Indian Journal of Ecology (2020) 47(4): 1077-1083

Manuscript Number: 3140
NAAS Rating: 4.96

Seymska Population of Russian Desman (*Desmana moschata* L.) in North-Easten Part of Ukraine: A History of Formation and Current State

Oleksandr Mikhailovich Yemets, Volodymyr Anatoliyovich Vlasenko, Viktor Mikhailovich Demenko, Valentyna Ivanivna Tatarynova, Tetiana Oleksandrivna Rozhkova, Alla Oleksandrivna Burdulaniuk, Olha Mikolaivna Bakumenko, Olena Mikolaivna Osmachko, Yuliia Mikhailivna Shcherbyna

Sumy National Agrarian University, G. Kondratieva 160, Sumy, Ukraine
E-mail: Yemets_A@ukr.net

Abstract: Endemic of the East European Plain and the oldest representative of Europe's modern fauna is the Russian desman (*Desmana moschata L.*). The animal is subject to strict protection. The International Union of nature protection has identified the status of Russian desman as an endangered species. The desman is registered in the European Red List as a vulnerable species. It is also listed in Annex II of the Berne Convention. In the Red Book of Ukraine desmans are listed as an endangered relict species. Nowadays only the seymska population *D. moschata* can be found in Ukraine. It is highly fragmented and numbers about 300-500 individuals. In terms of structure we can delineate 3 areas: the seymska-the largest, is in the floodplain of the Seym river; the vyrivska-covers the floodplain of the Vyr river, the left tributary of the Seym river; the klevenska-covers the floodplain of the Kleven river, the right tributary of the Seym river. In general, the population is in a very depressed state and is very affected by anthropogenic pressure.

Keywords: *Desmana moschata L.*, A modern state, The north-eastern Ukraine, The seymska population

The biota evolution, in particular animals evolution on Earth, is undulating with periods of flowering and extinction of species. Researchers of the evolution process have identified at least five periods of animals extinction. The most famous among them is Permian, when at least 95% of all living creatures that inhabited our planet disappeared. The recent studies of ecologists, taxonomists, zoologists and other fundamentalist researchers have provided a basis for statements about the sixth extinction that is going on today. According to the News line resource (2019), referencing William J. Ripple (Oregon State University in Corvallis, the USA), before the anthropogenic era per 10000 species of animals 2 of them disappeared every 100 years. During the twentieth century and the early part of the twenty-first century these figures increased by 114 times. In the coming decades the fauna of the Earth will lose at least 150 animal species, about 70% of modern species will significantly reduce their numbers and more than 60% of the species may completely disappear. The main reasons that will lead to such consequences are the powerful commercial use of modern fauna, excessive anthropogenic influence on animal habitats, destabilization of their habitats and significant reduction of unoccupied spaces in nature (William J. Ripple et al 2017, 2019). Earlier scientists (Vandna Devi et al 2019, Jeph and Khan 2019) also report in their works about a strong negative impact on the natural biodiversity of global climate changes, about anthropogenic pressure and other man-made factors.

Ukraine, despite its agrarian status, is one of the unique regions of the world where transformed or a little-transformed territories have remained well-preserved. The vast majority of territories are parts of different at rank nature conservation objects. It is here that species of flora and fauna, which are unique both to Ukraine and to the world, have been preserved and protected. One of them is the Russian desman (*Desmana moschata L.)*. This insectivorous mammal belongs to the mole (Talpidae) family and is endemic to the Eastern European Plain and is the oldest representative of modern fauna in Europe, if we take into account the age of fossil specimens. The oldest remains of these animals date back to the Pleistocene era. They were found in France, the Netherlands, Germany, Poland, Sweden, the United Kingdom, Hungary and Ukraine. As of today the Russian desman hasn't been officially registered in the territory of Western Europe. Its range is restricted to relatively small territories in Russia (European part and Western Siberia), eastern Ukraine and western Kazakhstan (Fig. 1). The area of this mammal is disjunctive. Relatively small populations are concentrated mainly in the basins of the Volga, Don, Dnieper and Ural rivers.

Sources: uk.wikipedia.org (2019)

Fig. 1. The modern area of the Russian desman distribution

The number of species is low and there is a clear possibility of further decline. Keeping this in mind the animal has been put on a number of red lists. In particular, the International Union of Nature Protection has designated the status of the Russian desman as an endangered species (Endangered, EN). In the European Red List it is registered as a vulnerable species (Vulnerable, V). This category includes species that are threatened with extinction as a result of on-going negative factors.

Taking into account the rate of reduction of the Russian desman population in a number, it is quite predictable that in the near future this animal will be transferred to the endangered species group. For this reason it is listed in Annex II (species to be protected) of the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats). In the Red Book, in all its three editions, the Russian desman is included in the status of endangered relict species. It follows from the foregoing that there is an urgent need to study the current distribution, the number of this unique animal in detail, to monitor the territories suitable for its continued survival and to think properly about the creation of conditions for the survival and resettlement of this micromammal.

The purpose of this work is to summarize the literature resources on the distribution of the desman in the territory of Ukraine, especially in its north-eastern part. The main reason to begin the research work was the detection of *D. moschata* in the Kleven river (the right tributary of the Seym river) in the territory of the Regional Landscape Park Seymskyi (Krolevets district, Sumy region). The animal was observed downstream in the Kleven riverbed area during a route survey.

MATERIAL AND METHODS

Literature, reports of research expeditions, desman territory surveys, desman identification activities in the territory of the Sumy region, archival documents of the Department of the Nature Reserve Fund and Environment of the Department of Ecology and Natural Resources Protection of the Sumy Regional State Administration were analysed during this research work.

RESULTS AND DISCUSSIONS

At present, within the European continent, the Russian desman's area is concentrated in the European part of the Russian Federation in the territory of 37 regions in the basins of the Volga, Don, Dnipro and Ural rivers. These are areas where the desman has existed since ancient times and where relatively few individual populations of this animal have remained. According to "Materials on the fauna of the Nizhny Novgorod Zavolzhye" (2002) at the beginning of the 21st century the number of desmans in Russia is about 35000 individuals. 20000 of them are in the Volga basin, 10000 are in the Don basin and another 5000 are in the Dnipro and Ural basins. However, other sources give different information. According to the results of fundamental studies Khakhin (2009) concluded that now the area of the desman in Russia is discrete by its nature and the status of the species is critical. This situation is observed in most areas where *D. moschata* in habits, except Ryazan, Kursk and Kurgan regions, where the animal population status is the most favourable (Table 1).

In general the author's account of the desman population shows an irreversible and all-encompassing decline in the number of species throughout its territory. According to the results of these studies the total number of desman in Russia was 28000 individuals in 2001. However, in 2005 the number was reduced to 25000 individuals. If the situation doesn't change, the number of species (600 individuals per year) will be reduced and it's highly likely the number of desmans in the Russian Federation will number about 17200 individuals in 2019.

The current population of desman in Ukraine is closely related to the population of this animal in Kursk region, Russia, and is its peripheral south-western area. The desman population in Kursk region was created through the resettlement of 95 animals from the Khopyor Nature Reserve in 1956 – 1961. By 1976 the animal had already inhabited the whole territoryin Kursk region, the territory which was suitable for its life. Nowadays it is the largest desman population in the Dnipro Basin. It numbers about 3 thousand individuals (Khakhin 2009). In the 1970's the animal also penetrated the territory of Ukraine – Putyvl district, Sumy region. It is highly likely that it's the only population of *D. moschata* in Ukraine today. The desman's presence here is documented and confirmed by factual material. In the twentieth century the spread of *D. moschata* in Ukraine was

somewhat different. Zahorodniuk (2002) observed the range of the desman in Ukraine has historically been formed in 3 parts: Dniprovska, Siversko-Donetska and Seymska (Fig. 2). The Dniprovska population existed until the 1930s. The reason for its disappearance, as mentioned by Pidoplichko (1951), could have been the completion of the natural process of shortening of this part of the area, which began in prehistoric times.

Table 1. Dynamics in the number of *D. moschata* in Russia (Khakhin 2009)

Constituent entities of the Russian federation	The number of individuals		
	1985 year	2001 year	2005 year
Astrakhan region	a few	a few	a few
Republic of Bashkortostan	a few	a few	a few
Bryansk region	a few	a few	50
Vladimir region	8,0thsd.	2,5thsd.	2,5thsd.
Volgograd region	1,5thsd.	2,5thsd.	2,5thsd.
Vologda region	a few	a few	a few
Voronezh region	5,0thsd.	2,0thsd.	1,2thsd.
Ivanovo region	1,0thsd.	200	200
Kaluga region	200	100	100
Kirov region	a few	a few	a few
Kostroma region	100	300	300
Kurgan region	2,0thsd.	2,0thsd.	1,5thsd.
Kursk region	2,0thsd.	3,5thsd.	3,0thsd.
Lipetsk region	2,0thsd.	1,0thsd.	1,0thsd.
The Mari El Republic	not marked	not marked	not marked
The Republic of Mordovia	1,0thsd.	500	500
Moscow region	a few	50	50
Nizhny Novgorod region	500	1,5thsd.	1,5thsd.
Novosibirsk region	a few	a few	a few
Orenburg region	500	150	100
Orel region		20	20
Penza region	500	200	200
Rostov region	200	100	1,0thsd.
Ryazan region	7,0thsd.	6,0thsd.	5,0thsd.
Samara region	a few	a few	a few
Saratov region	1,0thsd.	100	100
Smolensk region	300	400	400
Tambov region	5,0thsd.	3,0thsd.	3,0thsd.
The Republic of Tatarstan	a few	a few	a few
Tver region	a few	a few	a few
Tomsk region	100	a few	a few
Ulyanovsk region	100	a few	a few
Chelyabinsk region	300	100	100
The Chuvash Republic - Chuvashia	a few	100	100
Yaroslavl region	700	300	300
Total amount	~ 40 thsd.	~ 28 thsd.	~ 25 thsd.

The most powerful and the largest population of *D. moschata* in Ukraine was Siversko-Donetska. Up to this moment the question of its extinction hasn't been solved yet. However, the recent thorough field studies of Zagorodniuk (2002) do not shed any light on this mystery. The scientist, as part of a zoological expedition, examined the most promising 1000-kilometer part of the Siverskyi Donets floodplain from the Oskol River in Kharkiv region to the Derkul River, which is on the border of Lugansk and Rostov regions. About 70 flood lakes and riverbeds were surveyed, but in every case the results were negative. Neither animals' traces nor signs of their existence were found in the Siverskyi Donets Basin. Survey of hunters, taxidermists and questionnaires of local residents also yielded negative results. According to the results of the Zagorodniuk's research, it was concluded that there is an extremely high probability of the desman being absent in Siverskyi-Donetsk. The author considers the impact of anthropogenic factors as the main reason for the "landslide reduction of the Donetska population both in area and in number, both in quality of lands and in the number of habitable places".

The Seymska population is the youngest and highly likely the only one in Ukraine now. Its formation began in the 1970's through the natural penetration of animals from the territory of Russia and development of habitable reservoirs in

Comment: The author refers to Pidoplichko data (1951). The note "Modern finds" refers to the mentioned date

Fig. 2. The desman's area in Ukraine (Zagorodniuk 2002)

the river Seym and its tributaries. The desman's expansion in the territory of Ukraine probably started from the territories close to the Tetkiko locality, Kursk region, Russia, which spread to the border with Ukraine. On this territory Serdiuk (1978) described *D. moschata*. It is thought that these neighbouring territories nowadays are the source of the constant replenishment of "Ukrainian" desman population with new individuals. Skorobagatov (2000) mentioned that a possible immigration hotspot is a system of peat pits located on the Russian side opposite the village of Buniakine, Putyvl district, Sumy region. The immigrant individuals inhabit quarries near this specific location. Animals settle down in the reclamation canals, floodplain lakes and in the Seym riverbed downstream (Fig. 3, 4). The results of a number of research trips, conducted in the mentioned territory of Sumy region during different periods of time, can confirm the accurateness of this theory. Serdiuk (1978) conducted a survey of territories in the Putyvl district near the villages of Volyntsevo, Kozlivka and Chaplyshchi. These villages are located some distance from Buniakine, downstream of the Seym river. In Lake “Bolonia”, near Volyntsevo he observed 20 inhabited desman burrows. One inhabited burrow was found near the nameless lake near Kozlivka, but near Chaplyshchi in the floodplain, the author found desolated animal burrows. Thus, the desman actively migrates in search of bodies of water most favourable to its survival.

In 1978 an expedition of the Institute of Zoology of the Academy of Sciences of the USSR, consisting of V. Kryzhanovskyi, V. Abelientsev, H. Panov, I. Leheida, found out that desmans had been caught by local residents near Boiaro-Lezhachy village, in the gulf of the river Seym, and in “Khorobre” lake, as well as near the locality Ryzhivka in the system of lakes between the rivers Seym and Vyr. It should be noted that during the survey of bodies of water, where Serdiuk had worked before, neither animals nor traces of their stay could be found. The work report states that the lakes were highly dried up and had been subjected to extremely strong anthropogenic pressure, which made them unusable (Kryzhanovsky et al 1978). Probably the animals either died or migrated to other bodies of water. We can hypothesize that it was possibly a migration due to the fact that two adult desmans were found near the village of Volyntsevo in the same year 1978, but it was a reclamation canal during its reconstruction (Merzlikin 1992). New discoveries of animals near the mentioned localities date back to 1990 - 2006. According to Merzlikin, Mishta (2008) near Kozlivka village in the system of reclamation canals and the Horn River (the Seym's distributary), individual and inhabited burrows of the desmans were constantly found last in 2006. Near Volyntsevo in old peat quarries, single specimens of desmans were extracted by means of poaching in 1991 and in 2000. A hunting dog found a desman in the reclamation canal near Buniakine in the summer of 2001. Villagers from Boiaro-Lezhachy saw a few desmans in Lake Horobre in 2001-2002. At the same time the same authors report finding *D. moschata* and on the other territories close to the localities mentioned above. Some desman specimens were found in the reclamation canals to the northeast from Volyntsevo near the villages Yurieve and Lynove in 2000. Some individual specimens of animals were found in the reclamation canals near Manukhivka village, downstream from the river Seym near the village of Boiaro-Lezhachy, and in old riverbeds «Vileia» and «Pereriz» in 2002. Near Pisky village, which is located on the left bank of the Seym between Manukhivka and Kozlivka, local residents noticed some desmans during the spring floods every year from 1992 to 2006. In the same place a young desman was caught by a cat in 2001. Downstream in the Seym from Chaplyshchi village near Chumakove village, local residents noticed desman in the gulf of the river in 2003. Desman was also observed in former peat-mining quarries in 2004. In the bodies of water in the suburbs of the villages Peresypok, Chervone Ozero, Zinove several desmans were regularly observed from 1999 to 2005.

On the territory of the Regional Landscape Park Seymskyi, which extends from Chumakove to Chernihiv region downstream of the river Seym, according to the data of Merzlikin, Mishta (2008), some desman specimens were found near the previously mentioned village Zinove in the former peat lands «Zhuravlyne» and «Karasevi bolota», near the village of Dych and Putyvl town in 2004 and near the villages of Skunosove in 2000. In the last two cases the animals were caught by fishing nets in the river Seym. Below the town of Putyvl, Merzlikin (1995) observed a desman near the Kamen village in a flood lake in 1990. In 1991, as the author reports, 6 animals were caught by locals in lakes and in reclamation canals downstream of the river near the village of Zholdaky. According to the author this is the most remote point from the place of a settlement where the presence of *D. moschata* is accurately described. The author believes that the animal occupies more distant territories today and probably has penetrated into the water bodies of the region of Chernihiv. However, there were no literature sources to confirm this point of view. The territory, described above, where for almost 50 years the cases of desman detection have been registered, is, in our opinion, the native area of the seymska population of *D. moschata* in Ukraine. During this time two more areas began to form – the vyrivska, in the river Vyr (the left tributary of the Seym) and the klevenska in the river Kleven (the right tributary of the Seym). The vyrivskyi

district covers the territory of the river Vyr near the village Novi Vyrky and its lower downstream to Vorozhba locality (Fig. 5).

Most likely, the settlement of this area began in the 1970's. Tsyupka (2012) observed the maximum number of animals was found near the village of Novi Vyrky in the 1980s, when several dozen animals were caught in fishing nets every year. However, by 2005 the number of such cases had decreased to 7, and in 2006 to 2. The decrease in the number of animals happened to a large extent as a result of anthropogenic pressure and the migration of animals upstream of the river Vyr. The author reports about the desman's detection near the village Stari Vyrky, 3 km. away from the previous settlement and near the village of Vorozhba, 3 km. up from the village Stari Vyrky. Merzlikin and Mishta (2008) also report the identification of young *D. moschata* near Vorozhba. According to their data a young animal was caught in fishing nets in the river Vyr in the area of the riverbed between the railway bridge and the village. This happened in 2001. The same authors report about some desman sightings in 1997 and in 2001 in one of the ponds near Kindrativka village, Sumy region. Information was given by local residents and wasn't confirmed by factual research.

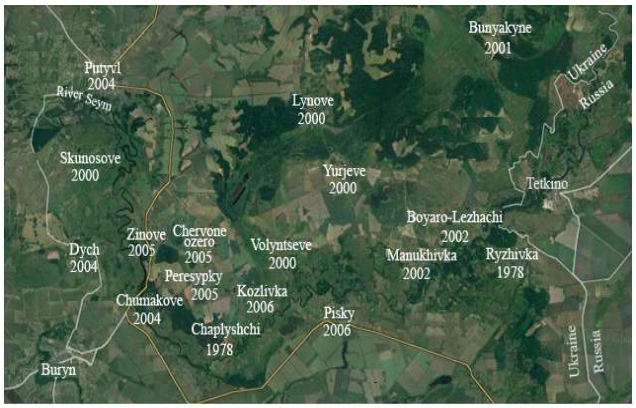

Fig. 3. The maternal area of the seymska population of *D. moschata*in (the numbers indicate the year when the animal was last observed)

Fig. 4. The maternal area of the seymska population of *D. moschata*in (the numbers indicate the year when the animal was last observed)

Highly likely the last reports were in reality about muskrats, which are common animals in our bodies of water. If the information had been accurate, then the desmans would have had to cover the distance of a few tens of kilometres from the town Bilopillia, where the tributary Kryga flows into the Vyr river and up to the village Kindrativka. The accuracy of this report is rather doubtful and needs to be checked. The Kleven area of desman is probably the youngest. This assumption is based on the lack of information in literature on the existence of *D. moschata* in the Kleven river during the formation of the seymska population of this animal.

For the first time the desman was found by Yemets (2019) in the aforementioned river. It occurred during an ecological survey of the area of Kleven river mouth from the Yatsyne village Putyvl district to the village of Kamin in Krolevets district. On the evening in August 6, 2018, not far from the village of Lytvynovychi (geographical coordinates: 51.395, 33.649), Krolevets district (Fig. 6) desmans were seen on intertwined leaves of white lily near a riverbank.

Fig. 5. The vyrivska area of the seymska population of *D. moschata* (the numbers indicate the year when the animal was last observed)

Note: The sign points to the place where a desman was detected

Fig. 6. The klevenska area of the seymska population of *D. moschata*in (the numbers indicate the year when the animal was last observed)

Visual contact lasted no more than 4-5 seconds after which the animal disappeared under water.

Unfortunately, this time was not enough to set up a camera and to take a photo of the animal in its natural environment. The desmans appeared in the Kleven river in approximately 1990 when they were observed by Merzlikin (see above) near Kamen village in the floodplain of the river Seym. By that time the animals had already inhabited 8 kilometres of the territory (the distance from the village of Kamen to the place where it was found). The results of the analysis of the ecological state of the river Kleven in this part of the territory between the villages of Yatsyne and Kamin made it possible to identify the part of the river mouth, which is the most promising area for a desman existence. This could be the part from the sluice near the village of Kamin to the sluice in the village Lytvynovychi (the animal was discovered here) and further upstream to the village of Stara Sharpivka. The banks of the river in this part are densely covered with shore vegetation and in places with shrubs and trees. The water level is regulated by the floodgates and is generally maintained mostly at the same level except during spring floods.

Recently floods have not been as strong and do not happen every year. The flow of the river in the described area is slow and the depth is enough to prevent the water from freezing all the way to the bottom. At the same time all food required by desmans can be found in the river. During spring floods the river joins with a number of floodplain lakes and a system of reclamation canals, allowing the animal to move to other bodies of water. The complete elimination of industrial cattle breeding in locations near the Seym floodplain influenced the desman's settlement in the river in 1990-2000. This has greatly reduced the anthropogenic pressure on the floodplains. At the same time, the aforementioned part of the channel is not an active recreation area. The inclusion of the floodplains of the Seym and Kleven in Regional Landscape Park Seymskyi and the normalization of its work contribute to the successful development of the mentioned territories by this rare animal.In spite of the long period of existence of the seymska population of *D. moschata*, its condition and number of species it contains remain unstudied. According to Mishta, Merzlikin (2009) the number of the desman here is 300-500 individuals. In our opinion, this data needs clarification, because no research of the seymska population, highly likely the last *D. moschata* population in Ukraine, has been carried out there for the last 20 years. At the same time our data analysis of different literature sources show that this population is not in good condition. The unsystematic and sporadic detection of single specimens of this animal in recent years testifies in favour of this opinion. The significant reduction of the desman's number began in the 1980's and continues to this moment. The main causes of the reduction in the population are excessive anthropogenic pressure on the animal's habitat. It is demonstrated by the use of prohibited fishing gear (nets, fishing tackle, electric fishing rods), grazing animals on the protected zones of rivers and banks of floodplains, excessive and unreasonable recreational load on water bodies, plowing of floodplains etc. At the same time the significant change of the hydrological regime of the Seym river negatively influences the desman's habitat. The full or partial absence of spring floods has already led shoaling and drying of floodplains. As a result, these places have become unfavourable for desmans existence.

CONCLUSION

The seymska population of *D. moschata* is the youngest and highly likely the last in Ukraine. It is composed of three areas: the maternal seymska, which covers riverbeds, bays, floodplain lakes, reclamation canals and water bodies in the former peat quarries in the floodplain of the Seym river; vyrivska, which covers riverbeds and a number of floodplains of the Vyr river, the left tributary of the Seym; klevenska, which is in a state of formation and covers an area of the Kleven riverbed (on the right tributary of the Seym) in its downstream. In general, the seymska population of the Russian desman is highly fragmented, small in number with very low animal density and in a state of great depression. The main factors that cause this condition are excessive anthropogenic pressure on the animals' habitat and certain global climatic changes.

REFERENCES

Jeph Anita and Khan JB 2019. Study on Some Threatened, Rare and Endangered Plant's Species in Reserve Forest Area of Jhunjhunu District, Rajasthan. *Indian Journal of Ecology* **46**(4): 755-759.

Khakhin G 2009. *Russian desman in danger: Dynamics of numbers and problems of protection*, Wildlife Conservation Center, Moscow, Russia, p. 156.

Kryzhanovsky V, Abelentsev V and Panov G 1978. *About the results of the survey of desman habitats upstream of the Seym river (Putyvl district, Sumy region).* Archival documents of the Department of Nature Reserve Fund and Environment of the Department of Ecology and Conservation of Natural Resources of Sumy Regional State Administration, Sumy.

Materials about the fauna of the Nizhny Novgorod, Zavolzhye 2002, pp. 294-325. **In**: *The Works of the State Nature Reserve "Kerzhensky"*, v.3, Nizhny Novgorod, Russia.

Merzlikin I 1992. On the influence of anthropogenic factors on the state of mammalian fauna of Sumy region, pp. 141-145. **In**: *Problems of protection and rational use of natural resources of Sumy region.* Collection of scientific works, Sumy, Ukraine.

Merzlikin I 1995. Preliminary report on desman (*D. moschata*) in the territory of Sumy region (Ukraine), pp. 30-32. **In**: *Scientific works of the Zoological Museum of Odessa State University named after I. Vernadskyi*, vol. 2, Odessa, Ukraine.

Merzlikin I and Mishta A 2008. New observations of the Russian desman (*D. moschata*) in Sumy region, pp. 206-208. **In**: *Findings of Animals of the Red Book of Ukraine*, Kyiv, Ukraine

Mishta A and Merzlikin I 2009. Russian Desman, *Desmana moschata* (Linnaeus, 1758), p. 486. **In:** I . Akimov (eds). *Red Book of Ukraine. Animal World*, Global consulting, Kyiv, Ukraine.

Newsline 2019. Scientists have named the reason why humanity should give up meat. https://www.newsline.com.ua/society/uchenye-nazvali-prichinu-pochemu-chelovechestvo-dolzhno-otkazatsya-06022019171700.

Pydoplychko I 1951. Desmans, pp. 186-190. **In**: I. Pydoplychko (eds). *About the Ice Age.* Issue 2, Publisher of the Academy of Sciences of the Ukrainian SSR, Kyiv, Ukraine.

Serdiuk N 1978. New data on the desman's distribution in Ukraine. *Journal of Zoologists* **2**: 79-80.

Skorobogatov E 2000. *Preliminary report on research work "Inventory of desman lands in the Seym river floodplain of Sumy region"*. Archival documents of the Department of Nature Reserve and Environment Department of Ecology and Conservation of Natural Resources of Sumy Regional State Administration, Sumy.

Tsyupka V 2012. New findings of the Russian desman (*Desmana moschata*) in the Seym River basin, pp. 145–147. **In**: *Proceedings of the Theological School*, vol. 11, Kyiv, Ukraine.

Uk.wikipedia.org 2019. The modern distribution of the desman. https://uk.wikipedia.org/wiki/Хохуля_руська

Vandna Devi, Fulekar MH and Bhawana Pathak 2019. Public perception on climate change and its impacts on various aspects: A case study of great Himalayan National Park (India). *Indian Journal of Ecology* **46**(3): 623-630.

William J. Ripple, Christopher Wolf, Thomas M. Newsome, Michael Hoffmann, Aaron J. Wirsing and Douglas J. McCauley 2017. Extinction risk is most acute for the world's largest and smallest vertebrates. *PNAS Early Edition* **114**(40): 10678-10683

William J. Ripple, Christopher Wolf, Thomas M. Newsome, Matthew G. Betts, Gerardo Ceballos, Franck Courchamp, Matt W. Hayward, Blaire Van Valkenburgh, Arian D. Wallach and Boris Worm 2019. Are we eating the world's megafauna to extinction? *Conservation Letters* **12**: e12627.

Yemets O 2019. Meeting with *Desmana moschata* on the territory of the Seimsky RLP, p. 57. **In**: M.Yu. Rusin & M.A. Ghazali (eds). Mammals on map of Ukraine. Materials of the *First Ukrainian Mammal Mapping Conference*, Kyiv, Kyiv Zoo, 28–29 March, 2019, Ghazali, Kyiv, Ukraine.

Zagorodniuk I, Kondratenko O, Domashlinets V 2002. *Russian Desman (Desmana moschata) in the Siversky Donets Basin,* National Academy of Sciences of Ukraine, Kyiv, Ukraine, p. 64.

Received 25 September, 2020; Accepted 10 November, 2020