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Research Article

Reptile dispersal from a hibernaculum in an agricultural landscape in Western France

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ABSTRACT – Observations have been made on post hibernation movements in four species of reptile, *Heirophis viridiflavus*, *Natrix natrix*, *Vipera aspis* and *Lacerta bilineata*, around a hibernaculum in western France. Movement around the hibernaculum was observed between late March and late May with most sightings in April. Sightings gradually declined as April progressed with no reptiles seen after May 28.

INTRODUCTION

Winter temperatures are a key factor in the survivorship of temperate reptiles and hence selection of an appropriate winter hibernaculum is a crucial life history attribute (e.g. *Vipera berus*: Viitanen, 1967; Presst, 1971; *Thamnophis sirtalis*: Gregory, 1977; *V. aspis*: Altweg et al,. 2005). The biology of hibernacula has been fairly well-studied in some North American reptiles (e.g. Macartney, et al., 1989; Brent Charland, 1989, Harvey & Weatherhead, 2006; Gregory, 2011) but less information is available on species from Europe (Viitanen, 1967; Presst, 1971; Whiting & Booth, 2012). At high latitudes in the northern hemisphere, most reptiles are in their wintering sites from mid-October to mid-March. Following Spring re-emergence activity usually consists of basking and short distance movement close to the den entrance (Street, 1979). Unless the hibernaculum lies within the home range, dispersal to a summer home range usually follows. Although an important aspect of their ecology these initial movements around the hibernation area and eventual dispersal from the den are rarely reported. This note describes post hibernation movements around a hibernaculum in western France.

METHODS

The study locality was in Vendee, Western France (46°27`N;1°53`W) in a fragmented landscape consisting mainly of agricultural land, small urban areas and patches of woodland usually connected by extensive hedgerows. Situated in the northern end of a hedgerow system surrounding what had previously been a drainage ditch, the den area consisted of a discontinuous series of drainage pipe remnants of approximately 1 m diameter. European ash (*Fraxinus excelsior*) formed the canopy with a dense understory of bramble growth (*Rubus fruticosus*). A combination of autumn leaf fall, drifting soil from agricultural land and lack of maintenance resulted in debris entering the pipes, leaving only limited openings of less than 15 cm at the top of the pipes for entry. The exact and full extent of the chamber was difficult to determine, but it is possible that it extended under the break in the hedgerow system at its northern limit near the den entrance (Fig. 1), since it had previously opened into a still in use drainage system.

Surveying commenced 22 March after the first sighting and continued throughout the active year. Most visits were twice daily but were dependent on weather. Surveying was undertaken between 09:20 and 10:50 hrs and 15:30 and 18:40 hrs (CET) and usually completed within one hour. Detection was by visual encounter by walking alongside both sides of the hedgerow surrounding the den at a distance of 4-6 m. This included hedgerows to the north/north east, west and south (Fig. 3). Also searched were areas of approximately 5-10m of farmland to the east and west of the hedgerows and the grassy areas next to the road. These areas had little vegetation at the time and only *Lacerta bilineata* was seen 2-3 m onto the

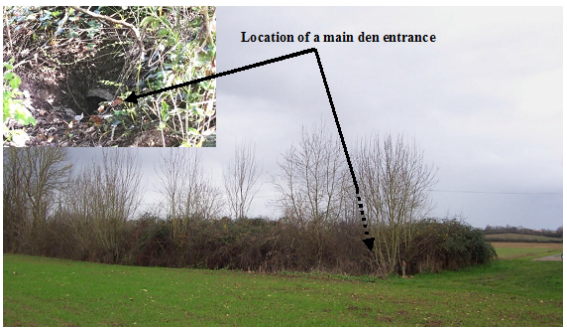

Figure 1. View of the area surrounding the hibernaculum from the north-east (photograph taken December) showing cover of dense bramble and ash. Insert shows location of one of the main entrances, an almost submerged drainage pipe, which was located about 4m into the bramble to the rear of the bottom arrow.

agricultural area west of the western hedgerow. Each hedgerow was surveyed once during a visit. When possible individual snakes or lizards were photographed for identification. All reptile locations were recorded and plotted on a map (*Google Earth*) along with date of observation. To estimate the areas within the sighting locations, convex polygons that enclosed all the sightings were constructed using the measuring tool on *Google Earth*. Areas within the polygons *A* were calculated using the formula of Heron of Alexandria,

$$A = \sqrt{(p\ (p - a)\ (p - b)\ (p - c))}$$

where p is the semi-perimeter and a, b and c the lengths of the sides. If the polygons had more than three sides the area was subdivided into irregular triangles and the values summed.

RESULTS

On 27 occasions between 22 March and 28 May three species of snake, *Natrix natrix*, *Hierophis viridiflavus* and *Vipera aspis* and the western green lizard, *L. bilineata*, were recorded around the hibernaculum. The initial observation was of an adult *H. viridiflavus* (in ecdysis) on 22 March close to the main den entrance. Five adult *L. bilineata* were subsequently seen basking alongside the western edge of the hedgerow on April 6. Three *L. bilineata* (based on body colouration and pattern) were later seen alongside the western hedgerow between April 7 and April 9 indicating road crossings. The most frequently seen species was *V. aspis*, initially observed on the afternoon of 28 March when 2 were basking on the western edge of the main hedgerow. On 3 occasions, between April 15 and 24, 5 *V. aspis* were recorded in a single visit. Based on size differences, three *N. natrix* were present but no more than one was observed on a single visit. The largest of these crossed the road bisecting the two hedgerows and was seen basking alongside the western hedgerow on April 7. Only *V. aspis* were not found at the western hedgerow, which would have required

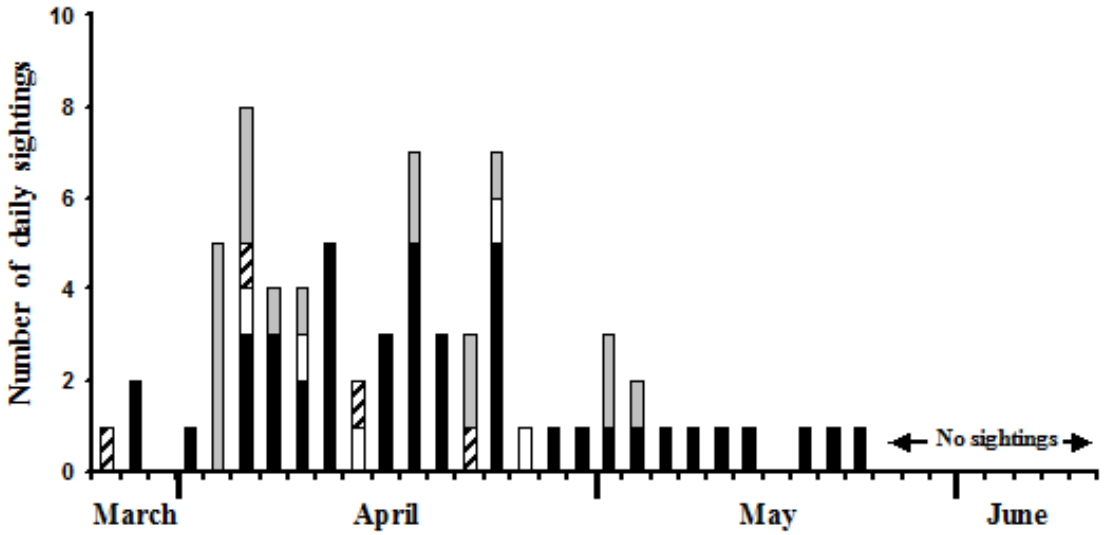

Figure 2. Sighting frequencies during surveys at the hibernaculum between 22 March and 28 May. Solid bars indicate *V. aspis*, crosshatched *H. viridiflavus*, open *N. natrix* and grey *L. bilineata*. Most sightings during May were of a single *V. aspis* (see Meek, 2013).

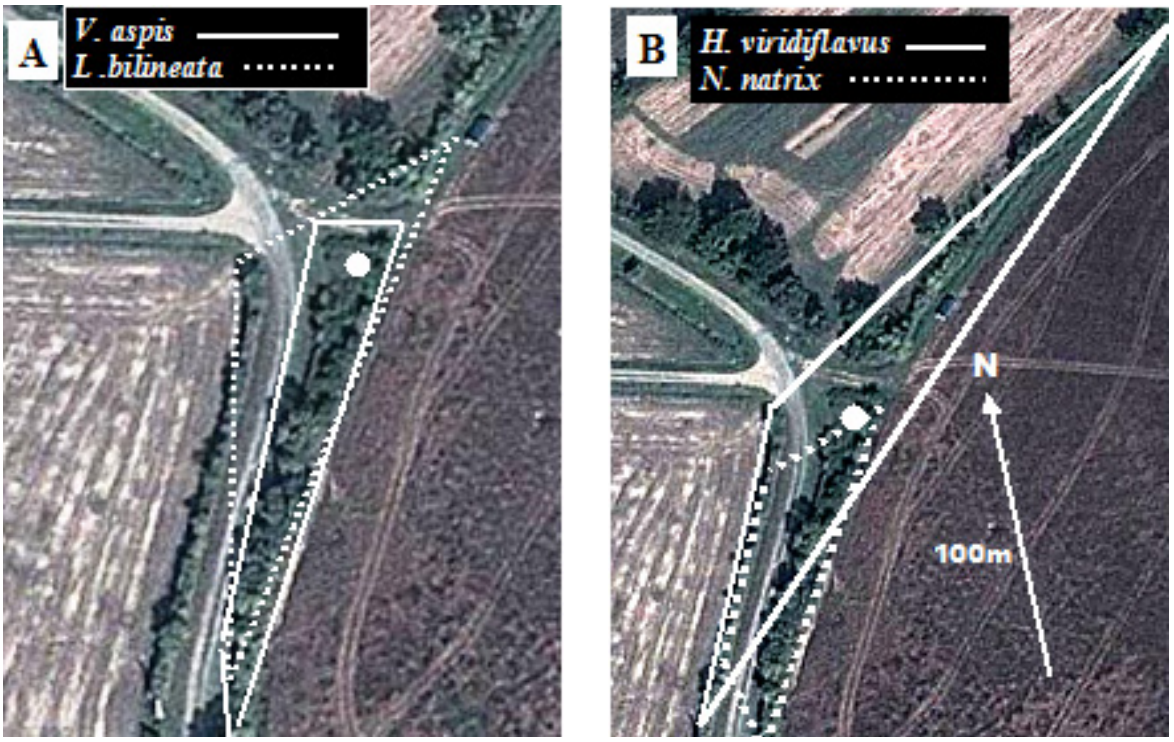

Figure 3. Aerial photographs (Google Earth) of the study locality showing main entrance to the hibernaculum (white circle) located at the northern end of the hedgerow. Lines are convex polygons that enclose all post hibernation sighting locations for *H. viridiflavus* and *V. aspis* (continuous) and *N. natrix* and *L. bilineata* (broken).

a road crossing.

Most sightings (all species) were during April (*mean* per visit = 3.7±3.27, *range* = 1 – 8) but towards the end of the month sightings declined. Observations of *V. aspis* after April 24 were of a single snake, which was found predated on 28 May (Meek, 2013). The final spring sightings of the remaining species were:- *H. viridiflavus*, 23 April, *N. natrix*, 25 April and *L. bilineata*, 5 May. Figure 2 shows daily sightings during the spring period. After 28 May no reptiles other than wall lizards (*Podarcis muralis*) were recorded until a *H. viridiflavus* was seen basking daily (am) at the opening of the hollow base of an oak tree (*Quercus sessiliflora*) situated in the hedgerow to the North East between 14-29 August. Late summer/ autumn sightings at the den area of *V. aspis* and *L. bilineata* were made during mid October and early November. Areas within the polygons were for *H. viridiflavus* 0.86ha (n = 1), *L. bilineata* 0.32 ha (n = 5), *V. aspis* 0.25 ha (n = 5) and *N. natrix* 0.36 ha (n = 3). Figures 3a & b show aerial photographs of the study area with the polygons that enclose the sightings.

DISCUSSION

The results indicate that after emergence from hibernation the reptiles remained close to the den area for an approximate 45-day period between March and late May then dispersed from the hibernaculum. However, activity before their initial detection (22 March) was likely and hence the time around the den longer. Previous studies have indicated reptiles remain in the vicinity of dens for around 5 weeks when hibernacula may be used as cold weather shelters (Gregory, 1982; 2011, Whiting & Booth, 2012). It is not known if the reptiles were spatially separated within the den but communal hibernation is known in *N. natrix*, *V. aspis* and *L. bilineata* (Street, 1979). The observation of *H. viridiflavus* is problematical. Based on body pattern it is likely that this was a single snake that may not have over wintered at the main den, but in the hollow base of a nearby oak tree where a *H. viridiflavus* was seen during August. Adults of this species are wide-ranging foragers that make short distance post hibernation movements before foraging more widely (Ciofi & Chelazzi, 1994). They do not normally hibernate communally (although see

Capula et al., 1997).

Many species show fidelity to hibernacula (Brown & Parker, 1976; Clark et al, 2008 – although see Harvey & Weatherhead, 2006) and although late autumn vegetation limited reptile detection, sightings of *L. bilineata* and *V. aspis* during October and early November in the vicinity of the den could suggest a return to the hibernaculum. Sightings of *L. bilineata* and *V. aspis*, including *V. aspis* neonates (most likely born Autumn 2013) at the den during spring 2014 support the notion of frequent winter den use – although not necessarily by the same reptiles. Longer distance movements from hibernacula would be unusual in lizards but in *L. bilineata* may be a consequence of living in an agricultural landscape with limited usable habitat or due to errors in detection. The latter is important since changes in basking, for example from open locations in spring to more secluded areas in hotter weather, may influence sighting frequencies and distort temporal estimates. Areas within the polygons are also subjective since they are derived from different sample sizes and could be impacted by errors in detection. Therefore the polygons are not comparable and simply indicate areas within which sightings were made.

The characteristics of the hibernaculum were similar to those found in previous studies (e.g. Burger et al., 1988). The entrance(s) were located deep in dense bramble a semi-evergreen that may have value in providing insulation from wind and low temperatures and by trapping drifting snow providing further insulation (Dolby & Grubb, 1999). Crucial is the potential for flooding, which although occurs at the southern end of the main hedgerow during midwinter has never been observed at the main den area at the northern end of the hedgerow which was on slightly higher ground. The south to north linear nature of the hedgerow presented basking opportunities at most times of day and must have advantages after spring emergence (e.g. Gienger & Beck, 2011; Whiting & Booth, 2012). The western hedgerow functioned as a buffer against cold north or north-west winds. The results highlight the importance of small patches of potentially key habitat for population persistence in hibernating reptiles, especially in environments dominated by agriculture where suitable sites may be limited.

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