Appendices

Appendix 1. Programme for Seminar on Reptile Survey Methods, 7 November 1995

Hodgson Room Zoological Society of London, Tuesday 7 November 1995
Chair: Dr Tony Gent, English Nature

0945 *Arrival and coffee*

1000 **Introduction from the Chair**

Session 1: Background to reptile survey

1005 **A statutory perspective on reptile survey** (Steve Gibson, Joint Nature Conservation Committee)

1020 **Training courses and translating survey data into conservation** (Jim Foster, Herpetofauna Conservation International Ltd)

1035 **Outline of reptile thermal ecology and its relevance to survey methods** (Martin Gaywood, Scottish Natural Heritage and Tony Gent, English Nature

1050 *Discussion: The conservation objectives and scientific basis of reptile survey*

Session 2: Field studies I - widespread species

1120 **Monitoring common lizards and slow-worms at a site in Canterbury, with special reference to refugia materials, refugia occupancy and individual identification** (Anne Riddell, University of Kent)

1135 **Slow-worms in Kent: estimates of population density and post-translocation monitoring** (Renata Platenberg, Canterbury Christchurch College and Tom Langton, Herpetofauna Consultants International)

1150 **Results of a 'grid' system of tinning for common reptiles in Northamptonshire** (Tony Gent, English Nature and Mabel Cheung, Royal Holloway College)

1205 *Discussion: The use of refugia in reptile surveys*

1230 *Lunch*

Session 3: Field studies II - All species

1345 **Monitoring sand lizards in Dorset under the Species Recovery Programme** (Keith Corbett, Herpetological Conservation Trust)

1400 **Monitoring the effects of stock-grazing on reptiles** (Stuart Graham, English Nature)

1415 **Results from one month's observation of a reptile transect study** (Bill Whitaker, Herpetological Conservation Trust)

1430 **Survey methodology for British reptiles: a practical proposition?** (Howard Inns, British Herpetological Society Conservation Committee)

1445 **Validation of reptile survey methologies** (Chris Reading, Institute of Terrestrial Ecology)

1500 *Tea*

1515 *Discussion: Towards a standard survey methodology for British reptiles?*

1625 Concluding remarks

1630 Meeting closes

Appendix 2. List of attendees at seminar

Henry Arnold, Institute of Terrestrial Ecology
James Cadbury, Royal Society for the Protection of Birds
Mabel Cheung, Royal Holloway College, University of London
Jan Clemons, British Herpetological Society Conservation Committee
Keith Corbett, Herpelogical Conservation Trust
Jim Foster, Froglife
Tony Gent, English Nature
Steve Gibson, Joint Nature Conservation Committee
Stuart Graham, English Nature
Howard Inns, British Herpetological Society Conservation Committee
Tom Langton, Froglife/Herpetofauna Consultants International
Rebecca May, Aberystwyth University
Andrew Nicholson, English Nature
Renata Platenberg, Christchurch College, Canterbury
Chris Reading, Institute of Terrestrial Ecology
Anne Riddell, University of Kent
Bill Whitaker, Herpelogical Conservation Trust

Appendix 3. Reptile survey training course

Produced by Froglife, secretariat to Herpetofauna Groups of Britain and Ireland

1. The need for reptile surveys

The main reason for surveying areas for reptiles is to gather records (ie sightings) of where they occur, in order to assist with conservation. Accurate and up-to-date information on reptile distributions is fundamental to species and habitat protection. Site defence can only take place if we know which species are present or which species are likely to be present. In addition, survey and monitoring results can be useful in identifying trends in the status of populations, guiding future survey effort, assisting with management plans, and in compiling regional atlases. All records gained as a result of surveying should be entered onto the Joint Nature Conservation Committee record cards and sent to your regional recorder (normally the local reptile and amphibian group, environmental records centre or county recorder), or to the Biological Records Centre (in the absence of a regional recorder.) In some areas the JNCC card may be replaced by a standard card produced by the regional recorder; the important point is that records should be stored at both the local and national level.

It may help to distinguish between three terms which are commonly confused: *surveying* is a specific attempt to search an area for reptiles; *monitoring* involves repeated survey visits to a known site to assess abundance in relation to previous visits (ie to gain a measure of relative population size); and *recording* is the completion of a record card to report an occurrence as a result of surveying, monitoring, chance sighting or other report, and its subsequent sending to the appropriate record centre.

2. Identification of the British reptile species

For the purposes of general reptile surveying, the most important points to note are:

- ❑ species
- ❑ numbers observed
- ❑ age class (approximate) - presence of juveniles/eggs may give an indication of breeding success
- ❑ sex - if possible, but by no means necessary

There are six species of reptile native to Britain; three snakes: the grass snake *Natrix natrix*, adder (or Northen viper) *Vipera berus*, smooth snake *Coronella austriaca*; and three lizards: common (or viviparous) lizard *Lacerta vivipara*, slow-worm *Anguis fragilis*, and sand lizard *Lacerta agilis*. The smooth snake and sand lizard are now very rare and exhibit a localised distribution (lowland heath in Dorset, Hampshire and Surrey, and [smooth snake only] sand dunes in Merseyside). Handling or disturbing these species or their habitats requires a licence from the statutory nature conservation agency (English Nature). These notes refer mainly to the commoner species since for the vast majority of survey work the smooth snake and sand lizard will not be encountered. For advice on surveys for these species, contact the Herpetological Conservation Trust (tel 01202 391319), English Nature (01733 340345), or Countryside Council Wales (01248 370444). Exotic species, usually escaped pets, are occasionally found, especially close to urban areas. Specialist guides may need to be consulted

for these species, but Froglife may be able to help (tel 01986 784518); local museums and pet shops can also be consulted for identification of these species. (Refer to Table 1 for identification features.)

3. Biology, ecology and behaviour

In order to survey for snakes and lizards, it is useful to understand the basics of the reptile life cycle. Being able to predict where they are and what they are doing at certain points in the daily and yearly cycle will greatly enhance the chances of locating the animals.

3.1 Daily activity

All reptiles are *ectotherms* (ie they depend on external heat sources to raise their body temperature), and many aspects of their ecology and behaviour reflect this fact. Much of a reptile's time during daylight hours in the active season is spent attempting to reach and maintain the preferred body temperature to permit activities such as foraging. Ectotherms can gain heat through direct contact with warm objects (such as rocks or tins which have been warmed by the sun), or by basking to absorb solar radiation. The ambient temperature and strength of sunlight will influence when reptiles are out basking.

Contrary to popular opinion, the best time to find reptiles is not midday in August when the sun is at its most intense; during this weather, reptiles quickly reach their activity temperatures earlier in the day and tend not to bask at the hottest times. If they are seen at this time they tend to be so active that they make for cover rapidly at the slightest disturbance. Moreover, our native reptiles will sometimes *aestivate* (i.e. seek shelter, usually underground, and become inactive) in particularly hot weather.

The best time to see snakes and lizards is in the spring when the temperatures are not too extreme (and before vegetation becomes too concealing), or early morning/late afternoon in summer. The British reptiles vary in their tendency to bask in the open, from common lizards, which favour exposed locations, to smooth snakes and slow-worms, which prefer to bask in partial cover or under warm refuges. These habits are important to bear in mind when surveying. All native species are almost entirely *diurnal* (active during the daylight hours) and spend the night resting under refuges or underground, but there are some reports of grass snakes foraging on warm nights.

3.2 Reproduction

Of our native reptiles, only the grass snake and sand lizard lay eggs, the others giving birth to live young inside thin membranes or *pellicles*. In general, mating takes place in April - June, and the young appear in late summer or early autumn. Grass snakes lay between 10 and 40 eggs in late June/July in heaps of rotting vegetation (eg compost heaps, sawdust piles, manure heaps). The eggs are leathery, ovoid and around 30mm long by 15mm wide, usually laid in clumps (the eggs being adhered by a secretion from the female). Young grass snakes hatch out in late August/September. Adders give birth to 6-20 live young in late August/early September. For common lizards, 4-10 young are born in July - August. Slow-worms give birth to 6-12 young later in the year, from late August-early September.

3.3 Hibernation

Reptiles hibernate when the temperatures are too low to support activity, which is generally from mid-October to mid-March, but this period is subject to wide variation depending on species and local weather conditions. Adders tend to emerge earliest, grass snakes latest. Hibernation areas must be clear of the high winter water table to avoid flooding, be insulated enough to prevent freezing temperatures, and should afford some protection from predators. Favoured areas include well-drained overgrown banks, crevices in rocky areas, compost heaps, under log piles, amongst tree roots and inside mammal burrows. All species are known to hibernate communally at times, especially adders, and the area around a *hibernaculum* is a good place to find reptiles upon first emergence in the spring.

3.4 Foraging and diet

All native reptiles are carnivorous, and the snakes will feed only on vertebrates (though there are some reports of juveniles feeding on insects). Lizards take frequent, small meals of invertebrates such as insects, molluscs etc (although sand lizards will take small vertebrates occasionally), while snakes feed relatively infrequently on larger prey items. As a generalisation, grass snakes prefer amphibians, adders take small mammals and lizards, and smooth snakes prey on other reptiles, although there are overlaps between these preferences. Adult adders are thought to feed only from June-October. The availability of prey items can affect behaviour. For example, grass snakes are sometimes particularly abundant around ponds when frogs and toads are metamorphosing and emerging from the water around July; slow-worms may be easier to find immediately after wet weather following a long, hot, dry spell since the mollusc prey that they specialise on will be more plentiful. To locate their prey, snakes use a combination of vision, chemical and vibrational senses (having no eardrum, they cannot hear, but can detect ground vibrations through the lower jaw). Lizards rely largely on vision, but may also use aural and chemical senses.

4. Planning a survey

4.1 Survey objective

Firstly, decide on the goal of the survey. In other words, what do you want to know as a result of the survey? There are three main reasons for undertaking reptile surveys:

a. to determine the presence (or absence) of reptiles on a site you know little about (*presence/absence survey*);

b. to obtain a basic idea of the abundance of reptiles on a site, and/or their distribution within a site (*detailed survey*);

c. to determine changes in abundance of reptiles on a site (*monitoring*).

The desired objective will determine (to some extent) the methods you employ to carry out the survey. For example, presence/absence surveys would include cursory or opportunistic visits (as well as specific attempts to survey a site), and will involve the determination and examination of important reptile habitat features within the site. However, this will not necessarily tell you much about population size, as the sample effort will be biased towards areas where you expect to find reptiles. For this, a detailed survey would be required, where a greater area of the site is searched in a more standardised manner (eg by walking transects [fixed paths along which observations are made]). The exact methodology for this still

requires research, and so for detailed surveys which aim to establish some idea of relative population size, only approximate guidelines are available at present. An attempt has been made to classify populations according to survey results for the compilation of Key Reptile Sites, and it is suggested that this approach is used (see *Assessing survey results*, below, and Appendix 1). Monitoring effectively requires repeated detailed surveys

4.2 Preparation

Obtain permission (preferably in writing) from the land owner, tenant or manager, and make sure they know what activities you will be involved in and when. For some sites, especially on nature reserves, permits may be required.

Do some research to find out if there any past records of reptiles for the site and its surroundings. To do this, contact the county museum, Wildlife Trust, environmental records centre, local reptile and amphibian group, ranger service, etc.

If you are going to undertake a detailed survey or monitoring exercise, especially if it involves several people, it may be useful to draw up a standard survey form on which to record sightings (essential information: date, species seen, numbers, location). This will help to collate records at the end of the survey. Draw up a rota for site visits if many surveyors are involved.

It may help to draw up a base map of the site (eg by enlarging the portion of the Ordnance Survey map on a photocopier). On this should be marked important habitat features, transect route if used, historical records, and position of refuges (see *Artificial refuges*, below) if used.

5. Survey techniques and survey effort

5.1 General

Reptiles can be challenging to survey, not necessarily in terms of the intensity of effort required, but in terms of the predictability of finding the animals. Even determining presence can be difficult sometimes, especially if the popluation is a small one. At present (1996) there are virtually no standard, simple means of obtaining an estimate of either *relative* or *absolute population size*, or indeed of objective quantitative assessment of survey results, but work is underway to remedy this situation. These difficulties arise because reptiles tend to occur at relatively low population densities, occur over a wide area, are secretive in nature, and generally do not exhibit massive aggregations which facilitate survey (eg as in amphibians). There are two main ways to look for reptiles: by direct observation for basking animals in suitable weather conditions, and by searching under previously positioned artificial refuges. The two methods are not mutually exclusive and indeed should be used in combination where possible. The use of refuges, however, does have some limitations and disadvantages, as discussed below.

In general, it is recommended that *at least five site visits in good weather and at the appropriate time of year* may be needed (regardless of which method is used) to establish presence/absence. In other words, even if a site is visited three times in good conditions and no reptiles are seen, do not assume that they are absent from the site. To give some indication of population size, ten visits are recommended, as survey results seem to be subject to high variation. Always record the maximum number of animals seen per visit, as this will give a figure for absolute minimum population size. In general, the more visits, the better.

5.2 Direct observation

5.2.1 **Where to search.** There are several ways to maximise your chances of finding reptiles. When faced with large areas of potential reptile habitat, it can often be daunting to know where to start looking. Try to identify potential important reptile areas on the site being surveyed. This becomes easier with practice, but the following *habitat features* are worth checking, especially for basking animals: banks and slopes (especially south-facing), gullies, tumuli, log/brash/rock piles, exposed root systems of fallen trees, rides and paths, boardwalks, and sun-traps created by small open areas surrounded by thick vegetation. Larger features which represent discontinuities in habitat types are often profitable to search, eg the following interfaces: woodland/grassland, scrub/grassland, rough/short grassland, bare/vegetated ground, hedgerow/field; disused or overgrown railway embankments/cuttings.

5.2.2 **When to search.** Most animals will probably be seen whilst basking, so time the visit to coincide with suitable weather, ie in sun, or hazy sun, when the heat is not too intense; as the temperature exceeds 20°C it often becomes increasingly difficult to find the animals. The most profitable range of air temperatures is 9-18 ºC (bright sun up to 15 ºC and hazy or intermittent sun above 15 ºC).

Grass snakes and common lizards are the most tolerant of high temperatures. Adders and common lizards can sometimes be found very early in the year, just after emergence from hibernation, at surprisingly low temperatures. Hot spells following cold periods, or after rain following dry spells, are particularly profitable. Windy and wet weather is usually unsuitable for reptile surveying.

In general, the most productive months to survey for reptiles are April, May, June and September. Early in the season, reptiles may be seen towards the middle of the day when it is warmest. In summer, early morning and late afternoon are best.

5.2.3 **How to search.** Walk slowly with the minimum of disturbance to the vegetation so as not to make too much noise, and try not to cast a shadow on the area of search. Scan the area up to several metres ahead, and be especially vigilant towards sounds. Listening out for rustles in the undergrowth is often an excellent way of detecting reptiles; common lizards make short dashes producing brief crackles in rough grass or heather, while snakes tend to produce longer sustained rustles. If a reptile is disturbed and moves off before it can be identified, it is worth marking the spot and returning about ten minutes later, as the animal will often return to a favoured basking spot. This works particularly well for common lizards.

Turn over any refuges encountered, such as rocks, logs and bark, but be sure to replace them carefully afterwards in such a way that no animals are harmed (the best way is to let any uncovered animals retreat into the surrounding vegetation before replacing the refuge). Reptiles vary in their tendency to utilise refuges, slow-worms being the most often uncovered, and common lizards perhaps the least.

5.2.4 **Signs.** Reptiles do not leave droppings which can be reliably used for field survey, but they do leave behind *sloughs* (shed skins). These tend to be encountered infrequently but may give positive identification if not too damaged. Snakes normally shed their skins in one piece, rather like an inverted sock. The best way to distinguish between species is the pattern and size of the head scales (adders have few enlarged scales on top of the head, while grass snakes have many - see a detailed text such as Buckley,

1982), along with traces of the original colouration (adder sloughs often retain some of the zig-zag). The anal scale (or shield) is divided in the grass snake, single in the adder (see Figure 1). Common and sand lizards usually shed in many pieces and are not so often found. Slow-worm sloughs are often scrunched up into a concertina shape.

5.3 Artificial refuges ("tinning")

It is possible to greatly increase the likelihood of finding reptiles by placing objects which they can use for shelter or to facilitate increasing their body temperatures. Often this will involve placing sheets of corrugated iron or tin in sunny areas where they quickly reach a higher temperature than the surroundings. Reptiles can then crawl underneath and effectively "bask" in a relatively safe environment. Tins can often act as reptile "magnets," attracting animals from the surrounding area. However, it is important to remember that using refuges should not detract from searching by direct observation; it can be easy to fall into the trap of walking quickly between tins to check them, and thereby negelecting to look elsewhere on the site - this should be avoided. Always look upon tinning as additional to more conventional searching.

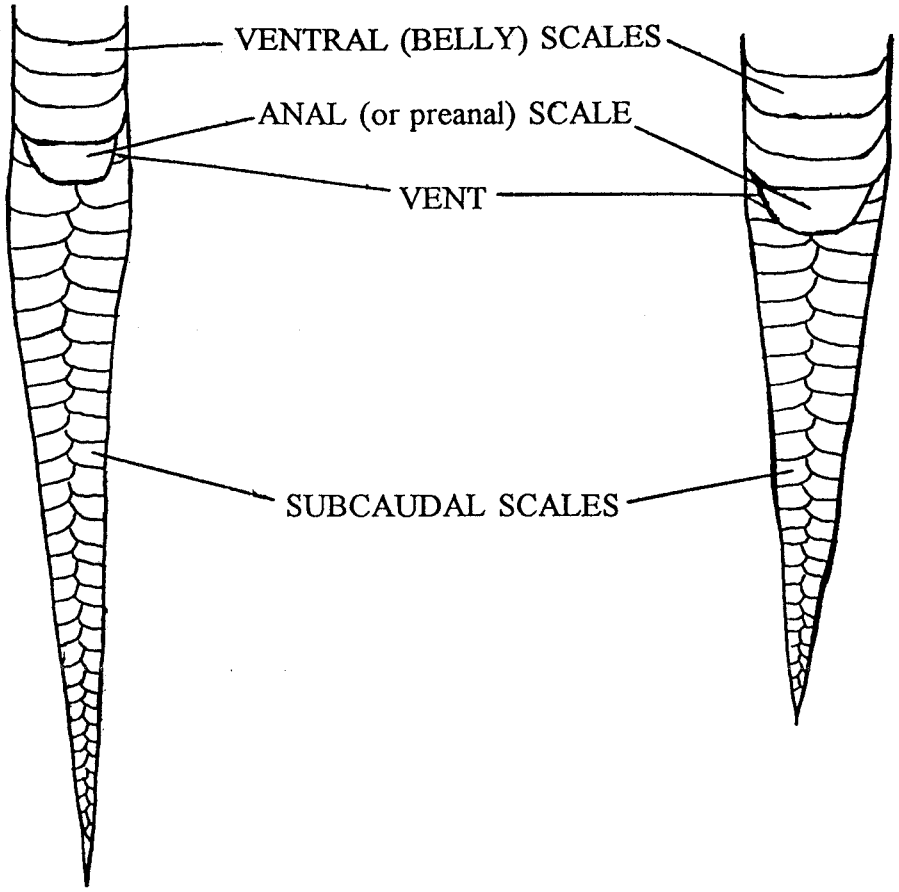
5.3.1 **What to use as "tins".** The best material is corrugated iron or tin, which can be obtained from scrapyards, but roofing felt (in particular), plywood, wooden boards and roof tiles will also work. A recommended size for tins is 0.5 m^2; smaller or larger tins can be used but this size represents a good compromise between providing a decent refuge and something that can be carried fairly easily. On sites where human disturbance is possible, small tins can be used.

5.3.2 **Where to place tins.** They should be put in positions so as to absorb sunlight; it is a good idea to put some in partial shade as well as some in direct sun, since they can heat up very quickly. Positioning tins in good reptile *microhabitats*, such on sunny banks, at the interface between woodland and rough grass, or near to log piles, will increase the chance that they will be used. It is better to put tins on a layer of short or flattened vegetation than on bare ground so as to create a humid space under it and to generate a gradient of temperatures. If the site is subject to high public pressure, it may be best to place tins away from paths and tracks, or possibly to avoid using them at all (see *Dos and don'ts for tinning*, below).

5.3.3 **How many to use.** This depends on many factors, such as likelihood of disturbance, size of site, how far the surveyor is prepared to carry the tins (they can be cumbersome to carry), and what the survey is attempting to do. As a rule, the more tins used, the more likely it is that reptiles will be found; similarly, the more tins used, the larger the number of reptiles that will be found. For most survey purposes, between 5 and 10 tins per hectare is recommended. The success of tinning probably depends as much upon where they are placed on the site as how many there are.

5.3.4 **When to turn tins.** Tins may be used within a few days of being placed on the site. Look under tins when they reach a suitable temperature for animals to use them to warm up, but before they become too hot to the touch. Reptiles may actually use them when seemingly too hot as long as there is a thick layer of vegetation underneath, which helps to generate a gradient of temperatures. If it is likely that adders are present, use a stick to turn the tin.

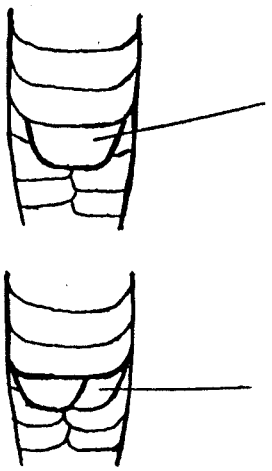
1a: Sex differences in tail appearance



Male: may have slight bulge after vent; tail tapers smoothly; tail relatively longer than in female

Female: no bulge after vent; tail tapers more abruptly than in male; tail relatively shorter than in male

1b: Species differences in anal scale



Adder: anal scale undivided

Grass snake: anal scale divided

Figure 1. Identifying and sexing snakes by external appearance of underside of tail (NB. characters exaggerated for clarity)

5.3.5 **Hints for tinning.** It may be useful to number tins if they are going to be visited several times in a season so that preferred areas will be more easily recorded. It often helps to make a map of where tins have been placed on the site. Painting tins in dark colours may help to disguise them. When deciding where to put tins early in the season, remember that the vegetation may grow up in a few months time to obscure a potential sun-trap. It may be useful to write a notice on the tins explaining what they are for (simply stating "ecological survey" may be better than "reptile survey" to avoid possible public relations problems), not to disturb them, and a contact phone number for more information. Be especially careful when turning tins if you suspect adders may be present.

5.3.6 **Dos and don'ts for tinning.** Always ask the landowner's permission before placing and checking tins. It is best not to place tins on areas which are subject to high public pressure, as it renders the reptiles more prone to collection (or worse), the tins may be tampered with, and there is also the danger that people or pets may injure themselves on jagged edges. Always remove tins at the end of the survey. Never place tins on a site which supports sand lizards or smooth snakes without first obtaining a licence from English Nature.

5.4 Individual identification

For adders and slow-worms it is possible to recognise individuals by virtue of their haed and neck markings. Keeping track of certain individuals can be an interesting exercise (eg to study migration), and counting the number of individuals on a site can help to establish an indication of population size. Individual identification can also be facilitated by marking (but see section 8.5). However, identfying individuals is a time-consuming process and will be superfluous for most survey purposes; the methods used are beyond the scope of these notes.

6. Assessing site importance

Besides the basic presence of the reptiles, there are several points to bear in mind when surveying. Important areas within the site to note are hibernacula (identified by seeing relatively large numbers of animals lying out nearby in early spring), egg-laying sites for grass snakes, areas where many young animals are found, foraging grounds (eg toad ponds for grass snakes), and favoured basking spots. To identify these areas, it may help to plot all sightings on a map, with dates, and thereby pinpoint particular hotspots of reptiles or seasonal shifts in preferred areas. Try to link up sightings to habitat features, so that the vegetation structure and management of preferred areas can be recorded.

Relative population size is very difficult to determine for reptiles, but there has been one recent attempt to quantify reptile populations and communities with a view to classifying them in terms of biological importance and suitability for protection (Key Reptile Site Register - see Appendix 1). In general, the larger the populations and the more species present, the higher the site score. Use your survey results to find out how the site fares according to this classification. In the absence of such detailed survey results, simply establishing presence, and subsequently evidence of breeding, will be sufficient.

7. Translating survey results into conservation

All sightings should be converted into records and sent to the regional recorder or Biological Records Centre as appropriate. A brief report on the findings is often useful, and this can be circulated to interested groups such as the landowner, local reptile and amphibian group, Wildlife Trust, environmental records centre, and Froglife.

A more detailed report can mention aspects such as important features of the site (breeding areas, etc), connections to adjacent sites, how current habitat management is likely to affect the reptiles (and whether it should be modified), importance of the site on a regional scale and recommendations for protection, further survey, etc.

Although the four common reptiles have species protection, there is no particular protection for their habitat unless it happens to be listed under another designation such as Local Nature Reserve or Site of Special Scientific Interest. The Key Reptile Site Register criteria can be used to nominate sites, and hopefully also to promote them to Wildlife Site status (designated by county Wildlife Trusts and recognised in local authority plans) so that they receive some habitat protection and are flagged up in the planning process. For more details see Appendix 1 or contact Froglife.

8. Relevant legislation

8.1 Wildlife and Countryside Act 1981.

All British reptiles are listed in Schedule 5 of this Act, and as such receive protection under the provisions of Section 9. Different parts of Section 9 apply to different species, resulting basically in two levels of protection. "Full protection" is afforded to the smooth snake and sand lizard, making it an offence to intentionally kill, injure, take or possess them. Intentional disturbance whilst occupying a place used for shelter or protection, and destruction of these places, is also unlawful. The Act also prohibits their trade (sale, exchange, barter, transporting for sale or advertising to sell or buy). Partial protection is given to the grass snake, adder, common lizard and slow-worm, for which it is an offence to intentionally kill, injure or trade in. Anything prohibited by the Act can be made lawful via licensing by the appropriate authority if there is sufficient justification. For the surveyor, the most relevant parts of the Act are those relating to injury and (for the rare species) taking and disturbance. In addition, the Act contains provisions for the designation of nationally important sites (SSSIs), and there are certain prohibited activities which the surveyor should be aware of, such as the release of any plants or animals (even if that species occurs naturally on the site), and the removal of animals from the site. The appropriate statutory agency should be contacted for further advice.

8.2 Conservation (Natural Habitats & c.) Regulations 1994 ["Habitats Regulations"]

This legislation implements European Directive 43/92 (the "Habitats [and species] Directive"). In many ways the protection offered by the Conservation Regulations is similar to that in the Wildlife and Countryside Act, but there are some differences, and the provisions are meant to be additional to those in the older legislation. The sand lizard and smooth snake are listed on Schedule 2 of the Regulations, prohibiting (under Regulation 39) deliberate capture or killing; deliberate disturbance; deliberate taking or destruction of eggs; damage or destruction of breeding sites or resting places; keeping; sale/exchange; and transport. As the Regulations do not specifically deal with the four "common" reptiles they have little relevance in this context.

8.3 Protection of Animals Act 1911

This law prohibits cruelty and ill-treatment of animals when they are confined or held in captivity (which would include wild-caught reptiles).

8.4 Dangerous Wild Animals Act 1976

Adders are listed under this legislation, making it an offence to keep them without a licence from the local authority.

8.5 Animals (Scientific Procedures) Act 1986

Certain activities such as toe-clipping or other invasive marking procedures are prohibited by this Act unless licensed by the Home Office; not relevant for normal survey purposes, but it is possible that an intensive monitoring programme may involve these practices.

8.6 Other legislation

Some protected areas, such as National Nature Reserves, fall under legislation which makes it illegal to capture any animal, regardless of its status under other legislation.

NB: This is only a brief summary of the relavant legislation; for further details contact the appropriate statutory conservation agency.

9. Welfare considerations

The welfare of the animals must be paramount in any survey, and for most normal reptile surveys this presents no problems as long as the following simple guidance is adhered to. Avoid capturing or handling reptiles *unless it is absolutely necessary* (obviously, capture of the smooth snakes and sand lizards is prohibited without a licence). All of our reptiles can be identified to species level without the need for capture, the latter only being necessary for sexing some species or measuring and this is not normally important for most survey purposes. If capture is required, it should be done by hand. For grass snakes and slow-worms, grasp the front half of the body first and hold firmly but gently, trying to support as much of the animal as possible. Common lizards should be caught under a cupped hand, or possibly using a noose, but this requires a great deal of practice to avoid damaging the animal. Capture of slow-worms and common lizards has to be performed with caution as they will sometimes drop their tails. Captured animals awaiting release may be kept for a short while in a cotton bag. Capture of adders is potentially dangerous and should only be undertaken by experienced workers.

10. Safety and code of conduct

Be especially careful with tins if they have jagged edges, and do not place them where they may cause damage to people, pets or livestock. Always ask for access permission before surveying on private land. If surveying in an area likely to contain adders, wear suitable footwear such as wellington boots. Unaccompanied surveying is not recommended; at least two persons should be present. Follow the country code. Never take animals away from a site unless for a very good reason. Never release animals onto a site unless there is a good reason and permission has been granted by the landowner. Remember that it is illegal to release any reptile or amphibian species into certain areas such as some nature reserves (including SSSIs and NNRs).

11. Further reading

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12. For further information, contact:

Jim Foster, Froglife (Herpetofauna Conservation International Ltd), Triton House, Bramfield, Halesworth, Suffolk IP19 9AE, tel 01986 784518, fax 01986 784579.

Annex 1: Key Reptile Site Register (KRSR). Background notes and selection criteria

Background

Reptiles are often under-recorded and over-looked in habitat management plans. Frequently, if an area is being considered for development the reptile interest on the site is neglected. There is presently little safeguard for reptiles except when they occur on a site with statutory notification, even though all native snakes and lizards are now protected against intentional killing and injury under the Wildlife and Countryside Act.

The development of county-based registers which detail important sites for reptiles should be a step forward for herpetofauna conservation. Registers can be compiled from existing records (from local Amphibian and Reptile groups (ARGs), Environmental Records Centres, Natural History Societies etc.) and also from new survey initiatives. The record for each site should collate information on species present, numbers observed, habitat, management, ownership, access, indication of likely threats. The registers will be updated on a regular basis.

To be most effective, the register should link to the planning system and integrate with existing schemes. Many wildlife trusts have a register for sites of county importance which means that planning proposals must take special notice of such areas, but often there are no criteria specially for reptiles. Interaction between local ARGs and wildlife trusts should help to rectify this by drawing up the Register and hopefully designating the sites as SBIs/SNCIs/ SINCs. If the appropriate information is collated and distributed then this should help to ensure that reptiles and their habitats are more carefully considered in planning issues and therefore better protected.

Selection criteria for Key Reptile Sites

Sites should be selected as follows:

- ❑ Three, four, five and six species sites
- ❑ Two snake species sites
- ❑ Exceptional one species sites (see Table A)
- ❑ Assemblage sites with a score of four and above (see Table A)
- ❑ Sites which do not meet the above criteria but which are of particular regional importance due to local rarity

Table A: A scoring system for classifying the size of reptile populations. Figures in the table refer to maximum numbers of animals seen by observation and/or placed under tins at a density of up to 10/ha, by one person in one day, or numbers presumed from long-term monitoring/reliable historical records

Species	Low population Score 1	Good population Score 2	Exceptional population Score 3
Adder	<5	5-10	>10
Grass snake	<5	5-10	>10
Common lizard	<5	5-20	>20
Slow-worm	<5	5-20	>20

Reptile Survey Training Course. Table 1: Identification Features

Common name: Scientific name:	Common/viviparous lizard *Lacerta vivipara*	Slow-worm *Anguis fragilis*	Grass snake *Natrix natrix*	Adder/(Northern) viper *Vipera berus*
Adult				
TL (typical)	140	340	750	550
TL (maximum)	180	500	1500 (F)	700 (F)
SVL (typical)	55	150	600	480
Colouration/markings/ general appearance	Ground colour brown, grey or greenish; occasionally melanistic (black); variable pattern of spots, flecks and stripes. Very variable. F: often has a more or less unbroken vertebral stripe; generally lighter than M, with fewer spots/flecks; belly yellowish or white and usually unspotted. M: vertebral stripe usually absent or very fragmented; generally darker brown with light spots/ flecks; belly yellow or orange with dark spots; head larger than F.	Legless. Shiny, cylindrical appearance. Small scales. F: brown, reddish-brown, copper or gold on dorsal surface; dark brown or black flanks, dark vertebral stripe (sometimes absent), may also have finer stripes either side of this. M: uniform brown, greyish-brown to gold; dorsal stripe usually absent or much reduced; may have blue/dark brown spots on anterior dorsal surface; head larger than F.	Slender build. Ground colour olive-green, grey or brownish; yellow, orange, cream or white collar (occasionally absent), bordered to the posterior by black; transverse black bars down flanks; often rows of black spots on dorsal surface; top of head darker than body. No marked difference in colouration between sexes, but F grows larger than M and colours (esp. collar) may fade with age.	Robust build; slender neck. F: ground colour brown, golden brown, reddish-brown, coppery or sandy; dark brown or dark red continuous zig-zag down back and tail, roundish blotches down flanks. M: ground colour silver, grey, whitish, buff or greenish; zig-zag and blotches as for F but black; markings particularly striking in April-May around mating season.
Tail and anal scale features	Tail 1.25 - 2 times body length. F: tail tapers smoothly from base M: bulge at base of tail NB: presence/absence of bulge at base of tail is often the most reliable sexing method as colouration very variable.	Intact tail longer than body, but often broken, poorly regenerated and blunt; tail relatively shorter in F than in M	Anal scale divided. M: often a slight bulge after vent, then tail tapers gradually. > 62 pairs of subcaudal scales. F: no bulge after vent, tail tapers more abruptly. < 62 pairs of subcaudal scales. (see Fig. 1)	Anal scale undivided. M: often a slight bulge after vent, then tail tapers gradually. F: no bulge after vent, tail tapers more abruptly. (see Fig. 1)

Common name: Scientific name:	Common/viviparous lizard *Lacerta vivipara*	Slow-worm *Anguis fragilis*	Grass snake *Natrix natrix*	Adder/(Northern) viper *Vipera berus*
Juvenile				
TL at birth/hatching (typ.)	30	80	170	150
Colouration/markings	Black or dark brown, uniform	Striking silvery, copper or gold on top; black flanks and vertebral stripe	Colouration same as adult but often slightly darker; collar very vivid.	Colouration similar to adult females - usually reddish-brown with dark brown or black markings
Typical habitats/habitat features	Wet and dry heath; bogs; moorland; woodland edge; rough grassland; derelict urban areas (e.g. old railway goods yards); road/rail embankments/cuttings	Rough grassland, heathland, moorland, woodland edge, meadows, urban fringe - overgrown gardens, allotments, road/rail emabankments/cuttings.	Areas around ponds, lakes, gravel pits, streams, rivers, canals, etc; damp meadows, marshes, wet valleys, gardens, woodland edge, heath, rough grassland, low intensity arable and pastoral farmland.	Heathland (wet and dry), bogs/marshy ground near to drier heath/grassland, moorland, open woodland, rough grassland and scrub, chalk downland, coastal dunes, road/rail embankments/ cuttings; rare on clay soils.
Behavioural notes	Often basks in exposed locations (on top of logs, rocks etc); active in hot, sunny weather more than other species (but can also be found in very cool conditions in spring, autumn); young easily observable in August, and gravid females in July; will usually return to basking spot after disturbance	Secretive - rarely basks in the open, usually found under logs etc; most likely to be detected using refugia; sheds tail readily if handled roughly; the reptile most likely to be seen close to human habitation.	Very alert and fast moving, will not normally allow close approach; wide-ranging; often seen basking on river banks, pond edges; often found in gardens or farmland when foraging or egg-laying in compost/manure heaps.	Often basks in open areas; may allow close approach - not so easily disturbed into retreat as grass snakes; often basks in groups.

All measurements are in mm, and are given as a guide only (for precise values, see more detailed texts)
Abbreviations: TL= total length; SVL= snout-vent length; M= male; F= female; typ.= typical.

Appendix 4: Survey and monitoring of reptiles

Species Conservation Handbook (HERPS 3:1) February 1994

Introduction

Survey is important to the understanding of reptile ecology and to the implementation of conservation measures. An understanding of distribution and abundance will allow conservation effort to be targeted effectively and necessary site safeguard and management measures to be implemented. Repeated survey (monitoring) will allow an assessment of changes in number and status; this in turn is important for understanding management needs.

However, reptiles are difficult to survey; many species are secretive and their activity is governed to a large degree by prevailing weather conditions. Whilst presence can often be demonstrated, it is more difficult to provide quantitative estimates of population size, show relative abundances or to prove the absence of a species.

Currently there is no standardised methodology for reptile survey or monitoring. This note is an introduction to methods used in Britain for the terrestrial species (ie excluding marine turtles). Research is being undertaken by English Nature, Institute of Terrestrial Ecology and Forest Enterprise to evaluate some of these methodologies with a view to developing a standardised and repeatable survey technique. It is envisaged that this research will allow revision of this note.

Licensing requirements

Reptiles are protected by several pieces of legislation. Licences can be issued to allow actions that would otherwise be prohibited by the legislation.

The Wildlife and Countryside Act 1981 prohibits killing or injuring any of the native species of reptile. Although it would be unusual to require such methods for survey or monitoring purposes, certain forms of marking, eg toe clipping or injecting sub-cutaneous transponder tags, would be considered `injurious' and would therefore require licensing. It is conceivable that some scientific study would require culling a sample of animals; such activity would need a good justification before a licence would be issued. In addition, two species are given a greater degree of protection. The smooth snake *Coronella austriaca* and the sand lizard *Lacerta agilis* are also protected against taking (handling), possession, disturbance whilst *"occupying a structure or place used for shelter or protection"* or destruction of or damage to such a place or structure. Consequently, scientific study or survey that requires catching or disturbing these animals (eg whilst under pieces of tin sheeting, etc) need to be licensed. English Nature is the authority for issuing licences under the Wildlife and Countryside Act for scientific and conservation purposes.

The Animals (Scientific Procedures) Act 1986 defines certain acts as `regulated procedures' if done in connection with scientific study. These procedures are defined as "*any experimental or other scientific procedure ... which may have the effect of causing that animal pain, suffering, distress or lasting harm*". Ringing, tagging or marking is not a `regulated procedure' if "*it causes only momentary pain or distress and no lasting harm*". Toe clipping, for example, *is* considered a regulated procedure. This legislation relates to all reptile species; it is administered by the Home Office.

Other legislation may apply. If animals need to be taken into captivity, their welfare is governed by the Protection of Animals Act 1911 which prohibits ill-treatment. In addition, keeping adders in captivity requires licensing under the Dangerous Wild Animals Act 1976; licensing under this Act is administered by Local Authorities.

Reptile biology and behaviour

Reptiles are ectothermic; that is they derive the warmth of their bodies from external sources of heat energy. Maintenance of high body temperatures is necessary for all metabolic functions; for example digestion of food in grass snakes is most efficient at about 25°C (and is severely retarded at temperatures below 15°C) and reptiles suffer impaired vision, hearing and ability to move if their body temperatures cool too greatly. However, reptiles can overheat so they also need to regulate their body temperatures to prevent it getting too high. Reptiles often control their body temperatures quite precisely and this is a major factor that determines their behaviour. The behaviours associated with body temperature maintenance are termed *thermoregulation*. The need to thermoregulate will, in turn, influence the ease with which these animals can be observed and so will affect survey.

Spellerberg (1976) studied the thermal biology of the six native species of reptile and determined means and ranges of activity temperatures (Voluntary Mean and Voluntary Range temperatures) and the lower temperature at which the animal loses the ability to move (Critical Minimum). He also described the main methods of thermoregulation shown by the different species. These are summarised below:

Table 1 : Main methods of thermoregulation, voluntary mean temperature, voluntary range and critical minimum temperatures for the British reptiles; *source Spellerberg, 1976.*

Species	Method of thermoreg-ulation	Voluntary mean (°C)	Voluntary range (°C)	Critical minimum (°C)
Common lizard	Shuttling heliotherm	32	22 - 38	2.8
Sand Lizard	Shuttling heliotherm	31	23 - 38	2.5
Slow-worm	Thigmotherm	23	14 - 29	4.0
Adder	Posturing heliotherm	30	20 - 38	3.0
Grass snake	Shuttling heliotherm	26	15 - 36	3.9
Smooth snake	Thigmotherm / shuttling heliotherm	27	20 - 34	3.5

The term ***heliotherm*** relates to an animal that is warmed by the direct rays of the sun and may influence this further by `posturing' (ie orientating or flattening it body, etc) or by `shuttling' between patches of sun and shade. Mosaic basking is a behaviour often shown by snakes where they bask partially obscured by vegetation which both facilitates temperature control and offers cover from predators, etc. ***Thigmotherms*** are those animals that warm themselves by selecting areas that have been warmed by the sun, eg warm areas below stones or below vegetation. As a general rule, whilst all species show all these behaviours to some degree, the snakes tend to bask for longer periods of time, followed by greater periods of activity (or inactivity) below cover, than the two legged-lizard species. Within the snakes, though, adders generally emerge earlier and go back under cover later than the other two species. Common

and sand lizards both tend to be more active than snakes or slow-worms and scuttle between sun and shade to regulate their body temperatures.

The critical minimum temperature represents an absolute lower activity temperature and one which is 'ecologically lethal'. In practice, though, reptiles will generally remain under cover to avoid conditions that yield body temperatures below the lower value in the Voluntary temperature range.

Similar studies have been undertaken by other workers for the British species and refinements to these figures are available (see Key bibliography). Remote recording of body temperatures in the field has shown that many species have a period of rapid warming followed by a `plateau phase' where they maintain consistently high body temperatures when the weather allows it. These studies also show that body temperatures in the field will exceed, and will fall much lower than, those presented by Spellerberg and indicate that the 'preferred' body temperatures are generally greater than the Voluntary Mean reported above. Despite this, the work by Spellerberg is useful in presenting comparable data for the different species.

Different areas within a habitat will become more or less favourable at different times during the day and at different times of year (eg with different degrees of vegetation growth or leaf cover). Consequently reptiles will use different parts of the habitat in different ways at different times. Figure 1 shows temperatures measured in different microhabitats in a heathland site to illustrate daily fluctuations. It should be remembered that by actively seeking sun shine, reptiles can warm up even more rapidly than the surrounding habitat.

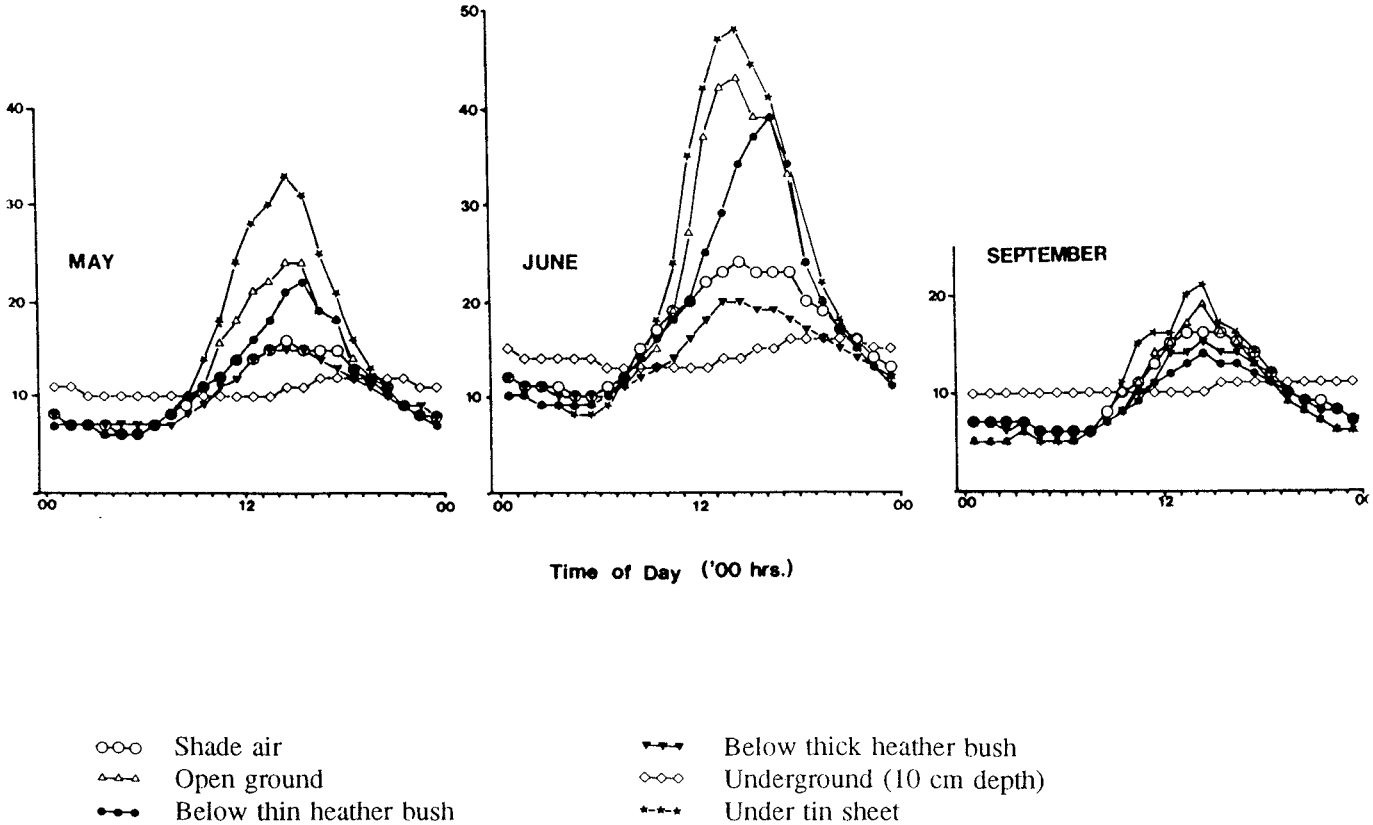

Figure 1 : Mean temperatures at different places in a heathland habitat during the day (for months during 1986) : *source Gent, 1988.*

Preferred habitats

Reptiles are found in a wide variety of habitats. These include heathland, sand dunes, meadows, grassland, derelict industrial `wasteland', hedgerows and open woodland. In general, these are habitats that are open and have structurally diverse ground vegetation which can provide a range of thermal microhabitats.

The habitat must provide all the needs of the species; however these differ between the species and within each species at different times of day/year, etc. The lizard species eat invertebrates; the slow-worm tends to take soft bodied prey such as slugs, the sand lizard can take harder bodied insects. Amphibians form an important part of the diet of grass snakes, for example; the smooth snake and adder require other vertebrate prey (lizards and small mammals). By taking larger prey, snakes feed less often than lizards. The sand lizard and grass snake both lay eggs. The former species requires open sandy ground where the eggs can be warmed by the sun; the latter uses decomposing vegetation (a compost heap or wood-chip pile for example) where the eggs are incubated by the heat of decomposition.

Some species use different parts of their range at different times of year. Adders for example often have a summer area (often wetter ground, eg grassy valleys or bogs) and a different over-wintering site (often a drier, lightly wooded area). Reptiles might most easily be seen early in the year as they bask prior to leaving their over-wintering area. During the day, reptiles will select different parts of the site, often on the basis of thermal considerations (see above).

Lizards have smaller home range areas than snakes. Typically lizards will move only 10's of meters (giving home ranges of low 100's - 1000 m^2); smooth snakes probably have the smallest home ranges of snakes, these usually being up to 1 - 10 ha (moving low 10's m per day). Adders and grass snakes move over much larger areas still (10's of ha) and may move several hundreds of metres in a day. Summer and winter areas may be several kilometres apart.

An understanding of these different habitat and micro-habitat preferences and changes with season and time of day will assist with directing survey effort. It is essential to consider these elements when interpreting survey results.

Survey methods

Direct observation and counting is the most frequently used method for surveying for reptiles. At the simplest level involves walking through an area looking for animals and recording the species which are present.

This method requires a degree of competence as a field observer. Reptiles are not always easy to see. The observer should walk slowly, concentrating on the ground both immediately in front (for snakes) and a bit further ahead for lizards. Combining reptile survey with other field survey (eg for birds) is rarely successful. Lizards will often flee quickly, but return to almost the same spot fairly soon afterwards (often within 5 minutes). The observer needs to be able to identify reptiles quickly. Often the sex of the animal (though not usually for the smooth snake or grass snake), age (or approximate size) can also be recorded from a casual observation. Precise locations can be marked on maps which may assist subsequent survey or monitoring and may be especially useful if the information is being used to develop site management proposals.

Searching should concentrate on particular features. These features include edges, for example the interface between tall and short vegetation, the edges of bushes or gaps between ground vegetation. Lizards often bask on objects, such as wood piles, gate posts or logs; snakes are often seen basking on the ground but tucked under over-hanging vegetation. Usually the animals are seen whilst basking; so a sunny sheltered spot (perhaps a gap between heather plants) is likely to be selected. Straight line transects or truly random walks are unlikely to reveal the full potential number of sightings and, given that the animals are hard to find, may not yield high enough numbers to allow meaningful comparisons. `Transects' should therefore be selected to include likely basking spots.

Some quantification of time spent searching is useful; indeed *`number of sightings per hour'* often provides a valuable statistic for comparisons between sites or between years.

Successful searching also depends on prevailing weather conditions and season. Even subtle changes in weather conditions can result in dramatic differences in success rate; indeed preceding weather conditions will affect the number of observations made. Survey should be aimed at warm but not hot days. Early in the year, eg March to April, animals are usually seen during the warmest parts of the day only, ie mid morning to mid-afternoon. During the hotter months, the ground can become too hot and reptiles are most often recorded early morning, mid- to late- afternoon or during cooler days. During the summer reptiles are quite often seen shortly after rain. In essence it is worth considering whether it is likely that reptiles will be active given that they will be attempting to maintain body temperatures at about the level shown in Table 1 above.

This method is useful for assessing ***adult numbers*** early in the year (say in April to June) and for looking for ***new born lizards*** (for common lizards these appear late June to end of August; for sand lizards mid-August to September). Recording juveniles can give an indication of breeding success that provides a comparable measure between years.

Direct observation will yield only a small proportion of the total population. It has been suggested that as a `rule of thumb', even for the more visible species in good weather conditions, only between one fifth and one third of the total population is the maximum that will be seen during any one visit. Clearly this quantification is difficult and cannot be relied on to give an estimate of population size.

Placing ***artificial refuges*** such as pieces of corrugated tin sheeting (usually either old slightly and rusty sheets or ones painted in dark colours), wooden boards or roof tiles can be valuable in assisting survey. This is especially so for the more secretive species such as slow-worm or smooth snake (which are hard to find by direct searching) but is also useful for adder and grass snake. These objects can be particularly useful for sampling in relatively uniform vegetation where obvious edge features are hard to define, eg in the middle of a block of heathland or grassland. The legged lizards may be found under tins, but more often will use them as platforms to bask on top of.

The numbers and densities of tins will be determined by a number of factors. As a rule the greater the density of tins, the greater the chance of observing reptiles. Small numbers (eg 2-5 tins) can be successful for confirming the presence of a species, especially on sites where the number of refuges must be kept to a minimum, eg due to public pressure. However generally a larger number should be used. Practically, grids of 6 - 10 should be considered a minimum for simply looking for the presence of reptiles; these should be positioned in different areas of likely habitat on a site. To allow meaningful comparisons between areas replicated grids of 20-30 tins are likely to be needed.

Tins can be of any size though generally the larger they are the better they are. A size of 75 x 60 cm is practical and effective; larger tins may be favoured by some but considerably smaller ones can also be productive. The practical problems associated with transporting tins should also be considered when deciding on what size the tins should be.

Refuges should be placed in open or partially shaded areas. Taller vegetation, such as a heather bush, over-hanging the edge of the refuge is useful in providing slight shading, obscuring the outline of the tin (making it harder to be seen by other people) and seems to encourage their use by snakes. Although tins can be placed on bare ground, it is usually best to place them over a layer of flattened vegetation. This retains humidity and allows a gradient of temperatures below the tin. Consequently reptiles might still be found under the tins on quite hot days. Tins are less likely to be successful if placed in completely shaded or water-logged areas.

Reptiles will be usually be found under tins when they are neither too hot nor too cold. During one study of smooth snakes in which 57 observations were made of snakes beneath tins, the temperature below the tins at the time of observation ranged between 12° and 30°C (which corresponded to a range of air temperatures between 11° and 27°C). The inter-quartile range (ie middle 50% of observations) were when the tin temperature was between 17 and 24°C (air temperature 16 - 21°C) suggesting that it is most profitable to look beneath tins during this range of temperatures for this species. One might suspect similar temperatures are good for finding for grass snakes, slightly warmer ones for adders and slightly cooler temperatures for slow-worms. This is currently being investigated further.

Whilst the use of refuges is valuable for survey they have some disadvantages which must be considered when using them. Tins will also make reptiles more accessible to collectors and those wishing to harm them as well as to potentially increased disturbance from other interested people. Consequently tins should be located where they are either inaccessible or hard to see; they can also be camouflaged or partially obscured by vegetation. **Tins should be removed from a site once a survey is finished**, especially if the site is used by rare reptiles. In addition to the risk to reptiles, tins can have sharp edges. These can be a danger to people, domestic and wild animals. Care is needed if tins are sited on areas that are managed by machinery.

Some studies have sampled reptiles by using ***pitfall traps*** either with or without drift fences. For survey of British species in most habitats the effort required to provide these can rarely be justified. In the majority of cases the animals are neither mobile enough, nor show sufficiently predictable directions of movement, to capture adequate sample sizes. However, if pitfall traps are used they need to regularly checked with a frequency that reflects the prevailing weather conditions and the temperatures that each trap will reach. Shading is essential for traps on hot days unless these are permanently manned.

Other field signs can be used to indicate the presence of species. Reptiles shed their skins; lizards shed them in pieces whilst snakes shed them intact. These skins, or ***sloughs***, can be identified to species. ***Tracks*** are less useful; the presence of `lizard' or `snake' can be deduced from prints in soft sand but rarely can these be identified to species. However these can give a guide as to where to look.

For the sand lizard the presence of the characteristic ***egg laying scrapes*** in sandy banks can give an indication of presence and some measure of abundance. However, since females may dig several `trial' burrows before egg laying (and may lay a second brood), they cannot be used directly to assess population sizes.

Capturing and handling reptiles is some necessary during survey, perhaps for weighing or measuring, or for sexing. Most reptiles can, and should, be caught by hand. Slow-worms, smooth snakes and grass snakes should be firmly, but not tightly, held between head and mid-body. The other lizard species should be caught by enclosing their whole body and head in the hand. Lizards may need to be trapped first under a cupped hand; the success of these will depend on the vegetation they are on. Hand capturing lizards is most likely to be successful on soft ground or in very should vegetation; rarely will it be successful if the animals are up in vegetation and this method should not be tried if the animal is on hard ground as it is too easy to cause it damage. Small nooses of cotton tied to the end of a stick can be useful for catching legged lizards. The noose can often be quite easily slipped over the head of the lizard and pulled gently closed. However some degree of skill (and considerable care) is needed to avoid damaging the animal.

Adders are venomous; capturing these is potentially dangerous. Gloves and `snake grabbers' can be used; however these do not guarantee safety unless used by trained personnel and can greatly increase the risk of injury to the animal. It is important not to grasp any reptiles too tightly or to handle roughly; they can easily suffer internal damage. Since lizards drop their tails, especially on warmer days, these should be handled with particular care and should not be grasped by the tail.

On first handling most reptiles will thrash about violently, snakes are also likely to defecate; this is especially so with the grass snake which produces a foul smelling excretion as part of its defence mechanisms. Generally reptiles will calm down after a short while. However it is often useful to hold them in a soft cloth bag to allow them to become calm (such bags should be kept clean to decrease the likelihood of spreading disease).

Individual identification and sexing

Reptiles can be identified as individuals either by describing natural marks and features or by marking in some way. The former approach is generally preferred as it is less intrusive.

Natural features include description of the sex and size as well as body coloration, patterns and scars. *Sexing* may be possible for some species from coloration, especially during the breeding season. Female **adders** tend to be reddish or brownish, males generally grey and more distinctly coloured; male **sand lizards** have green flanks and yellowish-green or pale blue finely spotted undersides, females are brown with whitish or pale yellow unspotted undersides; male **common lizards** tend to be darker on the back with scattered white centred spots and have a yellow, orange or reddish underside peppered with fine black spots whilst the female is usually paler with a broken dorsal stripe and the underside is either only slightly spotted or more usually a plain yellowish white or bluish grey; male **slow-worms** tend to be more uniform and grey, females generally have a brownish back with a slight dorsal stripe and darker, almost black, flanks. However these may not be reliable; for example black adders occur and may be either male or female and colour differences are unlikely to be so pronounced in young or non-breeding individuals.

Other features are also useful guides to sexing; on handling male reptiles may extrude one or both of their hemi-penes from the cloaca. These can usually be detected as bulges at the base of the tail just below the cloaca in all species; females, which lack these organs, often show a more pronounced tapering of the tail. Male lizards have notably larger head than females. Male snakes have relatively longer (and broader) tails. The ratio of the measurements from snout to vent and vent to tip of tail can be used to sex snakes. With their longer tails, males also have correspondingly more pairs of sub-caudal scales (ie the scales on the underside of

the body from the cloaca to the tip of the tail). Counting these provides another means of sexing snakes (see reference books, eg Smith (1973), for further details).

Different individuals are often quite distinctively marked. Features that have been used are the pattern of anal plate and the surrounding scales (common lizards), belly scale patterns (grass snakes), markings on the head and neck (smooth snakes and adders) or back (sand lizards) or spots on the chin (slow-worms). These are sufficiently consistent to allow recognition during a season and often for much longer. The features can be drawn or photographed; in both cases it is often useful to retain the animal in a clear plastic box or bag or to manufacture a `vice' made of perspex and foam sponge to restrain the animal whilst taking measurements. Reptiles often show scars, perhaps resulting from attacks by other animals. These can be useful aids to subsequent recognition.

The snout to vent length is the most useful measure of size; tails in lizards can be dropped. Some recorders also note head width and tail length. Weights can vary (snakes eat large meals, gravid females show marked reduction in weight on giving birth or laying eggs) so the value of this measurement is questionable for survey.

Artificial marking includes such methods as toe clipping for legged lizards, clipping the edges of ventral scales of snakes, marking with sub-cutaneously injected transponder tags (PIT Tags) and marking with paint or dyes. The former method is becoming less favoured and requires licensing under the Animals (Scientific Procedures) Act 1986 and the use of ventral scale is generally only advocated if large populations are to be sampled because of the possibility of damaging snakes or making them more prone to injury. PIT tagging is expensive and can only be justified for long term and detailed scientific study. The latter method has only short term value since paints applied externally will be lost each time the animals shed their skins. The application of dyes subcutaneously has been tried but is generally considered to be of limited value.

Evaluation

How many visits are needed ? This depends on the purpose. Clearly fewer visits are needed for simple recording presence than for estimations of population size.

As a minimum, three visits should be made to a site to give some indication of numbers. These should be at a comparable time in the season (eg three between April and June; or three later in the season) since visits over a protracted period will be sampling different parts of the population (eg through different habitat use, birth of young, etc). As such, to gain an insight into the whole population, these series of visits should be repeated at different stages of the season.

Totals can be recorded as highest counts of all animals, or of animals in any particular age or sex class, seen in any visit. Absolute numbers should be given and these can represent an absolute minimum population size. Extrapolation to give a total population estimate is difficult and should be based on the likely carrying capacity of a particular site based on the availability of habitat features. Where estimates are given, the raw data should also always be quoted.

Comparisons can be made with data from other sites. Ideally directly comparable effort is required to allow a meaningful comparison. However such information is rarely available. Assessment of sites invariably involves some subjectivity.

Observations can be compared with data from other known reptile sites and an indication of relative importance, eg 'the best site in the County', etc, can be derived. For the common species this should be by reference to the De Montfort University Reptile sites report (Swan and Oldham 1993) or by contacting English Nature or the County Wildlife Trust. For the rarer species, English Nature or the specialist voluntary organisations such as British Herpetological Society or the Herpetological Conservation Trust should be contacted (these data are considered confidential and are consequently not readily divulged).

The quality of sites can be assessed by reference to the SSSI Guidelines produced by Nature Conservancy Council. All established sand lizard and smooth snake populations outside Dorset are eligible for notification as SSSI; all important and established populations of these species in Dorset can be selected. However, unlike the amphibians, there is no simple scoring system for the commoner species; the guidelines simply refer to the best locality containing at least three of the commoner species in any area of search as being eligible for selection as SSSI.

Monitoring

Monitoring can be achieved on a site by any repeatable survey method. Lack of comparability of method will mean that any differences in observations may be more a function of method than a representation of fact. Practicality may determine that only single visits to sites can be made each year, however these should aim to standardise time of year and, as far as possible weather conditions. Given the importance of weather and season in influencing survey results, surveys should be repeated on several occasions, standardising as far as possible the duration of the visit and the weather and season. Ideally at least three visits should be made to gain data from which comparisons can be made between years. The data to use will be the totals of the best visit or maximum counts obtained for each age class/sex, as described above.

Recording schemes

Data for common species should be sent to the Biological Records Centre at the Institute of Terrestrial Ecology in Huntingdon, preferably on the JNCC/ITE reptile record cards. Information about rare reptiles can be sent to the Biological Records Centre, English Nature or the Herpetological Conservation Trust, preferably accompanied by a detailed map. Photographic or other evidence to confirm identification is useful if the record is from the edge or outside of the species' known range. Addresses are as follows:

Biological Records Centre
ITE
Monks Wood
Abbots Ripton
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Appendix 5: 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 the 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 reptiles 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 the 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 consequently 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 & Semlitsch 1981; Campbell & Christman 1982; Vogt & Hine 1982); and with the use of artificial refuges (Grant, Tucker, Lovich, Mills, Dixon, Gibbons & 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 & Hine 1982) to tropical cloud forests (Barker, unpub. 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 useful 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* (1982). 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 this 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 lizard *Lacerta agilis* have recently been reintroduced to part of the heath. The site may have originally also supported smooth snake *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. Secondhand 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 20 groups of five sheets (four 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

Grant *et al* (1992) in their more comprehensive studies in South Carolina recorded an average encounter rate of between five and six 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.

Discussion

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

- The lag-time effect on the refuges can be seen from the summarised results in Table 1. For 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 dependant 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

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 two 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. They were lifted to face away from the researcher in case of the presence of a venomous species.

An important additional feature in the study was the recording of incidental observations of reptiles along the 20 set transects connecting the groups of 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 (more detail is given in Appendix 1). In the 12 site checks, the total number of encounters for both refuge and transect records was 18 reptiles or amphibians. Of these, seven 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 seven encounters, or an average encounter rate of approximately one animal per 100 refuges.

Table 1. Summary of results

	Number of individuals noted		Encounter rate (%)
Species	Refuges	Transects	
Lacerta vivapara	5	7	0.58
Vipera berus	0	3	0.25
Natrix natrix	0	2	0.17
Bufo bufo	1	0	0.08

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 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 use 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.

Acknowledgements

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Appendix 1. Results table - giving details of observations each visit

Results showing lag-time effect on encounter rate for refuges and success of transect observations

Transect Refuge Group	30 Jun	5 Jul	6 Jul	7 Jul	12 Jul	18 Jul	20 Jul	22 Jul	28 Jul	8 Sep	23 Sep	24 Nov
1				Lv (T)		Vb (T)	Lv(x2) (T)		Mouse (R)			
2					Vb (T)			Lv (R)				Lv (R)
3												
4												
5												
6								Lv (T)				
7												
8												
9												
10												
11							Lv (T)				Lv (R)	
12												
13												
14												
15											Lv (R)	
16								Nn (T)	Lv (T)		Bb (R)	
17												
										Nn (T)		
19										Lv (T)	Lv (R)	
20						Vb (T)						

Lv = *Lacerta vivapara*
Vb = *Vipara berus*
Nn = *Natrix natrix*
Bb = *Bufo bufo*

(R) = Refuge record
(T) = Transect record

Appendix 6: Extract from: SGS Environment. 1995. Wildlife Enhancement Scheme in Dorset: Monitoring Project.

Confidential report to English Nature pp 8, 10-13

[Editor's note: A short extract of this confidential report is enclosed where proposed methods for reptile survey are discussed. The objective of the study was to develop a Monitoring Scheme which would assess the impacts of heathland management on reptile populations.]

"**Selection of species**

Initial discussions at the start up meeting in October suggested that sand lizard would definitely be one of the species requiring monitoring, on sites where it occurs, since the major concerns that have been raised with regards to grazing (section 3.0) are based around this species. Smooth snake is similarly rare and protected under Annex IVa of the EC Habitats Directive, Appendix II of the Bern Convention and Section 5 of the Wildlife and Countryside Act 1981. However, it is a wide ranging, secretive species, and is notoriously difficult to monitor for its presence, without even being able to determine population estimates. Consideration was given to the commoner species, so that populations may have been more easily assessed, but on discussion with experts from HCT and Doug Mills, the time required was thought better spent looking at sand lizards in greater detail. In particular, because this species utilises a more restricted habitat, mature dry heath, which is the habitat under most concern for possible detrimental impacts from the introduced management. The fact that it is a colonial species occupying particular banks and utilising certain sandy exposures also makes the possible use of control sites more achievable. There has also been a considerably greater amount of study of this species.

The grass snake was ruled out since it is not common on most of the sites. Adder and slow-worm were also discounted since a major effort would have been required on the placement of tins for which no suitable monitoring method has yet been devised. The common lizard was the only reptile in addition to sand lizard to be thought worth considering, and the use of a standard 'reptile walk' was considered. However, although desirable, with the more wide ranging distribution of the common lizard, and the lack of suitable baseline, it was thought that the available resources would be better used concentrating on one species in detail.

Where controls were not feasible, or likely, the standard reptile walk looking in particular for common and sand lizards may be a solution, particularly on sites where limited knowledge is available. All reptiles could be noted along this type of walk."

"**Monitoring methods**

Monitoring for reptiles is particularly difficult as they are difficult to survey. Many are secretive and their activity is largely governed by the prevailing weather conditions. Presence can often be demonstrated, although, it is more difficult to provide quantitative estimates of population size, show relative abundance or to prove the absence of a species. There is currently no standardised methodology for reptile survey or monitoring, although, several studies are underway at present in order to develop such a technique. Gent (1994) contains descriptions of the methods currently used in Britain.

Direct observation and counting is the most frequently used method for survey. Combining survey with other field survey is rarely successful because of the field technique required. Searching along transects or random walks are unlikely to yield sufficient sightings unless basking spots are included. Successful searching depends on preceding and prevailing weather conditions and season.

For sand lizards, adults can be searched for best during the early part of the year, probably April-June, depending on the season. However, direct observation only yields a small proportion of the population, and quantification is difficult and cannot be relied upon for an accurate estimate of population size.

Doug Mills (1994a and b) has recently been undertaking a study to look at sand patches at Hartland and Slepe Heath during June to locate adult female egg digging and the numbers of scrapes. The orientation of the sandy slopes do not appear to matter, particularly when shallow gradients and also due to the fact that females also dig scrapes during the night, however lizards will tend to lay on the north edge on an east/west track (Mills, 1994b). A problem with this is that more than one scrape can be dug by one lizard. Distinctions in this study were made between 'group scrapes', on the basis of distance between scrapes. Groups of 1-4 digs were counted as one animal, 5-8 digs as two animals. It was found that 70% of multiple scrapes were shallow blind attempts not used for egg deposit. It is considered that comparable results could be attained by this method. However, difficulties could be experienced since heavy rain washes out, and trampling can destroy evidence of egg laying scrapes. Mills (1994) suggests that this method could be undertaken by fairly unskilled herpetologists, however, it is unlikely that this is the case without some specialised training since many other creatures make holes and marks in sand.

Numbers of adult females of three years and over could then be estimated, and using a male to female ratio of 1:1, an estimate of population size for three years and over animals, however this is not necessary for our purposes.

Hatchling lizards appear during mid-August to September for sand lizards and late June to end of August for common lizards. Recording juveniles can give an indication of breeding success that provides a comparable measure between years. In fact this may be of particular relevance in relation to this project as one of the concerns is due to the trampling of sandy tracks etc, the egg laying sites, by cattle. This type of study can also assist in determining further egg laying clutches that may have been missed in the previous scrape survey.

Mills (1994b) was to determine an appropriate technique for annual population monitoring. However, since his study was undertaken during the summer, and missed out the spring survey period, a comparison with an adult search method was not undertaken, so that comments on the reliability of this method are unreliable. It is also a problem that if the egg search method was done in isolation, and the weather washed out the scrapes before they could be recorded, or there was a prolonged wet spell in June, reliable data would not be available. The hatching survey is useful in conjunction with the egg scrape study and may also reflect underlying weather conditions rather than actual egg laying. It is suggested that the egg search method is therefore useful in conjunction with other methods, but particularly where bare sand is easy to study, as in the Mills study. Often at a site, large sand patches/firebreaks and tracks may be scarce, and egg laying occurring in small patches which are not only impossible to locate on aerial photographs, but also difficult to locate on the ground, particularly if they are to be re-surveyed annually. It is also difficult to locate on the ground, particularly if they are to be re-surveyed annually. It is also thought a possibly

damaging operation to the mature heath, to frequently thoroughly survey the area for small sand patches.

A series of visits combining all the methods would therefore be required throughout the year, however, it is important to standardise the time of year these are made and as far as possible the weather conditions. Ideally at least three visits should be made at each time of year, in order to standardise the duration and weather conditions.

Surveying for reptiles is highly time consuming. HCT have been monitoring Arne for adults and egg laying sites, and this has taken them 19.5 man days in half day sections during 1994.

Time for monitoring should therefore be concentrated on good comparable sites with controls for these methods in/out of colonies with exclusion plots. For this project it would not be sensible or practicable to monitor every population. At a minimum, the two control sites identified above could be the main study areas.

Another approach, which is more extensive, could be adopted on those sites which have smaller foci and no appropriate controls is the 'reptile walk' approach. A standardised walk could be undertaken during correct weather conditions, looking for animals during the spring survey period. However, this approach would be less quantitative and although comparable between years, a standardised surveyor would be necessary. This approach may however, detect gross changes over larger portions of a site. Stumpel and Siepel (1993) notes that to be studied at a fixed probability, fixed significance level and accepted difference of 10% between two years, the transect approach requires extreme effort and very large numbers of transects. However, this monitoring project is not designed to look at the whole of a site, but at representative samples which may give an indication of change. This method could be extended to look at all bare sand located within, for example, 10 m of the transect, and signs of egg scrapes noted. Likewise a hatchling survey could also be undertaken during the late summer for the same purposes. These last two methods would again require three survey visits to ensure appropriate coverage and at the same time of year as described above.

Other useful measurements for reptiles include monitoring bare ground, vegetation structure, lichen and litter cover. These may be included within the other vegetation structure and photographic studies included with this project.

Frequency of study

Such intensive methods described above would need to be accomplished fairly frequently, ideally annually at the start of the project, when major changes may occur. However, once the behaviour of the grazing animals has settled down, and major impacts have been found or discounted, the monitoring may only need to be done on a five yearly basis.

A standard transect 'reptile walk' should ideally be accomplished three times in the same season each year.

Standard weather conditions for the searching of individual lizards

The best weather for seeing individuals is that which will induce lizards to bask and is dependent on time of year and time of day. Unbroken sunshine is good early in the spring, when the lizards need to bask for long periods, but is poor in midsummer except for early in the morning. It also should be noted that young hatchling lizards are smaller, take less long to warm up and cool down, and are more likely to be seen throughout the day.

It is therefore suggested that in the early part of the year, survey in April or May (dependent on the season that year), should concentrate on mid-morning to mid-afternoon period, on warm, but not hot days. The temperature should be assessed in relation to the amount of sun, air temperature and wind. Windy days should be avoided since detecting movements is made more difficult.

The egg laying survey, searching for scrapes is described above, and should be undertaken during June. The weather conditions at the time are unimportant. However the proceeding conditions are very important, and regular visits should be undertaken after good weather, but before rain, so maximising the chances of finding scrapes.

The August-September visits for hatchling lizards should again concentrate on warm, not hot days, and most likely involve searches during early mornings/late afternoons for best results.

The 'transect' type of approach should be undertaken in the spring April-June using the above described conditions for the adults, and as above for the egg scrape and hatchling studies.

Unfortunately due to the timescale of the project, the limited data available from the consultation with HCT until part way through the field visits and the prevailing weather conditions at the time of the field visits, standard transects for reptiles were unable to be devised on the ground, but only on a map base. It is suggested that the transects are confirmed at the appropriate time of year with the field surveyor, who would hopefully be a local herpetologist familiar with the site. The transect would cover a range of habitats, and all reptile species could be noted. In fact the invertebrate monitoring walk could also be suitable, although, it would be preferable to be able to look at all available data on bare sand and colonies for this study. Suggested transects derived from aerial photographs and colony information is provided for all sites in section 7.0 but should be agreed with HCT/surveyors before being carried out.

Data storage

HCT are obtaining a computer database for the storage of reptile information. This would be an appropriate place for the records to be stored and handled."

References

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