

# Co-existence of reptiles and humans: observations on a population of northern vipers on a Scottish golf course

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**ABSTRACT** - A population of northern vipers *Vipera berus* was studied for a five-year period, from 2012 to 2016, on a golf course in Scotland. Numbers, distribution, movements and habitat were monitored. Snakes were found predominately in three core areas, which contained stands of bracken *Pteridium* spp., gorse *Ulex* spp., bramble *Rubus fruticosus* agg. and heather *Calluna vulgaris*, adjacent to wet ground and streams. However, they were also occasionally found elsewhere on the golf course, even using artificial sites, such as golf tees. The reasons for the survival of this population at such a developed site were explored, with the implications of these observations for northern viper conservation discussed.

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## INTRODUCTION

Many reptile species are declining both in range and numbers in the UK and Europe, which has prompted research to reveal the reasons for these trends (Corbett, 1989; Beebee & Griffiths, 2000; Gleed-Owen & Langham, 2012). This has resulted in conservation measures, including some legal protection and, where necessary, habitat restoration and habitat management practices (Wild and Entwistle, 1997; Baker et al., 2004; Edgar et al., 2010).

Scotland has in some areas apparently healthy populations of northern vipers and other reptiles (McInerny & Minting, 2016). One such area is around Loch Lomond, where populations have been studied to provide information on reptile breeding biology, numbers, habitat preferences and conservation (McInerny, 2014a; McInerny, 2014b; McInerny, 2016a; McInerny, 2016b).

In western Scotland northern vipers are found in a wide range of habitats, from upland moors and forest clearings to more developed areas, such as roadside verges, embankments and golf courses, sometimes near to human habitation, suggesting that the species is versatile in its habitat requirements (McInerny, 2014b; McInerny & Minting, 2016). To understand how northern vipers survive in a developed area, a population was studied on a golf course near Loch Lomond for a five-year period. Northern vipers had been observed at the site for many years; these anecdotal observations prompted the study described here. This paper describes snake numbers, breeding biology and movements, along with the areas and habitat within the golf course where animals were found, and should inform conservation approaches to protect northern vipers at other developed sites in Scotland and elsewhere.

## MATERIALS AND METHODS

### Study site

The study site is described briefly in McInerny (2014b), and in more detail here; it is kept anonymous to protect

both the reptiles and habitat, and to minimise interference to golfers using the course. The site is an 18-hole golf course near Loch Lomond of about 50 hectares, sloping to the south and ranging in altitude from 30-70 m (Fig. 1). A mature forestry plantation of spruce *Picea* spp. and an unsealed road forms the perimeter above, with a metalled road below.

The golf course contains large, managed areas of very short, cut grass on the tees, greens and fairways, areas of thicker cut grass along the sides of fairways, the 'rough', and artificial sand bunkers and golf tees (Fig. 1). These managed areas are interspersed with large sections of bracken, gorse, bramble and heather; areas of thicker tall grass are also present containing many mounds 1-3 m in size, these often covered with moss and grass. A number of small streams pass down the slope, and interspersed throughout the golf course are mature trees, predominately oak *Quercus* spp., with smaller numbers of birch *Betula* spp., ash *Fraxinus* spp. and rowan *Sorbus* spp.

The underlying geology is a mixture of glacial moraine and conglomerate rocks, with some exposed rock faces. A number of dry stonewalls cross and surround the course, and dry stonewalls have been created for some of the golf tees. Slow-worms *Anguis fragilis* and common lizards *Zootoca vivipara* are also found on the site.

### Survey work

The survey methods used are described in McInerny (2014a) and McInerny (2016a), and followed published protocols (Sewell et al., 2013), although artificial refuges were not used to locate animals, due to public access at the site. The site was monitored from 2012 to 2016, with 10-20 visits each year from early February to late October, with each visit lasting 2-3 hours, covering a survey distance of 3-4 km. On each visit the location, number, maturity and gender of snakes were recorded, with the recorded day count noted. Juveniles were defined as snakes less than a year old, with adult males and females recognised through their background body colour, and snout scale edge colour.



**Figure 1.** Distribution of northern vipers *V. berus*, on a Scottish golf course, 2012 to 2016. Core areas where vipers hibernated and were seen regularly are indicated by red boxes; locations of occasional sightings are shown by red dots. The layout of the golf course is mapped, with the 18 holes marked: open circles, tees; lines, fairways; ♪, greens and holes.

As artificial refuges were not used for monitoring, it is possible that sub-adults and juveniles were under-recorded (Hodges & Seabrook, 2016). Northern vipers were recognised through visual inspection and photographs of head-scale patterns, these being unique to individuals (Sheldon & Bradley, 1989; Benson, 1999). Thus, both day counts were recorded and minimum population numbers estimated. Habitat types were also surveyed, with these noted in relation to the location of snakes.

## RESULTS

### Northern viper numbers and annual cycle behaviour

The site held numbers of vipers, with 10 to 39 individuals counted each year (Table 1, Fig. 2). During the five-year period a minimum of 54 different snakes were recognised by head-scale patterns. Similar numbers of adult males and females were recorded, with a gender ratio of 1.0:1.1. Eight juveniles were observed.

Snakes first appeared in mid-February, with the majority emerging from underground hibernation sites in mid- to late March and early April (Fig. 2). Courtship and mating activity were observed in most years from early to late April, though in 2016 they were first seen in late March, on an unseasonably warm day. Many snakes were not observed through the summer, these either moving to feed elsewhere or remaining out of site under vegetation

or underground, before being found again at hibernation areas from August. Gravid females instead remained visible at the study site throughout the summer, basking for extended periods near to hibernation areas, to aid gestation of developing young which are live born; young were first seen in August. Animals remained near hibernation sites to late October, when they returned underground to hibernate. These observations suggest that the snakes' annual cycle was unaffected by the managed habitat of the golf course, or by disturbance from the golfers, with feeding and reproduction uninterrupted.

### Northern viper distribution in relation to habitat

Northern vipers were found at a number of places throughout the golf course, though they predominated in three core areas, near hibernation sites (Fig. 1). These were each about one hectare in size containing a mosaic of bracken, gorse, heather, tall grass and moss; in each a stream and wet ground were found nearby. Snakes were also observed basking in the core areas, and occasionally in the rough on the edges of adjacent fairways; one used an artificial tee as a basking site over two summers (Fig. 3). More rarely, adult males, adult females, and juveniles, were observed away from the core areas, on short grass on fairways and greens; such animals were always present temporarily. On a few occasions golfers also reported snakes on tees, fairways and greens. No evidence was

obtained that snakes moved between the three core areas, with it appearing that each core area contained a separate sub-population.

**Management practice at the golf course**

**Table 1.** Numbers of northern vipers *V. berus* on a Scottish golf course, 2012 to 2016. For each year, the number of visits, total number of day counts, and the minimum numbers of individual adult males, adult females and juveniles are shown. Individuals were identified through their head-scale patterns. During the five-year period a minimum of 54 different snakes were recognised.

Year	Visits	Day Counts	Individuals			
			Total	Male	Females	Juvenile
2012	20	36	19	6	11	2
2013	17	37	26	14	10	2
2014	16	77	39	13	22	4
2015	10	21	10	6	4	-
2016	14	36	23	13	10	-

The golf course was managed by at least two groundsmen working full-time from February to November. Large tractor-drawn grass cutters were used on the fairways and rough, with more specialised fine cutters on and around the greens. Areas of bracken and gorse were largely left unmanaged, though occasionally bracken, gorse, trees and bushes were pruned or removed.

The groundsmen rarely encountered snakes. Though northern vipers are shy and very well camouflaged, they can be tolerant of noise and activity (McInerny, 2016a). For example, on a number of occasions basking snakes were seen not to move in spite of grass-cutting equipment passing within 1-2 m. Perhaps surprisingly, therefore, no dead snakes were found by the author or groundsmen during the five-year study period.

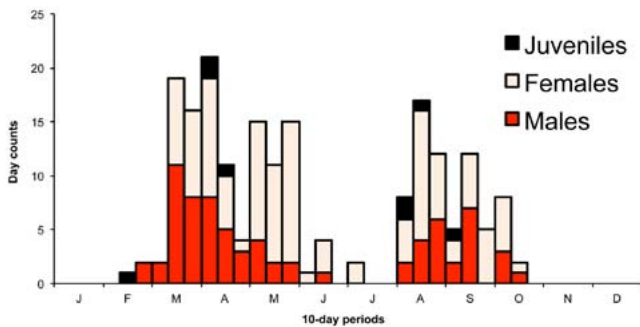
Disturbance of snakes by golfers was minimal. Golfers largely remained on the fairways, rough and greens, rarely venturing into areas of bracken and gorse to find lost golf balls, being aware that snakes were present. This was demonstrated by the observation that at least 200 golf balls were found by the author while searching for reptiles in areas of bracken and gorse during the five-year study.

**DISCUSSION**

This study describes a population of northern vipers on a golf course near Loch Lomond, Scotland. It revealed up to 54 individuals, with slow-worms and common lizards also present. Highest numbers were encountered in three core areas each about one hectare in size which contained areas of bracken, gorse, heather, tall grass, moss, wet ground and streams, where disturbance by golfers was minimal.

It appears that the golf course layout provides suitable habitat to allow reptiles to feed and breed, as annual cycle behaviour similar to that reported elsewhere was observed (Viitanen, 1967; Prestt, 1971; Neumeyer, 1987; Andersson, 2003; Phelps, 2004; Hodges & Seabrook, 2016; McInerny, 2016b). Furthermore, the management and use of the golf course did not appear to result in snake mortality, allowing the population to persist. This may also apply at other golf courses in Scotland, as northern vipers are present in at least three others (pers. obs.), which have similar habitat profiles of bracken, gorse and grass, interspersed between greens and fairways.

In the UK there are over 3,000 golf courses, with at least 100 of these recognised as environmentally important, being designated SSSIs (Gange et al., 2003). There is now an increased realisation that golf courses can, if managed sympathetically, be important areas for biodiversity (SGEG, 2004; Tanner & Gange, 2005; Mackey et al., 2014). In the context of reptiles, habitat management regimes have been introduced at the Royal Birkdale and Hesketh golf courses in Merseyside, England, to benefit sand lizards *Lacerta agilis* (Edgar et al., 2010). At another golf course in southern England log piles have been added to rough areas to provide cover and basking sites for northern vipers (Kent Reptile and Amphibian Group, pers. comm.). The observations presented here suggest that golf courses can sustain populations of northern vipers and other reptiles, if suitable habitat is present. Considering the general



**Figure 2.** Total numbers of northern vipers *V. berus* on a Scottish golf course, 2012 to 2016. Total day counts for 10-day periods over the five-year period for adult males (red), adult females (pink) and juveniles (black) are plotted.



**Figure 3.** Northern viper *V. berus* basking on an artificial golf course tee. This male used the same tee as a sunning site during two consecutive summers, and was seen by many golfers.

decline in northern viper numbers and range in the UK, their presence in golf courses may become increasingly important, contributing to the species' conservation.

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