

Distribution and mammal fauna composition in protected areas of Saint Petersburg

Andrew G. Bublichenko

ABSTRACT. The features of the historical formation of modern natural landscapes in the city area of Saint Petersburg are described. The role of protected areas of the city as an “ecological framework” for the preservation and maintenance of the urban environment and the specific problems of urban nature protected areas (PAs) are considered. The data on the location, area, and species diversity of mammals in each of the existing nature protected areas of Saint Petersburg are presented. The reasons for the differences in the faunas of the protected areas of the northern and southern coasts of the Gulf of Finland due to their landscape and geographical characteristics and the current state of habitats are revealed. Based on the above data, it is concluded that the increased anthropogenic load in some protected areas leads to the reduction or disappearance of mammal groups such as ungulates or large carnivores. However, in other areas, the composition of fauna remains close to the natural, and the number of observed mammal species is up to 80% of the region’s inhabitants.

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Распределение и видовой состав фауны млекопитающих особо охраняемых природных территорий Санкт-Петербурга

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РЕЗЮМЕ. Описаны особенности исторического формирования современных природных ландшафтов в городской черте Санкт-Петербурга. Рассмотрена роль особых охраняемых природных территорий (ООПТ) города как «экологического каркаса» для сохранения и поддержания городской среды, а также специфические проблемы городских ООПТ. Приведены данные о местоположении, площади и видовом разнообразии млекопитающих на каждой из существующих природных территорий Санкт-Петербурга. Обсуждаются причины различий фаун ООПТ северного и южного побережий Финского залива в связи с их ландшафтно-географическими характеристиками и современным состоянием местообитаний. На основании приведенных данных делается вывод, что усиление антропогенной нагрузки на части охраняемых территорий приводит к сокращению численности или исчезновению таких групп млекопитающих, как копытные или крупные хищники; тем не менее, на других участках состав фауны остается близким к природному, а число отмеченных видов млекопитающих составляет до 80% от обитающих на территории региона.

КЛЮЧЕВЫЕ СЛОВА: млекопитающие, городские территории, особо охраняемые природные территории, фауна, видовое разнообразие, Красная книга, Санкт-Петербург, Финский залив.

Introduction

The rapid development of Saint Petersburg, built in a short time and under a global plan, radically changed the nature and landscapes of the Neva River Lowland. The number of islands in the Neva delta has decreased; their outlines have changed; old waterways were filled

up, new channels were dug, swamps were destroyed, the level of the seaside shore terrace was artificially raised. The latest transformations that had a powerful impact on the natural conditions of the city were the construction of a protective dam that isolated most of the Neva Bay from the sea, as well as the hydraulic deposition of artificial coastal areas in the area of the Marine Facade

and Lakhta. For a long time, peat mining, which was actively carried out here until the 1970s, was also a type of anthropogenic impact specific for the territory of Saint Petersburg (Isachenko & Isachenko, 2020).

The layout of formal parks and gardens on the boggy banks and the Littorina terrace during the city's construction in the XVIII–XIX centuries (Summer Garden, Tavrichesky Garden, park ensembles of the southern coast of the Gulf of Finland), as well as the post-war landscaping of urban areas (Primorsky Victory Park, Moscow Victory Park, and South Primorsky Park), determined the region's uncharacteristic nemoral type of vegetation on a large part of its territory. At the same time, there are still plantations close in structure to the original forest areas within the city limits. These are the parks of the Forest Engineering Academy, the Polytechnic Institute, Sosnovsky, and Piskarevsky forest parks, etc. A separate mention should be made of the urban forests of the Kurortny District, directly bordering the southern taiga massifs of the Leningrad Region.

The peculiarity of the urban environment lies in the mosaic of opposite dwellings and their isolation. Many ecological parameters change in a pattern from the periphery to the city center, with the outskirts violating the linearity of the traced gradients in some respects. It is in these areas that unusually high biodiversity is often noted; mosaic is superimposed on stressed zoning of the environment from the periphery to the outskirts (Klausnitzer, 1990). Refugia and corridors for settling green urban areas serve as non-urbanized ecosystems — remnants of forests, groves, swamps, meadows, etc. As the area of these island habitats decreases, the total number of resources (food, shelters, etc.) naturally decreases. Still, their range is preserved, which initially determines the presence of a significant number of animal species. However, later, their number usually decreases due to the instability of small zoocenosis and the pressure of immigrants who displace representatives of the indigenous fauna.

Nature protected areas (PAs) in cities are an essential part of their “ecological framework”, which is necessary to maintain the quality of the urban environment. The key differences of urban PAs are the limited area and increased recreational pressure, which negatively affects both the species diversity and the number of mammals living there. Among the main anthropogenic factors negatively affecting the fauna are the developed road and traffic network and the active construction of adjacent territories, which often separate protected areas from large forest areas. Such fragmentation degrades habitat quality and prevents the free exchange of individuals between micro-populations, which leads to the gradual degradation of the latter. This primarily affects small mammals, which do not have sufficient mobility and are sensitive to artificial barriers.

Materials and methods

This work based on the author's long-term observations, supplemented by data from literary sources

and working materials provided by the Directorate of Protected Areas, Saint Petersburg (DPA SPb). The years of primary faunal survey completion and establishment dates of nature protected areas are presented in Table 1.

The primary purpose of the work carried out from 1997 to 2018 was to study the current state of the mammal fauna of protected areas of Saint Petersburg (Fig. 1), its species composition, spatial distribution, and residence status of species, as well as places of their concentration and ways of active movement. We followed a common pattern of counting and trapping in all areas to get comparable results. The spatial distribution of ungulates and carnivores was estimated based on the data from winter route counts and summer trace activity surveys conducted according to standard methods, and for small rodents and insectivores, based on data from captures conducted according to modified standard methods (Karaseva *et al.*, 2008; Numerov *et al.*, 2010). We recorded all observations of chiropterans during evening routes; their abundance was relatively estimated based on habitat suitability, using literature and archival data. In addition, an ultrasonic detector D-100 (Pettersson Electronic AB) was used for counting bats. Small mammals were captured using Sherman live traps installed in the most typical habitats, taking into account the species specificity of the animals. Traps were set in lines up to 25 pieces with an interval of 10 m. In addition, pitfall traps were used to catch shrews. These traps, connected by guide fences or trapping grooves, were located at a distance of 10 m from each other. In total, more than 6000 trap-days were worked out during the studies, and 690 specimens of small mammals of 16 species were captured.

The relative number of mammal species found in this area, the presence or absence of typical taiga species, and the ratio of exoanthropic to synanthropic species were the main comparison criteria for all sites surveyed.

Based on the collected materials, lists of mammal species inhabiting the protected areas of Saint Petersburg were compiled (see Appendix 1), indicating their residence status and degree of vulnerability.

The main criterion for determining the present status of a species in an area was the frequency of observations of tracks on the route, and for insectivores and small rodents, the relative abundance in captures as well. In presenting the results of the study, we consider it appropriate to use a conventional abundance scale for mammal species (Appendix 2), which allowed us, while maintaining general trends in the abundance ratio, to level out the long-term variability of this indicator and not to overload the article with excessive content.

Results and discussion

Recently in Saint Petersburg there are 15 protected areas of regional significance: seven reserves and eight natural monuments located in Krasnoselsky, Kronshtadtsky, Kurortny, Petrogradsky, Petrodvortsovy, Primorsky, and Pushkinsky districts; another 14 territories

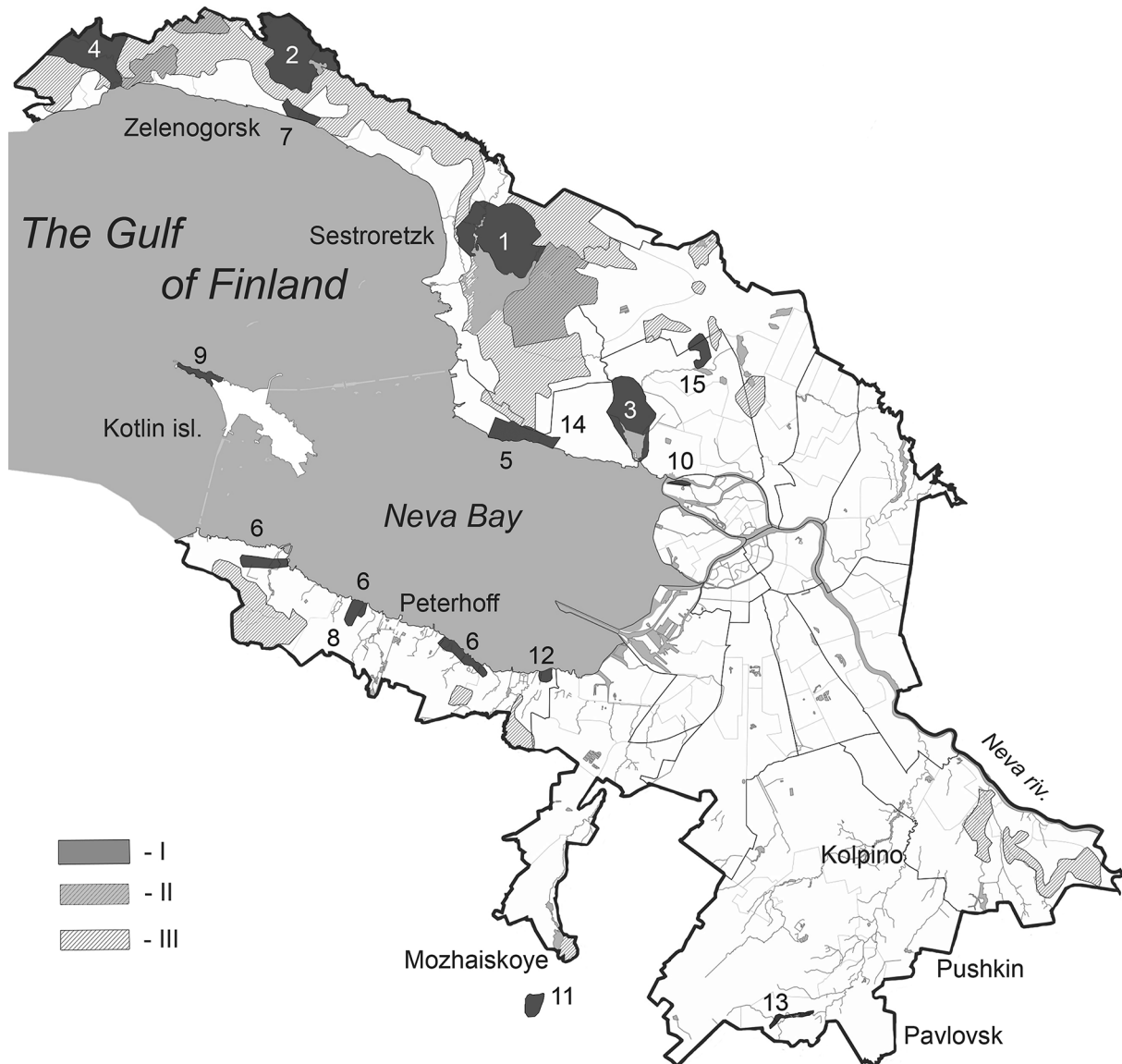


Fig. 1. Existing and prospective natural protected areas (PAs) of Saint Petersburg (from Isachenko & Isachenko, 2020). Legend: I — approved by 2020 PAs (1 — Sestroretsk Swamp, 2 — Shchuchye Lake, 3 — Yuntolovsky, 4 — Gladyshevsky, 5 — Northern Coast of the Neva Bay, 6 — Southern Coast of the Neva Bay, 7 — Komarovskiy Coast, 8 — Sergievka Park, 9 — Western Kotlin, 10 — Elagin Island, 11 — Duderhof Heights, 12 — Strelninsky Coast, 13 — Popovka River Valley, 14 — Petrovskiy Pond, 15 — Novoorlovskiy); II — PAs that have passed a comprehensive survey and are at different stages of organization; III — promising PAs according to the Law of Saint Petersburg, 2014 “On the list of areas of territories, in respect of which it is planned to conduct comprehensive environmental surveys”.

have the status of perspective or are in the process of arrangement (Fig. 1).

To date, 51 mammal species have been recorded here, out of 65 that permanently inhabit the territory of the Leningrad Region (Akhmatovich, 2019). These species belong to 6 orders: Lipotyphla — 6 species, Chiroptera — 9, Lagomorpha — 2, Rodentia — 17, Carnivora — 12, and Ungulata — 3. Fifteen of these species are listed in the Red Data Book of Saint Petersburg (Belyaev & Serebriisky, 2020).

Such a high level of species diversity, as a rule, is not typical for typical urban areas with no more than 8 to 12 synanthropic and hemisynanthropic species (Okulova *et al.*, 1996; Tikhonova *et al.*, 1997; Maksimova & Aksenova, 2004; Gorbunova & Tretyakov, 2012). In this case, it plays a role that most of the areas under consideration are located outside the dense urban development and border, directly or indirectly, with intact forest areas of the Leningrad Region.

The Table 1 shows that the most remarkable diversity of mammal fauna reaches the territories of the Kurortny and Primorsky districts, relatively recently incorporated into the “big city”; the southern coast of the Gulf of Finland (Petrodvortsovy District) is not so representative in this case, although the vast areas of old park plantings here create an exceptional habitat for species associated in their origin with broadleaved forests.

The wildlife regional sanctuary “Gladyshevsky”, located on the Karelian Isthmus, in the northwestern part of the urban area, is undoubtedly the richest in faunal respect (Bublichenko & Bublichenko, 2005a). The developed hydrological network and proximity to intact forests to the north determine the presence here of exoanthropic mammal species, such as the common otter *Lutra lutra* and the European badger *Meles meles*. It is known that brown bear *Ursus arctos* and wolf *Canis lupus* also enter this area. In total, ten species of carnivores are noted in this area (Bastaev, 2019), which is quite unusual for urban areas.

Here, in the Kurortny District, there is the “Shchuchye Lake” Regional Sanctuary. Despite the constant recreational load, eight species of mammals included in the Red Data Book of Saint Petersburg were noted here, including flying squirrel *Pteromys volans*, roe deer *Capreolus capreolus*, and six species of bats (Bublichenko, 2017; Belova, 2019). There are regular visits of the brown bear, moose *Alces alces*, and wild boar *Sus scrofa*. Among small mammals, the lesser shrew *Sorex minutus* leaning to southern taiga habitats in the region is common and even numerous.

The territory of the largest swamp system of Saint Petersburg, the Sestroretsk Swamp, is unique. Water shrew *Neomys fodiens*, European beaver *Castor fiber*, muskrat *Ondatra zibethica*, American mink *Neovison vison* were found on the outskirts of the swamp massif and waterways. Breeding holes of the red fox *Vulpes vulpes* were found on islands among the swamp, and birch mouse *Sicista betulina*, which is rare for Karelian Isthmus, as well as bear and lynx *Lynx lynx* were observed in the adjacent forest areas (Bublichenko, 2011; Khramtsov *et al.*, 2016).

The oldest PA in Saint Petersburg, “Yuntolovsky” Wildlife Sanctuary, is located in the Primorsky District of the city and includes most of the territory of the Lakhtinsky swamp, Lakhtinsky Razliv, and adjacent forest areas with a predominance of pine and birch plantations (Khrabryi, 2005). Despite the proximity of residential areas and the constant recreational load, the fauna of the reserve has 29 mammal species, 4 of which (water shrew *Neomys fodiens*, Daubenton’s bat *Myotis daubentonii*, noctule bat *Nyctalus noctula*, and particoloured bat *Vespertilio murinus*) are included in the list of protected animals of Saint Petersburg (Geltman *et al.*, 2018).

A little to the west, away from the main urban development, there is another protected area — the protected area “Northern Coast of the Neva Bay”. Even though this area is currently isolated from the main forest areas by the Primorsky Highway, more than 30 mammal species can still be found here (Khramtsov *et al.*, 2016; Bublichenko, 2020), including those rare for

Table 1. Protected areas of regional significance in Saint Petersburg.

No.	Name of the nature protected area	District of Saint Petersburg	Area, ha	Established	Number of species / orders of mammals in Red Data Book, n/m*
1	Natural monument «Elagin Island»	Petrogradsky	96.8	2012	22/5; 0/3
2	Wildlife regional sanctuary «Yuntolovsky»	Primorsky	976.8	1990	29/6; 1/4
3	Wildlife regional sanctuary «Northern Coast of the Neva Bay»	Primorsky	330.0	2009	32/6; 1/6
4	Natural monument «Petrovsky Pond»	Primorsky	3.1	2011	15/4; 1/1
5	Wildlife regional sanctuary «Novoorlovsky»	Primorsky	138.3	2015	12/4; 0/0?
6	Natural monument «Komarovskiy Coast»	Kurortny	180.0	1992	20/5; 0/1
7	Wildlife regional sanctuary «Gladyshevsky»	Kurortny	765.0	1996	36/6; 2/6
8	Wildlife regional sanctuary «Shchuchye Lake»	Kurortny	1157.0	2011	32/6; 2/8
	Wildlife regional sanctuary «Sestroretsk Swamp»	Kurortny	1877.0	2011	22/6; 1/4
10	Natural monument «Strelinsky Coast»	Petrodvortsovy	40.0	1992	17/5; 0/2
11	Natural monument «Sergievka Park»	Petrodvortsovy	120.0	1992	34/6; 1/7
12	Wildlife regional sanctuary «Southern Coast of the Neva Bay»	Petrodvortsovy	266.0	2013	33/6; 1/7
13	Wildlife regional sanctuary «Western Kotlin»	Kronshtadtsky	1020.0	2012	11/4; 0/3
14	Natural monument «Duderhof Heights»	Krasnoselsky	650.0	1992	29/6; 0/6
15	Natural monument «Popovka River Valley»	Pushkinsky	25.7	2013	15/5; 2/3

* Red Data Book of Saint Petersburg; n — is the number of species permanently inhabiting the area and m — possible seasonal observations (the latter refers mainly to chiropterans).

urban forests — water shrew, two species of bats (pond bat *Myotis dasycneme*, included in the IUCN Red Data Book, and Nathusius's pipistrelle *Pipistrellus nathusii*), and lynx (Geltman *et al.*, 2018). Ungulates, such as wild boar and moose, also enter here. The Baltic ringed seal *Pusa hispida bothnica*, which is included in the Red Books of the IUCN, Russia, Helsinki Commission Red Data List, and the lists of protected species of Saint Petersburg, appears very rarely in the water area.

The poorest fauna on the northern coast of the Gulf of Finland is recorded in Novoorlovsky Park ("Novoorlovsky" nature protected area), only recently approved in this status. The impoverishment of faunal complexes, in this case, is associated both with a high level of anthropogenic pressure and with the nature of the prevailing vegetation cover — pure pine forests in the Northwest are never characterized by species diversity.

The richest and most well-studied area on the southern shore of the Gulf of Finland is Sergievka Park, which was the base of Leningrad State University (now Saint Petersburg State University) and its Biological Research Institute for many years. The location of the PA and its isolation from large forest areas determines the absence here of large mammals, such as bears, wolves, and ungulates. At the same time, a diverse landscape and the presence of old-growth vegetation of both broadleaved and southern taiga type allow representatives of such groups as insectivores, rodents, and chiropterans to exist here successfully (Pchelintsev & Chistyakov, 2005). The number of species of chiropterans occurring in the area is unique — 9 out of 10 species inhabiting the Leningrad Region. Seven of them are included in the Red Data Books of various ranks, including whiskered bat *Myotis mystacinus*, which is extremely rare in the region. There are also up to twelve species of rodents — the birch mouse *Sicista betulina*, harvest mouse *Micromys minutus*, and yellow-necked mouse *Sylvaemus flavicollis*, which are not often found in urban habitats, should be mentioned (Belova, 2019).

The "Southern Coast of the Neva Bay" Wildlife Sanctuary, located near the Sergievka Park, is no less diverse in the species composition of mammals. The habitat conditions of animals here, except for the "Kronshtadt Colony" cluster, are generally similar. As in the previous case, most species are representatives of insectivores, chiropterans, and rodents. Among the species included in the Red Data Book of Saint Petersburg, water shrew, three species of bats, noctule bat, particoloured bat and Nathusius's pipistrelle, should be mentioned (data of DPA SPb, 2017).

The fauna of the third protected area on the southern shore of the Gulf of Finland, "Strelninsky Coast", is much poorer in species composition, but it also counts up to 20 species of mammals (Bublichenko & Bublichenko, 2005b). At present, visits to the territory of the nature monument are sharply limited due to the pass regime of the "Congress Palace" territory, which has a favorable effect on the fauna, reducing the risk of disturbance (Bastaev, 2019).

The only protected urban nature area in the Gulf of Finland is the "Western Kotlin" Regional Wildlife

Sanctuary. The extreme degree of anthropogenic disturbance of landscapes, the limited area, and the high degree of anthropogenic load have led to insectivorous mammals, lagomorphs, ungulates, and most of carnivorans absent here. Nevertheless, this is the only place in the city boundaries where one can observe the gray seal *Halichoerus grypus macrorhinus* and the Baltic ringed seal *Pusa hispida botnica*, included in the Red Data Books of the Russian Federation and Saint Petersburg; northern bat *Eptesicus nilssonii* overwinters in the ruins of the Shants Fort (data of DPA SPb, 2019).

The territory of the natural monument "Duderkhof Heights" has almost no connection with large natural forests. It is surrounded by streets, residential houses with household plots, and social facilities all around its perimeter. Two nearby mountains, Voronya and Orekhovaya, are the highest elevations in the city. A characteristic feature of PAs is the predominance of deciduous tree plantations associated with the history of these landscapes (Bublichenko, 2006). Despite the high anthropogenic pressure, 29 mammal species permanently inhabit or occur on the territory of this natural monument, including those rare for the city — roe deer *Capreolus capreolus*, brown hare *Lepus europaeus*, Brandt's bat *Myotis brandtii*, Daubenton's bat, pond bat, and Nathusius's pipistrelle (Belova, 2019).

The most "urban" of the Saint Petersburg PAs is the "Elagin Island". Despite the isolated position and proximity to the city center, 21 mammal species were recorded here during the observation period (Khrantsov *et al.*, 2016). However, encounters with most of them are extremely rare and random, and typical inhabitants of urban gardens and parks — the red squirrel *Sciurus vulgaris*, striped field mouse *Apodemus agrarius*, brown rat *Rattus norvegicus*, and common voles *Microtus arvalis* are dominant. Nevertheless, among insectivores, the water shrew is regularly observed here, and among the chiropterans — Daubenton's bats and pond bats, as well as the particoloured bat.

Conclusion

Most nature protected areas in Saint Petersburg have a small territory and are usually isolated from large forested areas of natural origin. Nevertheless, the total diversity of mammal species on them reaches 80% of the total number of species in the region. The degree of isolation, remoteness from the city center, fragmentation, and nature of habitats to varying degrees determines the presence or availability of certain species in the area and the "loss" or weak representation of some taxonomic groups. Thus, in the PAs most distant from the large forest areas, such as "Sergievka Park", "Strelninsky Coast", "Elagin Island", "Western Kotlin", there are almost no representatives of the ungulates — wild boar, roe deer, and moose (Tab. 1); the number of predators is also low here. The exception in this case is the red fox and, to a lesser extent, the western polecat and least weasel, which relatively quickly adapt to anthropogenically disturbed

habitats. The pine marten has also been actively breaking into new urban habitats, and its numbers have been increasing noticeably in recent years.

If the isolation of habitats and changes in the character of vegetation in old park territories are a limiting factor for the specified groups of mammals, rodents and chiropterans, on the contrary, find favorable conditions for existence here. A change in stand composition and an increase in the number of old-growth broadleaved trees provide them with shelter and a permanent food reserve, while a decrease in predator numbers helps to maintain population stability.

On the contrary, in the sparsely transformed forested areas of the northern coast of the Gulf of Finland, the situation is rather close to the natural one. Although even here, exoanthropic species are largely reducing their numbers, if not disappearing, giving way to hemisynanthropes. Such a scenario described in the literature (Surov & Bogomolov, 2013), although undesirable, is natural in territories exposed to constant anthropogenic impact. The only way out of this situation may be to limit the recreational load and ban any economic activity in PAs. Unfortunately, it is becoming increasingly difficult to meet these requirements even in remote areas due to the rapidly developing urban infrastructure.

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Appendix 1. The list of mammals registered in the Saint Petersburg nature protected areas.

No.	Species	Degree of vulnerability	Name of Nature Protected Area														
			Elagin Island	Yuntolovsky	Sestretorsk Swamp	Petrovsky Pond	Novoorlovsky	Gladyshevsky	Shehuchye Lake	Komarovsky Coast	Northern Coast of the Neva Bay	Strelimnsky Coast	Sergievka Park	Southern Coast of the Neva Bay	Western Kotlin	Duderkhof Heights	Popovka River Valley
Order Lipotyphla																	
1	European hedgehog <i>Erinaceus europaeus</i>		r	r+	r+	-	r+	r+	-	r+	c+	-	r+	r+	-	r+	sp+
2	European mole <i>Talpa europaea</i>		-	c+	c+	r+	c+	c+	c+	c+	a+	c+	c+	c+	-	r+	c+
3	Eurasian water shrew <i>Neomys fodiens</i>	SPb NT(4)	sp	r+	r+	r+	-	r+	-	-	r+	r+	r+	r+	-	-	r+
4	Common shrew <i>Sorex araneus</i>		r+	a+	a+	c+	c+	a+	c+	a+	a+	c+	a+	a+	r+	c+	r+
5	Laxmann's shrew <i>Sorex caecutiens</i>		-	?	?	-	-	r+	?	r+	-	-	r+	-	-	r+	-
6	Eurasian pygmy shrew <i>Sorex minutus</i>		-	c+	c+	-	-	r+	r+	r+	r+	-	r+	r+	-	-	-
Order Chiroptera																	
7	Pond bat <i>Myotis dasycneme</i>	SPb NT(4), IUCN (NT)	se	-	se	-	-	se	se	-	se	?	se	se	-	se	-
8	Daubenton's bat <i>Myotis daubentonii</i>	SPb NT(4)	se	se	se	-	-	se	se	-	-	?	se	se	-	se	-
9	Whiskered bat <i>Myotis mystacinus</i>	SPb VU(3)	-	-	-	-	-	-	-	-	-	-	se	-	-	-	-
10	Brandt's bat <i>Myotis brandtii</i>	SPb NT(4)	-	-	-	-	-	sp	se	-	se	-	se	se	se	se	-
11	Brown long-eared bat <i>Plecotus auritus</i>		-	-	-	-	se	se	se	se	se	se	se	se	se	se	se
12	Noctule <i>Nyctalus noctula</i>	SPb NT(4)	-	se	-	-	-	se	se	-	se	se	se	se	se	se	se
13	Nathusius's pipistrelle <i>Pipistrellus nathusii</i>	SPb NT(4)	-	-	-	-	-	se	se	-	se	se	se	se	se	-	se
14	Particoloured bat <i>Vespertilio murinus</i>	SPb NT(4)	se	se	-	-	-	se	se	se	se	-	se	se	se	se	-
15	Northern bat <i>Eptesicus nilssonii</i>		se	c+	se	se	se	se	se	se	se	se	se	se	se	se	se
Order Lagomorpha																	
16	Mountain hare <i>Lepus timidus</i>		r	c+	r+	r+	r	c+	c+	r+	c+	r+	r+	r	r+	c+	r+
17	Brown hare <i>Lepus europaeus</i>	SPb VU(3)	-	-	?		-	-	-	-	?	-	-	-	-	r	sp
Order Rodentia																	
18	Siberian flying squirrel <i>Pteromys volans</i>	SPb NT(4)	-	-	-	-	-	r+	r+	sp+	sp+	-	-	-	-	-	-
19	Eurasian red squirrel <i>Sciurus vulgaris</i>		a+	c+	r+	c+	c+	c+	c+	c+	c+	-	c+	c+	r+	r+	c+
20	Eurasian beaver <i>Castor fiber</i>		-	c+	c+	-	-	c+	r+	-	-	-	-	?	-	-	-
21	Northern birch mouse <i>Sicista betulina</i>		-	-	sp+	-	-	-	-	-	-	-	r+	r+	-	-	-
22	Muskkrat <i>Ondatra zibethicus</i>		sp	c+	a+	-	-	c+	r+	r+	r+	r+	sp+	?	r+	sp	-
23	Bank vole <i>Clethrionomys glareolus</i>		r+	a+	a+	c+	c+	a+	a+	a+	a+	c+	a+	a+	?	r+	c+
24	Eurasian water vole <i>Arvicola amphibius</i>		-	c+	c+	r+	-	r+	-	-	r+	-	c+	r+	-	-	r+
25	Root vole <i>Alexandromys oecconomus</i>		-	-	?	-	-	-	-	-	-	-	-	-	-	-	-
26	Common vole <i>Microtus arvalis</i>		c+	?	?	?	-	c+	?	?	c+	-	?	r+	a+	r+	a+
27	East European vole <i>Microtus rossiaemeridionalis</i>		r+	c+	sp+	r+	c+	?	c+	r+	?	-	a+	c+	?	?	?
28	Field vole <i>Microtus agrestis</i>		-	-	-	-	-	-	-	r+	-	-	-	-	-	-	-
29	Eurasian harvest mouse <i>Micromys minutus</i>		-	r+	-	-	-	-	-	-	-	-	sp+	?	-	-	r+
30	Pygmy wood mouse <i>Sylvaemus uralensis</i>		-	c+	r+	-	-	c+	r+	c+	r+	-	c+	r+	-	c+	-
31	Yellow-necked mouse <i>Sylvaemus flavicollis</i>		r	-	?	-	-	r+	r+	r+	-	-	a+	c+	-	a+	r+
32	Striped field mouse <i>Apodemus agrarius</i>		a+	c+	r+	r+	c+	c+	c+	r+	c+	c+	c+	c+	c+	a+	c+
33	House mouse <i>Mus musculus</i>		sp+	sp+	-	-	-	sp	-	sp	sp+	sp+	sp+	?	-	sp+	-
34	Common rat <i>Rattus norvegicus</i>		sp+	c+	-	-	c+	c+	sp	c+	r+	c+	sp+	sp+	sp+	sp+	c+
Order Carnivora																	
35	Gray wolf <i>Canis lupus</i>		-	-	-	-	-	r	-	-	-	-	-	-	-	-	-
36	Raccoon dog <i>Nyctereutes procyonoides</i>		r	r+	-	sp	-	r+	r	-	-	-	-	-	-	-	-
37	Red fox <i>Vulpes vulpes</i>		-	c+	r+	r	r	c+	c+	c+	c+	r+	r	r	r	r+	r+
38	Brown bear <i>Ursus arctos</i>		-	-	sp	-	-	r	sp	-	-	-	-	-	-	-	-
39	Baltic gray seal <i>Halichoerus grypus macrorhynchus</i>	SPb EN(2), RF(1)	-	-		-	-	-	-	-	-	-	-	-	sp	-	-

End of Appendix 1

No.	Species	Degree of vulnerability	Name of Nature Protected Area														
			Elagin Island	Yuntolovsky	Sestrotretsk Swamp	Petrovsky Pond	Novoorlovsky	Gladyshevsky	Shechuchye Lake	Komarovsky Coast	Northern Coast of the Neva Bay	Strelbinsky Coast	Sergievka Park	Southern Coast of the Neva Bay	Western Kotlin	Duderkhof Heights	Popovka River Valley
40	Baltic ringed seal <i>Pusa hispida botnica</i>	SPb CR(1) RF(1)	-	-	-	-	-	-	-	-	sp	-	-	?	?	-	-
41	Pine marten <i>Martes martes</i>		-	r+	r	r	-	r+	c+	r+	c+	-	r	r	-	-	-
42	European badger <i>Meles meles</i>		-	-	r	-	-	r	-	-	-	-	-	-	-	-	-
43	Least weasel <i>Mustela nivalis</i>		r	r+	r+	r	-	r+	r+	r+	r+	r+	r+	c+	?	r+	-
44	Stoat <i>Mustela erminea</i>		?	c+	r+	r	r	r+	c+	c+	c+	r+	c+	r+	-	r+	r+
45	American mink <i>Neovison vison</i>		r	c+	r+	-	-	c+	?	-	c+	r+	r+	r+	r+	-	r+
46	Western polecat <i>Mustela putorius</i>		?	r+	+	r	r	c+	c+	r+	r+	r+	r+	r+	-	r+	r+
47	Common otter <i>Lutra lutra</i>	SPb EN(2) IUCN (NT)	-	-	-	-	-	?	-	-	-	-	-	-	-	-	-
48	Eurasian lynx <i>Lynx lynx</i>	SPb VU(3)	-	-	sp	-	?	-	-	-	sp	-	-	-	-	-	-
Order Artiodactyla																	
49	Wild boar <i>Sus scrofa</i>		-	?	r	-	sp	r	r	sp	r	-	-	?	-	-	-
50	Western roe deer <i>Capreolus capreolus</i>	SPb VU(3)	-	sp	-	-	-	?	r	-	-	-	-	-	-	r	-
51	Eurasian elk <i>Alces alces</i>		-	sp	sp	r	-	r	r	-	r	-	?	?	-	r	-

The status of permanent residence (see comments in Appendix 2): a — abundant; c — common; r — rare; sp — sporadic; se — seasonal; ? — indefinite; + — breeds; - — absent.

Degree of vulnerability: IUCN European List (NT) — as Near Treatment in IUCN Red Book; RF(1) — as Critically Endangered in Red Data Book of Russian Federation; Red Data Book of Saint Petersburg: SPb CR(1) — as Critically Endangered; SPb EN(2) — as Endangered; SPb VU(3) — as Vulnerable; SPb NT(4) — as Near Treatment.

Appendix 2. The conventional scale of mammal abundance applied to itinerary examination.

Denomination	Extent of abundance	Content
a	Abundant	The species, which occurs in considerable abundance during each of diurnal/vespertine examination (the concrete rates of population density depend on current conditions of the season and year)
c	Common	The species, which is practically traceable or trappable during each of diurnal/vespertine examination (the concrete rates of population density depend on current conditions of the season and year)
r	Rare	The species, whose frequency of occurrence is no higher, than 1–2 times within the total period of survey
sp	Sporadic	The species, which occurs in distinct points 1–2 times within the season of survey, but not annually
se	Seasonal	The species (migrants or nomadic), which occurs within the summer season only
?	Indefinite	The existence of the species within the territory of survey is possible judging by physiographic factors, the data from literature and results of debriefing