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An overview of the Scottish National Adder Survey 2022-24

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ABSTRACT

A study was commissioned by NatureScot to analyse changes in the status of the adder (*Vipera berus*) and other native reptiles at 16 sites across mainland Scotland, the Isle of Skye and the Isle of Arran over a 30-year period from 1992-93 to 2022-24. In 2022-24, volunteer surveyors revisited sites that were previously surveyed in 1992-93 to identify changes in occupancy. Visual surveys recorded adder, common lizard (*Zootoca vivipara*), slow-worm (*Anguis fragilis*), common frog (*Rana temporaria*), common toad (*Bufo bufo*), smooth newt (*Lissotriton vulgaris)*, and palmate newt (*Lissotriton helveticus*). Adders were observed in comparable or even greater numbers at eight sites (seven of the original sites surveyed in 1992-93), but an apparent loss of adders at three of the original sites, and major declines at a previously favourable site on the Scottish Borders are cause for concern. Of the other reptiles, common lizards were the most widespread, recorded at 12 sites; and slow-worms were least often recorded, in low numbers at only four sites, though this could be expected in visual surveys for this cryptic species. This publication reviews the factors most likely to be affecting adders in Scotland, particularly the loss of suitable habitat, the likely historic impact of persecution and the potential effects of disturbance by recreational site users. It highlights the importance of sympathetic habitat management, with a particular focus on maintaining favourable micro-habitats for reptiles.

INTRODUCTION

Across Britain, populations of the adder (*Vipera berus*) have declined dramatically since the mid part of the 20th century (Baker *et al*., 2004; Gardner *et al*., 2019), and the species is considered to be "Near Threatened" in Scotland and Wales and "Vulnerable" in England, in the most recent IUCN Red List assessment (Foster *et al*., 2021). Although adders are still reported to be widespread across mainland Scotland and some islands in the Inner Hebrides (Reading *et al*., 1996; McInerny, 2014a; McInerny & Minting, 2016), anecdotal reports suggest populations may have declined across the range.

In 1992, the then Scottish Natural Heritage (SNH) (now NatureScot) commissioned a survey to investigate the status and distribution of the adder in Scotland with Biosphere Consultancies and the Scottish Agricultural Service. In addition to an extensive farm questionnaire, visual surveys were conducted by volunteers at 17 sites across Scotland to develop a base-line for adder distribution and abundance. Each site was visited 2-12 times, amounting to a total of 97 visits (Reading *et al*., 1994, 1996).

The results of the farm questionnaire showed adders to be absent from a number of regions including the Central Valley, the Outer Hebrides and the Northern Isles, as well as much of the mountainous Central Highlands region between Inverness and Glasgow (Reading *et al*., 1994, 1996). The study demonstrated adder distribution to be strongly correlated with land use, being positively associated with heterogeneous areas and negatively associated with intensively arable and rocky/rugged mountainous areas. Finally, the study provided evidence that adder abundance had declined over the ten-year period prior to the 1990s (Reading *et al*., 1994, 1996).

The objective of the present study was to repeat the original survey and questionnaire after a period of 30 years during 2022-24, following the same methodologies, to gain an insight into the adder's current status and determine whether further changes in adder populations could be detected. This paper covers the findings of the first two years of the field surveys conducted by volunteers between 1st April 2022 and 31st March 2024.

MATERIALS AND METHODS

Site Selections

Communications with Dr Chris Reading (U.K. Centre for Ecology and Hydrology), principal investigator on the original 1992-93 survey, enabled us to identify and map the 17 original sites (Fig. 1). Much can change in 30 years, and in some cases it was difficult to accurately replicate the original transect routes. Nevertheless, with advice from the land managers, and the original reptile records, we were able to identify survey routes for 15 of the original sites. We also identified one additional site (12b), in Edinburgh and the Lothians.

Recruiting surveyors

Surveyors were initially recruited during a half-day workshop at the online Scottish ARGs Meeting on

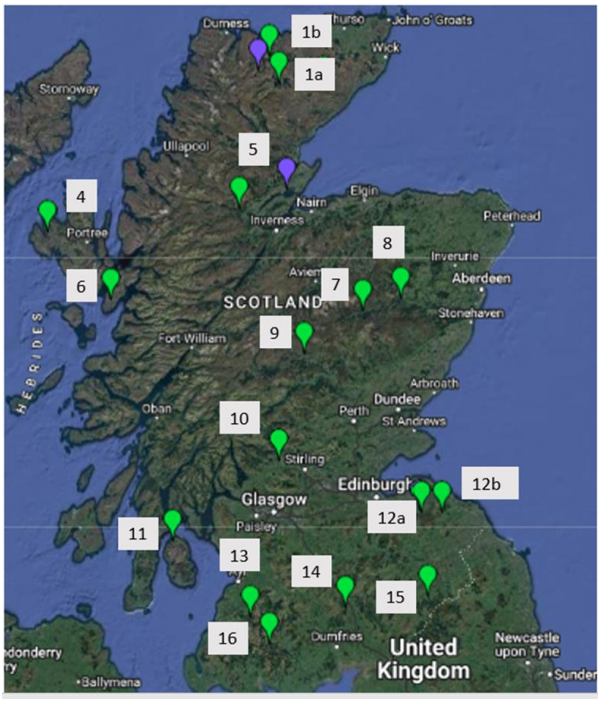

Fig. 1. Active Scottish National Adder Survey sites from 2022-23 (green markers) and from 1992-93 only (purple markers).

Saturday 30th October 2021. From this event, and subsequent appeals made through the partner organisations' networks and social media, we were able to recruit 102 potential volunteers for the survey. Each volunteer was provided with the *Scottish Adder Survey Protocol* which contained the methodology and how to upload the results to the online project portals.

Survey Protocols

The original objective was for each site to be visited at least eight times during the active reptile seasons (February/March – September/October) over the years 2022-24, with visits at least two weeks apart. More visits than this could overly disturb the animals. Although focusing on adders, volunteers were asked to record all reptile and amphibian species observed, including all life stages and sloughs (Figs. 2-4).

Fig. 2. Male adder (*Vipera berus*), Scottish Borders, Scotland, March 2022. (Photo: Andrew Mossop)

Fig. 3. Melanistic common lizard (*Zootoca vivipara*), Aberdeenshire, Scotland, 2023. (Photo: Stephen Corcoran)

Fig. 4. Female slow-worm (*Anguis fragilis*), Scottish Borders, Scotland, March 2022. (Photo: Andrew Mossop)

For reptile surveys, weather conditions are crucial to detectability (Prestt, 1971; Sewell *et al*., 2013; Bauwens & Claus, 2019). Early in the season (January – April) reptiles may be located basking even on relatively cold days (temperatures <10ºC) in sheltered sunny microclimates. However, we recommended that surveyors aimed for warm (from 10–20ºC) overcast days, particularly after a period of heavy rain. We advised surveyors not to survey during extreme weather events or high winds.

At each site we asked the surveyors to complete a roughly circular transect, walking for a period of about three hours (recording their start and end time), moving quietly and slowly scanning the ground and any suitable habitat features looking for animals. Surveyors were particularly asked to check southerly facing banks; sheltered microhabitats; "transitional" areas, e.g. the edge of a path or woodland ride, or at the edge of a scrub belt; and for common lizard basking on timber and rubble.

RESULTS

Table 1 summarises the number of survey visits during the period from 1st April 2022 to 31st March 2024. It should be noted that it was not always possible to achieve eight visits for each site. For some sites there were restrictions on the timing of visits due to forestry

Site Number*	Site Location	No. visits 1992-93	No. visits 2022-23
1a	Sutherland (Highland)	12	3
1b	Sutherland (Highland)	4	3
4	Isle of Skye (Highland)	10	8
5	Ross & Cromarty (Highland)	4	4
6	Isle of Skye (Highland)	4	5
7	Aberdeenshire	3	9
8	Aberdeenshire	5	12
9	Perth & Kinross	8	6
10	Stirling	5	14
11	Arran (Ayrshire & Arran)	3	4
12a	Edinburgh & the Lothians	7	3
12b†	Edinburgh & the Lothians	0	6
13	Ayrshire & Arran	7	3
14	Dumfries & Galloway	4	8
15	Scottish Borders	12	9
16	Dumfries & Galloway	7	4

Table 1. Number of Scottish National Adder Survey visits completed at active sites in 1992-93 and 2022-24. *Based on the 1992-93 survey numbering system with the sites shown in Fig. 1. †A new site adjacent to the original 1992-93 survey area, but not included in the original surveys.

and other operations, and the volunteers found it difficult to predict accurately when weather windows would be favourable which, particularly for the more remote sites, made planning difficult. For these reasons the results presented are based on the efforts of 29 active surveyors.

For each of the sites visited, we plotted peak counts for all amphibians and reptiles observed during the 2022-24 seasons following the protocols of Gardner *et al*. (2019), since different numbers of visits were made to each site (Table 1). Surveyors were asked to record all amphibians and reptiles, and there are records for adder (Fig. 2), common lizard (Fig. 3), slow-worm (Fig. 4), common frog, common toad, smooth newts, and palmate newts. These results are presented in Table 2 and Fig. 5.

DISCUSSION

For each site, all amphibians and reptiles were recorded, with common lizard being most frequently observed, then common toad, adder, common frog, and slow-worm. Smooth and palmate newts were less frequently observed, but this would be expected in what was primarily a visual survey for reptiles, since these species are most often recorded in ponds during the spring breeding season. As this is a visual encounter survey, we would also expect slow-worm to be under-recorded as they are typically cryptic, with a fossorial habit (McInerny, 2014a).

If refugia mats had been used, it is likely that higher numbers of slow-worms and amphibians would have been recorded. Adders were recorded from eight sites (seven of the original sites) in 2022-24, in contrast to the nine sites where adders were recorded in 1992-93. The largest numbers of adders were consistently recorded at Site 8 in Aberdeenshire with a peak count of 12 animals. This site is a national nature reserve, and managed sympathetically for reptiles. These comparative numbers appear to show declines, but with only a few visits to some sites it is hard to confirm absence. A single adder was recorded near some abandoned stone buildings on the trail to the site in north Arran, but as this was not within the 1992-93 survey area (no adders were reported from 1992-93) it was not included in the results. The forested site in the Borders had been a favoured site in the 1992-93, with a total of 48 animals recorded during 12 survey visits. However, the surveyors recorded only a single female adder (observed three times, but possibly the same animal) during nine separate visits in 2022-24. This accords with anecdotal evidence from the original survey team (J. Allan, pers. comm.) that forestry harvesting and extensive clearances of former suitable adder areas has led to the loss of what was previously a strong adder population (or movement of animals to new locations). Similarly, Site 4 in northern Skye, Site 7 near Braemar and Site 13 in Ayrshire & Arran, may have experienced localised changes to their management regimes that have not favoured adders, or caused them to move, making them harder to locate during a visual survey. Though as only a single individual was recorded at both Site 7 and Site 13 in 1992-93, it may be that there were only ever small populations of adders there.

It should also be noted that different surveyors visited the sites, each with differing levels of experience. Therefore, with so few survey visits, a negative sighting may reflect lack of experience, or poor weather conditions causing the animals to shelter out of sight, rather than definitive absence.

It was interesting to note that adders were recorded at the two sites in Edinburgh & the Lothians in the 2022-24 surveys, where they were recorded as absent in 1992-93. On Arran, one surveyor took a different route to the survey site and therefore found an adder at a location not previously visited. In both areas there are opportunistic records from recent years, logged on Record Pool

(www.recordpool.org.uk), and it may be that small adder populations persist in the locality.

Adder declines are likely to be due to a number of causes, primarily habitat loss, but also persecution, predation, disturbance, and burning of their habitat, and these threats may occur simultaneously. Agricultural intensification and commercial forestry are some of the biggest direct causes of adder habitat loss. Adders have suffered more than other widespread reptile species

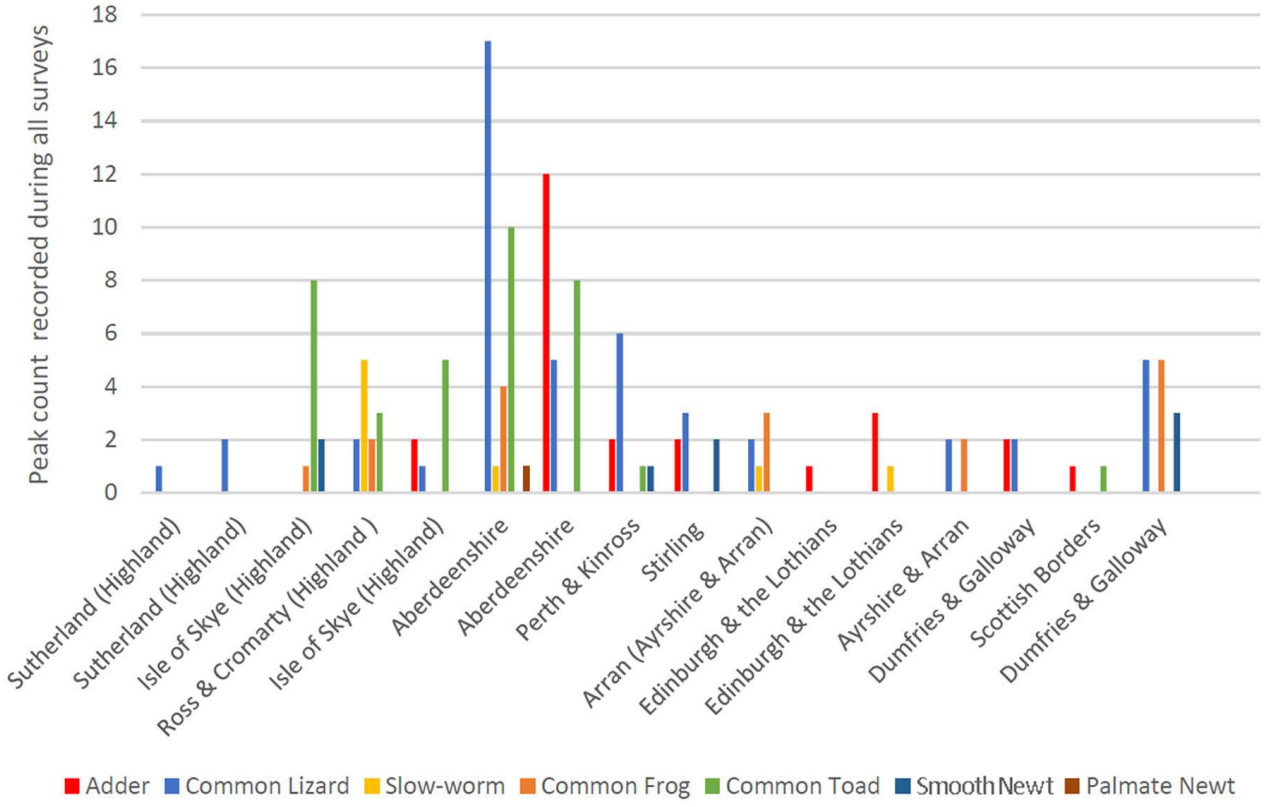

Fig. 5. Peak counts for all amphibian and reptile species at the 16 Scottish National Adder survey sites during 2022-24.

Site number*	Site location	Adder 1992-93	Adder 2022-24	Common lizard 1992-93	Common lizard 2022-24	Slow-worm 1992-93	Slow-worm 2022-24
1a	Sutherland (Highland)						
1b	Sutherland (Highland)						
4	Isle of Skye (Highland)						
5	Ross & Cromarty (Highland)						
6	Isle of Skye (Highland)						
7	Aberdeenshire						
8	Aberdeenshire						
9	Perth & Kinross						
10	Stirling and Forth Valley						
11	Ayrshire & Arran						
12a	Edinburgh & the Lothians						
12b†	Edinburgh & the Lothians						
13	Ayrshire & Arran						
14	Dumfries & Galloway						
15	Scottish Borders						
16	Dumfries & Galloway						

Table 2. Changes in occupancy at the sites (based on presence/absence only) for the three most regularly reported reptile species (adder, common lizard and slow-worm) in the 30 years between the original surveys during 1992-93 and 2022-24. *Based on the 1992-93 survey numbering system with the sites shown in Fig. 1. †A new site adjacent to the original 1992-93 survey area, but not included in the original surveys. Red: adder present; blue: common lizard present; yellow: slow-worm present; grey: site not surveyed; white: reptiles absent.

because, although they have habitat preferences that accord with that found across much of Scotland (*McInerny et al*. 2014b), they have been heavily persecuted in the past and they are less able to colonise new locations when populations recover (Gardner *et al*., 2019). In addition, despite some changes in attitudes by humans, adders are still sometimes deliberately killed, even though this is illegal, further diminishing already small and fragmented populations. Adders also appear to be sensitive to repeated disturbance by recreational site users and photographers (Baker *et al*., 2004).

Even on protected sites adder populations may not persist, as many standard habitat management practices do not favour the species. In some cases, unsympathetic habitat management, particularly widespread clearance of vegetation, over-grazing, burning and extensive scrub management, with the removal of hibernation sites and other important landscape features, can lead to severe declines and local extinctions (Worthington-Hill & Gill, 2019; Law *et al*., 2020). Conversely, lack of positive management, leading to degradation of key microhabitat features and shading of basking areas, may also negatively affect adders.

The results to date provide us with an overview of the status of adders and other species of amphibian and reptile at 16 sites, spread across mainland Scotland, the Isle of Skye and Arran. As this is an ongoing study, it is intended that a more extensive analysis and interpretation will be undertaken once the spring reptile emergence surveys from 2024 and questionnaire data collection are completed. Whilst it is encouraging that adders were observed at comparable or even greater numbers at eight sites (seven of the original sites surveyed in 1992-93), the apparent loss of adders at three of the original sites, and the major declines observed at Site 15 in the Scottish Borders should be a cause for concern. This highlights the importance of on-going monitoring and of obtaining a better understanding of adder distribution and habitat requirements (Prestt, 1971; McInerny, 2014b; Bauwens & Claus, 2019), in order to work in partnership with land managers to reverse any declines and work towards bolstering healthy populations for the future.

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