

The Herpetofauna of the Peri-urban Forest Seich Sou (Kedrinis Lofos), Thessaloniki, Greece

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Abstract. Peri-urban forests have both a protective and aesthetic role in cities, contributing to the health and well-being of their residents. Seich Sou is the peri-urban forest of Thessaloniki City, Greece, with an area of about 3000 ha. It offers protection from erosion and pollution, a place for recreation and it can also provide a wildlife refuge. To date, no thorough report on the Seich Sou's herpetofauna exists in the literature, which is the aim of the present work. The presence of 32 herpetofauna species (seven amphibians and 25 reptiles) has been confirmed in the peri-urban forest, after numerous herpetological surveys that have been conducted within a 17-year time period. Amongst them, eight are listed in the Appendix II of the Council Directive 92/43/EC, three are characterized as Near Threatened and one as Vulnerable in the IUCN Red List of Threatened Species.

Key words: reptiles, amphibians, fauna, hill, urban, species, Seih Sou.

Introduction

Urban and peri-urban forests play an essential role in the health and the quality of life of cities' residents, providing a large variety of cultural ecosystem services (Beckmann-Wübbelt et al., 2021). Forests and green areas surrounding cities are proven to be key contributors to the improvement of well-being, the quality of drinking water, protection against flooding events, air pollution and soil erosion, and mitigation of climate change (Spanos et al., 2010; Salvati et al., 2017; Beckmann-Wübbelt et al., 2021). Their health-related services have been recognized by the World Health Organization (WHO) and they have been highly appreciated by the public during the COVID-19 pandemic (Beckmann-Wübbelt et al., 2021). Urban and peri-urban forests can also hold significant potential for

biodiversity conservation and environmental education (e.g. O'Brien, 2009; Davies et al., 2017).

Seich Sou (Seih Sou/Seikh Su), or else known as Kedrinis Lofos, is the peri-urban forest of Thessaloniki City, Greece (Fig. 1). It is located East of Thessaloniki and ranges in altitudes from 60 m to 570 m a.s.l. (Chatzichristaki & Zagas, 2017; Kastridis et al., 2022). Seich Sou forest occupies a total area of approximately 3000 ha. The vegetation composition belongs to the *Quercetalia pubescentis* floristic zone, at *Ostryo-Carpinion* sub-zone and, after extensive reforestation, is currently composed mainly of *Pinus brutia* and *Cupressus sempervirens* (Chatzichristaki & Zagas, 2017; Stavrinou et al., 2017). The forest originally consisted of *Quercus pubescens*, prior to the 1930's (Stavrinou et al., 2017). The

understory consists of shrubs and herbaceous species, with the most common being *Quercus coccifera*, *Paliurus spina-christi*, *Cistus incanus*, *Crataegus monogyna*, *Fraxinus ornus* and *Ulmus campestris* (Tsitsoni et al., 2004; Spanos et al., 2010). The underlying geology of Seich Sou is gneiss (Kastridis et al., 2022). The climate of the area is considered as Mediterranean with dry and hot summer (Csa category), an annual precipitation of 444.5 mm and mean annual temperature of 15.9 °C (Chatzichristaki & Zagas, 2017; Kastridis et al., 2022). There are numerous brooks and streams that filter from Seich Sou, some of them all year round. Additionally, several water reservoirs occur, formed either naturally along brooks or by small anti-flood dams. The forest of Seich Sou plays a significant role, providing protection from erosion and pollution to the city of Thessaloniki, a natural environment for recreation and wildlife observation and, being close to the city's university, it is very often used as a case study area in research projects (e.g. Vordoglou et al., 2019, and references therein).

After an extensive wildfire in 1997 approximately 60% of the forest was destroyed. Subsequently, around half of the burnt area (~800ha) was planted with various forest species, whereas the rest of the area left to naturally regenerate (Chatzichristaki & Zagas, 2017). Recently (2019), an outbreak of Bark beetle *Tomicus piniperda* has destroyed more than 300 ha of forest area (Kastridis et al., 2022).

Regarding terrestrial herpetofauna, Greece constitutes one of the richest areas in Europe, hosting up to 95 species (the taxonomy of some taxa still needs to be clarified; Sillero et al., 2014; Speybroeck et al., 2020). However, large areas of the country, both mainland and insular, are herpetologically still underexplored, or even completely unexplored (e.g. Kalaentzis et al., 2018; Strachinis et al., 2019; Strachinis, 2021, 2022). According to the Atlas of Reptiles and Amphibians of Greece (2020), about 47% of these species can be found in Central Macedonia region and about 45% are found within the Thessaloniki prefecture (43

species in total), where Seich Sou is located. To date, there has been no comprehensive report on the herpetofauna of Seich Sou in the literature. In this note, herpetofaunal records from the forest of Seich Sou, obtained over a 17-year period, are presented for the first time.

Materials and Methods

Amphibian and reptile records presented in this document are from personal observations from herpetological surveys undertaken across the whole highlighted area (Fig. 1) between 2006 and 2022. Qualitative surveys were opportunistic and sparse, and not systematic or on a daily basis. Surveys consisted of both visual observation and a search of natural and incidental artificial refugia. All individuals were identified by their distinctive morphological characters (Arnold & Ovenden, 2002; Speybroeck et al., 2016). Base maps were generated using QGIS version 3.22.9 "Białowieża" (QGIS Development Team, 2022). The exact location and coordinates of all observations have been withheld to protect these populations from poaching or other threats, but are available for scientific purposes upon request.

Results and Discussion

In total, 32 species were identified. Seven species of amphibians (one urodelan and six anuran species) and 25 species of reptiles (six turtles, eight species of lizard and 11 snakes) were recorded; see Table 1. Locations for each species are shown in Fig. 2. The number of species identified constitutes about the 74% of all herpetofauna species known to have been historically recorded within the Thessaloniki prefecture and approximately 71% known to have been recorded in the Central Macedonia region (Atlas of Reptiles and Amphibians of Greece, 2020). One amphibian and seven reptile species of those recorded in Seich Sou are listed in the Appendix II of the Council Directive 92/43/EC, while three species of reptile are characterized as Near Threatened (NT) and one species of tortoise as Vulnerable (VU) in the IUCN Red List of Threatened Species (IUCN, 2022; Table 1).

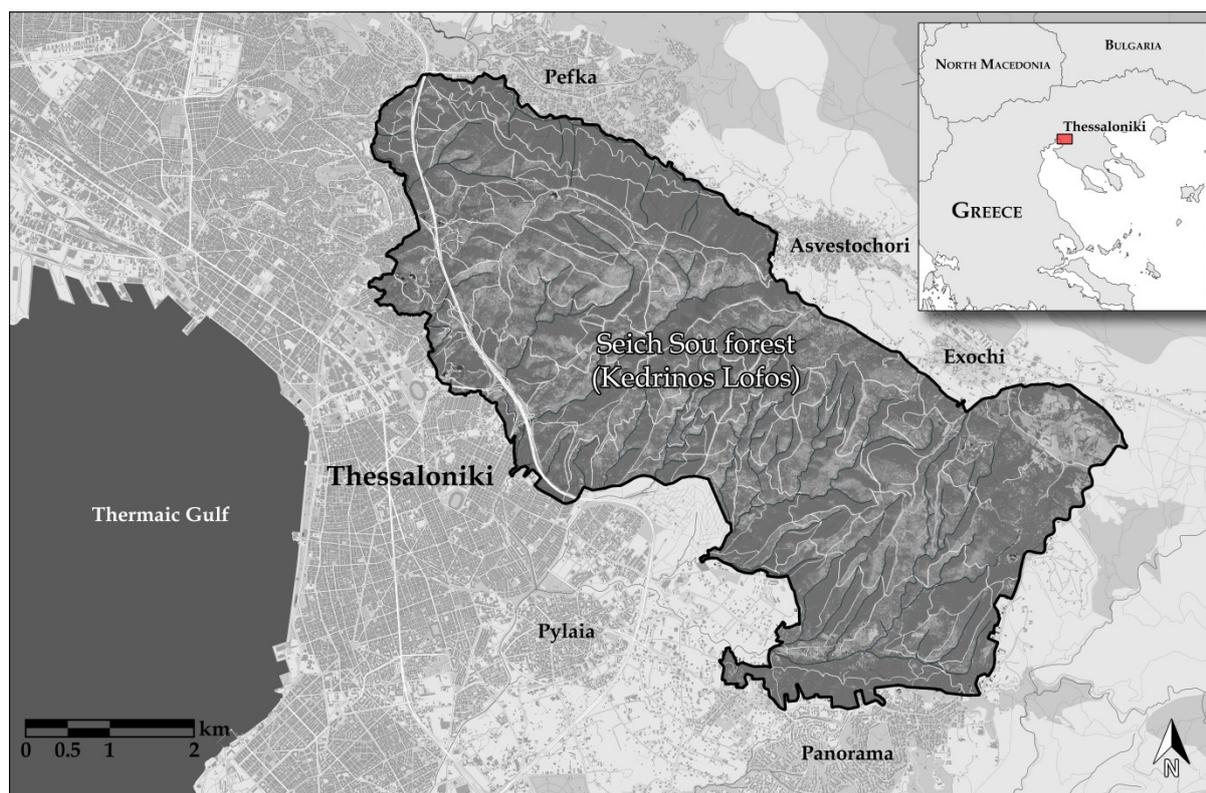


Fig. 1. Map of the study area. Seich Sou forest (Kedrinis Lofos) is outlined with black line.

The Red-eared Terrapin (*Trachemys scripta*) was the only invasive alien species (IAS) of Union concern observed, while two individuals of Margined Tortoise (*Testudo marginata*) recorded in the study area are probably as a result of translocation, as the species does not naturally occur East of the Axios valley. Starred Agama (*Laudakia stellio*) has been introduced to Thessaloniki area, probably in historical times (Klaptocz, 1910; Karameta et al., 2022) and since then it has actively dispersed across a large area, including a large part of the Chalkidiki prefecture.

The amphibian with the least observations was the Green Toad (*Bufo viridis*), while the least common native reptiles seem to be the European Pond Terrapin (*Emys orbicularis*), Kotschy's Gecko (*Mediodactylus kotschy*) and the Dice Snake (*Natrix tessellata*), which were only rarely

encountered. The only location where the European Pond Terrapin was recorded, was being shared with the IAS *Trachemys scripta*, along with several Balkan Terrapins (*Mauremys rivulata*).

The Sand Boa (*Eryx jaculus*) is represented only by one record in the study area, however, this could be due to its cryptic behavior (Christopoulos & Kotselis, 2021) and not necessarily due to rarity. The species is highly fossorial and nocturnal (Arnold & Ovenden, 2002) and thus it is not easily detected. Amongst the reptile species that are characterized as Near Threatened (IUCN: NT), the Four-lined Snake (*Elaphe quatuorlineata*) and the Hermann's Tortoise (*Testudo hermanni*) seem to be quite common with relatively healthy populations, while the Vulnerable (VU) Spur-thighed Tortoise (*Testudo graeca*) is also considerably represented within the area.

Table 1. List of herpetofauna species observed in Seich Sou forest, Thessaloniki, Greece. IUCN Red List status - LC: Least Concern; NT: Near Threatened; VU: Vulnerable (IUCN, 2022). C.D.: Council Directive 92/43/EC, Appendices II & IV (Council of the European Union, 1992). B.C.: Bern Convention, “On the conservation of European Wildlife and Natural Habitats”, Appendices II & III (Council of Europe, 1979). P.D.: Presidential Decree no. 67, Official Government Gazette 23/A/30-1-81, Board B (Hellenic Ministry of Environment and Energy, 1981). CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1975).

Order	Family	Species	Common name	Greek common name	IUCN Red List	Protection status				
						C.D.	B.C.	P.D.	CITES	
Urodela	Salamandridae	<i>Lissotriton graecus</i>	Greek Newt	Λισσοτριτώνας	LC		III	X		
Anura	Bombinatoridae	<i>Bombina variegata</i>	Yellow-bellied Toad	Κιτρινομπομπίνα	LC	II, IV	II			
	Bufonidae	<i>Bufo bufo</i>	Common European Toad	Χωματόφρωνος	LC		III	X		
		<i>Bufo viridis</i>	Green Toad	Πρασινόφρωνος	LC	IV	II	X		
	Hylidae	<i>Hyla arborea</i>	European Tree Frog	Δενδροβάτραχος	LC	IV	II	X		
	Ranidae	<i>Pelophylax kurtmuelleri</i>	Balkan Frog	Βαλκανικός βάτραχος	LC		III			
		<i>Rana dalmatina</i>	Agile Frog	Ευκίνητος βάτραχος	LC	IV	II	X		
Testudines	Emydidae	<i>Emys orbicularis</i>	European Pond Terrapin	Στυκτική νεροχελώνα	NT	II, IV	II	X		
		<i>Trachemys scripta</i>	Red-eared Terrapin	Αμερικάνικη νεροχελώνα	LC					
	Geoemydidae	<i>Mauremys rivulata</i>	Balkan Terrapin	Γραμμωτή νεροχελώνα	LC	II, IV	II	X		
	Testudinidae	<i>Testudo graeca</i>	Spur-thighed Tortoise	Ελληνική χελώνα	VU	II, IV	II	X	X	
		<i>Testudo hermanni</i>	Hermann's Tortoise	Μεσογειακή χελώνα	NT	II, IV	II	X	X	
	<i>Testudo marginata</i>	Marginated Tortoise	Κρασιπεδοχελώνα	LC	II, IV	II	X	X		
Squamata	Agamidae	<i>Laudakia stellio</i>	Starred Agama	Κροκοδειλάκι	LC	IV	II	X		
	Anguidae	<i>Anguis fragilis</i>	Slow Worm	Κονάκι	LC		III	X		
		<i>Pseudopus apodus</i>	European Glass Lizard	Τυφλίτης	LC	IV	II			
	Gekkonidae	<i>Hemidactylus turcicus</i>	Turkish Gecko	Σαμιαμιδι	LC		III	X		
		<i>Mediodactylus kotschy</i>	Kotschy's Gecko	Κυρτοδάκτυλος	LC	IV	II	X		
	Lacertidae	<i>Lacerta trilineata</i>	Balkan Green Lizard	Τρανόσαυρα	LC	IV	II	X		
		<i>Lacerta viridis</i>	Green Lizard	Πρασινόσαυρα	LC	IV	II	X		
	Scincidae	<i>Ablepharus kitaibelii</i>	Snake-eyed Skink	Αβλέφαρος	LC	IV	II			
	Erycidae	<i>Eryx jaculus</i>	Sand Boa	Έρυξ	LC	IV	III		X	
	Colubridae	<i>Dolichophis caspius</i>	Large Whip Snake	Έφιος	LC	IV	II			
		<i>Elaphe quatuorlineata</i>	Four-lined Snake	Λαφιάτης	NT	II, IV	II	X		
		<i>Platyceps najadum</i>	Dahl's Whip Snake	Σαΐτα	LC	IV	II	X		
		<i>Telescopus fallax</i>	European Cat Snake	Αγιόφιδο	LC	IV	II	X		
		<i>Zamenis situla</i>	Leopard Snake	Σπιτόφιδο	LC	II, IV	II	X		
		Natricidae	<i>Natrix natrix</i>	Grass Snake	Νερόφιδο	LC		III	X	
			<i>Natrix tessellata</i>	Dice Snake	Λιμνόφιδο	LC	IV	II	X	
	Psammophiidae	<i>Malpolon insignitus</i>	Eastern Montpellier Snake	Σαπιτής	LC		III	X		
	Typhlopidae	<i>Xerotyphlops vermicularis</i>	Worm Snake	Ανήλιος	LC		III			
	Viperidae	<i>Vipera ammodytes</i>	Nose-horned Viper	Οχιτά	LC	IV	II			

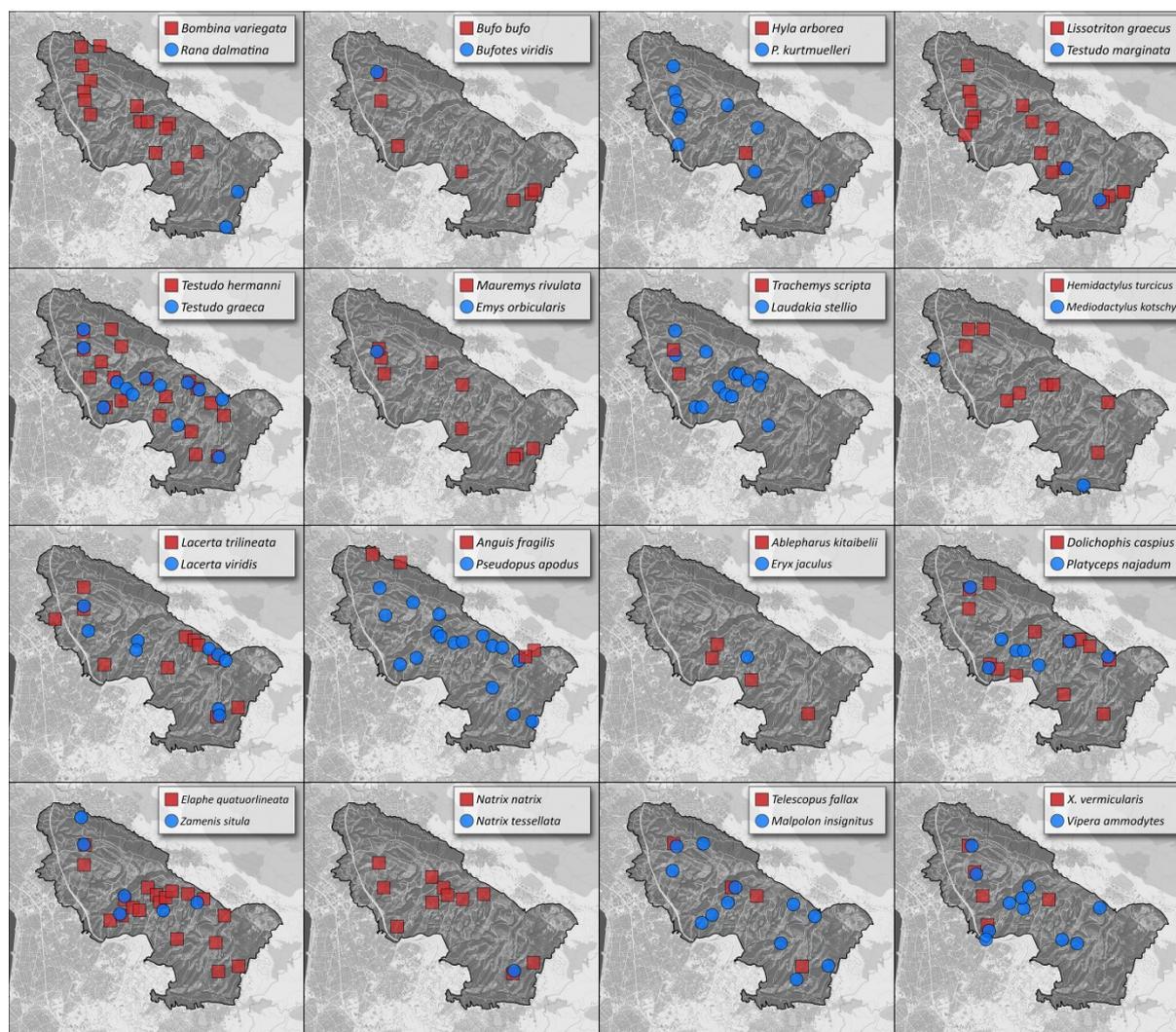


Fig. 2. Distribution maps for all amphibian and reptile species observed within the Seich Sou forest, Thessaloniki, Greece. Each spot demarcates a small area (25 ha) and might include more than one actual observation.

Species that have been recorded in nearby areas, but are surprisingly absent from within the study area, are the Balkan-Anatolian Crested Newt (*Triturus ivanbureschi*), the European Fire Salamander (*Salamandra salamandra*), the Erhard's Wall Lizard (*Podarcis erhardii*), the Balkan Wall Lizard (*Podarcis tauricus*) and the Aesculapian Snake (*Zamenis longissimus*). The Slow Worm (*Anguis fragilis*) was only observed in the North-East margin of the area where the forest is steeper, shadier and more humid. This is the area where the European Fire Salamander and the Aesculapian Snake would most likely be found, but yet to be confirmed.

The rich herpetofauna species composition within a relatively small area such as the Seich Sou forest, indicates a rich ecosystem of significant importance. However, the number of threats and pressures witnessed to be increasing throughout the study period, downgrading this significant habitat; e.g. wildfires, road construction, extensive littering, illegal motocross and off-road vehicle activity, illegal tree felling and collection of animals, systematic abandoning of dogs and other pets, insect infestations, etc. Some of the anthropogenic threats and pressures that downgrade the forest have already been identified in the literature (e.g. Stavrinou et al.,

2017; Kastridis et al., 2022). All of those pressures can have a significant impact on herpetofauna species, directly or indirectly, especially on those which are slow-moving, such as turtles. Management measures should be applied by the authorities to prevent all threats that Seich Sou is now facing, to protect and preserve this significant ecosystem and its rich biodiversity. Seich Sou can offer significant cultural ecosystem services to Thessaloniki's residents, contributing to their quality of life and conserve important species at the same time, as being a valuable wildlife refuge.

Acknowledgments

I would like to thank my good friend Stuart Graham for a pre-peer review of the manuscript.

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Received: 07.01.2023
Accepted: 19.01.2023