

Reptile and Amphibian Survey

Pen Dinas, Aberystwyth

Survey Period March – October 2020



Survey and report undertaken by Chloe Griffiths for the Nature of our Village Project at Penparcau Community Forum.

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Assisted by a team of volunteers from the local community.

Address of project:

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Reptile and Amphibian Survey: Pen Dinas, Aberystwyth

Summary of key findings

The biggest change in 2020 was the dramatic increase in the number of Common lizards seen during a single survey. 63 lizards were recorded on the 3rd September 2020, twice the number seen in the previous peaks of 2016 and 2017. Slow-worm and other species' numbers remained stable. One impact of Covid travel restrictions meant a much higher than usual footfall on

Pen Dinas, however there were also positive effects from the previous 2 years of site management, with more basking areas created.

The 5 year view.

Pen Dinas has always been a frequently-disturbed site, well used by walkers and their dogs which are often off lead. There has also been considerable disruption to the site for 2 years running historically. In 2018 paths were strimmed in May, removing all the long grass habitat that we normally see the lizards amongst during the visual surveys, followed by a heat wave in June and July, which meant that the grass and wild flowers did not grow back. In 2019 paths were widened and resurfaced on the lower and middle paths of Pen Dinas, causing months of disturbance and some removal of habitat. 5 years of survey data show that these have been temporary effects, and that the long-term trend in reptile numbers is positive. The site is large and complex enough for the animals to have moved away from the paths we follow on our survey as they became less suitable, possibly to areas of shorter vegetation amongst the gorse, which were affected by previous fires. Whilst there may have been a temporary lack of suitable habitat to bask in during 2018 and 2019, the lizards were able to make a strong return in 2020.

Unlike the lizards, which we see more frequently along paths and away from refugia, the Slow-worm are almost always seen underneath the refugia. They may therefore have been less affected by the removal of habitat along paths in 2019, which may be why their peak numbers in 2020 held steady, increasing from a maximum of 15 seen in one survey, to 16. They may actually have benefitted from the heat wave of 2018 as more daylight hours would have been suitable for catching food. We hypothesized that the path work would eventually have a beneficial effect on the lizards because it created more open south-facing areas suitable for basking and hunting once the vegetation returned, (see 2019 report) and this has proved correct.

1. Introduction

1.1. In 2020 a Reptile and Amphibian Survey using artificial refugia was carried out on Pen Dinas, Aberystwyth, by Chloe Griffiths and volunteers from the Nature of our Village biological recording project. This was the fifth consecutive year of the Reptile Survey, which itself aimed to add to the results of an earlier survey done by the Wildlife Trust of South and West Wales on the site in 2011-12. (Parry, R.J. 2012). This initial survey also covered the site at Parc y Llyn, however the 2016 to 2020 surveys were on Pen Dinas only. They should stand as additions to the existing 2011-12 survey only and do not attempt to repeat it in its entirety. Readers should first look at the WTSWW report for fine detail on the habitat surveyed and the constraints posed by the site.

In order to compare the results for Pen Dinas in 2011-12, and from 2016 to 2020, elements of the WTSWW report have been quoted and responded to. Quotes from the earlier report are in *italics* and appear inset. I have altered the section numbering from the earlier report to fit this report's structure. A

spreadsheet containing the data from the 2016 to 2020 surveys is available on request.

The current survey is designed to monitor the reptiles and amphibians recorded in the earlier WT survey and to make recommendations on how the habitat can be improved for them in response to our findings.

1.2. Study Site

Location: Aberystwyth

Site Name: Pen Dinas Local Nature Reserve

Designations: (LNR)

Map Reference: Ordnance Survey (O.S. Explorer 213) Aberystwyth & Cwm Rheidol

Grid Reference: SN583799

Area: c.2.1ha

(from WTSWW report 2011-12)

In 2020 the locations of the refugia remained in their original positions from the 3 previous years, clustered around 5 central points to the south west of Pen Dinas:

SN 58359 79957 central point of the Glade

SN 58126 80270 central point of Spencer's Sheds

SN 58148 80455 central point of the Dogleg off Middle Path

SN 58240 80368 central point of Pant-yr-Allt ruins

SN 58248 80131 central point of the Firebreak



Figure 1: Photo shows the middle path of Pen Dinas, where considerable numbers of Common lizards were observed, and the glade below, where 7 of the refugia were placed. Tanybwllch beach, where a further colony of lizards were recorded, is visible in the distance, separated from the hill by the river.

2. Methodology

2.1 Reptile and Amphibian Survey

2.1.1 The ecological survey was undertaken by an experienced ecologist from the Nature of our Village project in Penparcau with a team of local volunteers, over a period of 19 days, from February to October 2020 (**Table 1**). Three survey methodologies (pond dipping, artificial refugia and visual searches) were used at the site to obtain as much information about the fauna of the site as possible. The methodologies used followed the Amphibian and Reptile Conservation Trust's guidelines for the NARRS (National Amphibian and Reptile Recording Scheme).

Pen Dinas Survey Date in 2020	Survey method
3 March	Refugia and Visual Search
25 March	Refugia and Visual Search
6 April	Refugia and Visual Search
14 April	Refugia and Visual Search
21 April	Refugia and Visual Search
22 April	Pond Dip
29 April	Refugia and Visual Search
8 May	Refugia and Visual Search
14 May	Refugia and Visual Search
4 June	Refugia and Visual Search
10 June	Refugia and Visual Search
7 August	Refugia and Visual Search
3 September	Refugia and Visual Search
8 September	Refugia and Visual Search
15 September	Refugia and Visual Search
21 September	Refugia and Visual Search
29 September	Refugia and Visual Search
8 October	Refugia and Visual Search
20 October	Refugia and Visual Search

Table 1: Survey dates and methodologies used on the survey.

2.2 Artificial Refugia

2.2. Species Presence and Distribution

2.2.1. (In 2011-12)..a total of 295 artificial refugia were used during the survey and the majority of target species encountered were derived from this methodology. The two sites combined revealed a total of 32 observations of reptile and 51 observations of amphibian during the survey period. A total of four reptile species and two amphibian species were recorded during the survey (Table 3). The distribution of species and taxa varies considerably between study sites (Table 3).

It is important to consider the differences between the design of the 2011-12 survey and those that follow it before comparing them. The first survey made only 13 visits and over a shorter time period than later surveys, from 28 July 2011 to 16 September 2011, thus potentially missing some of the records from earlier in the year. The first survey also used 70 refugia rather than subsequent surveys which used 30. These 30 refugia have been in use since 2016 in suitable reptile and amphibian habitat within the study site. They are corrugated onduline sheets (50cm x 50cm). With the help of D. Kirby all refugia were spray painted with “Reptile survey” and were numbered on the underside with liquid paper. Each year we carry out a condition survey on the refugia and note which are damaged. D. Kirby kindly provided a set of car mats spray painted with “Reptile Survey” to replace the 3 damaged refugia. 5 years of data show that these proved unpopular with reptiles, perhaps because they lack the undulations to shelter underneath.

Temperatures were taken with a glass thermometer at the start of the survey, at the eastern entrance to Pen Dinas. It should be noted that the temperature at different locations around the hill varies during every survey as the transect goes from east to west and back, passing through some areas of shade and some of full sun.

3. Results

3.1. Species Presence and Distribution

Table 2 shows the total number of observations of reptiles, amphibians and mammals from the surveys in 2011-12, 2016 – 2020

Species	Total no. obs 2011-2012	Total no. obs 2016	Total no. obs 2017	Total no. obs 2018	Total no. obs 2019	Total no. obs 2020
Common lizard	3	106	119	37	95	157
Slow-worm	26	18	25	43	72	75
Frog	0	2	1	0	0	1
Toad	1	5	11	6	7	5
Palmate newt	0	2	2	6	2	12
Shrew species	0	2	0	0	0	2
Bank vole	0	1	4	9	10	4
Field vole	6	0	1	0	0	3
Pygmy shrew	0	0	2	1	0	0
Water shrew	0	1	0	0	0	1
Wood mouse	0	0	1	0	0	0
Small mammal	0	2	2	2	5	4
Grass snake	2	0	0	0	0	0
Adder	1	0	0	0	0	0

Table 2: Number of reptile, amphibian and mammal observations on Pen Dinas in 2011-12, 2016 to 2020. Data for 2011-12 is adapted from **Table 3** in the Wildlife Trust report on page 17 (which originally also showed Parc y Llyn data).

Table 3 shows the maximum count of observations of reptiles, amphibians and mammals on any one day from the surveys in 2011-12, 2016- 2020.

Species	Max count on 1 day in 2011-12	Max count on 1 day in 2016	Max count on 1 day in 2017	Max count on 1 day in 2018	Max count on 1 day in 2019	Max count on 1 day in 2020
Common lizard	2	32	32	11	21	63
Slow-worm	6	6	5	8	15	16
Frog	0	1	1	0	0	1
Toad	1	2	2	2	2	2
Palmate newt	0	1	1	6	2	12
Shrew species (unspecified)	0	1	0	0	0	1

Bank vole	0	1	1	6	2	1
Field vole	Found but no. not specified	0	1	0	0	3
Pygmy shrew	0	0	1	1	0	0
Water shrew	0	1	0	0	0	1
Wood mouse	0	0	1	0	0	0
Small mammal	0	1	1	1	2	2
Grass snake	1	0	0	0	0	0
Adder	1	0	0	0	0	0

Table 3 shows the maximum count of observations of reptiles, amphibians and mammals on any one day from the surveys in 2011-12, 2016-2020. Data for 2011-12 is adapted from **Table 3** and accompanying text in the Wildlife Trust report on page 17 (which originally also showed Parc y Llyn data).

3.1.2.

5 years of data show that the number of total observations of reptiles is now following an upward trend and at an all-time high. There were a total of 124 reptile observations (Common lizard and Slow-worm combined) in 2016, which rose to 144 in 2017, dropped to 80 in 2018, bounced back up to 191 in 2019 and peaked in 2020 at 232. For amphibians, the total observations were 9 in 2016, rising to 14 in 2017, dropping to 12 in 2018, falling further to the 2016 level of 9 observations in 2019, then peaking at 18 in 2020. It is notable that the maximum number of Common lizard seen on one day was 32 in both 2016 and 2017, however in 2018 it had dropped to 11, but rose again to 21 in 2019 and peaked at 63 in 2020. By contrast, the maximum number of Slow-worm on one day was up to 16 in 2020, similar to the count of 15 in 2019, up from 8 in 2018, from 5 in 2017 and 6 in 2016. Slow-worm numbers have steadily risen and now seem stable.

Total Common toad records were down from 11 in 2017 to 6 in 2018, and rose slightly to 7 in 2019, but dropped back to 2016 levels with only 5 recorded in 2020. No Common frogs were recorded during the 2018 or 2019 surveys, but 1 dead adult was found in 2020, with more found around the village. The total number of Palmate newts recorded rose from 2 in 2017 to 6 in 2018 with only 2 juveniles found in the pond dip in 2019, but a high of 12 juveniles in 2020, with no adults present. A total of two reptile and three amphibian species were recorded from 2016 to 2020. The distribution of species can be seen in **Figure 2**.

Table 4 calculates the mean number of individuals of all species seen during a whole year of surveys, by dividing the total number of observations throughout the year by the number of surveys carried out. It gives the average number of reptiles seen per survey by calculating the median value.

	2011-12	2016	2017	2018	2019	2020
Number of survey days per year	13	19	19	20	19	19
Total number of observations during the year	33	133	158	104	191	232
Mean number of individuals of all species per day	2.5	7	8.3	5.2	10	12.2
Change in mean number of individuals from all species per day from the previous year	-	+180%	+19%	-37%	+92%	+22%
Median number of Common lizard per survey	no data	5	4	2	4	6.5
Median number of Slow-worm per survey	no data	1	1	2.5	3	5

Table 4: Average numbers of species seen per survey with results specifically for the Reptile species.

3.1.2. Survey effort was kept as similar as possible in the years from 2016 to 2020. Both the mean and the median figures calculated above for the 2020 results tell a positive story for the numbers of reptiles recorded. The mean number of sightings of reptile species per survey in 2020 increased by just over a fifth in comparison with the previous year. The median number of Common Lizard seen per survey increased by approximately two thirds in comparison with 2019, as did the median number of Slow-worm.

The total number of observations of all species during 2020 rose by 21% on the previous year. The lower previous figures may be partly explained by two elements: weather and disturbance. There was a heat wave during June and July 2018 which reduced the available habitat for reptiles and then the site was strongly impacted by works to create new paths in 2019, although this ultimately created better habitat for basking.

The pie charts that follow show the total number of species records on Pen Dinas in 2017, 2018, 2019 and 2020 and demonstrate visually the substantial difference in the relationship between Slow-worm and Common lizard observations in each of these years. Please note that the charts will look slightly different as they change from Meta-chart to Excel.

Total number of species recorded during Reptile survey on Pen Dinas in 2018
Chloe Griffiths Ecology

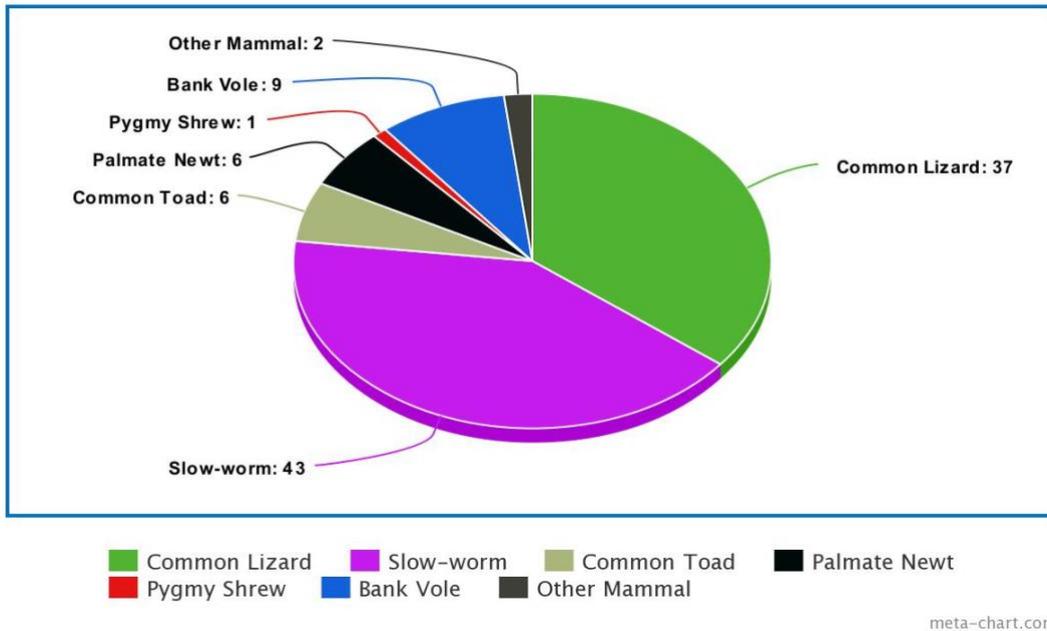


Figure 3: Total number of species records on Pen Dinas in 2018 made during Reptile Surveys.

Total number of species recorded during Reptile Survey on Pen Dinas in 2019.
Chloe Griffiths Ecology

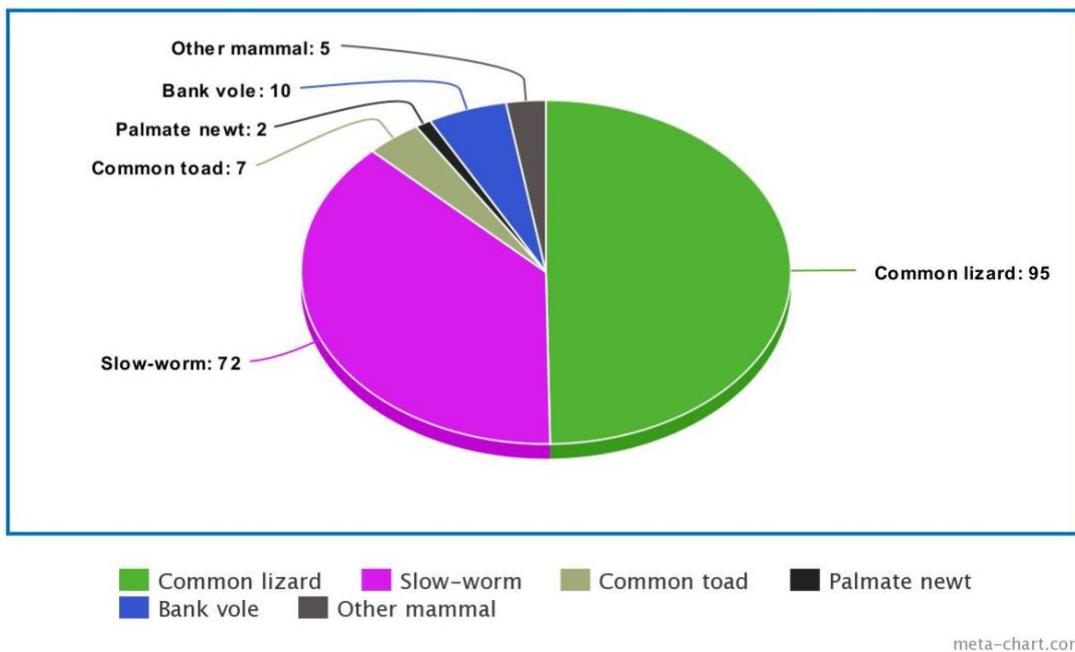


Figure 4: Total number of species records on Pen Dinas in 2019 made during Reptile Surveys.

Total number of records on Pen Dinas in 2020 made during Reptile Surveys shown as percentages by species

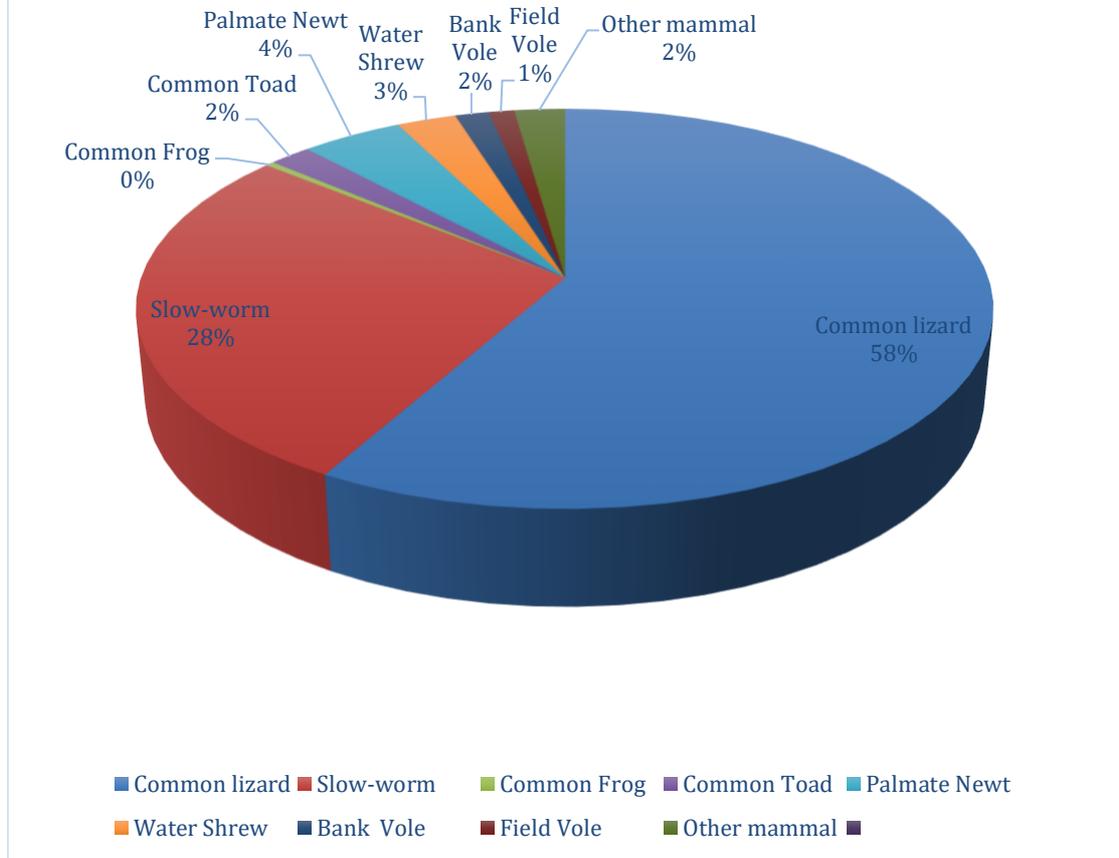


Figure 5: Total number of species records on Pen Dinas in 2020 made during Reptile Surveys.

3.1.3. All reptile species observations were made (on Pen Dinas). Of the reptiles, the most numerous observations were that of slow worm, with 26 observations during the survey (in 2011-12). Population estimates cannot be determined from the survey and it is very likely that an individual slow worm was recorded more than once. The maximum count of slow worm on any one survey day was six individuals, which occurred on 08/08/2011 and again on the 27/08/2011.

A 5 year perspective shows that for 4 out of each of the 5 years of surveys our project undertook, Slow-worm were recorded less often than Common lizard. The only year that reversed was 2018, in which the most numerous observations were that of Slow-worm, with a total of 43 records, the first time since the 2011-12 survey that it was recorded more often than the Common lizard. However, in 2020 the Common lizard was again the most frequently observed reptile with 157 sightings compared to 75 of Slow-worm. In 2019

there was a smaller difference, with only 95 Common lizard sightings compared to 72 of Slow-worm. In 2016 and 2017 Slow-worm was only the second most frequently observed reptile, with a total of 18 observations in 2016 and 25 in 2017. A maximum count on one day of 6 observations was made of Slow-worm on the 07/06/16, one of the hottest days of that year at 25°C. The following year the maximum count on one day was 5 on the 26/05/17, also at 25°C. This temperature is outside the usual parameters for ideal reptile surveys, which the Amphibian and Reptile Trust advise is between 10°C and 20°C. In 2018 Slow-worm reached a maximum count on one day of 8 on 12/06/18 at 20°C, then in 2019 the maximum count was of 15 individuals at 19°C on the 10/06/19 and in 2020 it slightly increased to 16 individuals at 7/8/2020 at 20°C.

- . *3.1.4. Common lizard was the next most frequently observed reptile, but much less than slow worm, with a total of three observations. A maximum count of two observations was made of common lizard on the 27/08/2011.*

Common lizard had 106 total observations in 2016, rose to 119 in 2017 then dropped to 37 in 2018, rose again to 95 in 2019 and peaked at 157 in 2020, in an increase of 65% on the previous year. The maximum count of lizard on any one survey day was 32 in both 2016 and 2017, down to 11 in 2018, back up to 21 in 2019 and almost double the previous peak at 63 in 2020. The peaks occurred on 29/09/16 and again almost exactly one year later on 28/09/17, however the peak in 2018 was 12 days earlier, on the 17/09/18, 5 days earlier again in 2019, (12/09/2019) and another 9 days earlier in 2020 on the 3rd of September. The corresponding temperature to these peaks was 16°C in 2016, 19°C in 2017, 20°C in 2018 and 18°C in both 2019 and 2020. None of these dates was the hottest day of its year.

- . *3.1.5. Grass snake was observed on two separate occasions, first on the 28/07/2011 and again on the 14/09/2011. Adder was only recorded once during the survey (14/09/2011).*

No Grass snake or Adder was observed on the site in 2016 - 2020. However, personal communications suggest that 2 Grass snake were brought in to a Penparcau garden near Pen Dinas by dogs in summer 2017. There have been no further reports to the project since then.

- . *3.1.6. Although amphibian species were found at both sites, they were observed predominantly at Site 1 (Parc y Llyn), with 50 of the 51 total observations. The majority of amphibian observations (98%) were of common toad.*

Between 2016 and 2020, 3 species of amphibian were found on Pen Dinas, with a total of 9 observations in 2016, 14 in 2017, 12 in 2018, a drop back to 2016 levels with 9 observations in 2019 doubling to a peak of 18 in 2020. Observations were very low compared to the reptile sightings, with 5 observations of Common toad in 2016, 11 in 2017, 6 in 2018, 7 in 2019 and back to 2016 levels with only 5 observations in 2020. There were 2 of Common frog in 2016 and 1 in 2017, with zero found during the surveys in 2018 or 2019 and only 1 dead adult in 2020. 2 Palmate newt were seen in both 2016 and 2017, and this increased to 6 in 2018, decreased to 2 again in 2019 and peaked at 12 juveniles in 2020. When observed, Toads were often found sheltering under the refugia, rarely during a visual search of the wider area.

3.1.7. No evidence of any newt species was found during the surveys.

In 2016, Palmate newt were found to be breeding in the spring next to the ruins of the Pant yr Allt farmhouse on Pen Dinas middle path, as a juvenile was found in the water that year, and a further pond dip found them to be still present in 2017. An adult was found in a bath (for horses to drink from) in a field at the base of Pen Dinas in 2016, and a further adult in 2017, under a refugium with a juvenile Slow-worm. In 2018 a survey of the spring at Pant yr Allt ruins produced one adult female and 5 juveniles and in 2019 this dropped to only 2 juveniles, found on the 25th April. In 2020 the pond dip took place on the 22nd April when 12 juveniles were recorded, the highest number of newts found during the survey since its inception.

3.1.8. Both reptile and amphibian numbers varied greatly between survey days, gradually tailing off as autumn progressed (Figure 5), which is to be expected.

The above statement for 2011-12 also proved true each year between 2016 and 2020. Reptile numbers in all 5 surveys peaked in either May (or April for 2019 and 2020) and again in September for every year.

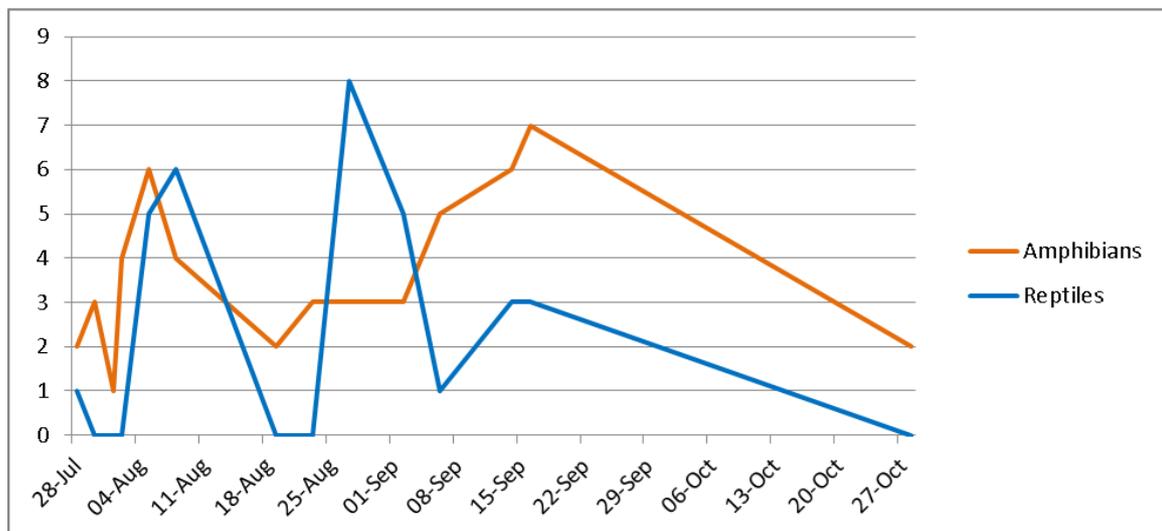


Figure 6: Number of amphibians and reptiles observed per survey day 2011-12 from the Wildlife Trust report.

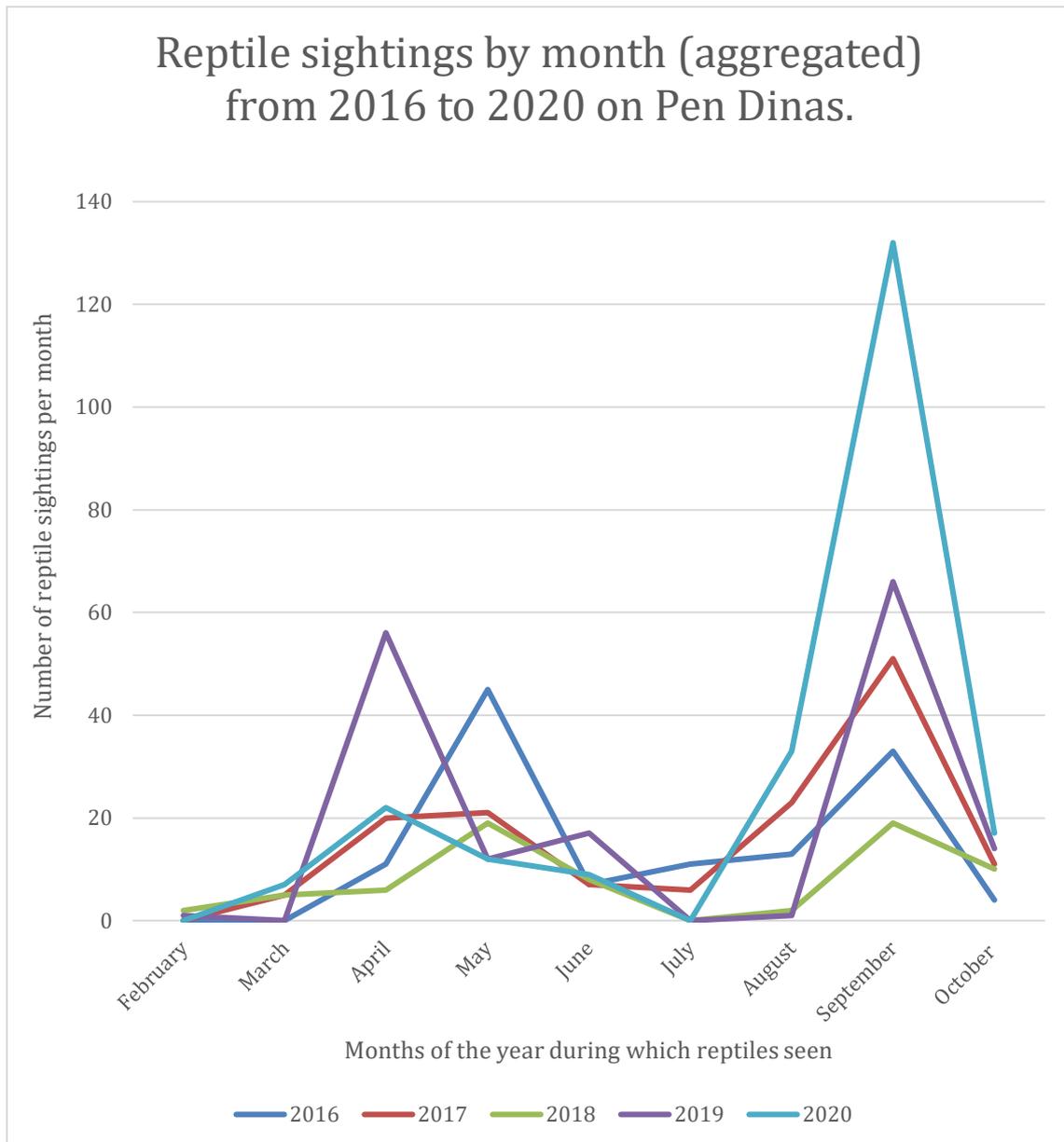


Figure 7: Reptile sightings by month (aggregated) from 2016 to 2020 on Pen Dinas. Note, no survey in July 2018, 2019 or 2020.

There is a clear difference in the first annual peak number of reptiles sighted in 2019 and 2020, where it occurs in April rather than in May, unlike during survey seasons 2016 to 2018. The second annual peak of reptiles seen in 2020 does however match previous years, occurring in September. However, in 2020 the peak is very much higher than during the same month in all previous years of the survey.

Table 5. Showing peak reptile sightings for each year between 2016 and 2020, mapped against the date on which they were recorded and the

temperature recorded on that day.

Date of peak Common lizard sighting	Temp. in °C	Number seen	Date of peak Slow-worm sighting	Temp. in °C	Number seen
29 Sept 2016	16	32	7 June 2016	25	6
28 Sept 2017	19	32	26 May 2017	25	5
17 Sept 2018	20	11	12 June 2018	20	8
12 Sept 2019	18	21	10 June 2019	19	15
3 Sept 2020	18	63	7 August 2020	20	16

Table 5. Peak reptile sightings from 2016 to 2020.

We cannot find a positive correlation between the peak temperatures recorded in April/May and September and the peak number of reptiles sighted, which suggests complexity in the conditions needed for optimum reptile basking.

The peak temperature in April and May 2020 on a day during which a survey was carried out was 22°C on the 21st of April, which produced 1 reptile record. Just over a week later, on the 29th April, it was only 15°C, yet produced 10 reptile records. This proved variable in 2019 too, when the peak temperature in May (of days on which surveys took place) was on the 16th, at 19°C and resulted in 5 reptiles. The peak of Spring temperatures actually came on April 23 2019, with a temperature of 23°C and 12 reptiles seen. However, this was not the highest number of reptiles seen in Spring, which was even earlier in the year, and at a lower temperature, this was 17 April, at 13°C and with 28 reptiles seen.

In September 2020 the peak temperature on a day during which a survey was carried out was 20°C on 2 days: the 15th and 21st when 19 reptiles were recorded on both days. However, the peak number of reptiles was seen on a day on which the temperature was 2 °C lower, the 3rd of September 2020, when 73 records were made at 18°C. In 2019 the peak temperature (also 20°C) was on the 24 September and only resulted in 6 reptiles recorded. The peak number of reptiles seen in September 2019 was 1 day later, at 18°C, when the number of reptiles rose to 11.

The tailing off of records as day length decreases is evident in the fact that on the 10th October 2018 the temperature reached 24°C, but only 2 reptiles were seen. A late-season survey on the 21 October 2019 showed a temperature of 15°C and only 5 reptiles. On the 20 October 2020 there were 10 reptiles at a temperature of 14°C.

We note that from our results, the highest number of reptiles seen in April/May and September is not always on the day of the month that has the highest

temperature recorded (of the days when surveys are carried out). We tested the temperature parameters (10°C – 20°C) for a standard Reptile survey and found that on the occasions that temperatures on survey days exceeded 20°C, we sometimes found higher than average numbers of reptiles. We therefore modified our practice and will continue to run reptile surveys on days where temperatures are above 20°C.

*3.1.9. In addition to reptiles and amphibians, the survey (using artificial refugia) also recorded a total of 42 field vole (*Myodes glareolus*), the majority (86%) of which were made at (Parc y Llyn).*

The 2016 survey, in addition to reptiles and amphibians, also recorded a total of 4 small mammal categories, (using artificial refugia) some to species level and some not. These was 1 observation of a Water shrew, 1 of a Bank vole, 2 of a Shrew (not to species level) and 2 of a small mammal (unspecified).

We did not observe Water shrew in 2017, 2018 or 2019, but did record them in 2020. One live animal was seen on 14th May, (also 2 dead adults, outside the scope of the survey, earlier in the year on the 5th January on a path near the Monument on Pen Dinas and one off Penparcau Road, killed by a cat.) Numbers of small mammals found during our surveys have always been small, but in 2020 we did see 3 Field Vole again after not seeing them since 2017. In 2018, 2019 and 2020 we did not find Wood mouse, and after finding 1 Pygmy Shrew in 2018, saw them on 2 occasions during 2020, but outside of the surveys noted in this report. Bank Vole sightings dropped to 4 from a peak of 10 in 2019 and there were 6 small mammal (unidentified) sightings, 2 of which were Shrews.

Small mammal nests and runs were often observed under refugia, sometimes with the animal exiting as the refugium was lifted.

4. Conclusion

4.1. Species Diversity and Distribution

. 4.1.1. *It is likely that reptile species found... have a much greater distribution and range over Pendinas. This is due to the connectivity of habitat, which forms many hectares of suitable habitat for reptiles.*

4.1.2. Extent and Coverage

. 4.1.2. *With regard to (Pen Dinas), it is believed that the results would be different if adjacent land could have been surveyed. The rough grassland pasture of adjacent horse paddocks appears suitable for a number of reptile species. In addition, although not surveyed the Pendinas Hill itself also appears suitable for reptile species and if taken into account would undoubtedly alter the current results.*

The surveys between 2016 and 2020 proved the hypothesis made in the above text to be correct. The visual search identified Common lizards using the full extent of the Middle Path around Pen Dinas, from the entrance at the top of Parc Dinas road all the way around the hill to the exit on to Felin-y-Mor road (known locally as Tip Road). Adults and their shed skins (sloughs) have been found on the top of Pen Dinas, south of the Monument, and heading north from the Monument, taking the “Isthmus” path leading east. This means that the whole circumference of the hill is being utilized. Beyond the scope of the survey, lizards were also seen basking on litter in the Dinas Terrace area, near the entrance to the Aberystwyth Holiday Village in 2016, 2017 and 2018, however as this area has been overtaken by scrub they have not been seen there since then. In 2018 Common lizard were noted further east along the cycle path that leads to Rhydyfelin, an area on the outer south-eastern edge of Pen Dinas.

Slow-worm territory around the village in 2020 has been observed to include further north along Felin-y-mor, next to or on roadside verges, the newly-cleared path to the west of the Monument at the top of Pen Dinas, the pavement near the entrance to the Aberystwyth Holiday Village, Maes Heli (in a compost heap) and land near Maes Crugiau, where they have made use of discarded items to shelter under. This latter area of the village has been particularly valuable habitat, with anecdotal evidence suggesting that Common lizards, Grass snakes, Common toads and Common frogs use this area too. We have recorded an adult Toad at a garden on Maes Crugiau, which had dug itself a hole underneath a plastic dustbin and in 2019 one was seen at Parc y Llyn near the cycle track, one on Piercefield Rd and one on Ty-cam. In 2020 we saved a Slow-worm that had fallen into a bath for horses to drink from, near Spenser’s Sheds; although chilled, it warmed in our hands and managed to move off to safety.

The newly-repaired pond at Parc y Llyn, although outside the survey area, has also seen very encouraging populations of Common frog, Common toad and Palmate newt.

Discussion with the Natural Historian Arthur Chater provided his recollection of plentiful Common lizards and Slow-worms using the grassy bank on Pen-Yr-Angor, Aberystwyth, which is on the western side of Pen Dinas. He also noted Palmate newts using a pond in his garden (Chater, 2017, pers. comm.). This suggests that Common lizards may be using the whole of Pen Dinas, where the habitat is suitable, and some of the area surrounding it, and that Palmate newts are making use of small garden ponds close to Pen Dinas, for the aquatic part of their life cycle.

“A new discovery in 2017 was the presence of Common lizards on the Tanybwllch SSSI (Allt Wen a Traeth Tanybwllch). This SSSI includes a vegetated sand and shingle spit, which has grassland on the leeward side of its bank. This area benefits from larger cobbles, which warm up in the sun and make ideal basking locations for the lizards.” (Griffiths, C. E. article in WWBIC Bulletin no. 28)

Common lizards were observed in this area on 3 separate occasions in 2017, but were not observed during 2018, despite searches throughout the summer and autumn. It was notable that, similarly to Pen Dinas, the vegetation that would normally shelter the lizards was very much reduced on Tanybwllch, and in some places entirely absent. This may have meant that it was too short to hide in, or simply too sparse to provide good cover. We were delighted however to find them again using the Tanybwllch site in 2019 and 2020. There were 3 sightings in 2020, 2 in mid-June and the last on 24th August, when 3 adult and 2 newborns were recorded amongst the cobbles.

We established in the 2017 report that:

“It is... possible that the Common lizards on Pen Dinas form a large, core population, with an exchange of individuals from a meta-population on Tanybwllch beach.” (Griffiths, C. E. 2017)

It seems that, even if they were not observed by our surveyors during 2018, they may still have been present on Tanybwllch beach, or if they were temporarily absent, their “core population” on Pen Dinas was robust enough to allow them to return in 2019 and 2020.

4.2 Trends

The most notable trend seen over 5 years is observable from a comparison of the 2011-12 and 2020 data and shows an enormous increase in numbers of reptile and amphibians observed of around 733% (30 in 2011-12 compared with 250 in 2020). Common lizard have been the most commonly recorded species in most years that surveys took place apart from 2011-12 and 2018. Their sightings may have dropped in 2018 due to the effects of the heat wave burning off the long grasses they use as cover to bask amongst, but have risen both years following, and peaked at 157 in 2020.

Slow-worm sightings decreased in 2016 by 30% (26 in 2011-12 compared with 18 in 2016) but by 2017 were almost back to their 2011-12 level with 25 total observations. In 2018 they had increased from the previous year by 72% with 43 observations and were the most commonly recorded reptile seen that year. By 2019 they were up to 72 sightings, an increase of 67% on the previous year, but were only the second-most recorded reptile that year. In 2020 there were at a very similar level, with 75 sightings, suggesting a stable population.

4.2.1. Maximum counts on one day show that over 5 years, the Slow-worm population appears to be steady and Common lizard numbers are rising. The counts were broadly similar from 2016 to 2017 but changed in 2018, with a large drop (from 32 to 11) in Common lizard sightings and a rise (from 5 to 8) in those of Slow-worm. By 2019 the maximum count for Common lizard had risen to 21 but was still not back up to the 2017 level. By comparison, Slow-worm, which rose in 2018, rose again in 2019 to 15. In 2020, Slow-worm figures kept steady, rising by 1 to 16. In the same year, the maximum count

of Common lizard seen on one day increased massively to 63: three times the previous year's figure of 21. It was notable that no observations of snakes had been made in 2016-20 unlike in 2011-12, despite personal communications that they were being found in nearby gardens and fields in 2017.

4.2.2. Common lizard usually give birth to young in July, and Slow-worm not until late August or early September. The first record of Common lizard young in 2020 was early, on the 17th of July. In 2019 a newborn was not observed until much later in the year, on the 11 September, 6 days earlier than in 2018 when the first sighting of young was on 17 September. A much earlier record was made in 2017, on 3 July and in 2016 the first was on the 7 August. Common lizard newborns were only picked up so early in 2017 and 2020 because of casual records, as we don't normally survey for reptiles during July. In 2018, 2019 and 2020 we did not run a survey during July. The 5 years of data on the date of first observed newborns for Common lizard covers such a range that it suggests we often miss the natal date for this species by not running Reptile surveys in July.

An earlier than usual record of Slow-worm newborns was made on 26 July 2020, more than a month earlier than they were first recorded in 2019 on 4 September. The 2019 record was itself 13 days earlier than in 2018 (17 September), and the 2018 date was 4 days earlier than they were first recorded in 2017, on 21 September. In 2016 they were not recorded until 5 October. The 5 years of data on the date of first observed newborns for Slow-worm shows that they are being recorded earlier and earlier each year. Due to the small size of our survey we do not know if this is a reflection of change in behaviour, but it is more likely to be a reflection of recorder effort. In order to come closer to the actual natal date of both reptile species in our observations surveys would need to continue throughout July and August.

4.3 Species diversity

4.3.1. Species diversity for the reptiles and amphibians of Pen Dinas was calculated using Simpson's Reciprocal Index, where 1 is the lowest possible figure, and the maximum value would be 5, as there are 5 species being included (2 reptiles and 3 amphibians). The higher the figure of the result, the higher the diversity of these species on Pen Dinas. The score is a way of measuring evenness, the relative abundance of the different species making up the richness of an area.

The index was calculated for the total observations of the surveys in 2011-12, 2016-2020.

Survey year	Simpson's Reciprocal Index
2011-12	1.33
2016	1.54
2017	1.69
2018	2.62
2019	2.19
2020	2.29

Table 6: Simpson's Reciprocal Diversity Index measure of species evenness across surveys in 2011-12, 2016-2020 on Pen Dinas.

4.3.2. The indices in **Table 6** show that the surveyed area of Pen Dinas appeared to be increasing in species diversity year on year since the start of the surveys in 2011. However, in 2018 and 2019 we did not record any Common frog, and in 2018 there was much less of a difference between numbers of Common lizard and Slow-worm recorded. This created greater evenness, and the figures in the Simpson's Reciprocal Index showed a more even relationship between the relative abundance of the different amphibian and reptile species on Pen Dinas in 2018 than in 2019 because of this. By 2020 the species evenness and biodiversity were rising slightly again, as Water shrew, Field Vole, Pygmy Shrew and Common Frog were found this year, albeit in very low numbers.

5. Limitations

- . *5.1. Disturbance*
- . *5.1.1. Results may also have differed if the sheets that were used were placed in different areas. It was decided that to reduce disturbance to the refugia and any species using the refugia, their location should stay as well hidden as possible from the public. Prior to the commencement of the project, it was acknowledged that the sites receive high levels of use by the public, which in turn would undoubtedly lead to some disturbance. With such well used public and open sites it was likely that some refugia would be interfered with and/or vandalised during the project. Despite the risk of vandalism the refugia were relatively free of interference.*

As the 2011-12 report notes, Pen Dinas is well used by members of the public, especially dog walkers and there are also people who use it as an occasional location for camping and parties in the summer months. The locations for the 2016 refugia were chosen with best reptile habitat in mind, and with an aim of being out of the public gaze as far as possible and these locations were for the most part continued every year since

2020 was the first year in 3 years in which no major physical impacts occurred on the site. The impact of travel restrictions due to the Covid-19 pandemic meant that more people were choosing to walk in local areas, and as Pen Dinas is surrounded by a population of 3,000 people, it did see increased footfall. Anecdotal evidence shows greater littering and dog fouling during this period. Another impact was the restriction in the number of people who could gather, meaning that in 2020 these surveys were carried out by the Project Officer alone. This may have meant less disturbance to the animals present, as there was no chatting, but probably also meant that the Officer missed several sightings.

In 2019, just as in 2018, there was a major impact on the reptile habitat on Pen Dinas, this time from the widening of paths. A clear result from the 2018 survey was a marked drop in the number of Common lizard records and the rise in those of Slow-worm. We note that in previous years 2016 and 2017 when peak numbers of lizards were recorded, they were almost all seen on the paths, and not either on top of, or underneath the refugia. In 2018 the paths were strimmed on 22 May 2018, removing most of the tall grasses and wild flowers that the lizards use to bask and hide amongst. By the 23rd of May it was 25 °C, and this was followed by a heat wave in June and July, which scorched off all remaining vegetation. (See photos in May and August 2018 below for comparison). This left almost no suitable habitat for basking and hiding, and may have meant that the lizards abandoned the paths along the route of our visual survey, for more suitable, un-strimmed habitat elsewhere on Pen Dinas. In 2019 their numbers recovered somewhat, and we made 95 sightings of Common lizard, but this was against the background of some of their basking sites being destroyed by machinery, considerable noise and disturbance.



New path being made on the lower slopes of Pen Dinas in 2019

In 2018 we hoped that, in spite of fewer lizards being recorded during the survey, they managed to make use of the area at the top of the hill, where no strimming occurs, and long grass was still present during the summer months, and we have to hope again that this was the case for the lizards in 2019.

Slow-worm, conversely, are almost always seen under or on top of refugia during our surveys. The refugia are not placed along strimmed paths, and therefore the Slow-worm were much less affected by either the removal of long grasses or the scorching which occurred along the paths during the heat wave. This may explain why we saw considerably more Slow-worm in 2018, as they may have benefited from the heat wave, which provided more suitable temperatures for hunting and prey capture. In 2019 we made 72 sightings of Slow-worm, in spite of the considerable disturbance to the paths, and it is possible that again, as refugia sites were on the whole, less disturbed than the paths where the visual searches take place, the Slow-worm were less impacted by this disruption and noise.



Middle Path Pen Dinas on 1st May 2018, pre-strimming.



Middle path Pen Dinas on 13th August 2018, post strimming and heat wave.

Another major impact on the environment for the reptiles occurred in 2019 when the middle and lower paths of Pen Dinas were widened and their surfaces faced with stone. This work took place over several months, from May to September, and thus affected what are usually peak months for reptile sightings. Ceredigion County Council improved the entirety of the middle path and the western end of the lower path. Machinery was on site to remove the soil and rocks, and to compress a new stone path. This generated noise and vibration along the paths where we normally carry out our visual survey. The work on the lower path actually destroyed a couple of our refugia and these were replaced immediately.

In early July 2020 some benevolent disturbance occurred at the Pant yr Allt site on Pen Dinas. A well-meaning member of the public independently removed bracken and other scrub, piled stones, moved existing refugia and added large tins to augment the 3 refugia already in place. Although some members of the public had concerns about possible destruction of habitat, this site very quickly re-grew a tall herb community and reptiles did begin to use the newly added resources.

5.2. Occupation rate of refugia and change to some of their locations.

5.2.1. At the end of the 2016 survey season the occupation rate of the refugia were assessed and it was found that the series of 8 refugia in the area around the turning circle at the end of Felin-y-Mor road (known locally as Spencer's Sheds) had produced zero reptile records. Accordingly, these were moved up to an area along a little-used path higher up Pen Dinas slopes (known as the Dogleg) which had produced good reptile numbers in 2016. By 2017 the

Spencer's Sheds area was left with only 3 refugia, 2 of which finally produced records of Common lizard, Toad and Bank vole, whilst the supplemented Dogleg area produced Slow-worm records. By the end of the 2017 survey, all 5 cluster locations had provided sightings of reptiles. In 2018 one further refugium on the firebreak finally had occupation by both Common lizard and Slow-worm on different occasions. This left only 2 refugia (out of 30) which had had zero occupation over the 3 years of the survey and this remained the same for 2019. In 2020 one more of these refugia was finally used and we note that the 5 year run of data shows only 1 refugia out of 30 has never been used over this entire period. A small change was made in 2020, when the area where refugium number 1 became overgrown. It was moved a few metres away to an area closer to the river, where a piece of well-rusted corrugated iron replaced the coroline sheet and has been extremely well-used throughout this year.

5.3. Vandalism

5.3.1. In 2016, 9 refugia were removed from their locations, whether by people, animals or weather is not known. Some were lost and some were put back in their original position multiple times before becoming permanently lost. A generous donation from F. Corke meant that these were replaced for 2017. In 2017 there was an incident sometime between the 21st and the 28th September when persons unknown removed all 12 refugia from the Firebreak area of Pen Dinas. All but 2 of the refugia were refound and replaced on the 28th. The final 2 were refound and replaced in January 2018 before the 3rd year of surveys restarted. No further obvious disturbance due to vandalism occurred in 2018, 2019 or 2020.

5.4. Visual search technique

5.4.1. A visual search was conducted alongside most of the refugia checks. Each survey included a considerable amount of time visually scanning the long grass and scrub matrix along the middle path of Pen Dinas, where it was mostly impossible to lay refugia due to the narrowness of the path, the thick scrub either side of it, and the steepness of the slopes above and below the path.

It produced a series of consistently higher reptile sightings than the refugia alone. This technique is an extremely slow walk, in silence along a public footpath, where the surveyor is often passed by members of the public and their dogs and so is rarely done in ideal conditions, however it has resulted in a peak of 63 Common lizard on one day in 2020. I showed this technique to a number of volunteers, however I would recommend only doing this with a maximum of 2 other people at a time, as it becomes impossible to avoid disturbance and sightings are compromised by larger group dynamics.

6. Recommendations

6.1. As the 2011-2 report notes, gorse is still dominant on the site, and this reduces areas suitable for reptile basking. The WTSWW report has fuller detail which still pertains in 2020. In 2017, work was carried out to clear part

of the gorse scrub from the Firebreak area to the west of Pen Dinas and this has been repeated in 2018 and 2019 although not in 2020 because of the Covid-19 pandemic. More habitat management should be undertaken on Pen Dinas to reduce suitable areas of gorse and create a mosaic of suitable habitat for reptiles. If Ceredigion County Council plan to continue to widen the paths around Pen Dinas to improve access, particularly on the lower path, this should be carried out with due care for the existing reptile population, and to maximize the long grass matrix at the sides of the paths which Common lizard use for basking.

6.2. The newly recorded Common lizard population on the Tanybwllch SSSI should be considered alongside the other important biological features of that site when its management is being planned. The risk of flood to the reptiles at Tanybwllch and the risk of fire to the reptiles on Pen Dinas should be considered during management to either site. Losses to either group could impact on the ability of the population as a whole to thrive if their stepping-stone sites are damaged. Keeping both Pen Dinas and Tanybwllch well managed for reptiles should mean that a strong enough population remains to allow individuals to re-colonise a denuded site.

6.3 As previously noted, some damaged refugia were replaced in 2018, and in one location the broken refugium was left in place and a second refugium placed on top. A survey on the 4th October 2018 at 16°C revealed this refugium being occupied by 4 juvenile Common lizard, which had formed an aggregation between the upper and lower refugium. An adult lizard was also present, resting on a stone that was underneath the upper refugia. We continued to note when lizards were found within a fold, or a broken off section of the refugia in 2020, and when a fold was present, this location proved to be a popular choice for basking. We hypothesize that the space between the base and the top layer may be warmer and drier than between soil/vegetation and a refugium and therefore at a certain temperature range more attractive to reptiles. It also has the advantage of providing cover from predators. Instead of repairing and replacing refugia as they become damaged, we will now retain them as long as possible, so that more reptiles can make use of this preferential habitat niche.

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Websites

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www.narrs.org.uk National Amphibian and Reptile Recording Scheme

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