріал розглянуто в хронологічному порядку, у чотирьох розділах: «Період до систематичних зборів» (з ХІХ ст. до 1920 р.), «Період польових експедиційних досліджень» (1920–1940), «Відновлення досліджень теріофауни на новому рівні» (1945–1970), «Період детальних стаціонарних досліджень» (1971–2000), «Сучасний етап досліджень» (з 2001 р. по теперішній час). Наведено список найбільш відомих дослідників Полісся відповідно до запропонованої періодизації. Автори роблять висновок про зв'язок кількості досліджень та публікацій за аналізований період, насамперед, з державними проектами з господарського освоєння цієї території (будівництво залізниці Брест–Москва наприкінці ХІХ ст., широкомасштабна меліорація Полісся протягом практично всього ХХ ст.). Відзначено ключову роль наукової діяльності А. В. Федюшина та І. М. Сержанина у розвитку теріологічних досліджень. Обговорюється роль організації заповідників на території, що постраждала від катастрофи на Чорнобильській АЕС у вивченні теріофауни цього регіону. Наведено повний список ссавців Полісся, що включає 80 видів. Зроблено висновок, що теріофауна Полісся до теперішнього часу вивчена не повною мірою (насамперед комаходні, рукокрилі, гризуни). Теріологічні дослідження по регіонах Полісся проводилися не рівномірно: від одноразових відвідувань та точкових експедицій до стаціонарних та моніторингових багаторічних досліджень. Вказано на недостатній рівень моніторингу, і як наслідок, відсутність належного аналізу зміни теріологічних комплексів. Існуючі колекційні фонди, де зберігаються екземпляри ссавців з Полісся, не каталогізовані в єдину базу даних і важкодоступні для вивчення. У Білорусі вчені-теріологи роз'єднані та не мають спільної платформи для обміну інформацією та досвідом. Наводиться позитивний досвід українських колег у створенні та підтримці багаторічної діяльності Теріологічної школи.

Ключові слова: теріологічні дослідження, теріологи, фауна ссавців, Полісся.

### Introduction

Polissia is a vast lowland located in the basins of the Pripyat, Dnieper, and Western Bug. This transboundary region within the borders of Poland, Ukraine, Belarus, and Russia is one of the most forested (up to 70% in some areas) and swampy (up to 20%) in Europe. The area of Belarusian Polissia is more than 30% of the territory of Belarus, Ukrainian Polissia is 19% of Ukraine. The landscape structure of Polissia is dominated by low-lying landscapes which are characterised by shallow groundwater and high waterlogging. On the watersheds and above the floodplain terraces of the rivers, pine and deciduous-pine forests are widespread, in the floodplains of the rivers—broad-leaved forests (mainly oak forests), on low-lying swamps—black alder and downy birch forests.

Despite a significant change in the natural complexes of Polissia associated primarily with large-scale hydrotechnical reclamation, this region is still characterised by high landscape and biological diversity of European importance. The floodplain of the Pripyat River remains one of the best-preserved valley ecological systems in Europe. Its uniqueness lies in the fact that open floodplain meadows and oak forests, oxbow reservoirs, lowland, transitional and raised bogs and heavily swampy forests have been preserved in their natural state. The total area of the protected areas of Polissia is currently about 10% of its territory.

In the theriological terms, the territory of Polissia began to be studied relatively recently. The first scientific publications on game and commercial species of mammals have been known since the 18th century [Rachinsky 1721, 1745]\*. A generalised summary of 56 species of Polissia mammals was compiled at the end of the 19th century [Nikolsky 1899]. The list of species of USSR mammals including the inhabitants of Polissia was published in the form of a guide [Bobrinsky *et al.* 1944]\*. By the second half of the 20th century, reviews on the fauna of this region appeared and became classic works of their time [Gromov *et al.* 1963]\*, [Serzhanin 1961], [Korneev, 1952\*, 1965]. Of

recent publications on the history of theriology, we should mention a review of studies in Europe in general [Hutterer & Kryštufek 2020] and in the territory of Ukraine [Zagorodniuk 1993].

To date, the bibliography on the theriofauna of Polissia includes more than 1000 sources. This publication provides an overview of the most significant works on Polissia region theriofauna. Due to their professional experience and interest, the authors of this publication paid more attention to the Belorussian part of Polissia, but they also tried to cover the studies of Polissia in the territory of Ukraine and Polissia as a whole. Given in the end of this article is list of publications on the Polissian theriofauna includes only a part of the works of mentioned here authors. References to sources not included in the bibliography are marked with \*.

In the analysed period of Polissia theriofauna study, the authors distinguish five stages characterised by a certain period and nature of research: 1) the period before systematic collecting—from the 19th century until 1920; 2) the period of field expeditionary research—from 1920 to 1940; 3) the resumption of research on the theriofauna at a new level—from 1945 to 1970; 4) the period of detailed stationary studies—from 1971 to 2000; 5) the current stage of research—from 2001 to the present.

### Period before systematic collecting

Until the beginning of the 20th century, there was only fragmentary information about the mammals of Polissia in the form of travel notes, expedition reports, and separate publications from disparate sources based among other things on the stories of local hunters.

In the 19th century, geographical (statistical) studies were launched in the territory of modern Belarus. The *Sovremennik* magazine published a series of notes ‘Journey through Polissia and the Belorussian Territory’ [Shpilevsky 1853–1855], which contained some information about mammals, mainly commercial species. Later, a list of species of mammals inhabiting the Minsk province was compiled, and some information about them is presented in the form of ‘Materials for the geography and statistics of Russia’ [Zelensky 1864].

By the end of the 19th century, several publications on the fauna appeared, caused by the unfolding reclamation in Polissia [Voeikov 1893]. On the instructions of the Western Expedition to drain the marshes of general Zhilinsky, a generalised summary of 56 species of the theriofauna of Polissia was compiled and included bicoloured shrew, European mink, flying squirrel, European ground squirrel, European hamster, mole rat, and other species. [Nikolsky 1899]. However, A. Nikolsky cited most information not based on his own research but on an analysis of available literature data. He gave a list of 25 literature sources on the Polissian fauna, mainly vertebrates, published in the period from 1721 to 1895. Of these, K. Kessler’s works on the fauna of Kyiv educational district governorates can be noted, where he mentions bear, lynx, three species of dormouse, flying squirrel which almost disappeared from Polissia [Kessler 1851]. It should be added that Karl Fedorovich Kessler created a zoological museum at Kyiv University and conducted several expeditions.

From 1911 to 1914, zoological studies were carried out in the north-eastern part of the Mozyr Poveť, the results of which were published in the journal ‘National Property of Belarus’ [Stamm 1923]. In 1913–1917, Shcherbina undertook several trips around Volhynia—in Ovruch, Lutsk, and Zhytomyr districts. Based on information received during these travels from residents, landowners, foresters, and hunters, he made a review of occurrence patterns and encounters of game mammal species: rodents, lagomorphs, large predators, and ungulates [Shcherbina 1924].

Judging by the collection materials from the Belarusian Polissia preserved in museum collections of Ukraine [Zagorodniuk *et al.* 2021], the main interest of researchers in the period before systematic collecting was focused on species of game and commercial fauna (from mole and hare to bison), as well as small rodents, mostly synanthropic species.

In general, this period of Polissia theriofauna studies were descriptive, not systematic, and were carried out by individual researchers in small areas. At the same time, they served as a theoretical and practical basis in planning and conducting extensive expeditionary work.

### Period of active expeditionary research in 1920–1940

In the early 1920s in Belarus and Ukraine, research and educational institutions are being created, the objects of study of which are theriofauna representatives. The thematic areas of institutional research were the inventory of the animal world, the study of ecology, economically valuable species first, and aspects of their protection and rational use. Scientists performed tasks to identify reserves and study the distribution of game and commercial mammal species. Expeditions were organised, including through Polissia.

Several studies were devoted to clarifying the areas of distribution of the beaver, which number at the beginning of the 20th century dropped critically. For the Ukrainian part of Polissia, M. Charlemagne's information on the Kyiv Governorate (Malinsky district) and Chernihiv Governorate is known [Charlemagne 1936]\*.

Materials of expeditionary studies in the Mozyr Polissia and the Ubert floodplain were published by S. Kirikov [Kirikov 1929], in the Turov region in the Zhitkovichi region—by A. Fedyushin [Fedyushin 1928], in the Gomel region—by V. Stanchinsky [1926]. V. Stanchinsky studied the distribution of beavers in the floodplain of the Sozh River and in the territory of the Smolensk Governorate on the instructions of Glavnauka (Main Directorate of Scientific, Art and Museum Institutions). During the expedition, along the way, he collected information about other species of mammals as well. Based on the results obtained, the zoologist concluded that it was necessary to conduct systematic stationary studies of the Western Region fauna (at present, the eastern and south-eastern regions of Belarus).

The results of the expedition led by V. Stanchinsky in 1925, as well as by K. Novikov [Novikov 1929] and A. Fedyushin (in 1925–1926) in the south-eastern part of Polissia in the territory of the Gomel region were summarised by V. Melander in the form of a regional annotated checklist of the theriofauna including 47 species of mammals. It contains, among other things, information about the occurrence of the European hamster (*Cricetus cricetus*) in the Gomel and Novozybkovsky uyezds, the mole rat (*Spalax typhlus*) near the village of Propoisk (now Slavgorod), and dormice (*Eliomys nitedula* and *E. quercinus*) in floodplains the Sozh and Dnieper rivers [Melander 1931].

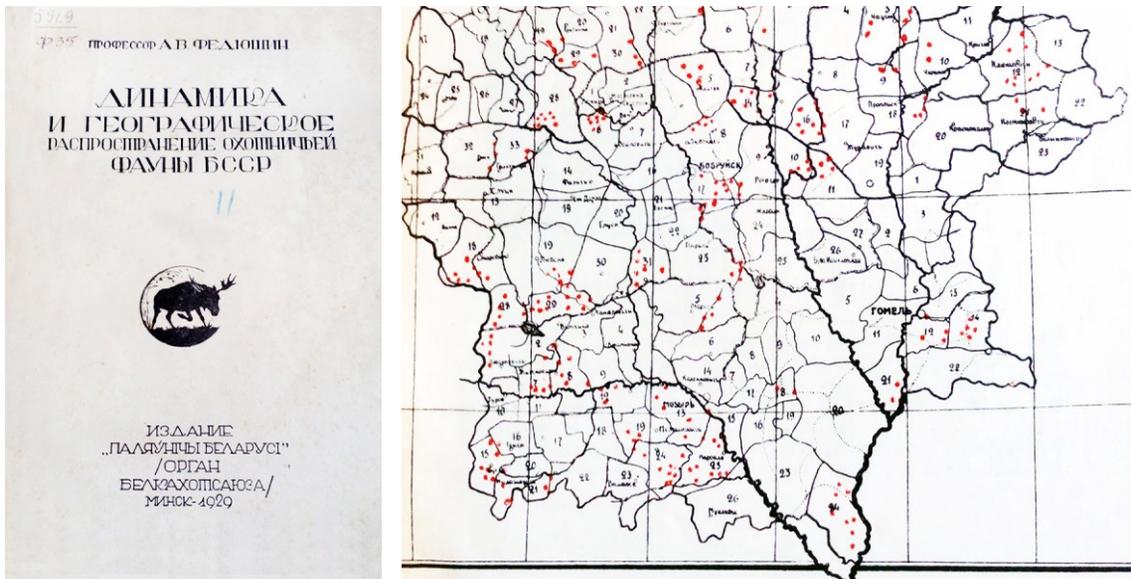


Fig. 1. Title page of A. Fedyushin's publication 'Dynamics and Geographical Distribution of the Game Fauna of BSSR' published in 1929 (left) and a fragment of the distribution map of the European mink in 1927 in the south-east of Belarus (after [Fedyushin 1929]) (right).

Рис. 1. Титульна сторінка публікації А. Федюшина «Динаміка та географічне поширення мисливської фауни БРСР», 1929 (ліворуч) та фрагмент карти поширення європейської норки у 1927 р. на південному сході Білорусі (по: [Fedyushin 1929]) (праворуч).



Fig. 2. Participants of A. Fedyushin's summer expedition to the Pripyat River and Lake Knyaz (Red Lake) in 1926. From right to left: Boris Fedorako, Viktor Slesarevich, Ivan Serzhanin, Anatoliy Fedyushin, local resident. Source: <http://bio.bsu.by/zoomuz/files/zoomuseum.pdf>

Рис. 2. Учасники літньої експедиції А. В. Федюшина на річку Прип'ять та озеро Князь (Червоне) у 1926 році. Справа ліворуч: Борис Федорако, Віктор Слесаревич, Іван Сержанін, Анатолій Федюшин, місцевий мешканець. Джерело: <http://bio.bsu.by/zoomuz/files/zoomuseum.pdf>

In 1930, in connection with the problems of developing the Polissia lowland, an expedition was organised by A. Fedyushin with the participation of I. Serzhanin, V. Slesarevich and other specialists who conducted research in six regions of the south-eastern part of the Gomel Polissia. The results of these studies were published in the Materials for the Study of the Flora and Fauna of Belarus from 1927 to 1933 and in the *Pracy Belaruskaga dzyarzhavnaga universiteta* ('Proceedings of the Belarussian State University') [Fedyushin 1928]. As a result of summarising the accumulated material, A. Fedyushin published several major works including the monograph 'Eurasian beaver. Its history, life, and breeding experiments' [Fedyushin 1935]. In the book 'Dynamics and Geographical Distribution of the Game Fauna of BSSR' [Fedyushin 1929] the zoologist presents maps based on the results of mammal surveys in 1927 (Fig. 1). As follows from these cartographic data, a hundred years ago, the European mink was widespread in the Gomel region.

It should be noted that Professor A. Fedyushin was the head of the Department of Zoology of the Belarussian University, and organised a zoological museum, which currently houses the materials collected in Polissia. The scientific collections accumulated during the numerous expeditions of A. Fedyushin became the scientific and methodological basis for the subsequent works of I. Serzhanin. In connection with the mass repressions that had begun (the closure of the Belarussian Bureau of Local Lore, the dismissal of the Belarussian Union of Hunters, etc.), A. Fedyushin moved to Omsk in 1933, where he became head of the department at the Agricultural Institute. Thus, Belarussian zoology has lost one of its outstanding scientists.

### Resumption of theriofauna research in 1945–1970

The restoration of the national economy after World War II required intensive measures to develop the Polissia region. From 1948 to 1956 in the region, studies of the theriofauna were carried out by scientists of the Academy of Sciences of the BSSR in connection with the problems of the development of the Polissia lowland and the resumed work on its reclamation. As a result of field work carried out by the Institute of Zoology of the BSSR Academy of Sciences, several dozens of publications were published on the species composition and its changes, biotopic distribution, and ecological features of rodents under conditions of drainage reclamation [Miholap 1956, 1957; etc.].

Since the early 1950s, the number of publications devoted to the study of mammal assemblages, individual species, and populations of non-commercial species has increased [Serzhanin & Miholap 1958; etc.]. V. Terekhovich [Terekhovich 1965, 1966]\* studied the biotopic distribution, feeding and reproduction features, and population dynamics of background species of small rodents (bank vole *Myodes glareolus*, yellow-necked wood mouse *Sylvaemus tauricus*, and common vole *Microtus arvalis*) in Belorussian Polissia. The theriofauna of Volhynian Polissia was studied by K. Tatarinov [Tatarinov 1960].

The appointment of I. N. Serzhanin as the Fauna Department head at the Institute of Biology (Minsk) was significant for the development of theriological research. Since 1958, on the initiative and under the guidance of this scientist, zoological conferences began to be held regularly in Belarus, at which the results of theriological studies were reported.

Scientists of the BSSR Academy of Sciences prepared summarising works based on the results of work in previous decades, published in the form of guides and monographs [Serzhanin 1961; Kurskov 1961; etc.]. The monograph 'Mammals of Belarus' by I. N. Serzhanin (2nd edition) became one of the classic works [Serzhanin 1961]. To create it, not only the collections of A. V. Fedyushin were used but also the scientific collections of the Zoological Museum of the USSR Academy of Sciences and reports on furs procurement. It included a brief historical outline of the study of the country's mammals, a systematic description of the living conditions of animals (relief, climate, soil, and vegetation), zoogeographical and biological features of 73 species. In addition, this monograph has become a real reference book for students of biological faculties.

### **Period of detailed stationary studies in 1971–2000**

In the late 1960s, new specially protected natural territories (reserves, zakazniks) were created in Polissia. The most famous of them are the Polesian Nature Reserve in Zhytomyr Oblast of Ukraine (1968) and the Pripyatski Landscape and Hydrological Reserve in Gomel Oblast of Belarus (1969; since 1996, the status of this protected area has been downgraded to Pripyatsky National Park [Bambiza 1999]\*). Scientific departments were organised in reserves, whose employees began to carry out an inventory of the theriofauna and stationary monitoring studies. The number of publications on mammalian ecology has increased. The protected areas began to attract specialists from universities of the Polissia region, structures of the Academy of Sciences of Belarus and Ukraine. Since 1977, Minsk has begun publishing an annual collection of scientific papers 'Zapovedniki Belorussii' ('Reserves of Belarus').

In 1981, A. N. Kurskov's monograph 'Rukokrylye Belorussii' ('Bats of Belarus') was published, which included a significant part of the material collected in the territory of the Belarusian Polissia over a 30-year period [Kurskov 1981]. The book provides information on the biology and ecology of 15 species, as well as practical recommendations for the protection of bats. This work served as a basis for further bat research and training of bat specialists.

The results of protected areas theriofauna inventory were summarised as annotated checklists and publications containing information about the species composition and distribution patterns of mammals in the Polissia Nature Reserve [Zenina 1999; Zhyla 1999; Zhyla & Zenina 1999; and others] and the Pripyat Reserve [Gatikh 1976; Zenina 1995; etc.]. It should be noted that the reduction in the status of the Pripyatsky Reserve in 1996 to national park changed not only its main tasks, but also affected the quantitative composition of the scientific department, and as a result, the quality of the theriological publications themselves. This is because 'if earlier its tasks included the preservation ... of natural complexes ..., the implementation of scientific research, now in addition to this ... forestry, hunting and agricultural activities, trading activities...' (quote from 'Biological diversity of the Pripyatsky National Park' [Bambiza 1999]\*).

In 1970–1990, zoologists continued to study the impact of land reclamation on the theriofauna in the Belorussian and Ukrainian Polissia. Generalising and final publications have appeared on the long-term study of the effect of land reclamation on the mammal assemblages of Polissia [Arzamasov *et al.* 1980; Voinstvensky *et al.* 1981]. The changes in the qualitative and quantitative composition of mammal assemblages in the territories subjected to drainage reclamation were studied. Measures have been proposed to minimise faunal losses and negative consequences from such economic activities in Polissia.

In the second half of the 1970s, under the guidance of Professor B. P. Savitsky, the educational, scientific and production association (UNPO) 'Fauna of Polissia' was created and actively worked. It included specialists from the Gomel and Brest state universities, the Mozyr Pedagogical Institute, the

Pripyatski Landscape and Hydrological Reserve, and the Białowieża Forest hunting ground, structures of the sanitary and epidemiological service.

As a result of these studies on the long-term topic ‘Development of principles and methods for the protection, reconstruction, and rational use of the wildlife of Polissia’ different works were published. They included works on the biology and distribution of the beaver [Golodushko 1975; Tolkachev & Sautin 1988, Tolkachev 1979\*], elk [Gatih 1982, 1977\*], otter [Rodikov 1982\*], and other species, primarily of the game fauna, and the role of mammals in the preservation of a number of natural focal diseases (tularaemia, tick-borne encephalitis, etc.) [Savitsky 1985\*; Shimalov & Shimalov 1998\*]. The monograph ‘The Elk in Belarus: Ecology and Forestry Importance’ [Dunin & Kozlo 1992] was published; it includes data obtained in the Polissia region.

Zoologists of the Brest State University summarised the results of many years of fieldwork on bats by publishing a reference guide [Demyanchik & Demyanchik 2000]. Dissertations were defended on the morphological variability of six species of small mammals (common and Eurasian pygmy shrews, bank and short-tailed field voles, and yellow-necked and pygmy wood mice) [Blotskaya, 2000\*]; analysis of biorhythms of eight dominating mammal species (representatives of insectivorans, rodents, lagomorphs, and carnivorans) [Gaiduk, 1998\*].

After the accident at the Chernobyl nuclear power plant, scientists from the Academy of Sciences of Belarus and Ukraine began long-term programs to monitor changes in the animal world under the influence of radiation [Frantsevich *et al.* 1991; Animal... 1995]. The creation of the Polesie State Radioecological Reserve in the Belarusian part of the Chernobyl zone and the Chernobyl Biosphere Radioecological Reserve in the Ukrainian part led to the beginning of stationary studies of the mammal fauna of these territories [Voronetsky *et al.* 1998; Kozlo *et al.* 1998; Kryzhanivsky 1998; Gaschak *et al.* 2006].

Results of long-term studies conducted by scientists since the 1980s have been summarised in reviews on mustelids [Sidorovich 1997], on the Dnieper Polissia mammals [Zagorodniuk 2002], and on bats [Zenina 1998]. A number of publications have been devoted to the European bison re-acclimatisation in the Pripyat Landscape and Hydrological Reserve and Polissia Radioecological Reserve [Kozlo & Uglianets 1999; Gashchak *et al.* 201; Kozlo 1999\*]. A checklist of the theriofauna of Ukraine including Polissia was compiled [Zagorodniuk 1999].

In the late 1990s, publications on the genetics and evolutionary aspects of murine rodents appeared [Zagorodniuk & Teslenko 1986; Gaschak *et al.* 2008]. At the same time, theriologists paid attention to the distribution of little-studied species of different groups of sibling species [Zagorodniuk 1993].

### **The current stage of research in 2001–2022**

Since the beginning of 2000, there has been a so-called ‘revisionary’ direction in mammal research using new emerging methods and technical means (camera traps, ultrasonic detectors, mist nets, etc.), as well as improvements in catching methods, due to which regional checklists of mammals were revised, especially in terms of identifying and clarification of species of rodents, bats, and insectivorans.

The results of these studies were the update to the Polissia theriofauna faunistic lists, the identification of new habitats of rare species in Polissia (greater noctule bat, western barbastelle, etc.) [Kusnezha *et al.* 2012; Dombrovsky *et al.* 2012, 2017; etc.], and confirmation of the occurrence of a new invasive species—the golden jackal [Grichik *et al.* 2018]. Additional data on the species composition and distribution of dormice [Zenina & Zhyla 2000], lesser white-toothed shrew and bicoloured shrew [Savarin 2009; Grichik *et al.* 2020; Zenina 2002\*], Mediterranean water shrew [Savarin & Molosh 2017], and bats [Bashta 2004, 2007, 2010\*] appeared.

The monograph ‘Mammals of Belarus’ [Savitsky *et al.* 2005] contains a checklist of mammals, species descriptions and other information about the theriofauna, including that of Polissia. The monograph includes a bibliography of 777 sources from the middle of the 18th century to the early 2000s.

Based on original data and analysis of literature for 1998–2018 (27 sources), A. Mishta [2022] included data on the occurrence of 78 species of mammals in the Polissia region of Ukraine (mainly according to research in natural reserves) in the GBIF (<https://bit.ly/3IzwAG2>).

Monitoring of Chornobyl theriofauna continued both in the Belarusian and Ukrainian parts. The results of many years of research in the Chornobyl zone have been summarised in various publications. Among them, it is worth noting the research of a team of scientists from the Chornobyl Radioecological Biosphere Reserve led by S. Gaschak [Gaschak *et al.* 2006, 2009, 2016, 2019].

The results of the past period of European bison reintroduction [Uglyanets 2012] and acclimatization of the Przewalski's horse in Polissia [Gaschak 2019] are summed up. There are theriofauna reviews of protected natural areas created in the early 2000s: Mizhrichynskyi Regional Landscape Park [Sagaydak 2012; Tishchenko & Sagaydak 2012; etc.], and Prypiat–Stokhid National Nature Park [Himin *et al.* 2010]. A number of monographs have been published, including the results of long-term studies of pathomorphological changes in the skull of the southern white-breasted hedgehog [Savarin 2015], and wolf ecology in the Polissia Nature Reserve [Zhyla 2009].

With the development of molecular genetic research methods available to scientists, population genetic studies have appeared [Kheydorova *et al.* 2016; Mashkov *et al.* 2021], their number and research coverage by species is increasing.

A generalised review of research periods with a list of Polissia theriofauna researchers is presented in Table 1 containing separate data on the five research periods we have identified. In general, two main trends can be distinguished in the Polissia theriofauna studies analysis from the 19th century to the present: as we approach the present, the duration of research periods is reduced, the total number of researchers and accumulated information about the theriofauna increases.

Table 1. Periodization of theriological research in Polissia and the researchers of the corresponding periods

Таблиця 1. Періодизація теріологічних досліджень Полісся та дослідників відповідних періодів

Period	Research period name	Polissia theriofauna researchers
19th cent. to 1920	Before systematic collecting	K. Kessler, A. Nikol'skij, M. Shcherbyna, P. Shpilevsky, A. Voeikov, I. Zelen'skij,
1920–1940	Field expeditionary research	A. Fedyushin, S. Kirikov, V. Melander, G. Novikov, K. Novikov, M. Sharleman, A. Shtamm, V. Stanchinsky
1945–1970	Resumption of theriofauna research at a new level	P. Grigoriev, A. Krapivnyj, E. Krapivnaya, A. Kurskov, V. Miholap, O. Miholap, V. Mihajlovskaya, A. Padutova, F. Rubin, E. Samusenko, I. Serzhanin, Yu. Serzhanin, K. Tatarinov, V. Terekhovich
1971–2000	Detailed stationary studies	A. Abramchuk, E. Blockaya, V. Demyanchik, T. Deryabina, A. Domashkevich, V. Dunin, L. Emelyanova, L. Frantsevich, V. Gajduk, V. Gajchenko, V. Gatikh, S. Gashchak, B. Golodushko, V. Grichik, M. Ivanchikov, A. Kash-talian, P. Kozlo, G. Krak, V. Kryzhanivsky, A. Kurskov, S. Kuchmel, S. Levyj, I. Legeida, E. Padutov, O. Pareiko, P. Popov, V. Prokopchuk, V. Rodikov, A. Rozhdestvenskaya, A. Savarin, B. Savitsky, E. Samusenko, V. Sautin, V. Sidorovich, Yu. Serzhanin, A. Tihanskij, V. Tolkachev, V. Tyshkevich, S. Teslenko, A. Uglyanets, I. Sheigas, V. Shimalov, B. Voroneckij, I. Zharkov, S. Zhyla, I. Zagorodniuk, I. Zenina,
2001–2022	The current stage of research	A. Abramchuk, A.-T. Bashta, I. Bolotina (Zenina), E. Buntova, E. Gaiduchenko, S. Gashchak, E. Godlevska, V. Grichik, V. Demyanchik, M. Demyanchik, V. Dombrovsky, T. Deryabina, L. Emel'yanova, P. Kozlo, E. Kheidorova, A. Kusnezh, A. Kusenkov, V. Lihvan, E. Mashkov, A. Mishta, V. Prokopchuk, A. Savarin, A. Sagaidak, V. Sidorovich, I. Solovei, V. Tyshchenko, V. Tyshkevich, A. Uglyanets, V. Fenchuk, M. Himin, P. Sheshurak, M. Shkvrya, A. Shpak, D. Vishnevsky, A. Voblenko, A. Vlashchenko, S. Zhyla, I. Zagorodniuk, O. Zalessky.

Considerable attention was paid to the topic of the Polissian mammal fauna and ecology studied within the framework of the Theriological School activities that has been held annually since 1994 as part of the activities of the Ukrainian Theriological Society of the National Academy of Sciences of Ukraine. Directly in Polissia, eight Theriological School seminars were held, primarily in the Polissia Nature Reserve (village of Selezivka), as well as in Chernobyl, Pushcha-Vodytsia, and Nizhyn (<http://terioshkola.org.ua/ua/chronicle.htm>). The results of these activities are presented in the form of series of scientific paper collections (<http://terioshkola.org.ua/ua/pts.htm>).

Over the past decade, Belarus has hosted thematic scientific forums dedicated to the analysis of Polissian natural complexes. We should note the conferences ‘Problems of rational use of natural resources and sustainable development of Polissia’ (NAS of Belarus, Minsk, 2016) and ‘The natural environment of Polissia: features and development prospects’ (Polissia Agrarian Ecological Institute of the National Academy of Sciences of Belarus, Brest, 2014, 2016, 2018). However, the results of the theriological studies presented there are largely traditional and are devoted, for example, to the abundance dynamics of dominant small-mammal species (in particular, shrews), game species (beaver, raccoon), and others. There are practically no publications on the variability and species diagnosis of difficult-to-identify species.

### Checklist of the Polissian theriofauna

For the period from the middle of the 19th to the beginning of the 21st century, the complete list of mammals in Polissia includes 80 species and 51 genera, which represent 20 families and 7 orders. In the list, we did not include species of domestic mammals (dogs, cats, goats, horses, cows, etc.), their feral groups [Zhyly 2021] or ones used in rewilding [Kozorez 2015]\*, accidentally entered wild, mostly representatives of alien species that escaped from captivity (zoos, private collections, pet corners), or introduced species kept mainly in enclosures for hunting (*Procyon lotor*, *Dama dama*, *Cervus nipon*, and *Ovis gmelini*). They do not form stable wild populations in Polissia.

EULIPOTYPHLA, 8 species of 4 genera:

*Talpa europaea*, *Crocidura leucodon*, *Crocidura suaveolens*, *Neomys fodiens*, *Neomys anomalus*, *Sorex araneus*, *Sorex caecutiens*, *Sorex minutus*.

CHIROPTERA, 14 species of 7 genera:

*Myotis nattereri*, *Myotis daubentonii*, *Myotis dasycneme*, *Myotis brandtii*, *Myotis mystacinus*, *Plecotus auritus*, *Barbastella barbastellus*, *Nyctalus leisleri*, *Nyctalus noctula*, *Pipistrellus nathusii*, *Pipistrellus pipistrellus*, *Vespertilio murinus*, *Eptesicus serotinus*, *Eptesicus nilssonii*.

LAGOMORPHA, 2 species of 1 genus:

*Lepus timidus*, *Lepus europaeus*.

RODENTIA, 18 species of 16 genera:

*Sciurus vulgaris*, *Dryomys nitedula*, *Glis glis*, *Muscardinus avellanarius*, *Castor fiber*, *Sicista betulina*, *Myodes glareolus*, *Arvicola amphibius*, *Terricola subterraneus*, *Microtus agrestis*, *Microtus oeconomus*, *Mus musculus*, *Rattus rattus*, *Apodemus agrarius*, *Micromys minutus*, *Sylvaemus tauricus*, *Sylvaemus sylvaticus*, *Sylvaemus uralensis*.

CARNIVORA, 11 species of 8 genera:

*Lynx lynx*, *Canis lupus*, *Vulpes vulpes*, *Ursus arctos*, *Martes foina*, *Martes martes*, *Mustela erminea*, *Mustela nivalis*, *Mustela putorius*, *Meles meles*, *Lutra lutra*.

ARTIODACTYLA, 4 species of 4 genera:

*Sus scrofa*, *Alces alces*, *Capreolus capreolus*, *Cervus elaphus*.

To characterise the fauna, we used the categories given in the publication by I. Zagorodniuk [Zagorodniuk 2014]. Species from among the permanent inhabitants, the number and nature of occurrence of which has changed significantly from the middle of the 19th century to the beginning of the 21st century are not singled out in a separate category: *Ursus arctos*, *Arvicola amphibius*.

We present as a list those species that can be attributed to the permanent inhabitants of Polissia (basic list, ‘bas’). Species allocated to categories other than ‘bas’ are presented in Table 2. We assigned 57 species of 40 genera to the category of permanent inhabitants of Polissia (‘bas’).

## Conclusions

The analysis of publications on the Polissian theriofauna allowed us to draw the following conclusions. The total number of studies and publications over the analysed period naturally increased, which is primarily due to state projects for the economic development of this territory. These include the construction of the Brest–Moscow railway at the end of the 19th century, the large-scale reclamation of Polissia throughout almost the entire 20th century.

Basic knowledge on the features of Belarusian Polissia and Belarus mammalian fauna was laid down by the works of Professor A. V. Fedyushin. Theriology received further development with the creation under the leadership of I. N. Serzhanin of the Fauna Department of the Institute of Biology, and later the Institute of Zoology of the National Academy of Sciences of Belarus. The formation of the Polesie State Radioecological and Chornobyl Radioecological Biosphere Reserves contributed to the in-depth study of the theriofauna of this region.

Table 2. Mammal species of Polissia allocated to other categories (except permanent residents)

Таблиця 2. Види ссавців Полісся, виділені до інших категорій (крім постійних жителів)

Categories allocated to species	Species categorised
‘nov’—species that were identified or renamed and included in the fauna in the 1930s and later	<i>Nyctalus lasiopterus</i> (noticed in 1930); <i>Pipistrellus pygmaeus</i> (distinguished in the end of the 20th cent. from <i>Pipistrellus pipistrellus</i> ); <i>Erinaceus roumanicus</i> ( <i>concolor</i> ) (renamed at the end of the 20th century of the former populations of <i>Erinaceus europaeus</i> in Polissia)
‘rep’—species that were ‘on paper’ in the composition of the fauna from the middle of the 19th century, and after a taxonomic revision of the second half of the 20th century were excluded from the composition of the fauna	<i>Erinaceus europaeus</i> (at the end of the 20th century, the former populations of <i>Erinaceus europaeus</i> were renamed to <i>Erinaceus roumanicus</i> ( <i>concolor</i> ) in Polissia)
‘adv’—alien species, including acclimatised species (introduced in nature), which appeared by introduction in Polissia or expansion from neighbouring regions, and are regularly found in the wild	<i>Rattus norvegicus</i> (appeared from the middle of the 19th to the middle of the 20th century); <i>Equus przewalskii</i> (1990s); <i>Ondatra zibethicus</i> ; <i>Mustela vison</i> ( <i>Neogale vison</i> ); <i>Nyctereutes procyonoides</i>
‘exp’—species that appeared in Polissia as a result of natural expansion from neighbouring countries, their habitats have changed significantly in Polissia	<i>Pipistrellus kuhlii</i> ( <i>P. lepidus</i> ) (beginning of the 21st century); <i>Plecotus austriacus</i> (presumably late 20th century); <i>Canis aureus</i> (early 2000s)
‘pha’—species known since the middle of the 19th century, but whose presence is not currently proven, and are probably extinct	<i>Eliomys quercinus</i> , <i>Felis silvestris</i> , <i>Myotis myotis</i> (last registration in the 1970s); <i>Mustela lutreola</i> (last registration in the 1980s); <i>Cricetus cricetus</i> (last registrations in the early 2010s); <i>Spermophilus suslicus</i> (probably disappeared in the first half of the 20th century) [Red Data... 2015]*
‘pos’—supposed inhabitants of Polissia, species that are registered along the edges of the Polissia region or presumably live there	<i>Sorex isodon</i> (Nerusso–Desnyanskoye Polissia) [Dubrovsky 2000]; <i>Pteromys volans</i> [Zagorodniuk 2022]
‘ini’—species restored in the region through reintroduction	<i>Bison bonasus</i> (second half of the 20th century)

For the period from the middle of the 19th to the beginning of the 21st century, the complete list of mammals of Polissia includes 80 species and 50 genera representing 20 families and 7 orders.

The theriofauna of Polissia has not been fully studied to date. This is due, among other factors, to its ongoing transformation caused by global and regional climate change. Thus, in the last decade, a new species was registered in this territory—the golden jackal (*Canis aureus* L.) [Grichik *et al.* 2018], and a giant noctule bat colony was discovered [Dombrovsky *et al.* 2017]. Additional information about the possible occurrence of the flying squirrel has appeared [Zagorodniuk 2022]. The degree of knowledge of different theriofauna groups varies significantly both for the selected periods and for the entire period of study from the middle of the 19th century. Theriological studies in various parts of the Polissia region were carried out unevenly: from single visits and spot expeditions to stationary and long-term monitoring studies. Many questions about the evolution and formation of the modern theriofauna of Polissia remain poorly studied. The increasing synanthropisation of various taxonomic groups of mammals requires detailed studies [Zagorodniuk 2003; Savarin 2006; Demianchuk & Nikiforov 2018].

Scientific collections containing specimens of mammals from Polissia are dispersed among the collections of zoological museums, universities, and private collections of zoologists. They are not catalogued in a single database and are difficult to study. A serious problem in the study of the theriofauna is the small number of specialists, which reduces the accuracy of species diagnostics, primarily of small mammals, and the overall level of publications.

In Belarus, theriologists who work in different departmental structures are divided. There is no common platform for the exchange of information and experience in the form of regular thematic seminars, there is no professional association of theriologists (theriological society). In this regard, it should be noted the positive experience of Ukrainian colleagues in creating and maintaining the long-term activity of the Theriological School, which unites specialists from Ukraine and neighbouring countries: Belarus, Poland, and others. An integral part of the school and its activities are the annual scientific and practical seminars and publications on the website [www.terioshkola.org.ua](http://www.terioshkola.org.ua).

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