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Cardiff University Slow Worm Project: The First Three Years

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CARDIFF UNIVERSITY Cardiff, 2019

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2019

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All photographs of slow worms were taken at Cardiff University by the author.

Contents

Executive summary

- The Cardiff University Slow Worm Project started in 2015 and has been running for three years.

- The aim of the project is to look after slow worms on Cardiff University land.

- The slow worm (*Anguis fragilis*) is a species of legless lizard which is in decline in Wales.

- The project is being carried out by the Cardiff University Grounds Maintenance Team in Sport in partnership with Cardiff University Residences.

- The project has created a slow worm habitat on a secret site at Cardiff University. Refugia (see Glossary) have been placed on the site, which are used by slow worms to help them warm up.

- A population of slow worms is breeding on or near site.

- The slow worms are surveyed at least once every other week during summer.

- The number of slow worms on site may be increasing. Slow worm populations will stop increasing when they reach maximum carrying capacity (see Glossary).

- The highest count so far was in August 2018 when 12 were seen on one visit.

- With a better camera the project could identify individuals and estimate the total population.

Introduction

The Cardiff University Slow Worm Project began in November 2015, and involved the creation and maintenance of a rough grassland/meadow habitat for the Common European Slow Worm (*Anguis fragilis*) on a secret site at Cardiff University together with regular monitoring of slow worms during summer. The project was set up by the Grounds Maintenance Team in Sport with permission from Residences Facilities.

The site

The location of the Cardiff University site is secret, but it is in a residential area within the Cardiff ring-road. The site is situated alongside a railway-line, and the slow worms were probably recruited from the railway embankment. The site is made up of a mosaic of lawns and thick copses. The additional high-value habitat created for our project was a rough grassland/meadow hybrid area on a 225m^2 steep, west-facing bank alongside a copse. Given the fast colonisation of the site, it is possible that there may have been a pre-existing population living in the thick copse areas of the site.

Slow worms

Slow worms are a kind of legless lizard, native to Britain. They are not venomous and are harmless to humans. They are often considered to be beneficial in gardens because their diet consists mainly of slugs along with worms, spiders and insects (Smith, 1990, pp. 50, 123). They can grow to be 40cm long in Britain, and can live up to 50 years in captivity, although typically only live 15 in the wild. Slow worms typically have a maximum range of only around 200m^2 (Smith, 1990, p. 39. 46; Beebee and Griffiths, 2000, pp. 115–123). This makes them vulnerable to careless land management choices, but also means that local populations can be entirely cared for by individual land owners.

Slow worms are subject to partial protection under the UK Wildlife and Countryside Act (1981, and as amended), and are probably in decline in Britain, and also in Wales, although they have been traditionally more common in Wales than most other areas (Smith, 1990, p. 10; Caerphilly County Borough Council, 2002). Cardiff University is committed to enhancing biodiversity on campus as part of its Biodiversity Policy Statement and Environmental Sustainability Action Plan (2018-2023).

There is only one known population of slow worms living at Cardiff University, and they have been monitored every summer since habitat was created for them three years ago. The population seems to have been recruited from a nearby railway embankment.

Method & materials

Equipment

1 Sheet of corrugated tin 1m x 1.3m (Refugium #1 – see Glossary)
2 Sheets of corrugated roofing material 1m x 0.7m (Refugium #2 & #3)
1 Smart phone for photos & recording
3 Pallets for hibernaculum
1 Tarpaulin for hibernaculum
2 Strimmers for annual cut
1 Rake for annual cut
4 Ton bags for annual cut
Yearly grass clippings & leaves for hibernaculum (needed before annual cut)

Method

We stopped mowing the grass along one edge of the site and allowed it to start development into tussocks. Each year we lightly strim the area to prevent shrubs from establishing, but we do not mow into the thatch, meaning that a good dynamic environment is being created close to the soil. We also remove the risings after strimming and have seeded the area with a wildflower mix in the second year to introduce additional biodiversity to the area.

Extract from the Site Management Plan

Spring/Summer: Do not mow the bank above the level of the wall during spring/summer. Do not trim the hedges above the level of the wall during spring/summer. The very bottom of the bank below the level of the wall, the bushes and trees here, and the lawn near the plum trees can be cut normally, but please do not spray this area with any pesticides.

November: The grass and hedge needs to be cut once a year, but because of the wildlife project on the site it is vital that this does not happen until November (later than the other wildflower sites). Before cutting, please stamp the ground to scare away any remaining wildlife and to release seeds from seed pods. Strim the grass down to the thatch, and cut the hedges back, and rake the clippings away, do not blow. After removing the clippings in the first year, we will seed with yellow rattle and stamp the seed into the ground. Pay particular attention to the scrub in the middle under the hawthorn tree – we do not want this spreading into the grassland area.

We laid three refugia in the area, one made of corrugated tin and two made of roofing material. Slow worms bask in the heat under these refugia and allow for surveying. The removed grass clippings are mixed with fallen leaves in a compost box-style hibernaculum (with three pallet walls and a tarpaulin over the top on another part of the site.

The site was visited at least once every two weeks during the survey season to record the number of slow worms under the refugia and attempt to take photographs. Photographs are important because they provide the only possible means of identifying slow worms to species level (Smith, 1990, pp. 20–1), which is the only way to estimate population. However, in our study it was not thought justifiable to put the slow worms through the stress of capture, and our limited photographic equipment usually meant that no distinguishing characteristics were visible. Occasionally discarded slow worm skins were collected. In all the three years, no slow worms were 'wild spotted' away from the refugia. Each visit recorded the date, time, weather and how many slow worms were seen. From the third year we also recorded which of the refugia the slow worms were seen under and the temperature. All records of slow worms are submitted to the Record Pool (www.recordpool.org.uk) at the end of each season.

Project history

Pre-project

- **7th August 2015,** one of the site's lawns was left un-mowed for several weeks due to health and safety concerns. A slow worm was recorded on site at this time.
- **January 2016,** a proposal was accepted to allow part of the site to revert to rough grassland/meadow with the hope of establishing a slow worm population.

Project year 1 (2016) (average count:2, peak count:6)

- **February 2016**, official start of the new management plan and the first of the refugia was placed on site.
- **4th May 2016**, The first slow worm was spotted under the new refugia in the restored habitat.
- **30th September 2016,** The first juvenile slow worm was recorded.
- **17th October 2016,** The last slow worm of the season was recorded.

Project year 2 (2017) (average count:2, peak count:8)

- **31st March 2017,** first slow worms of year spotted. The rough grassland area was seeded (in furrows to avoid disturbance) with meadow wildflowers with the hope of attracting other wildlife.
- **August-September 2017,** problems with Refugium #1 (see Results) two further refugia and a hibernaculum were added to the site.
- **7th September 2017,** The last slow worm of the season was recorded.

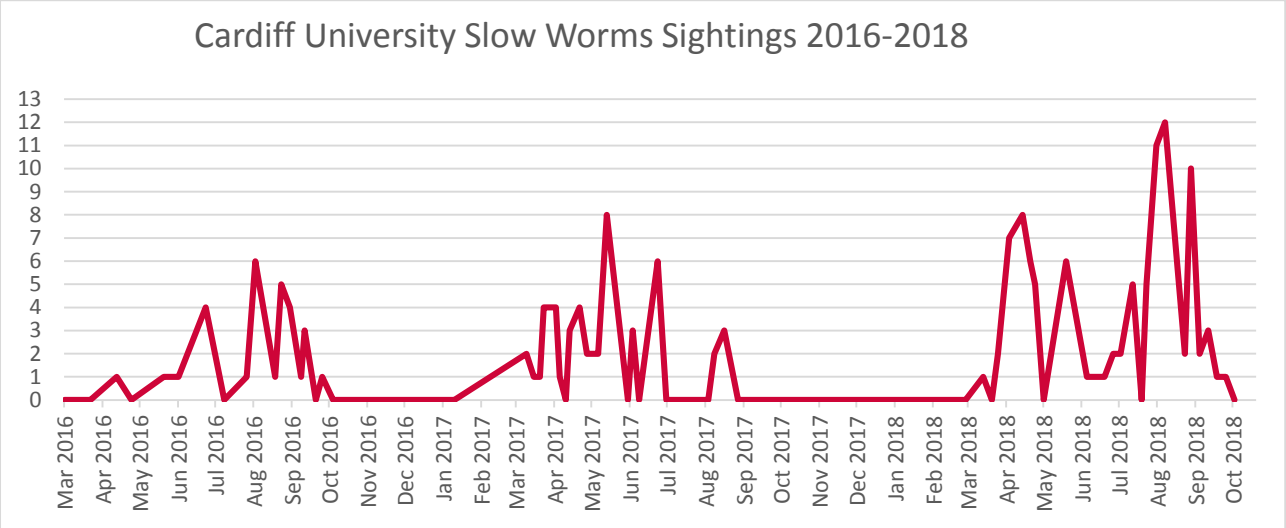
Project year 3 (2018) (average count:4, peak count:12)

- **4th April 2018,** first slow worms of year spotted.
- **June-Sep 2018,** contractors on site, slow worm area closed to public access.
- **17th October 2018,** The last slow worm of the season was recorded.

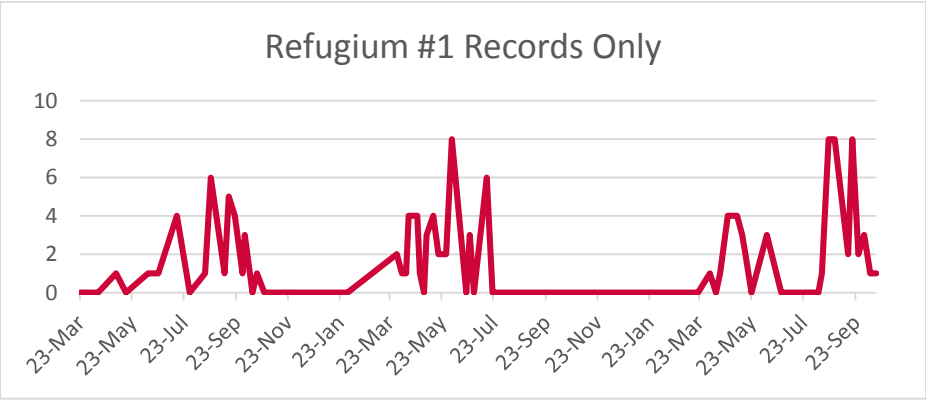
Results

The full results are found in Appendix 1.

Population growth or increased capture rate?

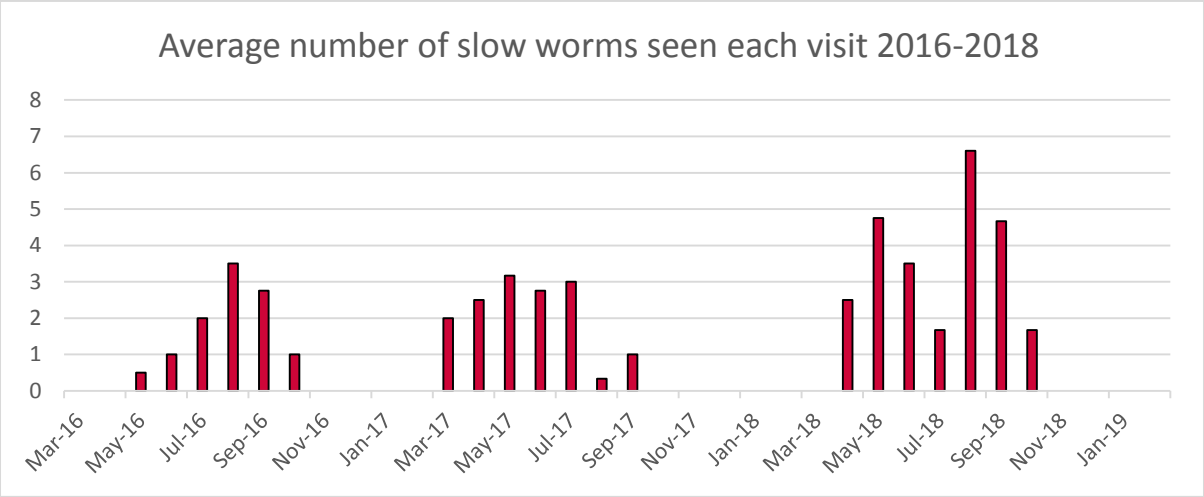


The most striking thing here is that the average number of slow worms recorded increased in year 3. It is tempting to attribute this to population growth, although there is not a clear relationship between survey count and population (Smith, 1990, p. 27). Some of the variability is due to the additional refugia added to the site in year 2. Additionally, the main slow worm habitat was enclosed in a building site and closed to visitors in year 3. Both of these factors would have increased the capture rate in year 3 (see Glossary). Importantly, the peak number of slow worms recorded under Refugium #1 (8) did not change between year 2 and year 3.



To estimate the population it is necessary to take photographs good enough to identify individual animals (Smith, 1990, pp. 20–27). This allows the capture rate to be calculated (see glossary), which will allow us to estimate approximately what percentage of the slow worm population are represented in our records.

Best & worst survey months



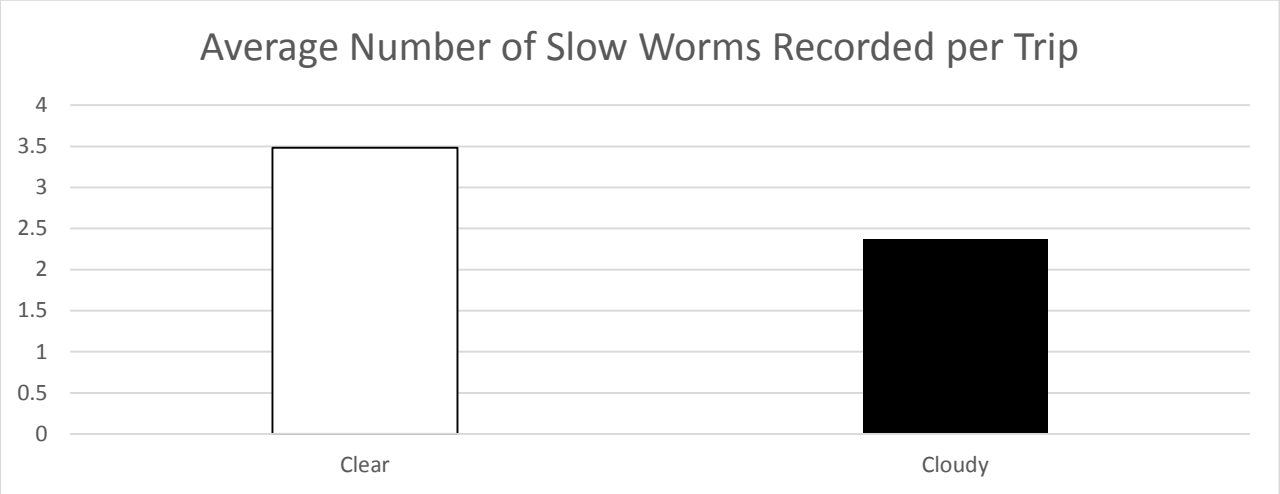
If we take the monthly average figure of the number of slow worms seen on each visit, the highest average number of sightings in 2016 and 2018 were made in August. This is surprising since typically peak slow worm activity is detected in June (Smith, 1990, pp. 33–4; Beebee and Griffiths, 2000, pp. 117–118). Slow worm emergence was detected in Cardiff slightly later than elsewhere (31st March 2017, 4th April 2018 but the last season sighting is comparable with other British sites (17th October 2016 & 2018).

In August 2017 there were some problems, meaning that August was actually the poorest month for recording slow worms that year. A wood pigeon had nested in a shrub near Refugium #1. This meant it was not possible to prune back the shrub in nesting season and Refugium #1 became overshadowed. Some voles also built a nest underneath around the same time, and few slow worms were seen there for a couple of months (prompting the positioning of Refugium #2 & #3).

After slow worms have started appearing each year, the lowest average number of sightings is usually in October as the slow worms start to go into hibernation. In the very first year (2016) the slow worms did not start to appear until May, and numbers were low until July, but this was probably due to the length of time it took for the grass to start growing back and the slow worms to be recruited from the adjacent railway embankment habitat.

Further surveying is needed to put these dates in context. Since the site was visited only once a fortnight/week all dates are approximate. The site was usually visited in the afternoon or at midday which may decrease the capture rate at the hottest period of the year if temperatures under the refugia become too hot.

Weather

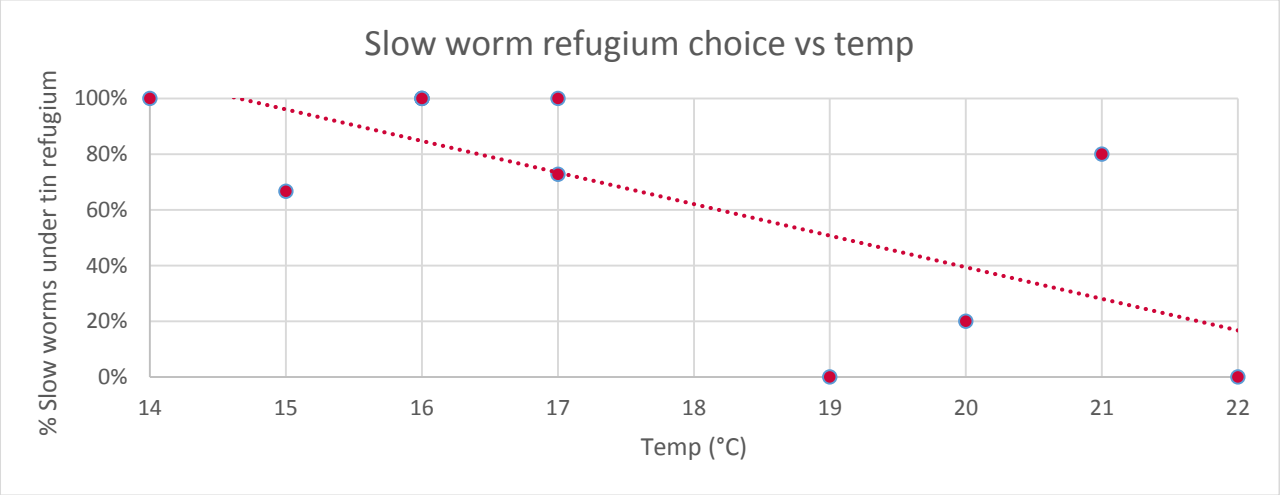


Anecdotally the greatest number of slow worms seems to be recorded on a warm day after rain. On average the number of slow worms seen on clear days (3.5) was higher than the number seen on cloudy days (2.4) but these results were *not* found to be statistically significant in a Mann-Whitney U-Test. Cloud cover occasionally but not always affects number of slow worms found on other sites (Smith, 1990, p. 36).

Temperature

From 2018 we started recording the temperature on surveys. At first, we tried taking local readings, but this was complicated because the air temperature varied across the site. The environmental temperature is also hard to determine because lifting a refugium changes the temperature beneath it (Smith, 1990, pp. 103–4). From July 2018 we started recording only the rough Met Office figure for the ambient temperature in Cardiff to ensure objectivity and simplicity.

Slow worms were recorded throughout the temperature range which occurred from July-October 2018. Interestingly, there was a significant ($p=0.05$[1]) negative correlation between the temperature and the percentage of slow worms found under Refugium #1 vs Refugia #2 and #3. Refugium #1 is made of tin and heated faster on cool days. Refugia #2 and #3 are made of corrugated roofing material and did not get as hot on hot days.



This suggests that slow worms may be choosing whether to use specific refugia based on temperature. This is interesting because the extent to which slow worms are active 'thermoregulators' rather than passive 'thermoconformers' is debated (Smith, 1990, pp. 93, 108–9). Further, unlike other reptiles, adult slow worms did not show a preference between two other refugia materials (felt and corrugated roofing material) in a previous study (Fish, 2016).

Of course, our conclusion is based on a small number of site visits (n=11) from a single survey season. Additional evidence is needed to form firm conclusions about the impact of temperature on slow worm refugia choice.

[1] Significance measured using a Spearman's Rank Correlation Coefficient comparison of temperature against the % of slow worms recorded under Refugium #1 instead of Refugium #2 or #3. One nul record was discarded.

Recommendations

1. During its first three years the project has been very successful at establishing and maintaining a population of slow worms at Cardiff University. The land management decisions have been successful and we should be cautious making changes to the existing management plan (See Method). Other areas of Cardiff, especially areas adjacent to the railway embankment could be managed using the same plan with the hope of establishing additional populations of slow worm.

2. The emergence and peak count dates of the slow worms at Cardiff remain of particular interest because they seem to differ from the national average. These should continue to be monitored carefully.

3. In order to assess local abundance, it is necessary to be able to recognise individual slow worms. Obtaining better photographic equipment for individual recognition is a high priority.

4. In order to improve analysis of how local conditions affect slow worm behaviour, it is important to continue recording the ambient temperature. It would also be valuable to adopt a more systematic approach to monitoring the weather. The Okta scale of cloud cover would be easy to adopt and is widely used in other conservation projects.

Appendix 1

Date	Time Start	Time Left	Weather	Approx temp °C	Species	Abundance	Refugium 1	Refugium 2	Refugium 3
04 May-16	14:30	15:00	sunny, hot		Slow worm	1	1	n.a	n.a
11 Jun-16	19:00	19:30	clear, warm		Slow worm	1	1	n.a	n.a
23 Jun-16	19:30	20:00	cloudy, warm		Slow worm	1	1	n.a	n.a
15 Jul-16	12:00	12:30	drizzle		Slow worm	4	4	n.a	n.a
17 Aug-16	14:30	15:00	cloudy, warm		Slow worm	1	1	n.a	n.a
24 Aug-16	14:30	15:00	hot, clear		Slow worm	6	6	n.a	n.a
09 Sep-16	16:15	16:45	hot, cloudy		Slow worm	1	1	n.a	n.a
14 Sep-16	15:00	15:15	hot, clear		Slow worm	5	5	n.a	n.a
21 Sep-16	15:00	15:15	warm, cloudy		Slow worm	4	4	n.a	n.a
30 Sep-16	15:15	15:30	drizzle		Slow worm	1	1	n.a	n.a
03 Oct-16	15:00	15:30	sunny, clear		Slow worm	3	3	n.a	n.a
17 Oct-16	15:15	15:30	warm, wet		Slow worm	1	1	n.a	n.a
31 Mar-17	11:00	11:45	sunny, clear		Slow worm	2	2	n.a	n.a
06 Apr-17	16:30	17:00	sunny, clear		Slow worm	1	1	n.a	n.a
11 Apr-17	08:45	12:00	sunny, hot		Slow worm	1	1	n.a	n.a
14 Apr-17	16:00	16:30	warm, cloudy		Slow worm	4	4	n.a	n.a
24 Apr-17	14:00	14:30	warm, cloudy		Slow worm	4	4	n.a	n.a
27 Apr-17	16:00	16:30	warm, clear		Slow worm	1	1	n.a	n.a
02 May-17	11:00	11:30	warm, clear		Slow worm	3	3	n.a	n.a
13 May-17	18:00	18:30	warm, sunny		Slow worm	4	4	n.a	n.a
19 May-17	17:00	17:30	warm, sunny		Slow worm	2	2	n.a	n.a
28 May-17	19:00	19:30	cloudy, cool		Slow worm	2	2	n.a	n.a

04 Jun-17	09:00	09:30	warm, sunny		Slow worm	8	8	n.a	n.a
25 Jun-17	16:00	16:30	warm, overcast		Slow worm	3	3	n.a	n.a
15 Jul-17	13:00	13:30	warm, overcast		Slow worm	6	6	n.a	n.a
30 Aug-17	16:00	16:30	sunny, warm		Slow worms	2	0	1	1
07 Sep-17	15:00	15:30	warm, overcast		Slow worms	3	0	2	1
28 Feb-18	15:00	15:30	cold, clear		Slow worm	0	0	0	0
07 Mar-18	15:00	15:30	warm, clear		Slow worm	0	0	0	0
14 Mar-18	15:00	15:30	overcast, cool		Slow worm	0	0	0	0
21 Mar-18	16:00	16:30	overcast, cool		Slow worm	0	0	0	0
04 Apr-18	15:00	15:30	warm, clear		Slow worm	1	1	0	0
11 Apr-18	16:00	16:30	overcast, cool		Slow worm	0	0	0	0
16 Apr-18	14:00	14:30	cloudy, warm		Slow worm	2	1	0	1
25 Apr-18	15:00	15:30	sunny, warm, windy		Slow worm	7	4	2	1
06 May-18	12:30	13:00	sunny, hot, still		Slow worm	8	4	3	1
12 May-18	18:00	18:30	overcast, cool		Slow worm	6	3	3	0
16 May-18	15:00	15:30	warm, clear		Slow worm	5	2	3	0
23 May-18	14:30	15:00	too hot		Slow worm	0	0	0	0
10 Jun-18	19:45	20:15	warm but evening		Slow worm	6	3	2	1
27 Jun-18	15:00	15:15			Slow worm	1	0	1	0
11 Jul-18	14:45	15:15	warm, clear		Slow worm	1	0	1	0
18 Jul-18	15:00	15:30	warm, clear		Slow worm	2	0	2	0
24 Jul-18	15:00	15:30	cool	19	Slow worm	2	0	1	1
03 Aug-18	14:00	14:30	warm, clear	22	Slow worm	5	0	5	0
10 Aug-18	18:00	18:30	cool	17	Slow worm	0	0	0	0
14 Aug-18	11:30	12:00	warm	20	Slow worm	5	1	3	1
22 Aug-18	11:30	12:00	cool, showers	17	Slow worm	11	8	3	0
29 Aug-18	11:30	12:00	sunny, cool	15	Slow worm	12	8	2	2
14 Sep-18	15:00	15:30	cool	16	Slow worm	2	2	0	0
19 Sep-18	11:30	12:00	sunny	21	Slow worm	10	8	1	1

26 Sep-18	11:30	12:00	cool	17	Slow worm	2	2	0	0
03 Oct-18	11:30	12:00	damp, sunny	14	Slow worm	3	3	0	0
10 Oct-18	10:30	11:00	damp, cloudy	16	Slow worm	1	1	0	0
17 Oct-18	11:30	12:00	damp, cloudy	16	Slow worm	1	1	0	0

Glossary

Average count: The number of slow worms found during a single survey on a typical day. This number is calculated by dividing the total number of slow worms found over a longer period (typically a month or a year) by the number of surveys carried out in that period.

Capture Rate (CR): The chance of recording an individual slow worm during a survey season. If the capture rate can be calculated, a population can be estimated based on the number recorded.

Carrying capacity: The number of individuals a habitat can naturally provide for. This is usually dictated by the amount of food available. When a population reaches this limit it will stop increasing.

Hibernaculum: A structure built for reptiles to hibernate in. The temporary hibernaculum at Cardiff University is three crates tied together in a U shape, filled with a mixture of leaves and grass cuttings to produce heat like a compost heap, and covered with a tarpaulin.

Meadow: A grassland habitat which is mowed once a year. Usually rich in wildflowers and does not have tussocks.

Okta scale: A scale which surveyors use to estimate cloud cover by dividing the sky into eight segments and calculating how many of the segments are filled with cloud.

Peak count: The maximum number of animals seen in a single survey year. This may be many times lower than the total population.

Recruitment: The process by which a new habitat obtains a population of any given species.

Refugia: Small pieces of fabric, typically tin, roofing material or tarred felt. These are left to warm in the sun and slow worms like to warm themselves underneath them. Also called coverboards. Refugia is a plural, the singular form is **Refugium.**

Rough grassland: A grassland habitat with a long thatch substrate for small mammals and reptiles. Often has tussocks. Sometimes rich in wildflowers. Usually cut once every other year, or lightly grazed.

Slow worm: *Anguis Fragilis;* A harmless reptile.

Wild spotting: When reptiles are spotted sunning themselves away from refugia.

Acknowledgements

This project would not have been possible without the close relationship which exists between Residences and Grounds Maintenance teams.

Tony Bell, the grounds supervisor (photographed below) currently maintains the site with the assistance of the Grounds Maintenance team. The site's local management team has been very patient and understanding about the project.

Laurie Raye assisted with some surveys and the photograph on p.5.

Martin Gentile assisted with statistical analysis.

Participants in the UK Amphibian and Reptile Group Discussion Forum on Facebook have assisted in discussion and analysis.

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