A LIVE TRAPPING METHOD FOR THE PROTECTED EUROPEAN SLUG, *GEOMALACUS MACULOSUS* ALLMAN 1843 (ARIONIDAE)

The Kerry Slug, *Geomalacus maculosus* Allman 1843, was first discovered in Co. Kerry, Ireland in 1842 and described as a new species in 1843 (Allman, 1843, 1844, 1846). It is now also known from northern Spain and northern Portugal and although the species has been reported from Brittany in France (Demars, 1873), there is no voucher material in museum collections nor any subsequent records and consequently the French record is now widely regarded as being erroneous (Platts & Speight, 1988; Falkner *et al.*, 2002). Although, in recent times, *G. maculosus* has been repeatedly collected in south-west Ireland and northern Spain, there is evidence of a decline in its core Iberian range (Platts & Speight, 1988). In Portugal records of the species over the past 100 years have been rare (Platts & Speight, 1988) and in Ireland there is a dearth of quantitative data on favourable management practices, the habitat size required to sustain populations and genetic variation across its home range (Anonymous, 2008). For these reasons and because of its narrow global distribution, *G. maculosus* is listed as a protected species in Appendix II of the Bern Convention and subsequently in Annex IV (a) of the EU Habitats Directive 92/43/EC. Under Irish legislation, the slug has further protection under the Wildlife Act 1976 under Statutory Instrument No. 112 of 1990 and seven Special Areas of Conservation have been designated for its conservation (Anonymous, 2010).

The lack of an effective and repeatable trapping method (Anonymous, 2010) has hampered research on *G. maculosus* and the development of strategies for its conservation. To address this limitation, the efficacy of a range of refuge traps were tested at two sites in south-west Ireland. The first site, Glengarriff Nature Reserve (51.75327N, 9.56417W) located in West Cork is classified as an oak-birch-holly woodland (WN1) according to Fossitt (2000). The second site is a lowland blanket bog (PB3) according to Fossitt (2000) and is located in Cashelkeelty, Co. Kerry (51.75717N, 9.80257W). In the woodland, eight mature sessile oak (*Quercus petraea* (Mattuschka) Liebl.) with bryophyte-covered trunks and a circumference of >1.5 m (measured 1.5 m from the ground surface) were randomly selected while at the blanket bog site, eight sandstone outcrops (>10 m^2) were randomly chosen. At both study sites, numerous *G. maculosus* were observed during preliminary investigations.

Refuge traps have frequently been used to sample slugs in a wide range of habitats (e.g. Archard *et al.*, 2004; Clements & Murray, 1991; Young, 1990), but their potential use in collecting *G. maculosus* has not been investigated. In this study a number of different, baited, refuge trap types were tested. These included a wood trap and a styrofoam trap which comprised a 0.25 m^2 square of plywood and styrofoam respectively. Since *G. maculosus* is known to feed on carrots in captivity (Platts & Speight, 1988) these traps were baited with 2.5 cm lengths of carrot. Metric traps (0.25 m^2), manufactured by De Sangosse (Pont du Casse, France), are made up of absorbent material covered with a reflective upper surface and a black perforated plastic on the underside. They were used for two additional refuge trap types. The first was baited with carrot and the second with ethylene glycol. The latter was used following the example of Brady & Pearce (2007) who successfully collected *Pallifera* species in the eastern U.S. using pitfall traps baited with venison and ethylene glycol, the latter intended as a preservative. The authors postulated that slugs were attracted by the ethylene glycol as opposed to the venison because they are considered strict herbivores. All slugs within the genus *Pallifera* are known to feed on mosses and lichens (Burch, 1962) as is the case with *G. maculosus* throughout its range (Platts & Speight, 1988). In the current study, 70% ethylene glycol solution was placed in a Petri-dish under metric traps with a netted top to prevent specimens from drowning i.e. it was used as an attractant rather than a preservative.

In the deciduous woodland the above four trap types (wood trap, styrofoam trap, carrot-baited metric trap and ethylene glycol-baited metric

trap) were placed flat on the ground surface at the base of each of the eight trunks on either the north, south, east or west side so that for the eight trees each trap type was represented at each aspect twice. Similarly, at the blanket bog, the four trap types were placed flat on the ground at the north, south, east or west edge of each sandstone outcrop and each trap type was also represented at each aspect twice. Herein, at both the blanket bog and woodland sites, these traps are collectively referred to as the woodland floor traps and the blanket bog traps respectively. All traps were secured in place using six inch nails (one in each corner) so that the distance from the trap to the ground surface was approximately 5 mm and all metric traps were saturated with deionised water prior to use.

A fifth trap type was also tested in each habitat. In the woodland this consisted of individual metric traps arranged in a continuous band around the trunk of each tree (herein referred to as a tree trunk trap). The traps (saturated with deionised water) were secured to the tree trunk 1.5 m from the ground surface. In addition, a 2.5 cm length of organic carrot was nailed to the trunk underneath each individual metric trap. On the blanket bog, individual metric traps were placed on the north, south, east and west side of each sandstone outcrop (herein referred to as outcrop traps). Styrofoam and wood traps were not used for this purpose because it proved difficult to secure them on slopes. The outcrop traps were saturated with water prior to use and were kept in place using a rawlplug masonry nail (2.5 mm×25 mm) on each corner. They were baited with a 2.5 cm piece of organic carrot.

All traps were set simultaneously and checked on a weekly basis from 19th August 2009 to 30th September 2009. In the woodland, however, sampling was continued for an additional three weeks until 10th October 2009 as the total number of individuals increased weekly for the first six weeks of sampling. During each visit, the numbers of *G. maculosus* were counted but were not removed from the sites. In addition, the organic carrot was replaced and the underside of each trap was moistened for 15 seconds using a mist gun filled with deionised water. All of the traps were examined between the hours of 8am and 11am.

In the woodland the vast majority of *G. maculosus* individuals were found under the tree trunk traps throughout the duration of this study (Fig. 1). In fact, only two individuals were collected using the woodland floor traps, one on the upper surface of a wood trap and another on the upper surface of a Styrofoam trap. Both specimens were actively crawling on the traps and appeared not to be using them for shelter. It is surprising that such low numbers of *G. maculosus* were collected on the woodland floor as this is thought to be a microhabitat for the species in Ireland (Platts & Speight, 1988). The maximum number of individuals collected under a single trunk trap in the woodland was 24 specimens and the maximum total number collected during a single week was 59 individuals.

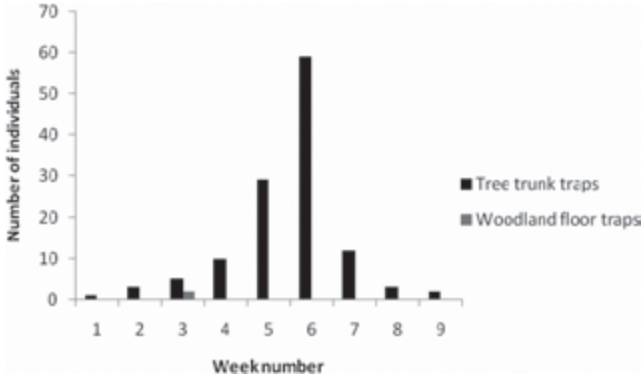

Figure 1 The total number of *Geomalacus maculosus* Allman collected under the tree trunk traps and woodland floor traps during the nine weeks of sampling in Glengarriff Nature Reserve, Co. Cork, Ireland.

The dates for the sampling weeks are Week 1: 20/8 to 26/8; Week 2: 27/8 to 2/9; Week 3: 3/9 to 9/9; Week 4: 10/9 to 16/9; Week 5: 17/9 to 23/9; Week 6: 24/9 to 30/9; Week 7: 1/10 to 6/10; Week 8: 7/10 to 13/10; Week 9: 14/10 to 20/10.

A similar pattern was observed on the blanket bog with the vast majority of specimens collected on the outcrop traps on each sampling occasion (Fig. 2). Only a single specimen was collected under the blanket bog traps (carrot-baited metric trap) on the 26th August, 2nd September and 23rd September. The maximum number of *G. maculosus* collected on a single outcrop and during a single sampling week was six and twenty-one individuals respectively.

In conclusion, this study shows that metric traps are suitable for collecting *G. maculosus* and will enable quantitative sampling of the species in both its woodland and blanket bog biomes. This in turn will facilitate research on

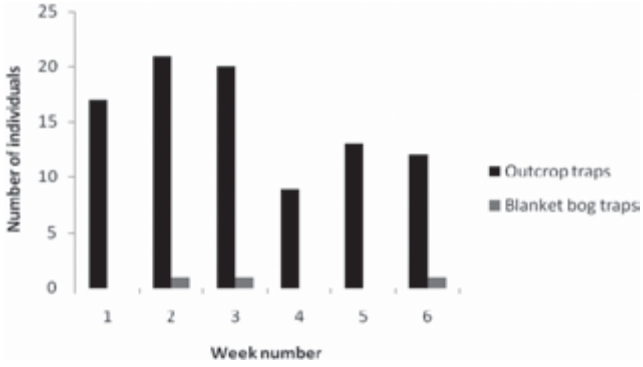

Figure 2 The total number of *Geomalacus maculosus* Allman collected under the outcrop traps and blanket bog traps during the six weeks of sampling at Cashelkeelty, Co. Kerry, Ireland.

The dates for the sampling weeks are Week 1: 19/8 to 25/8; Week 2: 26/8 to 1/9; Week 3: 2/9 to 8/9; Week 4: 9/9 to 15/9; Week 5: 16/9 to 22/9; Week 6: 23/9 to 29/9.

distribution and population dynamics which will enable national conservation agencies to make more informed decisions on conservation strategies for this slug. Currently, tree trunk and outcrop traps have been put in place by the authors to enable such long-term monitoring of the species to take place.

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