ECOLOGIA BALKANICA

2026, Vol. 18, Issue 1 June 2026 pp. 183-188

Batrachophagy of the Eastern Grass Snake, Natrix natrix (Linnaeus, 1758), in Bulgaria: published data and new records

Emanuil Mitrevichin[1*], Lidia Sakelarieva[1], Hristo Peshev[2], Atanas Grozdanov[3], Alexander Pulev[1]

[1]South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, 2700 Blagoevgrad, BULGARIA

[2]Fund for Wild Flora and Fauna, 49 Ivan Mihaylov Str., office 327, P.O.Box 78, Blagoevgrad, BULGARIA

[3]Sofia University "St. Kliment Ohridski", Faculty of Biology, Department of Zoology and Anthropology, 8 Dragan Tsankov Blvd., Sofia, BULGARIA

*Corresponding author: mitrevichin.emanuil@gmail.com

Abstract. The food spectrum of *Natrix natrix* in Bulgaria remains understudied, despite the few works on this topic. We summarize all data reported in the literature on the batrachophagy of the species in the country and provide 17 new observations. The results indicated that *N. natrix* has a wide food spectrum and may feed on at least 11 amphibian species. *Pelophylax ridibundus* was the most preferred prey. *Rana dalmatina* and *Bufo bufo* were also important components of the diet. In some areas, *Salamandra salamandra* may be more frequent prey for *N. natrix* than previously thought. However, most of the amphibian species, including *Triturus ivanbureschi*, *Bombina variegata*, *Pelobates balcanicus*, and *Rana temporaria*, were consumed less frequently. These findings can have important implications for the conservation of the species. Yet, further research on the feeding ecology of *N. natrix* in Bulgaria is needed to better understand its ecological requirements and to support effective conservation planning.

Key words: Natricidae, amphibians, diet, Balkan Peninsula.

Introduction

In Bulgaria, the diet of *Natrix natrix* (Linnaeus, 1758) consists primarily of frogs. The species also consumes toads, newts, and occasionally salamanders (Beshkov & Nanev, 2002). Other food items – fish, birds, lizards, rodents, and insects – may also be consumed, but only rarely (Michev, 1958; Beshkov & Nanev, 2002).

Although there is some general information on the batrachophagy of *N. natrix* in Bulgaria (Beshkov & Nanev, 2002; Buresch & Zonkow, 1934; Stojanov et al., 2011), a small number of studies offer case-specific observations (Beshkov & Dushkov, 1981; Buresch & Zonkow, 1942; Grozdanov et al., 2016, 2025a,b; Michev, 1958; Mitrevichin et al., 2025; Undjian, 2000). Most of these studies reported isolated cases in which *N. natrix* fed on particular amphibian species: *Pelobates balcanicus* Karaman, 1928 (Buresch & Zonkow, 1942), *Bufotes viridis* (Laurenti, 1768) (Undjian, 2000), *Pelophylax ridibundus* (Pallas, 1771) (Grozdanov et al., 2016, 2025b), *Hyla orientalis* Bedriaga, 1890 (Grozdanov et al., 2025a,b), and tadpoles of *Bombina variegata* (Linnaeus, 1758) (Mitrevichin et al., 2025) (Table 1).

To our knowledge, so far only two studies have specifically examined the diet of *N. natrix* in Bulgaria (Beshkov & Dushkov, 1981; Michev, 1958). Michev (1958) studied the feeding habits of *N. natrix* along the course of the Kitenska Reka River in the Strandzha Mountains and found that *P. ridibundus* was the most preferred prey (22.7%). Michev also concluded that the Eastern Grass

Snake may sometimes feed on individuals of the Agile Frog, *Rana dalmatina* Fitzinger in Bonaparte, 1838. The Fire Salamander, *Salamandra salamandra* (Linnaeus, 1758) was also mentioned by Michev as a part of the food spectrum of *N. natrix*, but from another part of the country. He reported several cases of Fire Salamanders found in the stomach contents of Eastern Grass Snakes. Beshkov & Dushkov (1981) investigated the feeding habits of *N. natrix* in western Bulgaria. Similar to Michev (1958), they found that the species predominantly consumed individuals of *P. ridibundus* (38.6%). In addition, Beshkov & Dushkov (1981) reported predation on individuals of *Triturus ivanbureschi* Arntzen and Wielstra, 2013, *H. orientalis*, *Rana graeca* Boulenger, 1891, and *B. variegata* (Table 1).

To date, almost no historical and contemporary data are available on the diet of *N. natrix* in Bulgaria. The aim of this study was to (i) summarize all the published data on the batrachophagy of *N. natrix* and (ii) provide new records to supplement the knowledge of the species diet.

Materials and methods

We have reviewed all published sources of information on the diet of *N. natrix* in Bulgaria known to us. The new data were gathered from 1998 to 2025 during field trips and surveys conducted across the country. They were not aimed at investigating the food spectrum of the species, and the data were collected as a result of opportunistic observations. This approach has its limitations, for example the small sample size. Yet, given the scarcity of systematic data on the diet of *N. natrix* in Bulgaria, these observations provide valuable information and suggest somewhat distinct food preferences in the species.

Results and Discussion

Differences in the dietary spectrum of grass snakes are largely determined by habitat characteristics, including the availability of prey and potential competitors. Thus, the local variations in the diet of the species are quite high (Luiselli et al., 2005). Although the sample size of the present study (published and new data) is small, it indicates that *N. natrix* consumes a wide variety of amphibians, which includes at least 11 species (Table 1). Our results showed that *P. ridibundus* was the most common prey. This finding is consistent with other studies, which demonstrate that individuals of the genus *Pelophylax* typically constitute a large part of the diet of *N. natrix* (Mebert et al., 2024; Šukalo et al., 2014, 2026). Similar results were presented for the diet of *N. helvetica* (Lacépède, 1789) (Gregory & Isaac, 2004). The predominance of *P. ridibundus* may be explained by the fact that it is one of the most abundant amphibians in the aquatic habitats in Bulgaria (Beshkov & Nanev, 2002).

Rana dalmatina and *B. bufo* also seemed to be important prey for *N. natrix* (Table 1). *Rana dalmatina* is comparatively widespread in Bulgaria, and its distribution largely overlaps with that of *N. natrix* (Beshkov & Nanev, 2002; Stojanov et al., 2011). This overlap increases the probability of encounters between individuals of the two species and results in higher predation by *N. natrix*. *Bufo bufo* is reported as a preferred prey for *N. natrix* in some local populations across the species range (Luiselli et al., 1997; Mebert et al., 2024). Furthermore, *B. bufo* is a vital component of the diet of *N. helvetica*, a closely related grass snake species (Filippi et al., 1996; Gregory & Isaac, 2004; Luiselli & Rugiero, 1991; Luiselli et al., 2005; Reading & Davies, 1996), whose biological and ecological characteristics are similar to those of *N. natrix*. The Eastern Grass Snake must also frequently consume individuals of *B. viridis*. The Green Toad is widespread in Bulgaria (Beshkov & Nanev, 2002; Stojanov et al., 2011), and *N. natrix* presumably preys on it when available.

It seems that *N. natrix* does not feed on the other amphibian species very often. For example, both *R. temporaria* and *R. graeca* are only documented once (Table 1). In fact, as far as we know, *R. temporaria* has not been previously reported as a prey species of *N. natrix* in Bulgaria. The limited overlap in the distributions of these species probably explains why *N. natrix* rarely preys on R. *graeca* and *R. temporaria*. *Rana temporaria* occurs mainly in high mountainous areas – usually above 1000 m (Beshkov & Nanev, 2002; Stojanov et al., 2011), whereas *N. natrix* is most widespread and abundant below 1000 m a.s.l. (Kornilev et al., 2023). Similarly, *R. graeca* is found mainly in southwestern Bulgaria (Pulev et al., 2015; Stojanov et al., 2011).

Triturus ivanbureschi, *B. variegata*, and *P. balcanicus* also appear to be rarely consumed by *N. natrix* in Bulgaria (Table 1). This is expected, as these amphibians normally do not constitute a significant part of the diet of *N. natrix* (Mebert et al., 2024). In fact, poisonous amphibian species are not gene-

rally preferred by the snake (Mebert et al., 2024). We also assume that *H. orientalis* is not a major element of the diet of *N. natrix* in the country because the two species occupy different microhabitats. *Hyla orientalis* is mainly arboreal, whereas *N. natrix* is semi-aquatic and is not an effective climber, though grass snakes have occasionally been observed climbing shrubs and trees, typically up to 3–4 m in height (Bringsøe & Aastrup, 2017 and citations therein). *Hyla orientalis* may thus become a potential prey for the snake predominantly during the breeding season when the frog inhabits various water bodies (Beshkov & Nanev, 2002). This interpretation is supported by the study of Kaczmarski (2020), who documented arboreal foraging and ambush behavior by grass snakes on treefrogs during their breeding season.

Even though *S. salamandra* is considered to be rarely consumed by *N. natrix* (Beshkov & Nanev, 2002; Mebert et al., 2024), we suggest that salamanders can sometimes be a relatively common part of the diet of *N. natrix* in Bulgaria. We base our suggestion on the fact that, to some extent, the two species have similar habitat requirements and coexist in some areas, particularly along mountain and foothill rivers and streams (Beshkov & Nanev, 2002; Biserkov et al., 2007). Indeed, Michev (1958) reported frequent predation of *S. salamandra* by *N. natrix*. Importantly, his observations were made for a short period: during one summer. This reveals that salamanders could be an alternative food item for grass snakes, especially when the abundance of other prey is low.

Note that two of our observations were made at dusk, and one at night. On 3 May 2025 at 7:16 p.m., an adult *N. natrix* was feeding on an adult *S. salamandra*; on 15 June 2025 at 11:15 p.m., another adult *N. natrix* was swallowing an adult *S. salamandra*; and on 25 August 2024 at 8:40 p.m., an adult *N. natrix* was feeding on an adult *B. viridis*. Such crepuscular and nocturnal activity is not exceptional, as this snake species can forage during warm nights (Kaczmarski, 2020; Mebert et al., 2024). In addition, two cases of night-time feeding from Bulgaria have previously been reported (Beshkov & Dushkov, 1981).

Table 1. Summary of the information on the batrachophagy of *N. natrix* in Bulgaria.

Prey species	Prey species age group	*N. natrix* age group	Location	Coordinates	Date and time	Source
Triturus ivanbureschi	ad.	-	western Bulgaria	-	1971–1974, 1979	Beshkov & Dushkov, 1981
Salamandra salamandra	ad.	-	Ribaritsa	-	summer 1956	Michev, 1958
Salamandra salamandra	ad.	ad.	NE of Trigrad	41°37'25" 24°24'01"	3 May 2025 7:16 p.m.	Hristo Peshev, Present study
Salamandra salamandra	ad.	ad.	Between Dolen and Presoka	41°25'24" 25°06'38"	15 June 2025 11:15 p.m.	Valentin Kamberov, Present study
Bombina variegata	ad.	-	western Bulgaria	-	1971–1974, 1979	Beshkov & Dushkov, 1981
Bombina variegata	larv.	juv.	near Rakitna	-	2021–2024	Mitrevichin et al., 2025
Pelobates balcanicus	ad.	ad.	near Elhovo	-	10 August 1936	Buresch & Zonkow, 1942
Pelobates balcanicus	ad.	ad.	NW of General Todorov	41°27'40" 23°16'15"	spring 2012	Deyan Duhalov, Present study
Bufo bufo	ad.	ad.	Blagoevgrad (Elenovo)	41°59'52" 23°06'20"	2 May 2017	Emanuil Mitrevichin, Present study
Bufo bufo	ad.	ad.	South Park Sofia	42°40'05" 23°18'28"	17 May 2022	Atanas Grozdanov, Present study
Bufo bufo	ad.	ad.	Hotnishki waterfall near Hotnitsa	43°08'45" 25°30'52"	24 June 2024 2:35 p.m.	Lilyana Georgieva, Present study

Bufotes viridis	ad.	ad.	Nisovo	-	9 October 1997	Undzhijan, 2000
Bufotes viridis	ad.	ad.	Provadia	43°09'46" 27°26'51"	25 August 2024 8:40 p.m.	Tsoni Zlatev, Present study
Hyla orientalis	ad.	-	western Bulgaria	-	1971–1974, 1979	Beshkov & Dushkov, 1981
Hyla orientalis	juv.	ad.*	South Park Sofia	42°40'06" 23°18'26"*	April 2006*	Grozdanov et al., 2025a,b
Rana temporaria	ad.	ad.	W of Govedartsi	42°15'19" 23°26'59"	26 June 2021 12:25 p.m.	Anna Nikol Klimentova, Present study
Rana dalmatina	ad.	-	Kitenska Reka river	-	August 1957	Michev, 1958
Rana dalmatina	ad.	-	western Bulgaria	-	1971–1974, 1979	Beshkov & Dushkov, 1981
Rana dalmatina	ad., larv.	-	-	-	-	Undzhijan, 2000
Rana dalmatina	ad.	ad.	Ahtopol	42°06'00" 27°56'02"	24 August 2010 11:25 a.m.	Krasimir Donchev, Present study
Rana dalmatina	ad.	ad.	Krumovgrad	41°26'31" 25°39'22"	2016–2021	Deyan Duhalov, Present study
Rana graeca	ad., larv.	-	western Bulgaria	-	1971–1974, 1979	Beshkov & Dushkov, 1981
Pelophylax ridibundus	ad.	-	Kitenska Reka river	-	August 1957	Michev, 1958
Pelophylax ridibundus	ad.	-	western Bulgaria	-	1971–1974, 1979	Beshkov & Dushkov, 1981
Pelophylax ridibundus	ad., larv.	-	-	-	-	Undzhijan, 2000
Pelophylax ridibundus	ad.	ad.	Pancharevo Dam	42°36'16" 23°24'10"	May 1998	Atanas Grozdanov, Present study
Pelophylax ridibundus	ad.*	ad.*	South Park Sofia	42°40'05" 23°18'26"*	1 June 2009*	Grozdanov et al., 2025b
Pelophylax ridibundus	ad.*	ad.*	South Park Sofia	42°39'38" 23°18'27"*	-	Grozdanov et al., 2025b
Pelophylax ridibundus	larv.	juv.	N of Mostovo	41°51'22" 24°56'05"	29 August 2012 3:20 p.m.	Krasimir Donchev, Present study
Pelophylax ridibundus	ad.	ad.	SW of Rakitna	41°50'37" 23°10'21"	25 April 2015	Grozdanov et al., 2016
Pelophylax ridibundus	larv.	juv.	E of Mamarchevo	42°07'08" 26°47'59"	14 April 2018 11:30 a.m.	Krasimir Donchev, Present study
Pelophylax ridibundus	ad.	ad.	E of Archar	43°47'16" 23°01'18"	16 June 2020 3:55 p.m.	Krasimir Donchev, Present study
Pelophylax ridibundus	ad.	ad.	N of Primorsko	42°17'13" 27°44'58"	9 October 2022 1:45 p.m.	Dimitar Pazderkov, Present study
Pelophylax ridibundus	ad.	ad.	NW of Ahtopol	42°06'17" 27°55'20"	3 July 2024	Atanas Grozdanov, Present study
Pelophylax ridibundus	juv.	juv.	NE of Dolna Banya	42°19'57" 23°47'30"	07 June 2025	Lilia Philipova, Present study

*additional data about the species published by Grozdanov et al. 2025a,b

Conclusions

Although the opportunistic nature of the data means these findings should be considered to be qualitative, this paper has revealed that *N. natrix* feeds on a variety of amphibian species across Bulgaria and probably prefers some of them. Our findings might have important implications for the conservation of the species, as reductions in amphibian abundance due to various threats could increase the vulnerability of *N. natrix* populations in some regions. Given the overall lack of research on the food spectrum of the species, we recommend that future studies on the feeding ecology of the Eastern Grass Snake in Bulgaria be prioritized.

Acknowledgments

We are grateful to everyone who kindly provided their personal observations and data.

References

Beshkov, V., & Dushkov, D. (1981). Materials on the batrachophagy and herpetophagy of snakes in Bulgaria. *Ekologiya*, 9, 43–50. [in Bulgarian, Russian and English summary]

Beshkov, V., & Nanev, K. (2002). *Amphibians and reptiles in Bulgaria*. Sofia, Bulgaria: Pensoft, 120 p. [in Bulgarian]

Biserkov, V., Naumov, B., Tzankov, N., Stojanov, A., Petrov, B., Dobrev, D., & Stoev, P. (2007). *A field guide to amphibians and reptiles of Bulgaria.* Sofia, Bulgaria: Green Balkans, 196 p. [in Bulgarian]

Bringsøe, H., & Aastrup, P. (2017). *Natrix natrix* (Linnaeus, 1758) climbing tree to a height of 475 cm. *Herpetozoa*, 29(3–4), 212–214.

Buresch, I., & Zonkow, J. (1934). Untersuchungen über die Verbreitungder Reptilien und Amphibien in Bulgarien und auf der Balkanhalbinsel. II Teil: Schlangen (Serpentes). *Mitteilungen aus den Königlichen naturwissenschaftlichen Instituten in Sofia – Bulgarien*, 7, 106-188. [in Bulgarian, German summary]

Buresch, I., & Zonkow, J. (1942). Untersuchungen über die Verbreitung der Amphibien und Reptilien in Bulgarien und auf der Balkanhalbinsel. IV Teil: Froschlurche (Amphibia, Salientia). *Mitteilungen aus den Königlichen naturwissenschaftlichen Instituten in Sofia – Bulgarien*, 15, 68–154. [in Bulgarian, German summary]

Filippi, E., Capula, M., Luiselli, L., & Agrimi, U. (1996). The prey spectrum of *Natrix natrix* (Linnaeus, 1758) and *Natrix tessellata* (Laurenti, 1768) in sympatric populations (Squamata: Serpentes: Colubridae). *Herpetozoa*, 8(3–4), 155–164.

Gregory, P., & Isaac, L. (2004). Food habits of the grass snake in southeastern England: Is *Natrix natrix* a generalist predator? *Journal of Herpetology*, 38(1), 88–95. doi: 10.1670/87-03A

Grozdanov, A., Peshev, H., Stoynov, E., Vangelova, N., van Leest, M., Wielpstra, H., & Parvanov, D. (2016). Contribution to the faunistic research and conservation of the herpetofauna of northern Kresna Gorge and some adjacent areas. *Annuaire del'Université de Sofia "St. Kliment Ohridski" Faculte de Biologie*, 101(4), 44–54.

Grozdanov, A., Sokolov, A., Petrov, P., Dimitrov, D., Atanasov, V., Peshev, H., & Mitrevichin, E. (2025a). New data on the batrachofauna of South Park, Sofia (Bulgaria) – species composition, distribution, and conservation threats. *ZooNotes*, 270, 1–4. doi: 10.69085/zn20250270

Grozdanov, A., Mitrevichin, E., Atanasov, V., Sokolov, A., Petrov, P., Dimitrov, D., & Peshev, H. (2025b). Contribution to the research of reptile species of South Park, Sofia city – species, distribution, and conservation threats. *ZooNotes*, 272, 1–4. doi: 10.69085/zn20250272

Kaczmarski, M. (2020). Arboreal foraging and ambush by grass snakes (*Natrix natrix*) on European treefrogs (*Hyla arborea*). *Herpetological Bulletin*, 154, 39–40. doi: 10.33256/hb154.3940

Kornilev, Y., Popgeorgiev, G., Plachiyski, D., Dyugmedzhiev, A., Mladenov, V., Andonov, K., Lukanov, S., Vacheva, E., Slavchev, M., & Naumov, B. (2023). Distribution of the grass snake (*Natrix natrix*) and dice snake (*Natrix tessellata*) in Bulgaria. *Historia Naturalis Bulgarica*, 45(9), 239–254. doi: 10.48027/hnb.45.093

Luiselli, L., & Rugiero, L. (1991). Food niche partitioning by water snakes (Genus *Natrix*) at a freshwater environment in central Italy. *Journal of Freshwater Ecology*, 6(4), 439–444. doi: 10.1080/02705060.1991.9665323

Luiselli, L., Capula, M., & Shine, R. (1997). Food habits, growth rates, and reproductive biology of grass snakes (*Natrix natrix*) (Colubridae) in the Italian Alps. *Journal of Zoology*, 241(2), 371–380. doi: 10.1111/j.1469-7998.1997.tb01965.x

Luiselli, L., Filippi, E., & Capula, M. (2005). Geographic variation in diet composition of the grass snake (*Natrix natrix*) along the mainland and an island of Italy: The effects of habitat

type and interference with potential competitors. *Herpetological Journal*, 15(4), 221–230.

Mebert, K., Jablonski, D., & Pleguezuelos, J.M. (2024/updated July 2025). Grass snakes: Eastern Grass Snake (*Natrix natrix*), Western Grass Snake (*Natrix helvetica*), Ibero-Maghrebian Grass Snake (*Natrix astreptophora*). In Murphy, J.C.M. (Ed.), *Aquatic snakes, diversity and natural history.* JCM Natural History with Herpetological Conservation International, pp. 464–479.

Michev, T. (1958). The Grass snake (*Natrix natrix*). *Priroda i znanie*, 11(2), 17–18. [in Bulgarian]

Mitrevichin, E., Sakelarieva, L., Peshev, H. & Pulev, A. (2025). Notes on the herpetofauna in the northwestern foothills of the Pirin Mountains, south-western Bulgaria. *ZooNotes*, 274, 1–4. doi: 10.69085/zn20250274

Pulev, A., Sakelarieva, L., & Manolev, G. (2015). Distribution of Balkan Stream Frog *Rana graeca* Boulenger, 1891 (Anura: Ranidae) in south-western Bulgaria. *Journal of Balkan Ecology*, 18(4), 375–388.

Reading, C., & Davies, J. (1996). Predation by grass snakes (*Natrix natrix*) at a site in southern England. *Journal of Zoology*, 239(1), 73–82. doi: 10.1111/j.1469-7998.1996.tb05437.x

Stojanov, A., Tzankov, N., & Naumov, B. (2011). *Die Amphibien und Reptilien Bulgariens*. Frankfurt am Main, Germany: Chimaira, 582 p., 500 col photos. [in German]

Šukalo, G., Đorđević, S., Gvozdenović, S., Simović, A., Anđelković, M., Blagojević, V., & Tomović, L. (2014). Intra- and inter-population variability of food preferences of two *Natrix* species on the Balkan Peninsula. *Herpetological Conservation and Biology*, 9(1), 123–136.

Šukalo, G., Nikolić, S., Dmitrović, D., & Tomović, L. (2026). Sexual dimorphism, feeding ecology, and reproductive traits in the grass snake (*Natrix natrix*) from the Ramsar site "Bardača Wetland" (Republic of Srpska, Bosnia and Herzegovina). *Acta Herpetologica,* 21, 18320. doi: 10.36253/a_h-18320

Undjian, E. (2000). *Die Lurche und Kriechtiere des Lomtales und des Naturparkes „Russenski Lom", Bezirke Russe und Rasgrad Nordostbulgarien.* Russe, Bulgaria: NP Russenski Lom. [in Bulgarian, German summary]

Received: 22.03.2026
Accepted: 12.05.2026