



## Bats over the Western Black Sea Open Water Area

*Heliana Dundarova\**, *Boyan Michev* & *Ivan Pandourski*

Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria

**Abstract:** Migration activity of bats of *Pipistrellus nathusii* across the European seas have been reported mainly for the North and Baltic Sea basins. Recently, we have recorded the species for first time within the Bulgarian Black Sea exclusive economic zone (100 km off the country's coast). In addition, six species, i.e. *Myotis daubentonii*, *Nyctalus leisleri*, *N. lasiopterus*, *Pipistrellus pipistrellus*, *P. nathusii* and *Eptesicus serotinus*, were identified over St. Anastasia Island in the Burgas Bay. These results suggest the necessity for organisation of a long-term acoustic monitoring for determination of bat migration movements along the Bulgarian Black Sea coast and in open sea areas using ships and platforms.

**Key words:** Chiroptera, migration, echolocation, island

### Introduction

Evidence of bat flight activity across seas in Europe is available for the North, Baltic and Black Seas (STRELKOV 1969, AHLÉN 1997, AHLÉN et al. 2007, WALTER et al. 2005); however, studies on seasonal bat movements over the Black Sea are sporadic. E.g., unidentified bat species were detected around the lights of a ship at a distance of 15–20 km off the Eastern Caucasus Coast in October 1925 (KUZYAKIN 1950). PUZANOV (1938) observed a single bat specimen in the central part of the Black Sea during the spring migration. KAGALMITSKY (1960) reported hundreds of bats landing on the masts of the sailing ship “Vega” located between the Crimean Peninsula and the coast of Asia Minor, about 100 miles off the nearest shore. KURSKOV (1978) determined the migration route of the Ukrainian bat populations along the Dnieper River to the south-eastern coast of the Crimean Peninsula and from there across the Black Sea to the Balkan Peninsula. The author believed that the overcoming of large sea areas by bats is determined by paleo-historical factors such as the ancient shorelines of the basins preceding the recent

Black Sea. AHLÉN (2009) suggested that bats used other sensory systems for long-distance navigation based on their ultrasounds, which were with slightly lower frequencies and longer pulse intervals; he believed that bats flew close to the water to use water surface echoes for orientation.

Data on bat movements along the Bulgarian Black Sea Coast (areas of salt, brackish and fresh-water coastal water bodies) were published by PANDOURSKI (2004) and PANDOURSKI & WITCHER (2007). Presence of bats in sea caves on the Southern Bulgarian Black Sea Coast as well as over estuaries in the same area was reported by POPOV et al. (2005).

In this article, we present for the first time details on bat species composition and their flight activity over the Bulgarian St. Anastasia Island, as well as the longest flight of *Nathusius pipistrelle* over the western part of the Black Sea.

### Materials and Methods

The fieldwork was carried out in the autumn of 2011 at two sites during the research voyage on the Bulgarian research ship Academic in the sea area above

\*Corresponding author: [heliana.dundarova@iber.bas.bg](mailto:heliana.dundarova@iber.bas.bg)

the continental shelf in the Exclusive Economic Zone (EEZ) of the Republic of Bulgaria and in the summer of 2020 at one site on St. Anastasia Island (Fig. 1):

- **Site 1** – 191 km east of Cape Shabla and 240 km south-west of the Crimean Peninsula. A flying individual near the ship was observed at 09:03 am and echolocation calls were recorded using Petersson D 240x. Date: 09.09.2011. Coordinates N43.274306 E30.938111.

- **Site 2** – 144 km east of the nearest coast (Cape Shabla) and 284 km south-west of the Crimean Peninsula. A male individual of *Pipistrellus nathusii* landing on the ship was caught at 09:55 am (Fig. 2). The weather was sunny and calm. Date 10.09.2011. Coordinates N43.244972 E30.348583.

- **Site 3** – St. Anastasia Island (N42.468020 E27.552794), Burgas Bay, within the inland sea waters of the Republic of Bulgaria (Fig. 3). The island is formed by rocks of volcanic origin and covers an area of only 0.9 hectares. Echolocation calls were recorded using M500-384 USB Ultrasound Microphone and BatSound Touch recording program that saves the recordings as 16-bit .WAV files. Sound analysis was performed using BatSound 3.1 for Windows (FFT size 512, Hanning window). Date: 28.06 – 29.06.2020 from 22:18 pm to 00:16 am.

## Results

Based on analyses of bat echolocation calls, six species were identified. For the percentage of recorded flights of each species at the site 3, see Fig. 4.

***Myotis* sp. 45 KHz phonetic type:** a single overflight was registered (site 3). The echolocation call frequency of the most energy was concentrated between 42.8 and 44.0 KHz. The interpulse interval varied from 4.3 ms to 6.7 ms.

***Nyctalus leisleri* (Kuhl, 1817) (Leisler's bat):** eight overflights were registered at the site 3. The specimens emitted alternating echolocation calls with the most energy from 22.4 KHz to 26.9 KHz.

***Nyctalus lasiopterus* (Schreber, 1780) (greater noctule bat):** registered with a single overflight (site 3). The analysis of alternating echolocation calls of a flying specimen in open space gave us a reason for unequivocal species determination. The duration of the calls with lower frequencies was between 21.0 ms and 21.9 ms. The frequencies with the most energy were between 14.8 KHz and 15.9 KHz. The terminal frequencies were between 12.1 KHz and 12.4 KHz. The duration of the calls with higher frequencies was shorter – 15 ms, with the most energy at 17.6 KHz and terminal frequency at 14.8 KHz. The interpulse interval varied from 285



Fig. 1. Map of the study region, where the sites 1 and 2 present the points where *Pipistrellus nathusii* were registered, and the site 3 is St. Anastasia Island.

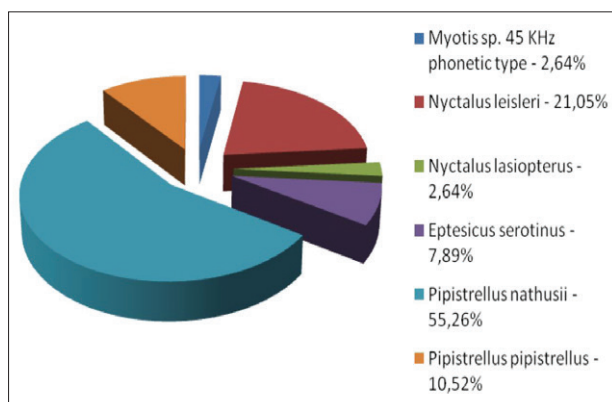


Fig. 2. Flying *Nathusius' pipistrelle Pipistrellus nathusii* around the ship "Akademik" at the site 2 (photo B. Michev).



Fig. 3. St. Anastasia Island (photo H. Dundarova).

ms to 816 ms. These sound characteristics clearly distinguished the species from the noctule *Nyctalus noctula* (Schreber, 1774) and the European free-tailed bat *Tadarida teniotis* (Rafinesque, 1814). They completely corresponded to the proposed by ESTÓK & SIEMERS (2009) call features for determination of the greater noctule bat in flight in open habitats.



**Fig. 4.** Ratio of the number of registered overflights (%) of the species at the site 3 (St. Anastasia Island).

***Pipistrellus pipistrellus* (Schreber, 1774) (common pipistrelle):** registered with four overflights (site 3). Emitted echolocation calls completely overlapped with those of the common pipistrelle: the frequencies with the most energy varied between 45.1 KHz and 46.7 KHz.

***Pipistrellus nathusii* (Keyserling & Blasius, 1839) (Nathusius' pipistrelle):** registered with 21 overflights (site 3). A single male specimen was captured on the ship "Akademik" (site 1) and flight of an individual was documented with recording of echolocation calls and photo-documented above the open sea area at the site 2 (Fig. 3). Echolocation calls have typical characteristics for the species and their frequencies with the most energy varied between 37.4 KHz and 42.0 KHz.

***Eptesicus serotinus* (Schreber, 1774) (Sero-tine bat):** registered with three overflights at the site 3. Emitted echolocation calls had the most energy at 25.3 – 31.0 KHz, with regular interpulse interval between 245 ms and 250 ms.

## Discussion

The majority of recorded bat species on St. Anastasia Island, except for *Nyctalus leisleri*, are common over the Burgas wetlands and the city of Burgas (PANDOURSKI 2004), at a distance of 7.5 to 15 km from the studied site. The island, as well as the water area of Burgas Bay, can be considered part of their feeding habitat.

Daubenton's bat *Myotis daubentonii* (Kuhl, 1817) is an abundant species in the Burgas wetlands during the breeding season, which gives us a reason to believe that our registered individual on St. Anastasia Island belongs to this species. *Pipistrellus pipistrellus* is a common and abundant species during the summer and autumn periods in the city of

Burgas, 6.5 km from the site 3. *Pipistrellus nathusii* is extremely numerous along the entire Bulgarian Black Sea Coast, especially during the autumn migration period (PANDOURSKI 2004).

The greater noctule bat *N. lasiopterus* has been reported periodically from the southern Bulgarian Black Sea Coast (BENDA et al. 2003) including the estuary of the Silistar River on the Strandzha Mts. coast (PANDOURSKI & WITCHER 2007). The serotine bat *Eptesicus serotinus* has also been observed in the city of Burgas, the adjacent wetlands and some sea caves in the Dobrich Region (BENDA et al. 2003).

It is known that *Pipistrellus nathusii*, *Nyctalus leisleri* and *N. lasiopterus* are migrant species, whereas *Eptesicus serotinus* is a sedentary species (HUTTER et al. 2005). The Nathusius' pipistrelle and the serotine bat are found regularly on oil platforms and ships in the North Sea (BOSHAMER & BEKKER 2008), contrary to expectations for the second species. Furthermore, *P. nathusii* fly over the Baltic Sea from the southernmost points of Sweden and forage over the sea in areas with an abundance of insects in the air and crustaceans in the surface waters (AHLÉN 1997, AHLÉN et al. 2009). Therefore, the occurrence of the species hundreds of kilometres off the land, in the Black Sea raises the question about potential foraging above the sea surface, navigation of bats during flight and the role of ships and platforms as resting places during the migration period. The initial step for such explorations should be acoustic monitoring on important sites in the North and South Black Sea coast and using boats/ships or platforms in the open sea area.

**Acknowledgements:** *In memory of our colleague, the late Tanyo Michev.* The study was supported by the Bulgarian Ministry of Education and Science under the National Research Program "Young scientists and postdoctoral students" approved by DCM # 577/17.08.2018. The authors would like to thank to the SC "Chudni Skali" represented by Lazar Milchev for his logistic work. We are grateful to Peter Ostoich for providing linguistic proofreading of the manuscript.

## References

- AHLÉN I. 1997. Migratory behaviour at south Swedish coast. *Zeitschrift für Säugetierkunde* 62: 375–380.
- AHLÉN I., BACH L., BAAGØE H. J. & PETERSSON P. 2007. Bats and offshore wind turbines studied in southern Scandinavia. Swedish Environmental Protection Agency, Stockholm, Sweden, Report 5571: 1–35.
- AHLÉN I., BAAGØE H. J. & BACH L. 2009. Behavior of Scandinavian bats during migration and foraging at sea. *Journal of Mammalogy* 90(6): 1318–1323.
- BENDA P., IVANOVA T., HORÁČEK I., HANÁK V., ČERVENÝ J.,

- GAISLER J., GUEORGUIEVA A., PETROV B. & VOHRALÍK V. 2003. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean. Part 3. Review of bat distribution in Bulgaria. *Acta Societatis Zoologicae Bohemicae* 67: 245–357.
- BOSHAMER J. P. C. & BEKKER J. P. 2008. Nathusius' pipistrelles (*Pipistrellus nathusii*) and other species of bats on offshore platforms in the Dutch sector of the North Sea. *Lutra* 51: 17–36.
- ESTÓK P. & SIEMERS B. M. 2009. Calls of a bird-eater: the echolocation behaviour of the enigmatic greater noctule, *Nyctalus lasiopterus*. *Acta Chiropterologica* 11(2): 405–414.
- HUTTERER R., IVANOVA T., MEYER-CORDS C. & RODRIGUES L. 2005. Bat migrations in Europe. A review of banding data and literature. Federal Agency for Nature Conservation, Bonn.
- KAGALMITSKY V. G. 1960. Bats above the sea. *Priroda*. Issue 10: 95 (In Russian).
- KURSKOV A. N. 1978. The bat hunters. Forestry Publishing House, 136 p. (In Russian).
- KUZYAKIN A. P. 1950: Bats (systematic, lifecycle and benefits for agriculture and forestry). Moscow: Sovetskaya Nauka, 444 p. (In Russian).
- PANDOURSKI I. 2004. Bats (Mammalia, Chiroptera) of the Burgas Wetlands, Bulgarian Black Sea Coast. *Acta Zoologica Bulgarica* 56 (3): 283–298.
- PANDOURSKI I. & WITCHER R. 2007. Bats of non-lotic Bulgarian wetlands. In: MICHEV T. M. & STOYNEVA M. P. (Eds.): Inventory of Bulgarian wetlands and their biodiversity. Part 1: Non-Lotic Wetlands. Sofia: Publishing House Elsi-M, 364 p.
- POPOV V., PANDOURSKI I., PANDOURSKA-WITCHER R. & BESHKOV V. 2005. Small mammals (Insectivora, Chiroptera, Lagomorpha, Rodentia) in the area of Strandzha Mountain, South-Eastern Bulgaria. In: Challenges of establishment and management of a trans-border biosphere reserve between Bulgaria and Turkey in Strandzha Mountain. Proceedings of an UNESCO-BAS-MOEW workshop, Burgas, Bulgaria, 11-13 November 2005, pp. 87–104.
- PUZANOV I. I. 1938. Zoogeography. Book on Demand Ltd, 368 p. (In Russian).
- STRELKOV P. P. 1963. Order Chiroptera – Bats. In: SOKOLOV I. I. (Ed.): Mammals of the Fauna of the USSR. Part 1. Moscow & Leningrad: Izdatel'stvo Akademii Nauk SSSR, pp. 122–218. (In Russian).
- WALTER G., MATTHES H. & JOOST M. 2007. Fledermauszug über Nord- und Ostsee – Ergebnisse aus Offshore-Untersuchungen und deren Einordnung in das bisher bekannte Bild zum Zugeschehen. *Nyctalus* (Neue Folge), Berlin 12: 221–233.

Received: 04.01.2021

Accepted: 07.03.2021