

**Preliminary evidence on the efficacy of Artificial Cover Objects
as a monitoring tool for the Dice snake *Natrix tessellata*
in an anthropised landscape**

(Serpentes: Natricidae)

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Artificial Cover Objects (ACOs) are a cost-effective and efficient tool for monitoring reptiles and amphibians, particularly useful in detecting elusive or inactive individuals. In this study, a single corrugated bitumen ACO was deployed above a rocky embankment along a lakeshore in a highly anthropised area, aiming to increase the detectability of the Dice snake (*Natrix tessellata*). Over 24 field surveys, 14 out of 21 individuals were recorded under the artificial shelter. Instances of communal sheltering were also observed and are briefly described. These preliminary results suggest that this type of ACO may facilitate the detection and monitoring of *N. tessellata* in human-modified landscapes. Given the species' tendency to use artificial structures, such shelters could represent a valuable addition to standardised survey methods, supporting further ecological and conservation research on this species.

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Introduction

The use of Artificial Cover Objects (ACOs) is a safe, efficient and cost-effective method for monitoring and conserving reptiles and amphibians (Liberman et al. 2024). Amphibians and reptiles use these as shelters for predator avoidance, thermoregulation, hydoregulation, and protection from harsh conditions (Lillywhite 1987, Cowan et al. 2021). In addition, ACOs have proven to increase surveys efficiency (Engelstoft & Ovaska 2000, Sewell et al. 2012) and to facilitate the detection of inactive or highly elusive and cryptic reptiles (Michael et al. 2012, Faraone et al. 2023). Among the various types of ACOs, corrugated bitumen sheets are particularly popular for surveying reptiles (Liberman et al. 2024). These sheets are

available in different sizes, feature narrow openings, heat rapidly, and are also lightweight, durable, and inexpensive (Lettink & Cree 2007).

The Dice snake, *Natrix tessellata* (Laurenti 1768), is a semi-aquatic and mainly piscivorous natricid widespread across Europe, North Africa, the Middle East and Central Asia (Mebert 2011, Di Nicola et al. 2021). In Italy, its presence covers all mainland regions, excluding the southern areas of Puglia and Calabria and western Liguria, with populations that can occur in high densities (Di Nicola et al. 2021). There is some evidence that these animals like to hide and bask using artificial structures such as rocky embankments (Conelli et al. 2011) and plastic sheets (De Leo et al. 2006). Even though some studies using ACOs in Italy are present (e.g., Zanfei et al. 2022,

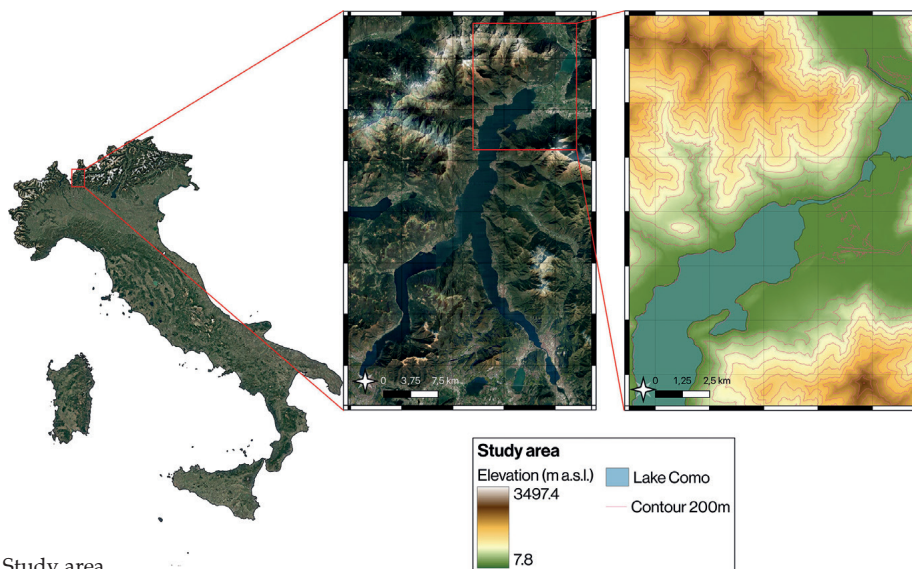


Fig. 1. Study area.

Chiacchio et al. 2023), there is a lack of successful studies using ACOs as a monitoring technique for *N. tessellata*.

Table 1. Observations of Dice snakes (*Natrix tessellata*) in the selected transect with an artificial shelter. SVL, snout-vent length (in cm); M, male; F, female; Yes, snake found under shelter; No, snake found outside shelter.

Date	Time	Sex	SVL	Shelter
16-03-2024	13:30	M	52	No
19-04-2024	15:45	F	67	Yes
25-04-2024	13:55	F	65	No
19-05-2024	13:30	F	68	No
19-05-2024	13:55	F	65	Yes
19-05-2024	13:55	F	67	Yes
01-06-2024	11:15	F	75	Yes
01-06-2024	11:15	F	75	Yes
01-06-2024	11:15	F	70	Yes
22-06-2024	09:15	F	74	Yes
30-06-2024	11:05	F	68	No
24-07-2024	07:30	F	68	Yes
05-08-2024	07:20	F	68	Yes
09-08-2024	10:35	F	74	No
07-09-2024	10:05	F	67	No
09-09-2024	10:40	F	68	No
09-09-2024	18:25	F	80	Yes
09-09-2024	18:25	F	76	Yes
28-09-2024	12:30	F	76	Yes
29-09-2024	12:25	F	65	Yes
29-09-2024	12:25	F	76	Yes

Material and methods

From March to October 2024, 24 surveys were conducted in the northern part of Lake Como (Fig. 1) as part of a health monitoring project (Di Nicola et al. 2026). We chose a suitable transect of about 100 m (approx. coordinates 46°10' N, 9°24' E, altitude 250 m a.s.l.) in which we placed a singular ACO with an area of 0.85 m² and a thickness of 2.6 mm, made of corrugated bitumen, above a rocky embankment along the lakeshore within an anthropised landscape (Fig. 2A).

Results

During the 24 surveys, a total of 21 Dice snakes were recorded (Tab. 1, Fig. 2B), 14 of which (66.66 %) were found under the ACO. On four occasions, communal sheltering was observed (i.e., 19th May, 1st June, 9th September and 28th September) with two (n=3) or three (n=1) adult females. The snakes were found separately and coiled in a resting position. Since the snakes were not in contact, it is believed that they were spacing themselves apart and social interaction was limited to mutual tolerance. In fact, under some conditions (e.g., scarce or patchy suitable cover), animals may be forced to aggregate and share a resource (Gregory 2004).

Discussion

Of the 21 Dice snakes observed, two-thirds were found under the ACO. In the year preceding the present study, we conducted five surveys along



Fig. 2. A. Placement of the ACO. B. Dorsal view of one of the *N. tessellata* found under the ACO.

the same transect without using ACOs, and we encountered only one snake. Although the number of snakes encountered and captured at a given location and period depends on numerous variables, in this transect, it is also significantly influenced by the site

characteristics, presenting numerous refuges in the crevices of the boulders that constitute the shore. Therefore, while this data from a single use of an ACO is insufficient to predict trends across different populations and contexts, it provides additional

evidence that implementing them in surveys in this type of habitat could enhance our ability to encounter a greater number of snakes.

The preliminary data presented in this work suggest that corrugated bitumen could be an effective method for surveying this species. Moreover, given the high prevalence of *Ophidiomyces ophidiicola* reported in the Dice snake (Di Nicola et al. 2025), it's important to monitor the health status of more populations, and we believe that these types of ACOs could be a valuable tool for engaging a higher number of snakes. Since these ACOs are relatively easy and inexpensive to implement, their use can be a practical aid in standardised snake population studies.

Further studies using multiple artificial cover objects in different habitats are needed (Margenau et al. 2020). These investigations could help us understand if the effectiveness of shelters is associated with certain predictors such as time of year, size, sex, or age class, allowing us to develop more effective monitoring strategies.

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