# ARTIFICIAL REFUGES WITH TRANSECTS AS A POSSIBLE REPTILE SURVEY METHODOLOGY

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## ABSTRACT

A review is made of the suitability of existing methodologies of reptile survey in a British environment. The assessment is supported by field data obtained from survey of a heathland in southern England, using artificial refuges with transects. The paper provides an indication of the effectiveness of this methodology. Recommendations are made regarding a potential standard survey methodology that could be suitable for use by herpetologists in cool, high latitude climates.

## INTRODUCTION

At present there is no standard methodology for quantitatively surveying terrestrial reptile species in Britain. The Guidelines for Baseline Ecological Assessment in the UK (Institute of Environmental assessment, 1995) states that:

"No standard quantitative technique exists for surveying reptiles, although a qualitative method based on sightings is available."

An information note produced by English Nature (Gent, 1994) usefully reviews some reptile survey and monitoring methods and discusses their UK licensing requirements.

The purpose of this paper is to review briefly the main reptile survey methods and discuss one particular method used recently in southern England. We deal only with methodologies not involving land-based or semi-aquatic testudines (ie not tortoises or terrapins) since only a small number of established alien populations of this group occur within Britain.

The requirement for a quantitative reptile survey is to provide a cost- and time-effective methodology for assessing species composition and also to provide a preliminary indication of population density. To provide reliable population data the methodology also needs to include elements such as 'mark and recapture'. Additional considerations for a survey methodology include low raw material costs, a low maintenance requirement, and in areas of high public access, some resistance against vandalism.

## EXISTING REPTILE SURVEY METHODS

Many of existing reptile survey methodologies have been developed in the USA. The climatic conditions in the States tend to provide warmer and sunnier summers, the season during which reptiles are most active and these areas tend also to have more diverse reptile communities, containing higher densities of individual reptiles.
Methodologies commonly used in the USA include: direct observation and transect walking; night-time car cruising (Karns, 1986); active (limited area or timed) search and

seize techniques sometimes involving removal (Bury, 1982; Karns, 1986); pitfall and funnel trapping coupled with drift (barrier) fencing (Gibbons and Semlitsch, 1981; Campbell and Christman, 1982; Vogt and Hine, 1982); and with the use of artificial refuges (Grant, Tucker, Lovich, Mills, Dixon, Givvons & Gibbons, 1992; Peterson and Dorcas, 1992).

One of the most effective, but high input (in terms of time and costs) methods used in the USA is the drift fence with traps technique, which utilizes a solid barrier to direct moving animals into the associated pitfall or funnel traps. This method has been found by Campbell *et al* (1982) to give good quantitative estimates of the reptile (and amphibian) community and reduce the inherent observer bias associated with observation and search methods. It is also noted as being effective in a wide range of habitat types from temperate grasslands (Vogt and Hine, 1982) to tropical cloud forests (Barker, unpubl. obs., 1988). However even this technique must be used with other methodologies, such as direct observation to obtain a complete herpetofaunal species list. The use of artificial refuges (coverboards) has also more recently been put forward by Grant *et al* (1992) as a successful means to quantify herpetofaunal communities.

In Britain, with a predominantly cool and cloudy maritime climate, even during summer many of the existing methodologies are often unsuitable due to the reduced activity of the reptiles. The effectiveness of the technique is also hampered by the low densities at which reptiles often occur in Britain. For example, night-time car cruising would only be worthwhile in large areas of good reptile habitat where an extensive network of quiet roads exists.

The low density and diversity of reptile communities also makes the drift fence trapping method unsuitable on many survey sites due to the large effort required in setting up a series of arrays. In addition, the method relies on the mobility of individuals for capture so the relatively sedentary British lizard species are less likely to be captured than more widely foraging species occurring elsewhere. The traps also require regular checking to ensure the welfare of target and non-target animals, and are susceptible to interference.

## ARTIFICIAL REFUGE AND TRANSECT METHODOLOGY

The use of artificial refuges is suggested as a possible method by Gent (1994) and the survey results published from the USA are generally encouraging, for example as found by Campbell *et al* (1992). Recently a quantitative reptile survey was required for a project in an area of lowland heath in southern England during the summer of 1994. The work thus provided an opportunity to test the effectiveness of the artificial refuge methodology under British conditions.

On account of its ecological importance the study area is designated as a Site of Special Scientific Interest, indicating its ecological importance. The site is characterised by large expanses of heath, predominantly heather (*Calluna vulgaris*) and cross-leaved heath (*Erica tetralix*) with purple moor grass (*Molinia caerulea*), together with extensive areas of gorse (*Ulex europeus*).

The site is known to contain five of the six species of reptile found in Britain; Grass Snake (*Natrix natrix*), Adder (*Vipera berus*), Viviparous Lizard (*Lacerta vivipara*) and Slow Worm (*Anguis fragilis*). Sand Lizards (*Lacerta agilis*) have recently been reintroduced to part of the heath. The site may have originally also supported Smooth Snakes (*Coronella austriaca*) but no historical records exist and recent fires are likely to

have eliminated any remnant population.

Overall the site is prime reptile habitat, though in common with most other English lowland heaths extensive scrub and woodland invasion is reducing its value for these species.

It was necessary to develop a low-cost methodology suitable for establishing the presence or absence of these reptile species in one part of the heath as part of an assessment of a potential development. Constraints to the survey were cost and distance. Due to the distance to the heath it was necessary to devise a methodology which did not require daily inspection. For this reason techniques requiring regular monitoring such as pitfall and funnel trapping along drift fencing were discounted.

It was decided to use coverboards placed along a fixed transect, combined with visual analysis of heathland along the transect route. The coverboards selected were Welsh slate roofing tiles (approximately 60 cm x 30 cm) obtained from a local reclamation yard. Their black colour would permit maximum absorption of incoming solar radiation and their matt texture made them relatively unobtrusive, thus minimising the risk of vandalism. Furthermore, they were relatively inexpensive.

Supplementary coverboards were provided from rubber car floor mats obtained from scrapyards. These had similar advantages to Welsh slates in that they were matt and black. Second-hand corrugated metal roof sheeting and wooden boards were not locally available in sufficient numbers for use in this study. The high conductivity of metal sheeting means that it heats and cools rapidly, thus reducing its value in unsettled weather. On the other hand Welsh slates retain some heat during the late afternoon and through brief periods of rain, although it is relatively slower to warm in the morning. Metal sheeting has, however, been used with success at another heathland site without public access in Dorset (Mahon, pers. Comm.).

The coverboards were distributed in twenty groups of five sheets (4 tiles and one rubber mat) along the transect. At each location they were placed in a variety of microclimatic locations. Microclimates chosen included:

morning sun; full midday sun; afternoon sun; full shade; north facing slope (reduced insolation levels); south facing slope (maximum insolation levels); bare ground; bare ground/scrub boundary; scrub; "woodland" (dense scrub and young trees); damp site; dry site

It was considered that optimisation of microclimatic variation would permit reptiles to vary the coverboards used according to the weather. For example during hot and sunny weather reptiles would be unlikely to be found under a coverboard exposed to the midday sun; in these conditions the coverboard became extremely hot. However, during cool and cloudy weather reptiles might be more likely to be found under the tile exposed to maximum incoming solar radiation.

The coverboards were placed on site in mid June 1994 and monitored regularly until their removal on 24 November 1994 on completion of the study. Although there is some evidence put forward by Grant *et al* (1992) that coverboards only reach their maximum efficiency approximately 2 months after installation, monitoring was commenced immediately. The reason for this 'lag time' is unclear but probably relates to conditions under the boards and time taken for the reptiles to locate them.

During the duration of the experiment, monitoring visits were undertaken on 12 occasions, concentrated from July to September. Visits were chosen to coincide with a variety of weather conditions and at different times of day. On each occasion all coverboards were lifted and replaced after inspection. These were lifted to face away from the researcher in case of the presence of venomous species.

An important additional feature in the study was the recording of incidental observations of reptiles along the twenty set transects connecting the groups coverboards.

## RESULTS

The following species were recorded during the survey. The results include sightings of species recorded during the transect walk.

*Lacerta vivipara*
*Vipera berus*
*Natrix natrix* (sloughed skin)

*Bufo bufo* (Common Toad, amphibian)

A summary of the results obtained during the study are given in Table 1. In the twelve site checks, the total number of encounters for both refuge and transect records was 18 reptiles or amphibians. Of these 7 records came directly from refuge encounters and 11 from observations along the associated transects. The total number of refuge checks during the study was 1200, providing 7 encounters, or an average encounter rate of approximately 1 animal per 100 refuges.

Grant *et al* (1992) in their more comprehensive studies in South Carolina recorded an average encounter rate of between 5-6 animals per 100 refuges. This is well above our encounter rate and a number of possible reasons are given in the discussion section below.

Although great care had been taken to conceal the coverboards a significant proportion (approximately 25%) were removed or destroyed during the course of the study. These were not replaced.

**Table 1**

Summary of Results

| | No. of individuals noted | | Encounter Rate (%) |
|---|---|---|---|
| Species | Refuges | Transects | |
| *Lacerta vivipara* | 5 | 7 | 0.58 |
| *Vipera berus* | 0 | 3 | 0.25 |
| *Natrix natrix* | 0 | 2 | 0.17 |
| *Bufo bufo* | 1 | 0 | 0.08 |

## DISCUSSION

This study was of limited success, which could be attributed to the following factors:

There was a lag-time effect on the refuges - for the first few weeks no encounters were recorded from the refuges.

The late start of the study may have also reduced the effectiveness of the survey technique because the productive late spring/early summer survey period was missed.

The unusually hot summer during 1994 is likely to have reduced the effectiveness of coverboards. Extended periods of high temperatures and sunshine (c. 25 °C) meant that the reptiles were not dependent on coverboards for warmth; indeed those in full sun became so hot that had reptiles used them they would probably have perished. During this period monitoring surveys were only effective when undertaken during early to mid-morning.

Greater success was recorded during the cooler temperatures of late summer and autumn. Indeed a juvenile Common Lizard was recorded under a coverboard on 24 November when most reptiles were hibernating. The reasons for this are likely to include the lower air temperatures that occur in autumn and thus the increased value of warmed coverboards to reptiles, together with the longer period since establishment.

Although fragile and vulnerable to both deliberate and accidental trampling, the Welsh slates were effective as coverboards. The flexible nature of the rubber mats made them slightly more difficult to examine safely, although they also proved to be reasonably effective.

It is felt that the relatively small size of the coverboards used may have reduced their desirability to reptiles, although further investigation would be necessary to establish this. However, any benefits of larger coverboards would need to be countered by consideration of the greater area of ground cover that would be lost by the use of larger boards.

## RECOMMENDATIONS FOR FUTURE SURVEYS

As a result of data review and field survey it is recommended that a standard reptile survey methodology should include the following features:

1. The use of coverboards of varying size and materials. These could include large Welsh roofing slates, secondhand (and therefore rusted) corrugated sheeting, and large wooden boards. Pieces of plywood would be ideal for this purpose. It may be of benefit to paint some of the boards white for use by reptiles during hot weather to minimise heating. On some sites, however, this may be visually unacceptable. Car floor mats and similar materials could also be used.

2. Although wooden boards were not used in this experiment they have been used with success by Grant *et al* (1992) in the United States. They state that "...far more animals were encountered beneath wood", though the fact that his work was undertaken in South Carolina, which is substantially warmer than Britain suggests that metal coverboards may have become too hot for reptiles. Further work within a cool, temperate climate, will be necessary to establish the relative value of wooden coverboards in British conditions.

3. Ideally coverboards should be put in place at least two months before the monitoring is undertaken, though the reasons for this apparent 'lag-time' are currently unknown. The boards should be placed so as to include as wide a range of microclimates as possible so that reptiles may be recovered during a variety of weather conditions.

4. Monitoring visits should be undertaken at different times during the day, though it should be borne in mind that coverboard searches during the middle of the day in hot and sunny conditions are unlikely to be successful.

5. It is recommended that a coverboard survey be undertaken along a fixed transect, similar to the Pollard Walk used for butterfly surveys, and details of reptiles recorded along the transect be systematically recorded.

6. Although other methodologies were not assessed under British conditions the authors consider that a coverboard based survey is likely to be most successful, particularly during cool and cloudy weather and at higher latitudes and altitudes, such as in mountainous areas and in northern Britain.

7. Other methods, such as drift fencing with funnel and pitfall traps are not recommended, except where they can be monitored daily and in areas where there is limited, or no public access. There are few areas where reptiles are sufficiently frequent near roads in Britain to justify night-time 'car-cruising'.

## CONCLUSIONS

A literature search combined with a field experiment undertaken on an area of heathland in southern England indicates that the optimum methodology for reptile survey in Britain is likely to include the issue of coverboards combined with direct observation. Success has been obtained from using coverboards made of large Welsh roofing slates and corrugated roofing sheets. The use of large wooden plywood boards is also likely to be successful. The coverboards used should be sited to include the broadest possible range of microclimates.

There is a clear need, however, for concentrated survey work and assessment to be undertaken to determine the optimum methodology for surveying the six species of reptile occurring in Britain. This research is currently being undertaken by English Nature.

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