REPTILES & AMPHIBIANS

Winter Activity in an Urban Population of Montpellier Snakes (*Malpolon monspessulanus*) in Northwestern Spain

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The Montpellier Snake, *Malpolon monspessulanus* (Hermann 1804), is distributed across North Africa (from the Atlantic Coast of the Sahara to the border of Algeria and Tunisia), most of the Iberian Peninsula (except for the Cantabrian area), southern France, and northeastern Italy (Pleguezuelos 2014). It is absent in areas with an annual isotherm of 8–9 °C and more than 90 freezing days per year (Blázquez and Pleguezuelos 2002). *Malpolon monspessulanus* is a Mediterranean species that typically inhabits scrub and open areas below 2,100 m asl. However, it can be found in anthropogenically altered areas. In Galicia, these snakes occupy the warmest regions along the southern coast, in river valleys, and in a few small northern areas of the Eurosiberian region (Cabana 2011).

The species is diurnally active (Valverde 1967), although reports document crepuscular activity during the hotter months (González de la Vega 1988). Activity peaks in June (Pleguezuelos and Brito 2008) and detectability appears to be higher during hotter years in the southeastern Iberian Peninsula (Moreno-Rueda and Pleguezuelos 2007). Its activity period typically runs from spring to autumn (Pleguezuelos 2021), although active individuals have been reported in southern Portugal in November (Malkmus 2008). These observations of this species during autumn and winter in its northwestern range could be a response to climate warming.

We herein document the activity of juvenile and adult Montpellier Snakes in an urban area in Vigo, Pontevedra, northwestern Spain (42.2079, -8.7317) during autumn and winter. Habitat in the area is a combination of stone walls, small cultivated fields, and an industrial area. This area has been regularly monitored as part of a study on urban reptiles and introduced species. Temperature and precipitation data were retrieved from the regional meteorological service in Vigo (elev. 100 m asl) (Meteogalicia 2024).

Between 2021 and 2024, we encountered two juveniles and one male *M. monspessulanus* during autumn and winter in the study area (Fig.1). The first encounter was on 17 September 2021. Between November 2021 and March 2024, individuals were detected thermoregulating on a stone wall in an urban area, which we considered unusual considering the species' documented activity period. Specifically, on 12 December 2021, we found a juvenile and an adult male, and on 14 January 2024, we found two juveniles and one adult male. On 17 January 2024, we found a dead juvenile nearby. In all, we encountered Montpellier Snakes 27 times during autumn/winter between November 2021 and March 2024 (Table 1), suggesting that these snakes were at least tolerant of lower temperatures (< 7 °C) and rainy days.

Climate change appears to be altering the distribution and behavior of amphibians and reptiles. Moreno-Rueda et al. (2012) and Sillero (2021) reported shifts in the distribution of Spanish reptiles to the north and to higher elevations. Bas (1984) had noted that the activity period for *M. monspessulanus* in Galicia extended from March to October. Moreno-Rueda et al. (2009) reported an extension of the activity period and Cabana (2011) an extension of the

Figure 1. A juvenile Montpellier Snake (*Malpolon monspessulanus*) in Vigo, Pontevedra, Spain, on 6 December 2024. Photograph by Cesar Ayres.

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Table 1. Maximum and minimum temperature and rainfall data for each day Montpellier Snakes (*Malpolon monspessulanus*) individuals were detected in Vigo, Pontevedra, northwestern Spain.

Date	Temperature (°C) Max.	Min.	Rain (cm)
14 February 2024	23.8	16.1	0.0
13 February 2024	19.4	13.6	1.8
19 January 2024	14.8	4.5	0.0
14 January 2024	17.8	12.6	11.7
14 January 2024	17.8	12.6	11.7
14 January 2024	17.8	12.6	11.7
06 January 2024	13.2	4.4	0.0
30 January 2023	13.0	8.2	25.0
30 December 2023	13.0	8.2	25.0
19 November 2023	20.0	12.3	0.0
05 January 2023	15.2	6.3	0.0
12 January 2022	18.1	8.0	0.0
11 January 2022	18.0	7.7	0.0
07 January 2022	14.7	6.7	0.0
02 January 2022	18.4	11.4	0.0
02 January 2022	18.4	11.4	0.0
01 January 2022	22.2	14.6	11.0
31 December 2021	22.6	12.4	0.0
30 December 2021	18.5	11.6	0.0
30 December 2021	18.5	11.6	0.0
30 December 2021	18.5	11.6	0.0
28 December 2021	18.6	14.8	3.1
25 December 2021	17.7	11.7	3.8
12 December 2021	16.6	7.0	0.0
12 December 2021	16.6	7.0	0.0
18 November 2021	18.8	7.7	0.0
12 November 2021	18.8	7.0	0.0

range toward more northerly areas in eastern Galicia. In our study area, maximum and minimum temperatures during the study period seem to reflect an increasing trend in winter temperatures.

Our data indicate that this species is adjusting to climate change by extending its activity period. Rugiero et al. (2013) reported shifts in the annual phenology of Asp Vipers (*Vipera aspis*) that correlate with climate change. Capula et al. (2016) reported long-term, climate change-related shifts in monthly patterns of road-killed Western Whipsnakes (*Hierophis viridiflavus*). The impact of a prolonged activity period on individual fitness is uncertain, but indications of issues related to nocturnal temperature increases exist in other reptiles (Rutschmann et al. 2023). Higher winter temperatures could have a negative impact on snake survival due to increased metabolic rates and energy consumption during brumation (Capula et al. 2016) and, according to Lopez Calderon et al. (2017), climate change could affect Montpellier Snake populations in the southeastern Iberian Peninsula by causing the loss of the oldest and longest-living individuals.

Further monitoring studies, using temperature dataloggers and measurements of snake corporal temperature, would be useful for better understanding the changes in the activity period of this Mediterranean species at the northern limit of its distribution.

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