

SPATIAL DISTRIBUTION AND A BUNDANCE OF AMPHIBIANS AND REPTILES IN SOUTH PARK OF SOFIA, BULGARIA:
TENDENCIES, PROBLEMS AND RECOMMENDATIONS FOR BETTER PARK MANAGEMENT

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Introduction

Urban parks are an important part of the urban green system. Parks are small areas of relatively natural habitats surrounded from exclusively anthropogenic environment and include populations of many species of animals that represent great value and need to be studied and conservation. Also a study of biodiversity in urban areas is of great importance for there is limited information on this topic.

South Park is one of the largest parks in Sofia. The idea of building it occurred for the first time the urban plan of Prof. Muesmann which is the first serious attempt to link urban planning with creation of a green system of urban parks in the capital of Bulgaria.

The park is planned in four parts, arranged in north-south direction. It is an important part of the green system of Sofia, forming a southern wedge of vegetation connecting downtown Sofia with the common green belt of the city. Equally important, it preserves the local biodiversity.

Amphibians and Reptiles are smallest classes in Bulgarian vertebrate fauna. They include 7 Tailed amphibian species and 12 frog species, as well as 7 turtle species, 13 lizard species and 18 snake species. All of them have high conservation status.

This study aims to complement and update the information about the amphibian fauna in South Park in Sofia and to present the first information on its reptile fauna. The main tasks are:

- 1. Determination of species composition from both classes of vertebrates in the park
- 2. Establishing the abundance and spatial distribution of amphibians and reptiles inhabiting the park.
- 3. Comparison between current and past state of the fauna of the park and forecasting of future developments.
- 4. Identification of environmental factors and anthropogenic factors which have negative effect on the animals in the park.
- 5. Suggestions and recommendations for better management of urban resources to protect the existing biodiversity.

Green Toad
(Pseudepidalea viridis Laurenti, 1768)

The Green Toad is a common species in highly urbanized areas. It was detected for the first time in South Park Part III. The reason we find this adapted to urban areas species in the park most likely is that it finds fewer breeding sites among these urban areas. This causes the frog to carry out long migrations to more distant water bodies.Reproduction of the green toad is detected in an artificial concrete pond. Human presence around this pond is very strong and is an example of negative anthropogenic impact. It is managed by private individuals and it is used for commercial purposes. Green toad has survived in the urban environment because of its successful adaptation to urban landscapes and little need for water. The main threats to species are road collisions and the direct killing by human.

Common Toad
(Bufo bufo Linnaeus, 1758)

The Common Toad was observed for the first time in South Park. We found it in 2 (14,2%, n=14) reservoirs with very low number of individuals. Located in the center of the park the two reservoirs vary greatly in appearance and size. The high level of urbanization leading to the reduction of breeding ponds is one of the main reasons for the disappearance of the Common Toad from large cities. Other factors influencing the size of urban populations are road traffic, pollution of water bodies, and their senseless killing from people. The species has the ability to adapt to urban environment only if there are sufficient amount of ponds suitable for breeding.

Red-eared Slider
(Trachemys scripta Schoepff, 1792)

Red-eared Slider naturally inhabits the southern Mississippi River Basin in North America. Red-eared Slider has great ecological plasticity and competitiveness and is able to displace native Terrapin species. In reservoirs of South Park the Red-eared Slider is the most numerous reptile species. It was found in 28.6% (n = 14) of the water bodies, as in most cases between 2 and 5 individuals were observed. In one of the lakes, however, 15 individuals were recorded. The reason probably is regularly release of new individuals by humans in that particular water body because of its proximity to the most visited part of the park. Red-eared Slider successfully adapts to various environmental conditions. There is no record of breeding, but the continuous release of new individuals by humans leads to increase in the population which has no natural enemies in South Park. For a short period of time the Slider has already outnumbered the native species (Evuropean Pond Turtle) in South Park and presents a major threat to its survival.

European Pond Terrapin
(Emys orbicularis Linnaeus , 1758)

This species was found in 21, 4% (n = 14) of the water bodies with very low quantity. One of the factors determining the presence or absence of the species in a pond and the quantity in it is the availability of suitable basking places. On global scale the European Pond Terrapin is included in the Red List of IUCN in category "Near Threatened". South Park offers good conditions for survival of the species. The main negative factor is the human impact: direct disturbance (e.g. fishermen, children) as well as indirect disturbance through the release of new specimens of invasive species. Other reasons causing decline of the species worldwide beside above mentioned include destruction of its natural habitat, as well as water pollution.

vegetation. The Green Lizard mostly uses concrete slabs and big rock alongside the water bodies for basking. Species richness in the park is very low. It was not found in the central part of the park. The reasons are probably strong human presence and especially the absence of suitable habitats for basking.

Materials and methods

Surveys were conducted in the spring of 2011, between 28. March to 15. June. We have tried to cover the whole breeding season of most species of amphibians in the region and the period of higher activity of reptiles during their breeding period May – June.

To determine the number of amphibians and reptiles we used the following methods:

- 1. Observations were carried out at night to enable us to recognize the amphibian species from the sound they make.
- 2. The abundance of Agile Frog, whose male have no vocal sacs and do not make loud sounds are recorded by visually counting them in the waterways and by counting the piles of eggs laid by the female. The latter can not be confused with eggs of the Marsh Frog as it lays its eggs 20-30 days earlier right after the first spring warming.
- 3. The counting of the Balkan crested newt was done visually in ponds and large lakes using flashlight: it is the only amphibian species to show activity when flashed.
- 4. Reptile fauna was determined by daily observations. We used binoculars to survey the entire water bodies from different angles, depending on its size and visibility.
- 5. Non aquatic species were established using transect methods and examination of suitable basking places (e.g. big rocks, concrete slabs etc.)

Common Tree Frog
(Hyla arborea Linneaus, 1758)

Common Tree Frog is the third most widespread species in South Park. Its abundance, however, is relatively lower than that established 27 years ago. It was detected in 43% (n = 14) of the ponds. In most reservoirs singing males were not more than 10-15. Temporary ponds or those that significantly reduce its sizes during the summer months cannot provide the necessary conditions for the survival of the larvae of the Common Tree Frog. "Bottleneck" in the biology of the species are conditions outside the breeding season - trees and high vegetation. Fragmentation of habitat types, mowing the grass and using pesticides against insects represent a great risk for the survival of the species.

Marsh Frog
(Pelophylax ridibundus Pallas, 1771)

Marsh Frog is the most common species in the lakes of South Park. Unlike Agile Frog and Tree Frog, the richness of the Marsh Frog highly depends on the size of reservoirs. By increasing the size of the water body and shifting conditions towards more natural the number of individuals also increases. However in large reservoirs which are most visited by fishermen the species richness is lower. The population of the Marsh Frog in South Park is in stable condition. The species is characterized by high ecological plasticity. Negative impact on it may occur if suitable habitats are reduced, mainly by draining certain ponds during summer months.

Grass Snake
(Natrix natrix Linneaus, 1758)

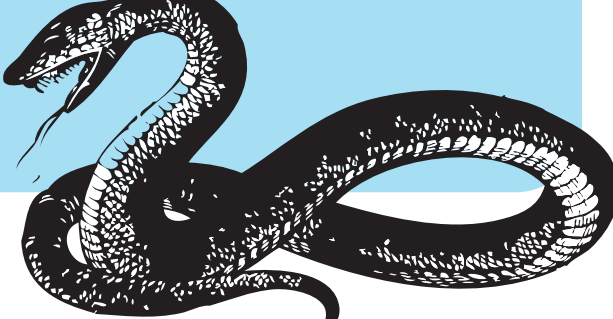
The Grass Snake is the most common reptile species in the waterways of South Park. Both subspecies occurring in Bulgaria (N. natrix natrix and N. n. persa) were observed predominating the nominate subspecies. The species is found in 35,7% (n = 14) of the ponds in the park. During most of the day the snake prefers grassy tufts along the coast for catching and enters the water in distress or to hunt. This peculiarity of the species makes it more noticeable than Dice Snake which can have a negative effect on the survival rate in this particular environment with high anthropogenic pressure.

Dice Snake
(Natrix tessellata Laurenti, 1768)

Dice Snake is a rare species for South Park compared to the Grass Snake. It was detected in only one medium sized lake. Only three individuals were observed making it one of the rarest reptiles in the park. The food spectrum of Dice Snake consists mainly of fish (Pisces) and much less amphibians. This peculiarity of the species is the cause of its close association with water and usually does not go more than 20 meters from the reservoirs being active mainly during the morning hours. Food resources are not limiting factor for this type - 5 ponds are visited by fishermen every day. It may be expected in the future to be found in other lakes.

Green Lizard
(Lacerta viridis Laurenti, 1768)

The Green Lizard is the only representative of the suborder Sauria on the territory of South Park. It was established in only five places in the peripheral parts of the South Park Part III. These places have very little human presence, rich in grass and shrub vegetation near forest



Balkan Crested Newt
(Triturus karelenii Strauch, 1870)

Over the past 27 years the population of the Balkan Crested Newt has declined severely in South Park. It was a common species in the past whereas now it was found only in two ponds (14,2%, n=14). One of the main reasons for the absence of species from most ponds is predatory fish. Another problem is the pollution of water. To improve the status of the species serious measurements must be taken in order to restore good water quality in the park as well as dealing with the predatory fish species, especially introduced species.

Agile Frog
(Rana dalmatina Bonaparte, 1840)

This new study showed that the Agile Frog is one of the most common amphibians in South Park. Unlike the previous study, however, nowadays there is a drop in the species richness. We found it in 11 (73%) of the 15 surveyed ponds in the park. In most of the ponds the Agile Frog was present with large numbers. The study confirms the dependence of the richness of the Agile Frog from the surrounding habitats (this frog species depends greatly on forest habitats) and not from the size of the wetland. South Park provides suitable habitat and sufficient number of ponds for breeding and larval development. Possible threats include pollution of water reservoirs, restocking the water bodies with predatory fish by local fishermen.

Recommendations

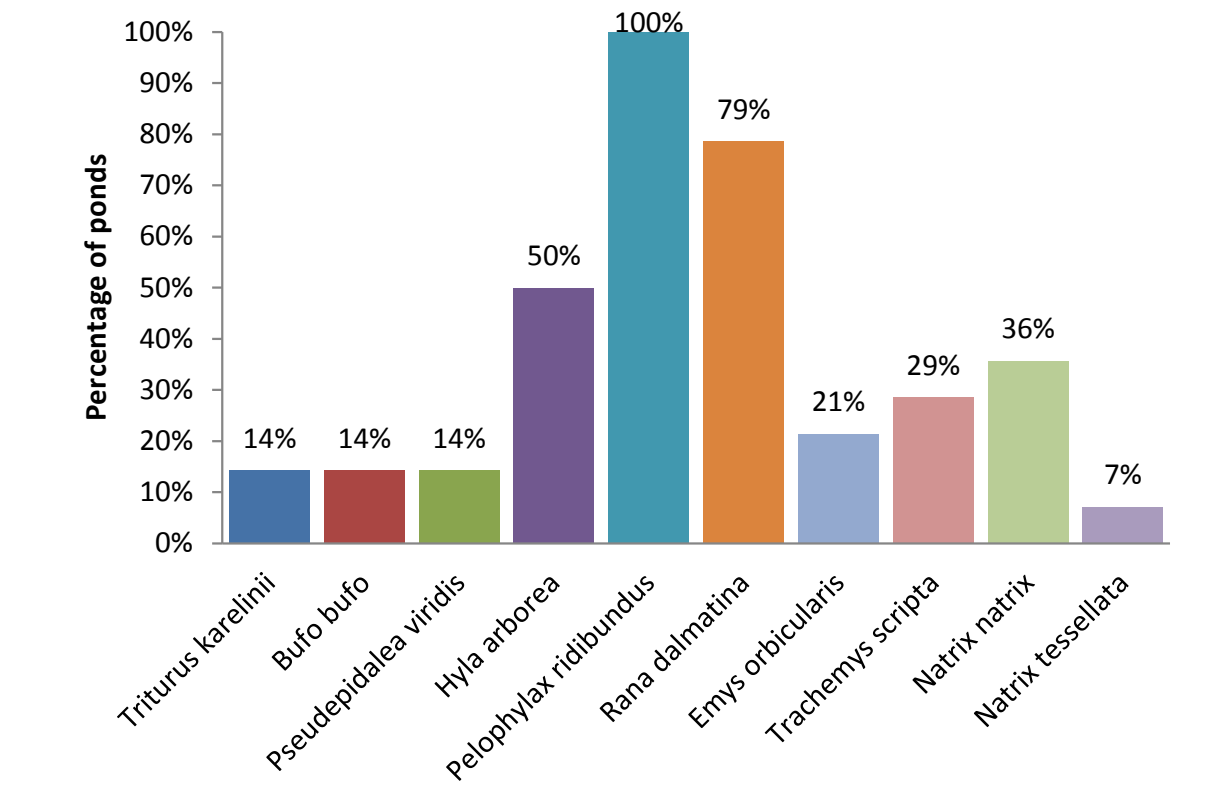
Following measurements are needed in order to preserve the fauna of amphibians and reptiles in South Park

- 1. Maintaining good water quality in South Park.
- 2. Building new ponds will increase the number of amphibians and the aquatic reptiles. Territories around the newly built facilities should correspond to the biological needs of species. It is imperative to keep some parts of the park free of chemicals and unmowed.
- 3. Taking measures to limit the number of invasive species in the park.
- 4. Applying conservation laws in case of direct or indirect destruction of amphibians and reptiles and their habitats in the park.
- 5. Increasing the conservation culture of the population through educational programs.

Conclusion

- 1. Six species of amphibians were found on the territory of South Park representing 31.5% of amphibian fauna of Bulgaria (n = 19). Reptile fauna of South Park includes 5 species (13.2% of Bulgarian herpetofauna, n = 38), one of which (Trachemys scripta) is an introduced species.
- 2. Over the past 27 years the distribution of amphibians in South Park generally decreased. As a result, one species, Yellow-bellied toad (Bombina variegata), disappeared from the park. Green and brown toads were established for the first time in South park Part III.
- 3. The most drastic reduction was recorded for the Balkan Crested Newt (Triturus karelenii). Agile and Marsh frog have more stable populations followed by the Common Tree Frog.
- 4. Reptiles in the park are mainly associated with wetland habitats and are in low numbers - two species of water turtles and water snakes. Green lizard inhabits the peripheral, less frequently visited parts of the park and has low numbers as well.
- 5. All species in the territory of South Park have important conservation significance and are included in the annexes of Bern Convention, European Directive 92/43 and Biodiversity Act of Bulgaria. Eight species are listed in the IUCN Red List in category of "low risk" and one species (Emys orbicularis) is in categorized as "near threatened".
- 6. The main negative factors that have influenced the distribution and abundance of amphibians and reptiles of South Park are: urbanization of areas associated with permanent destruction of wetlands, waterbodies settlement with invasive species, direct persecution of large species of amphibians and Reptiles from people and dogs, potentially high threat of pollution of the water bodies with various solid waste.

Abundance of amphibians and reptiles inhabiting wetlands in South Park, Sofia



Pond	size (m ²)	Species											Total number of species	
		<i>Triturus karelinii</i>	<i>Bufo bufo</i>	<i>Pseudoeidalea viridis</i>	<i>Hyla arborea</i>	<i>Pelophylax ridibundus</i>	<i>Rana dalmatina</i>	<i>Emys orbicularis</i>	<i>Trachemys scripta</i>	<i>Natrix natrix</i>	<i>Natrix tessellata</i>	amphibians		reptiles
1	900	+	-	-	-	++	lar	-	-	3	-	3	1	4
2	314	-	+	+	+	+	-	-	-	-	-	4	0	4
3	1762	-	+	+	++	+++	+++	3	15	2	-	5	3	8
4	13	-	-	-	-	-	-	-	-	-	-	0	0	0
5	63	-	-	-	-	-	-	-	-	-	-	0	0	0
6	627	-	-	-	-	+	++	-	-	-	-	2	0	2
7	769	+	-	-	+	++	+++	-	-	-	-	4	0	4
8	356	-	-	-	+	++	++	2	2	-	3	3	3	6
9	7445	-	-	-	-	+++	+++	2	1	1	-	2	3	5
10	339	-	-	-	-	-	-	-	-	-	-	0	0	0
11	2733	-	-	-	-	++	+	-	1	-	2	1	3	3
12	4268	-	-	-	++	-	-	1	2	-	1	2	3	3
13	360	-	-	-	+	-	-	-	-	-	-	1	0	1
14	629	-	-	-	++	++	lar	-	-	-	3	0	3	3
15	485	-	-	+	++	lar	-	-	-	-	3	0	3	3
16	827	-	-	-	+	++	lar	-	-	-	3	0	3	3
17	2736	-	-	-	-	+++	lar	-	-	-	2	1	3	3

- unhabited; + Low numbers; ++ Average numbers; +++ High numbers; lar. - Larvae found