JOINT NATURE CONSERVATION COMMITTEE

Herpetofauna Workers' Manual

Edited by

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Contents

Preface

The United Kingdom has only a small amphibian and reptile fauna. There are six species of amphibian and six species of terrestrial reptile widely recognised as native to these islands, with a further five species of marine turtle recorded either regularly or as rare vagrants to the seas surrounding the British Isles. In addition, some species have become extinct here since the last Ice Age, and there is a selection of established non-native species plus the possibility that there might even be other species that may, in fact, be native.

Within this small number of species, though, there is still much of interest. Some species are at the edge of their European range in Britain; for others, there are internationally important populations resident here.

Recent years have seen an increase in both the numbers and the activities of herpetologists, whether amateur, academic or commercial. This has come about for a number of reasons, including legislative protection of amphibians and reptiles and its consequent obligations; increasing interest in the environment; increased awareness of amphibian and reptile declines throughout the world; and the development of local interest groups. In particular, there has been a big increase in the voluntary sector.

This upsurge in interest and activity has brought its own problems. People want to know how to get more involved, what to do and how they should do it, what they can and cannot do legally, whom to contact if they need help, how to enlist the help of others – the list goes on. Attempts have already been made to meet some of these needs, through the Herpetofauna Workers' Guide and guidance notes produced by Froglife, leaflets produced by the British Herpetological Society Conservation Committee, annual National and Regional meetings and a variety of publications by statutory and other non-statutory organisations. But there are still gaps. Above all there is a need for a single accessible text, available to a wide range of people involved with the conservation and management of amphibians and reptiles, that covers a wide range of herpetological issues.

This Manual is, the editors and authors hope, a significant step towards filling this gap, though we have intentionally limited its scope to looking primarily at the 12 non-marine species that are widely recognised as being native. While there is reference to non-natives we have not addressed issues that are specifically relevant to them, nor have we included details or descriptions of those species where there has been discussion about native status. We have also made only passing reference to the marine turtles; the issues relating to these species are by and large very different from those that affect our non-marine herpetofauna and are likely to be of most relevance to a different audience. Further information on marine turtles is available elsewhere, e.g. Davenport & Gaywood (1997), which gives advice on dealing with live, stranded and fouled marine turtles.

The idea for the Manual was first suggested by Tom Langton in the light of the success of the Bat Workers' Manual published by the Nature Conservancy Council. The project to write this Manual was then taken forward by a small group of specialists involved with amphibians and reptiles in the statutory and non-statutory sectors. The Joint Nature Conservation Committee commissioned 14 people to write 12 chapters. The authors represent a cross-section of herpetological expertise, all drawing on many years' experience in the field. Many others not named as authors have commented on chapters during the gestation of the text.

During the course of production, the editors have tried to preserve the views expressed by the authors. However, it is inevitable that some conflict of opinions will occur, although the similarity of approach was greater than had been expected. The opinions expressed are those of the authors, however, and do not necessarily reflect those of the statutory conservation agencies.

It is hoped that the result is a readily accessible text that will provide guidance on much of what faces those involved in herpetological conservation and a pointer to other information where necessary. It is not intended to be exhaustive – there are certainly many specialist areas that are not covered – but it should answer the majority of questions the majority of people have. We are also aware that techniques and perceptions will change, advice will be amended, new facts will be discovered and legislation be altered. Over time we therefore expect that some of the information in this Manual will be superseded. However, we feel that this represents a good overview at the time of writing and expect that it will prove a valuable source of information for a number of years to come. We hope that the Manual proves helpful for taking forward study and for developing new techniques and that it is part of the process involved in creating the next generation of ideas and understanding. In due course we hope that this Manual will serve as a good basis for updating the information needed in this field.

Although it has been written primarily for people involved in the conservation of amphibians and reptiles in the voluntary sector, we are sure it will also be of benefit to commercial and other professional herpetologists, to those who are teaching in schools and other educational establishments and to many others who have an interest in these two, quite fascinating, Classes of animal.

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Abbreviations used in text

ARG	Amphibian and reptile group
ASSI	Area of Special Scientific Interest
BHS	British Herpetological Society
BRC	Biological Records Centre
BTCV	British Trust for Conservation Volunteers
CCW	Countryside Council for Wales
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COSHH	Control of Substances Hazardous to Health (Regulations)
COTES	Control of Trade in Endangered Species (Enforcement) Regulations
CWS	County Wildlife Site
DETR	Department of the Environment, Transport and the Regions
EA	Environment Agency
EA	Environmental Assessment
EN	English Nature
FWAG	Farming and Wildlife Advisory Group
HCT	Herpetological Conservation Trust
HGBI	Herpetofauna Group of Britain and Ireland
JNCC	Joint Nature Conservation Committee
LNR	Local Nature Reserve
MAFF	Ministry of Agriculture, Fisheries and Food
NNR	National Nature Reserve
NT	National Trust
NTS	National Trust for Scotland
OLD (PDO)	Operation Likely to Damage (Potentially Damaging Operation)
RIGGS	Regionally Important Geological/ Geomorphological Site
RSPB	Royal Society for the Protection of Birds
RSPCA	Royal Society for the Prevention of Cruelty to Animals
SAC	Special Area of Conservation
SBI	Site of Biological Interest
SEH	Societas Europaea Herpetologica
SEPA	Scottish Environment Protection Agency
SINC	Site of Importance for Nature Conservation
SLNI	Site of Local Nature Importance
SNCI	Site of Nature Conservation Interest
SNCO	Statutory Nature Conservation Organisation
SNH	Scottish Natural Heritage
SOAEFD	Scottish Office Agriculture, Environment and Fisheries Department
SPA	Special Protection Area
SSPCA	Scottish Society for the Prevention of Cruelty to Animals
SSSI	Site of Special Scientific Interest
SVL	Snout to vent length
TBL	Total body length
TL	Tail length
USPCA	Ulster Society for the Prevention of Cruelty to Animals
WT	Wildlife Trust

Chapter 1 Surveying

Richard A. Griffiths and Howard Inns

1.1 Introduction

There are many ways of carrying out surveys of amphibians and reptiles, and different field workers have their own preferences. However, there are a few general guidelines that apply to most types of survey, and before setting off into the field it is important to consider these.

1.1.1 Why is the survey being carried out?

The reasons for carrying out a survey will often determine the methods used in the field, the types of data collected and the way they are recorded, and the fate of the information. If the survey is being performed as part of a co-ordinated programme, for example a local or national programme, there will be guidelines that will need to be adhered to if the survey is to make a useful contribution. Increasingly surveys are being undertaken to address international requirements, such as assessment of a species' conservation status as identified through the EC Habitats Directive, or as a means of developing Biodiversity Action Plans. It is important to find out what guidelines apply before starting work. If the survey is not part of a wider programme then there may be more flexibility in how it is designed. However, even when working independently, the data collected will almost certainly be of use to other people. It is therefore wise to contact the local amphibian and reptile group (ARG), Wildlife Trust (WT) or the Statutory Nature Conservation Organisation (SNCO) office to see what type of survey is needed in the particular area and what guidelines may be appropriate, and to avoid unnecessary duplication of effort. It should be noted that although the specific techniques described in this chapter are applicable to a wide range of purposes for which surveys are carried out, the frequency of visits to a site will vary depending on this purpose. Specifically, many more visits will be required to build up a picture of a population size and its distribution than will be necessary simply to identify sites where species occur (see Chapters 5, 6, 8 & 9 for other areas of conservation where survey plays an important part) .

1.1.2 What size area should be covered?

The answer to this question will largely be dictated by time and resources. If a very detailed survey is required where every single site is visited, then the area to be covered may be relatively small. The most useful surveys are 'blanket' surveys – those that investigate every site within a predefined area – and these can be identified on the basis of geological or soil boundaries, administrative areas or groups of kilometre squares on a map. It is very difficult without exhaustive effort to prove that a species is absent from a site. Some sites may need several visits to locate animals, and this too may restrict the area covered. It is important to check with other organisations to see if your area has been surveyed in the past, or if there are other areas that it may be more important to survey.

1.1.3 How detailed should the survey be?

There are two basic survey designs, which differ in the amount of information they collect. The simplest survey is one where presence of a species is recorded. This can often be achieved on a single visit to a site. However, because it is more difficult to demonstrate that a species is absent, several visits may be necessary. The second level of survey is one where some attempt is made to obtain information about the size of the populations present or a measure of population size relative to other sites or to other surveys at the same site. This will involve counting individuals observed using one of the methods described later. Because weather conditions and other factors will affect the numbers of animals seen on any one visit, repeated surveys at the same site will almost certainly be necessary. Information on the habitat characteristics of a site is useful, in addition to recording animals. This may involve noting percentage cover of different types of vegetation, water depth, proximity of urban development etc. When analysed, such data may help to explain the distribution and relative abundance of the species present in the area.

This can be extended by carrying out repeat surveys of this nature and assessing the biological significance of observed changes in population status. The specific methods chosen will depend upon the survey objectives.

1.2 Amphibians

1.2.1 Timing the survey

Figure 1 shows the best times to search for each species. Adult common frogs and common toads breed in ponds for only a short period each year but are usually very conspicuous at this time. In contrast the newts have a much longer breeding period but are much less conspicuous. Breeding activity also varies across the country and is generally earlier in the south and west than in the east and north, particularly in the case of frogs and toads. Similarly, the timing of breeding is delayed at greater altitudes. Figure 2 provides a guide to when frog spawn appears in different parts of the country and can be used to estimate the best time to start a survey. On average common toads breed 3–5 weeks after frogs, but this gap is much shorter in the east than in the west. Indeed, in some eastern parts of the country both species may breed at the same time of year.

Amphibian activity also varies according to the time of day. Breeding migrations occur after dark in all species and, rarely, at dawn in certain weather conditions, but amphibians are occasionally found wandering on land during daylight outside the breeding season. Spawning activity in common frogs and common toads may occur during day or night, although natterjacks are exclusively nocturnal. Newts are also most active during the twilight hours or after dark.

Lastly, it is important to bear in mind that the numbers of amphibians observed by almost any method are influenced by air and soil temperature. Even at the peak of the breeding season, cold snaps may reduce activity and can lead to low counts. It is important to take this into account if comparisons between sites or between years are among the aims of the study.

1.2.2 Survey techniques

Common frogs

Common frogs are 'explosive breeders', and usually use one (or sometimes two or three) communal spawn sites within a pond. These areas are usually in warm, shallow water, close to the shoreline, and often on the south-facing side.

If a pond is visited regularly at night in the early part of the breeding season it may be possible to make head counts. Not all frogs breed at exactly the same time and females may spend only a single day or night in the pond, so head counts are likely to be underestimates of the actual breeding population. Because of this, it is best to use head counts only in addition to spawn counting (see below).

As adult frogs are present at the spawn site for only a few days, it is often more convenient to count the number of spawn clumps that are left behind. Usually each female frog lays a single clump of spawn each year. However, frogs produce eggs from both ovaries. Although these are normally laid together as a single clump, sometimes they are laid in a 'dumb-bell' shape and sometimes separately as two small clumps. In

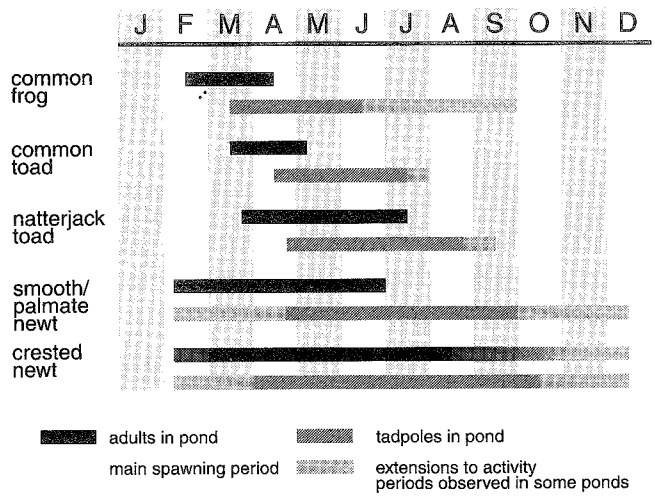


Figure 1 Activity times of amphibians (adapted from: Griffiths 1987).

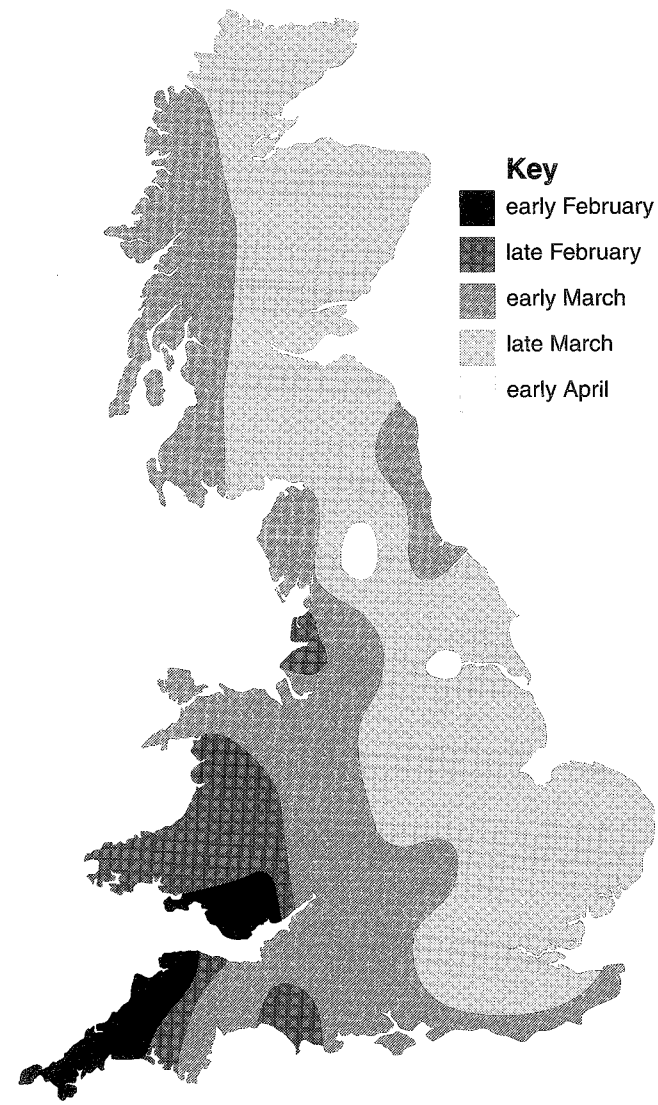


Figure 2 Spawning dates of the common frog (adapted from: Cooke 1976).

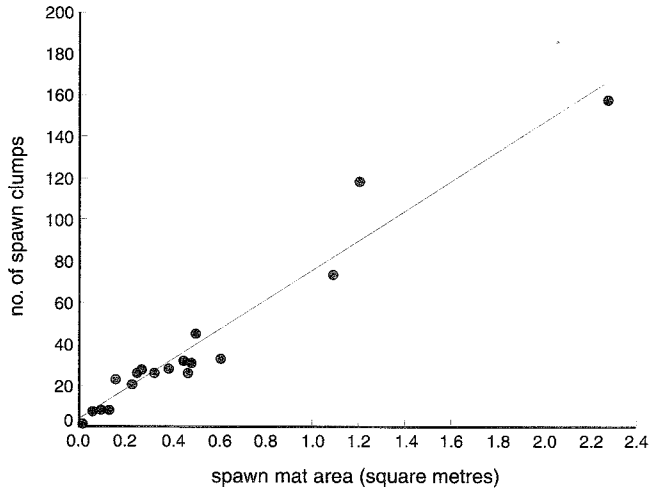


Figure 3 Relationship between spawn clumps and spawn mat area (adapted from: Griffiths, Raper & Brady 1996).

general, although not all adult females spawn every year, the number of clumps can be a good indication of female population size. As the spawn clumps tend to coalesce into a single 'spawn mat', it is sometimes difficult to distinguish separate clumps. However, there is a very strong relationship between spawn mat area and the number of clumps laid, so an estimate of the number of females can be obtained by measuring the area of the mat and reading off the number of clumps using Figure 3 (Griffiths, Raper & Brady 1996).

Common toads

Like frogs, common toads are explosive breeders and converge on a breeding site for only a few days in the spring. Unlike frogs, however, their eggs are laid in long strings and are intertwined amongst aquatic vegetation, often at greater depth, where they are less visible. This makes counting common toad spawn strings at many sites largely impractical. As with frogs, spawn is developed by both ovaries and a 'parallel' or 'pair' of strings is usually laid.

It is usually more practical to count the number of adult toads in the pond at the peak of the spawning period. Peak numbers in the pond are likely to be observed four to five days after the first paired animals are seen in the water (Swan & Oldham 1993a). At this time around 75% of males may be in the water, although only half of these are likely to be visible at any one time (British Herpetological Society 1996).

If it is not possible to count spawning toads, then the numbers observed during the inward migration may be assessed instead. This is generally less reliable, however, and only possible if a road or open ground close to the pond makes such counts feasible. Movements towards breeding ponds usually occur after dusk on mild, damp nights, when the air temperature is above 4 °C. Migrations usually peak about two weeks after the first toads are seen (although this period can be longer or shorter according to the time of year and weather conditions). Several nights should be monitored at this time to account for the day-to-day variation in toad numbers. During peak migrations, the number of toads counted on any one night may represent about 5% of the total breeding population (Gittins, Parker & Slater 1980; Cooke & Oldham 1995).

Whether counts of common toads are made away from or at the breeding site, more males than females are normally observed. This is because there is a natural male bias in the sex ratio, coupled with the fact that male toads spend longer at the breeding site than do females; if repeated counts are made at the same site it is possible that some males will be counted more than once.

Natterjack toad

Breeding activity in the natterjack toad occurs later than the common frog or common toad, but can last for several weeks from April until August. At this time peaks in breeding activity can often be identified by listening for natterjacks calling; males often call in unison and such 'choruses' can be identified at a considerable distance. However, estimating counts of large numbers of calling males is difficult and not recommended. Natterjacks do not use a single spawning area within a pond. Instead their spawn strings are usually laid individually or in small groups in different parts of the pond. Because natterjack breeding ponds are shallow, ephemeral pools that are often devoid of vegetation, it is usually a relatively easy task to count individual spawn strings. If this is done on a regular basis throughout the breeding period, counts of spawn strings should give a reliable indication of the number of breeding females in the population. Generally females lay a single spawn string, but they may sometimes spawn twice in one year, which could lead to an overestimate.

During the spring and summer, adult natterjacks actively forage in open areas on land. Night searches using a powerful torch can therefore be quite effective at this time. The best conditions for night searches are after rainfall when the temperature is above 9 °C. Under such conditions it may be possible to count around 10% of the total population in a single night (Denton & Beebee 1992a). A licence is required to search by torchlight for this species because of the disturbance caused (see 1.4).

Newts

The three species of British newts have similar ecologies, and the same survey methods can be applied to all three. Bear in mind, however, that there are differences between the species in how easily they are detected by different methods. The equipment needed for catching and handling newts is more fully described in Chapter 3.

Counts by torchlight

The simplest method of surveying for newts is to walk slowly around a pond after dark and scan the water's edge with a powerful torch. The score for any one site can be expressed as the total number observed during a circuit of the pond, as a density measure, i.e. average number of newts per unit of shoreline, or as a population index based upon the density measure multiplied by the length of shoreline (including areas not surveyed). The choice of scoring system may

depend upon the nature of the water body, any circumference:area effect and the objectives of the survey. The proportion of an adult newt population that is likely to be counted by torchlight will vary considerably between ponds. At two ponds where the population sizes of great crested newts were estimated, torch counts at peak season amounted to between 6% and 23% of the population (Cooke 1986). Torch counts can also be valuable for checking for newt larvae in the autumn.

Trapping

Trapping is time consuming and requires skill and patience to carry out properly. Traps come in a number of designs, the simplest of which is constructed from a plastic drinks bottle (see Chapter 3). Such traps are highly effective for catching all three species of newt, although some precautions are necessary to ensure that newts do not asphyxiate in them (see Chapter 3). A trapping programme can be standardised by placing traps at regular intervals around the perimeter of a pond (say, every 2–3 m), and expressing the catch as either the total number caught or the average number of newts per trap. In a large pond, or one with inaccessible shorelines, it may not be possible to set traps around the entire perimeter in a systematic way. If this is the case, trapping should focus on sectors of the shoreline (e.g. two or three 10 m stretches). Whether these sectors are defined randomly or according to the topography of the pond depends on the aims of the survey.

In smooth and palmate newts a male bias is normally obtained when trapping. In great crested newts trapping does not seem to result in strongly skewed sex ratios. There is also no evidence that smooth or palmate newts that have been captured on previous occasions subsequently avoid traps, or actively seek them (Griffiths 1985).

The number of newts captured in traps is proportional to the number of traps used. However, the proportion of the population captured on any one night varies between ponds. If trapping is standardised to 1 trap per 2 m of shoreline, then the total catch can amount to anything between 2% and 28% of the population on any one night at peak season (Griffiths & Raper 1994). Bottle trapping can kill newt larvae and adult newts in certain conditions (Chapter 3).

Netting

Dip-netting from the pond shoreline can be performed during the day or night. Newts tend to hide amongst submerged vegetation or along the edges of emergent vegetation during the day, so it may be best to target such areas. Netting for a set time or number of sweeps per length of bank can standardise the sampling, providing the average sweep length and length of pond perimeter covered is recorded (Cooke & Frazer 1976; Swan & Oldham 1993a). Relating the number of newts captured by netting to actual population sizes is not really practical and the proportion captured by this method is likely to be lower than that observed by torch counts or trapping. Dip-netting causes considerable disturbance to ponds and is best restricted to confirming the presence of species.

Egg searches

Unlike frog and toad spawn, newt eggs are laid individually on submerged or floating water plants. The female carefully wraps each egg in the leaf of a water plant. When several eggs are laid on the same plant the repeated foldings may give the leaf a characteristic 'concertina' appearance that can easily be spotted amongst vegetation. Great crested newt eggs are larger than those of the two smaller species, and are often easier to observe. Carefully searching the vegetation along the edge or at the surface of the pond may therefore reveal the presence of eggs. During the breeding season egg searches are an efficient method for establishing the presence of great crested newts in a pond, but cannot be used to give indications of relative population size. The eggs of smooth and palmate newts are small and impossible to distinguish between in the field, and egg-searching is therefore inconclusive for the smaller species.

Comparison of torch counts, trapping and netting

All three of the methods described above have their advantages and disadvantages, and their relative efficiency in detecting animals will, to some extent, depend on the characteristics of the pond (Table 1.1). Nevertheless, some general comparisons can be made which may guide field workers towards the most appropriate method for their purposes. In terms of the number of newts detected, netting is a less effective method than either torch counts or trapping. Indeed, daytime netting seems a particularly inefficient method for catching great crested newts. However, when it comes to determining sex ratios and relative abundance of different species within the same pond, netting is probably less biased than the other two methods.

Trapping is likely to succeed where netting has failed, and where murky water and/or dense vegetation prevent a count by torchlight. Searching for eggs can sometimes detect the presence of great crested newts in a pond where other, more quantitative methods have failed. At other sites, however, trapping or torch counts can reveal crested newts where egg searches have failed. Griffiths, Raper & Brady (1996) provide a detailed comparison of the main methods.

Clearly there is no method that is 100% effective in detecting the presence of newts. Small populations of newts can be missed by any of the methods, and if it is crucial to establish the presence or likely absence of newts then a combination of different methods may be advisable. A rule of thumb for general surveys may therefore be to use torchlight counts when ponds are clear and relatively unvegetated (e.g. early in spring), and netting in moderately vegetated or turbid ponds. Trapping is probably the best method that can be used in ponds heavily choked with vegetation.

Scoring system for relative abundance

Absolute counts are used as the primary method of site assessment, the method depending upon the objectives. SSSI designations use absolute counts based on numbers seen or netted during the day or counted at night (see Chapter 8, Box 1). If torch counts, trapping or netting are carried out in a standardised way, it may be possible to compare populations that have been surveyed by

Table 1.1 Advantages and disadvantages of survey methods for newts (see Section 1.4 for legal considerations)

Method	*Advantage*	*Disadvantage*
Night counts by torchlight	No licence needed if animals are not disturbed by the activity (see 1.4.1)	Difficult in murky or weedy ponds
	Minimal disturbance to pond or animals	Difficult in rainy or windy weather
	Minimum of equipment needed	Identification of newts may be difficult
	Quick method for great crested newts	Must be done after dark
Trapping	Usually causes little pond disturbance (but care needed to ensure this is kept to a minimum)	Effort to obtain or construct traps
	Can be used in murky or weedy ponds	Needs two visits to set and check and remove traps
	Allows accurate identification	Needs a licence for great crested newts
		Risk of killing newts and larvae
		Reported male bias in the two small species
		Stake supporting traps can puncture pond liners
Netting	Can be carried out in daytime	Not efficient at detecting great crested newts
	Allows accurate identification	Difficult in weedless or thickly weeded ponds
		Needs a licence for great crested newts
		Causes considerable disturbance to pond
Egg search	Very quick method for determining great crested newts presence	Inclusive for the two smaller species
	No equipment needed	Of little value for indicating population size
Ring-fence/ pitfalls	Reliable indicator of population size	Requires considerable effort and expense to install, maintain and monitor
	Useful for population census	Risk of vandalism/or interference
	Allows accurate identification	Risk of animals dying in pitfalls
		Needs licence for great crested newts
Searching refuges	Defects animals when on land	Only indicates presence
	No equipment needed	May disturb dormant newts
		Generally inefficient and has high risk of 'false negatives'

different survey methods. Griffiths, Raper & Brady (1996) calibrated these three methods against each other across a large sample of ponds in England and Wales. By calculating the average number of newts observed using each method and attaching statistical confidence limits, they devised a scoring system that allows newt populations to be classified as 'average', 'above average', 'good' or 'excellent' (Table 1.2). Scoring-out a newt population using this system requires observations to be recorded as the average number of newts per 2 m of shoreline. Torch counts should therefore be converted to densities by dividing the number of newts by the number of 2 m stretches surveyed. Likewise, if trapping is used, traps should be placed 2 m apart, while netting counts are determined by taking a single sweep at the same 2 m intervals. As far as possible, all of the accessible shoreline should be surveyed. If this is not practicable, or the pond is very large, counts should be made along a number of randomly chosen stretches of shoreline (see Griffiths, Raper & Brady 1996 for further details). An 'excellent' great crested newt population, for example, would be one where on average about two newts are observed per 2 m by trapping, or around one newt per 2 m by netting, assuming the standardised sampling methodology described above was used. Such a population would be expected to fall within the top 1% of great crested newt sites.

It is important to emphasise that the simple counts or catches obtained using these methods do not necessarily reflect actual population sizes. The only reliable way of obtaining the latter is to use mark-release-recapture, complete census, or drift-fence methods (e.g. Krebs 1989; Heyer *et al.* 1994). These methods are labour intensive and require considerable experience.

Other methods

The survey methods described above are those which have proved most popular and practical for general surveys and require little biological expertise. Other methods are available but are usually designed for more specialised types of survey.

Searching terrestrial refuges, by turning logs, stones or other hiding places in the vicinity of a pond, can sometimes reveal the presence of amphibians (e.g. Griffiths 1984). This method may be useful outside the breeding season, when it is important to get a quick assessment of which species may be present. It can be labour intensive, however, and is obviously dependent on how many hiding places are available to search. Failure to find a species does not therefore mean it is absent. A licence is required for such searches if natterjack toads or great crested newts are likely to be encountered (see 1.4).

Drift-fence and pitfall systems (see Chapter 3) have been widely used in studies of amphibian migration, and in 'toads on roads' projects (see Chapters 10 & 11). Such systems can be expensive and labour intensive to install and monitor but can be used to census a wide

Table 1.2 Criteria for determining the conservation status of newt populations using standardised methods

Species	*Category*	*Torching (clear water sites)*	*Torching (murky or vegetated sites)*	*Trapping*	*Netting*
Great crested newts	Average	0.67 ≤1.88	0.32 ≤0.74	>0.51 ≤0.96	>0.07 ≤0.23
	Above average	>1.88 ≤2.78	>0.74 ≤1.09	>0.96 ≤1.28	>0.23 ≤0.34
	Good	>2.78 ≤3.79	>1.09 ≤1.49	1.28 ≤1.63	0.34 ≤0.46
	Excellent	>3.79	>1.49	>1.63	>0.46
Other newts	Average	0.79 ≤2.15	0.49 ≤0.95	>0.64 ≤1.19	>0.44 ≤1.21
	Above average	>2.15 ≤3.11	>0.95 ≤1.28	>1.19 ≤1.56	>1.21 ≤1.73
	Good	>3.11 ≤4.16	>1.28 ≤1.65	1.56 ≤1.96	1.73 ≤2.30
	Excellent	>4.16	>1.65	>1.96	>2.30

Note: numbers quoted are those that need to be detected (males + females) per 2 m of shoreline. Further explanation in text (from Griffiths, Raper & Brady 1996).

range of species. However, some species can negotiate simple drift-fences by either climbing or burrowing. Further guidelines are given by Gibbons & Semlitsch (1981), Gittins (1983), Reading & Clarke (1983) and Langton (1989a).

1.3 Reptile surveying

Reptile survey can be difficult and the approach taken will be influenced by the objective of the survey, individual preference and ability, and site related parameters. These are reviewed and discussed in Foster & Gent (1996) and Reading (1996).

1.3.1 Survey planning

Unlike amphibians, reptiles do not conveniently congregate to breed, and their activity is dependent on the weather. These two factors have an influence on the scope of any reptile survey, and although it may be possible to visit a substantial number of ponds during the course of the breeding season to survey for amphibians, it is often better to concentrate on a much smaller number of sites for reptile survey.

Identification of suitable sites should start by getting leads from your local ARG, CWT, local natural history society or just local folklore. These often lead you to sites suitable for several reptile species. Some planning can also be done from the Ordnance Survey 1:25,000 Pathfinder maps. The most productive habitat for the widest range of species is often heathland, which can be readily identified. Scrub, rough grassland (which is generally how chalk downland is marked), moorland (below 500 m), sea cliffs and sand dunes can all be identified and are all potentially good reptile habitats. Examine the contours within the areas of suitable habitat and identify south facing slopes, as these are generally favoured by reptiles.

Once what are believed to be suitable sites have been identified, it is a good idea to conduct a habitat survey during the winter. Look for dry, species-rich, undisturbed open habitat with a mix of sparse and dense vegetation. Look particularly for sunny hollows, banks and gullies as these often provide a focus for reptiles. Also look for disused rabbit burrows on dry, south facing banks as these are favourite hibernation sites for snakes even if they are partially tree-covered.

Grass snakes have an affinity for water because of their diet. It may therefore be possible to identify potential sites specifically for this animal, such as ponds, lakes, gravel pits or canals with adjacent open habitat. Good amphibian ponds often support grass snakes if the surrounding habitat is suitable.

Some man-made features are worth considering as areas for survey, and these too can be identified from the map. Examples are disused railway lines, old quarries or sand pits and pylon lines crossing woodland, as these are kept clear of trees, thus creating excellent open reptile habitat. Out-of-play areas and the roughs of golf courses can also be worthwhile places to look.

In summary, be realistic about what can be done. Sites will need to be visited at least five times in suitable weather conditions to give a reasonable chance of finding all the reptile species present. Prepare as much as possible, including out of season surveys, to avoid wasting time during good recording weather. Remember that systematic searching of specific sites can be of greater conservation value than collecting isolated individual sightings from a number of sites.

1.3.2 Survey timing and weather

Reptile surveys can be conducted only during the animals' active season, which is broadly in line with British Summer Time. The main objective in reptile monitoring is to find basking animals. Reptiles need to spend a lot of time basking when the air temperature is low but the sun is shining, therefore April, May and September are the three key months. April and May have the added advantage of being the reptile mating season, which means that animals will be more obvious and less wary of observers. During June, July and August reptiles are active and because the air temperature is higher they do not need to spend as much time basking but move about freely, often deep in the vegetation; this makes them much more difficult to find. Reptile behaviour, and hence ease of seeing them, will be influenced by the animal's physiological conditions; for example gravid females will bask more and so be seen relatively more often than non-gravid animals.

During April and May, the best weather conditions for surveying are temperatures between 10 and 17 °C, intermittent or hazy sunshine, and little or no wind. Classic 'April showers' weather is excellent as long as the wind is not too strong and there are good gaps of sun between the showers. Very bright sunny days are often very poor because animals very quickly reach their active temperature and move off. The timing of your searches should coincide with the temperature window, which will typically be between 0900 and 1100 hrs and between 1600 and 1900 hrs. It is very noticeable that a long spell of good reptile weather seems to reduce the need to bask and conversely that sun after a long spell of wet or cloudy weather can produce excellent results, even during the warmer summer months. Sultry, thundery conditions seem to make reptiles, particularly snakes, active and visible. Very few reptiles can be found in windy conditions.

These comments apply to all British reptiles, but individual species do have their own preferences; these are discussed below.

1.3.3 Survey techniques

Generally applicable

A practical objective in surveying for reptiles is to find them basking but to avoid disturbing them. There will then be an opportunity to make an accurate identification; tails disappearing into the undergrowth are frustratingly difficult to identify! The ideal basking spot for a reptile is a pool of sunlight deep in the vegetation or on the sunny edge of dense vegetation. Focus on this type of basking spot, walking slowly and quietly, back to the sun, looking outside the area of shadow and as far ahead as possible. Most reptiles will take flight if approached to within a few metres or if the observer's shadow falls on them. Also bear in mind that snakes are sensitive to ground vibration and have very good olfactory senses. Lizards have excellent eyesight and hearing so reptile monitoring needs to be done slowly, quietly and gently.

All species are, to a greater or lesser extent, cryptically coloured and patterned, and basking animals are often partially obscured by vegetation. It is therefore a good idea to stop frequently and examine the scene in front. If using paths during searches, basking reptiles will be less likely to move off because of disturbed vegetation, but this may also limit success as snakes prefer to bask deep in their habitat away from regular disturbance. Walking off the path in some fragile habitats such as heathland and chalk downland needs care and special permission on many sites. Footwear and trousers should be worn as a precaution against tick bites, cuts and scratches from vegetation and against the faint possibility of adder bite. Binoculars with a good close focus capability (below 3 m) are very helpful for this type of reptile monitoring. They should be used as soon as a reptile is spotted and the temptation to get a little closer should be avoided until a positive identification has been made.

South facing slopes, banks, gullies, pits and tumuli should be sought out and given special attention, because they are angled into the sun's rays and thus, as well as being favourable for basking reptiles, are often much easier on the eye to survey. Choose slopes that suit the time of day, for example if a north/south ridge is a feature of the site, survey the east side in the morning and the west side in the evening.

Every surveying trip has its fair share of disappointments in the form of unidentified rustles in the undergrowth. If an animal retreats from its basking spot, it is quite likely to return. Do not disturb the vegetation but mark or memorise the spot, retreat immediately and wait at least five minutes, longer if a snake was suspected, before returning. Always re-approach a disturbed animal very cautiously as it may have taken up an alternative position close by.

The weather, topography of the site, vegetation type, skill of the surveyor, time of year and time of day are all such significant factors in determining whether reptiles are visible that it is almost impossible to establish any standard counting techniques. Surveys should therefore aim to establish presence, key foci and breeding success by monitoring hatchlings, gravid females or egg laying sites.

Reptiles have a well known affinity for hiding under debris exposed or partially exposed to the sun. Slow-worms in particular are well known for this, but all three snake species will readily use such cover, as will the other two lizard species, especially in poor weather conditions. Pieces of lightweight corrugated iron sheeting (tins) seem to be particularly attractive and have been used on many sites to assist in surveying reptile populations. Their value and use may depend on personal preference, the need for a repeatable survey technique and public access to the site (see papers and discussion in Foster & Gent (1996)). The value of tin survey and a method for its use is proposed in Reading (1996). Tins for reptile survey need be no more than 0.5 m square and should be well hidden in the vegetation but still exposed to the sun. Tins have the advantage that they can be checked even in cloudy weather, since they will be used by reptiles throughout the warmer months of the summer. Other materials have been used to good effect, including roofing felt, wood and black plastic. As adders will use such cover, care should be taken when lifting refuges. It is essential that such refuges are hidden from casual discovery but can be located by people engaged in the survey. Obvious landmarks such as trees or telegraph poles should be used as markers and positions should be marked on a sketch map used by each surveyor.

The use of such refuges must only be undertaken with great care, as attracting reptiles in this way makes them particularly vulnerable to collection. The following guidelines should be observed:

- Tins or other deliberately laid refuges should be numbered and labelled.
- The permission of the landowner or manager should be sought and they should be aware of the position of refuges and their sensitivity.
- Refuges should be removed at the end of the survey and should not remain in place longer than three seasons.
- Refuges should be removed, or at least relocated, if there is any suspicion that they are being disturbed by people not involved in the survey.

Species specific

In the following accounts air temperatures are given to indicate the weather conditions when animals are most likely to be seen. You need to be careful about applying these too rigidly, as air temperatures are poor indicators of either a reptile's body temperature or the temperature of its immediate surroundings. It is, in turn, these latter temperatures that largely govern activity. This aspect is discussed more in Foster & Gent 1996.

Common lizard

Common lizards can usually be found whenever the temperature exceeds approximately 9 °C and the sun is shining. While lizards may appear on exceptionally fine warm days during the winter, monitoring usually starts at the beginning of March. This species does not always hibernate communally so individuals will be found dotted throughout suitable habitats. Common lizards bask freely in temperatures up to approximately 18 °C. Gravid females continue to bask during June and July and give birth at the end of July or during the first part of August. August and September are excellent months for looking for tiny black hatchling common lizards, which are more numerous and bolder than adults and can give an indication about the breeding status of a colony.

Sand lizard

Sand lizards are more elusive and harder to find than common lizards. While they can occasionally be found earlier, sand lizard surveys should start in early April. Sand lizards will bask freely during April and May in temperatures between 10 and 18 °C. More so than common lizards, sand lizards are often found in discrete populations centred on a particular slope, bank or gully. Mating is usually over by the end of May and males

then become harder to find. Egg laying starts soon after and provides another useful monitoring opportunity. Females lay their eggs in open, exposed sand and often dig a number of test burrows before making their final choice. These test burrows can be identified and provide a useful clue about the presence of breeding lizards. They can be found in exposed sand, usually between 10 and 15 cm from the edge of the vegetation, and can best be described as oval-shaped burrows approximately 3 cm wide, loosely filled in with sand. Females often lay their eggs in the late afternoon or early evening on hot sultry days in early June, and if you choose this time to search for test burrows, you may find females in the process of laying eggs.

Sand lizard hatchlings start to appear during August and can be found in suitable conditions until the end of October. September is the key month for survey, and hatchlings, being (in a good year) more numerous and less nervous than adults, can reveal new colonies and give an indication of the viability of known populations. It is important to gain experience of distinguishing between these and common lizard hatchlings (see Chapter 4). Adult sand lizards are also seen at this time of year, although some individuals retire as early as late August.

Slow-worm

Most slow-worms are found by turning over debris and are rarely seen in the open. However, they do bask, their timing and temperature tolerance being similar to that of the common lizard. Their glossy appearance is what usually gives them away while basking, but careful observation is needed as slow-worms often bask partially hidden in the vegetation. Hatchlings, born in September, rarely bask. Slow-worms exhibit the widest habitat preference of Britain's reptiles and are frequently encountered in urban and suburban environments.

Grass snake

Grass snakes will use a wide variety of habitats, but because of their diet they have a strong association with fresh water. Grass snake monitoring should not start before the beginning of April. Both this species and the adder remain close to their usually communal hibernacula (which the two species often share) in the spring; a good objective in monitoring early in the season is to find such hibernacula. These are typically disused rabbit burrows in well drained slopes with some exposure to the sun. Sites where animals are found in the spring should be visited on suitable days in late September and early October as the snakes return to hibernate. This reptile will bask in temperatures between 12 and 20 °C. It is also generally more active than the other snakes and is frequently encountered very early in the morning and late in the evening; it has been found hunting on warm nights. It is without doubt the most nervous of our reptiles and to give a good enough view to confirm identification it needs to be spotted from a distance and approached very cautiously. It will often bask partially obscured by vegetation.

The grass snake's need to incubate its eggs gives an additional opportunity for monitoring in June and July by checking likely egg laying sites and by questioning gardeners, farmers, golf course groundsmen and stable hands. Compost heaps, stable manure, grass cuttings and sawdust piles are all commonly used. The presence of snakes around such sites can be detected by basking female snakes, and by round entrance holes in well consolidated piles such as sawdust or grass cuttings. The pile should not be disturbed, however, as this may damage its effectiveness as an incubator. Hatchling snakes can also be searched for around breeding sites during September, although unlike lizards, young snakes tend to be secretive and hard to find. It is important to stress the fact that incubation sites are vital to grass snakes and monitoring for them in this way gives an opportunity to interest landowners and managers in maintaining such sites and leaving them undisturbed during the incubation period. This is one of the most constructive conservation measures that can be taken for this species.

Adder

Like the common lizard, adders emerge relatively early from hibernation. At this time they will often bask together in the vicinity of their hibernacula. Monitoring can start in suitable weather from the beginning of March. If you do find such a concentration, it is worth checking the area frequently during the spring and again in the autumn. Another clue to a hibernation area is the discovery of several sloughs in the same vicinity, as emerging snakes slough for the first time in early April. Adders bask freely at temperatures between 8 and 16 °C and are the least tolerant of higher temperatures. Adders are less nervous than grass snakes and often bask in the open and move away slowly when disturbed. During the summer months, adders are harder to find but will regularly use 'tins'. Young adders are born live during August but are secretive and hard to find so there is little point in undertaking specific monitoring for them.

Smooth snake

This specialist of heathland is secretive and does not bask freely, which makes it exceedingly difficult to find, even on the limited number of sites that carry populations of this rare snake. It is seldom active before the beginning of April and if it does bask, it often coils around the base of a heather plant and is difficult to spot. Its weather preference for such activity is hazy rather than strong sunshine within the approximate temperature range of 13 to 19 °C. Young are normally born quite late in the season and are also secretive and hard to find.

The smooth snake does, however, readily use 'tins' and these have been used in past surveys as the primary way to locate snakes. Because animals under tins are so vulnerable, it should be stressed that surveys for this animal using tins, or on sites where it is likely to occur, should only be undertaken after appropriate licences have been obtained from English Nature (see Section 2.4), and advice can be obtained from the Herpetological Conservation Trust (HCT).

1.4 Legislative considerations

This section outlines the legal issues likely to be encountered when planning or carrying out a survey. A fuller explanation of the legal position is contained in Chapter 6. If there is any doubt as to the legality of any procedure, consult the appropriate authority (see 6.7).

1.4.1 Amphibians

Torching

Depending on the species concerned and the way that this method is carried out, for example the brightness of the torch, torching can 'disturb' an animal. Therefore a licence may be needed for surveys of the 'fully protected species'. It is advisable to contact the appropriate Statutory Nature Conservation Organisation (SNCO) to discuss the need for a licence before undertaking any survey which may cause disturbance.

In nearly all cases natterjacks are disturbed by torch counting – usually they stop calling or even retreat into the pond. A licence is therefore considered necessary for this species in Great Britain. For great crested newts, disturbance is usually minimal with an 'averagely' bright torch. If using brighter torches or if animals may be disturbed as a consequence of the method (e.g. weed moved aside to see them), a licence must be obtained. If in doubt consult the appropriate SNCO and apply for a licence if necessary. In Northern Ireland similar considerations are needed for the smooth newt as for the great crested newt in Great Britain.

Netting

Netting deliberately 'captures' and also 'disturbs' an animal. Thus a licence is required in order to survey for great crested newts with a net. A licence is also required when this species is not the target of the survey in places where it is likely to be encountered and could be disturbed by netting. Such a licence would be issued by the appropriate SNCO. Netting is not deemed an appropriate technique for surveying for natterjack toads. A licence would be issued only to allow the deliberate capture and disturbance. Netting can 'damage' its habitat. Such damage must be minimised and is only permitted as a genuine 'incidental result' of catching where it could not be avoided.

Egg searching

Careful searching of weeds for newt eggs should not cause 'disturbance' as long as eggs are not detached from plant material, and therefore need not be licensed. However, generally closer inspection of plant material is required, possibly involving the detachment of vegetation or opening up folded leaves. There is some debate as to whether this constitutes either disturbance or taking, and where this more intrusive searching is required advice should be obtained from the appropriate SNCO and, if necessary, a licence applied for. It is highly unlikely that any disturbance would occur through counting natterjack spawn strings; however, detailed studies that have involved temporarily removing strings (to allow newly laid strings to be identified or to count eggs within strings) do need to be licensed. A licence will be needed if spawn or eggs of natterjacks or great crested newts in Great Britain, or smooth newts in Northern Ireland, are taken.

Drift-fences/pit-fall traps

Pitfall traps used with or without a drift fence 'deliberately' capture and 'disturb' an animal, and constitute intentional 'obstruction of access' to a place used for shelter. A licence is therefore required to catch great crested newts or natterjack toads in Great Britain and smooth newts in Northern Ireland in a pit-fall trap used with or without a drift fence. This applies where these two species are the target species, and when they are not but their capture is foreseeable. The licence would be issued by the appropriate SNCO. The SNCO will wish to satisfy itself that appropriate measures will be taken to minimise fatalities and non-target captures. Amphibians and non-target reptiles and other vertebrates are covered by the Protection of Animals Act 1911 and the Protection of Animals (Scotland) Act 1912 while held in any trap (Chapter 3). Where shrews may also be captured, provision must be made to allow their escape; otherwise a licence is needed since these animals are protected against capture.

Refuge searches

Searching potential refuges can 'disturb' animals. As a consequence, refuge searches must be licensed by the appropriate SNCO where great crested newts or natterjack toads in Great Britain and smooth newts in Northern Ireland are likely to be encountered. This applies to both natural and artificial refuges. Care must be taken when using refuges to avoid causing 'damage' to a place used for shelter and protection.

1.4.2 Reptiles

Refuge searches

The checking of refuges (natural or artificial) where sand lizards or smooth snakes (in Great Britain) could be encountered requires a licence from the appropriate SNCO. Owing to the risks to these species of collection from artificially placed refuges, it is important that a licence is obtained before refuges are put out.

In Northern Ireland, a licence is required to search refuges for common lizards.

Other survey methods

Any other survey method likely to cause disturbance, or that will require catching or handling protected species (sand lizards and smooth snakes in Great Britain, common lizards in Northern Ireland) may need to be licensed and the appropriate SNCO should be approached for advice.

1.4.3 General

Access to land

It is important that, when carrying out a survey, participants have secured permission for access to land for the purposes of the survey. The onus is on the surveyor to obtain this permission and this may be a requirement on any licence issued by the SNCOs when dealing with protected species.

1.5 Previous surveys

The first attempt to produce co-ordinated distribution maps for the British herpetofauna was that by Col. R.H.R. Taylor, who published a series of dot maps for each species in 1948, which were later revised in 1963 (Taylor 1948, 1963). Building on Taylor's data set, the Biological Records Centre launched the first formal recording scheme in 1966, which led to the publication of the *Provisional Atlas of Amphibians and Reptiles of the British Isles* (Arnold 1973). These early survey schemes focused on establishing presence or likely absence of the different species in various parts of the country, but there was little co-ordination of effort at the local level. More recently, survey efforts have been channelled towards (1) obtaining more quantitative information on the conservation status of each species, with a view to identifying and protecting the best populations in different regions; and (2) identifying those factors which influence distribution and abundance. This has relied on harnessing the efforts of voluntary recorders. In pursuit of these goals, a series of surveys were commissioned by the Nature Conservancy Council and executed at Leicester Polytechnic, latterly De Montfort University, between 1983 and 1992. The reports produced from these surveys provide information on the distribution of the commoner British herpetofauna and how it has been reported to have changed over the past few decades (Oldham & Nicholson 1986; Hilton-Brown & Oldham 1991; Swan & Oldham 1989, 1993a, b). A new *Atlas of amphibians and reptiles in Britain* (Arnold 1995) has also been produced. In 1996, as part of its Action Plan for the great crested newt, SNH commissioned a survey of sites and surrounding areas in Scotland from which great crested newts had previously been recorded (Alexander 1997). This survey, and a previous one from 1995–6, resulted in the identification of 85 breeding sites across Scotland. These results have been passed on to the Biological Records Centre (BRC) at the Institute of Terrestrial Ecology at Monks Wood, and to the British Herpetological Society (BHS) in Scotland. In the recent cases noted above, it is hoped that the data can be used to encourage recording of unsurveyed areas and the monitoring of known sites.

The above relates to the terrestrial species and does not include the marine turtles. Some information has been published about the distribution of marine turtles around Britain. These include Brongersma (1972), who looked at observations in the European Atlantic, Penhallurick (1990),for Devon, Cornwall and the Scilly Isles, and Langton *et al.* (1996), who provides information about turtles in Scottish waters.

There have also been a number of extensive local surveys for species; sometimes these were funded by Local Authorities and carried out by voluntary nature conservation organisations. Between 1984 and 1987, for example, a survey to determine the distribution and population characteristics of the smooth snake was undertaken by the BHS under contract from the Nature Conservancy Council. Tins were used as the primary means of finding animals and all individuals found were individually identified by recording their head markings. In total 196 sites were surveyed and a total of 261 snakes were found on 86 sites, 82.4% of which were found under tins. Evidence of breeding was found on 40 sites. No smooth snakes were found, or have subsequently been found, outside the counties of Surrey, Hampshire and Dorset, and all animals were found on or adjacent to dry lowland heath (Braithwaite *et al.* 1989).

1.6 Future surveys

While reappraising the future needs of reptile and amphibian recording in Britain, the Joint Nature Conservation Committee launched a new recording scheme for reptiles and amphibians in 1993, in conjunction with the BRC. This has been promoted by the SNCOs and Froglife in conjunction with the growing number of ARGs within the Herpetofauna Groups of Britain and Ireland network.

The aim of the new scheme is not simply to produce an updated set of dot-maps for the United Kingdom but to collate and analyse information on habitat features and attempt to describe long-term trends in population sizes in different parts of the country. Over the years, then, there has been a trend towards encouraging better organisation of herpetofauna surveys at the local level while maintaining central co-ordination. This aims to channel data effectively between local and national levels.

The HCT and BHS Conservation Committee have an ongoing programme of monitoring for the sand lizard, smooth snake and natterjack toad, and these organisations can provide advice. Froglife encourages increased attention to amphibian and reptile site monitoring through the Herpetofauna Groups of Britain and Ireland network and a number of other special projects, for example frogs, toads and grass snakes.

Chapter 2 Field identification, sexing and ageing

John Buckley and Howard Inns

2.1 Introduction

It is important to be able correctly to identify animals in the wild. This allows the distributions of species to be described, changes in status to be recognised and conservation measures to be implemented. This chapter describes the native species of amphibian and reptile and makes reference to the non-native species that have been introduced to and become established in the UK.

The general biology of all these species is summarised in Smith (1973) and Frazer (1983). The animals are described in field guides, such as Arnold, Burton & Ovenden (1978). Other well illustrated guides exist, such as Wisniewski (1987) and Banks (1991) on newts and Slater (1992) on the common toad. Booklets on adders (Stafford 1987) and the British lizards (Stafford 1989) are well illustrated with colour photographs and can be useful for identification of these species.

2.2 Amphibians

The six native species of amphibian can usually be identified without handling the specimens. However, it may sometimes be necessary to handle the animals (Chapter 3), and in such instances a licence must be obtained from the appropriate Statutory Nature Conservation Organisation (SNCO) to handle natterjack toads or great crested newts in Great Britain and for smooth newts and common lizards in Northern Ireland (Chapter 7).

2.2.1 Native newt species

Adults

The newt has a long body and tail and four short legs. Although superficially resembling lizards, newts can be distinguished from reptiles because their skin (and that of all other amphibians) is totally devoid of scales. The small glands on the skin of the great crested newt give rise to its other common name, the warty newt. The smooth or common newt has a smooth skin, as does the palmate newt. The skin of newts found on the land looks dry, matt or velvety.

Adult newts can be sexed during the breeding season by examining the cloaca, which in males is a bulbous and darkly pigmented structure. In females it is smaller and less conspicuous (Figure 1).

In the early spring adults return to the water to breed and distinct changes of appearance take place, especially in the males. Colours and markings become more distinct and the males of all species develop growths of skin which may form a crest along the back of the body and tail and a deepening of the underside of the tail. This development varies in size and form in each species.

Great crested newt

The great crested newt is the most distinctive of the three species. It is a large species, males reaching a typical adult length of 140–150 mm with females being slightly larger. The skin is textured and the basic coloration is very dark brown or black. During the breeding season the body may show a number of black blotches dotted irregularly over the back and sides of the body and the front end of the tail. The sides of the head and body may be stippled with fine white markings. The male has a white stripe in the centre of each side of the tail and this becomes much more noticeable during the breeding season (Figure 2). The male develops a high jagged crest along the back, extending from the middle or back of the head to the tip of the tail except for a gap above the base of the tail. The crest is most strongly notched over the head and body and smoother over the tail. The belly is yellow or orange blotched with black; the lighter colour extend along the lower edge of the tail in females, but not in males.

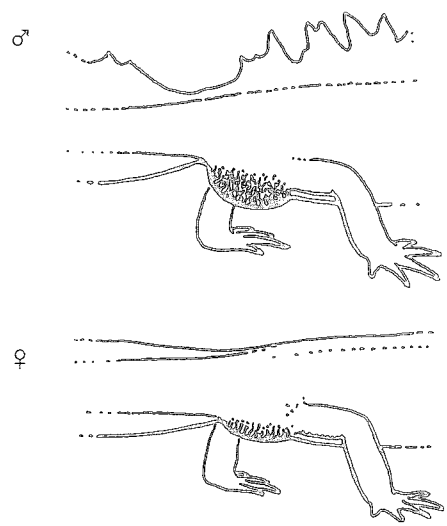


Figure 1 Sexing newts; male and female cloacal regions – lateral view.

It is quite a long-lived species; in captivity a male has lived 25 years and a female 27 years. Skeleto-chronological studies of wild animals, which involve looking at annual 'growth rings' in bones (e.g. Francillon-Viellot *et al.* 1990), have shown that some individuals may live for 14 years. In general, males are thought to mature at 2 or 3 years and females a year later, but this is likely to vary.

The sizes for newts of different ages, given in Frazer (1983), are: year 1, 43–62 mm; year 2, 81–100 mm; year 3, 87–118 mm; year 4, 118–150 mm. The average size for males was 120 mm and for females 111 mm. Some caution is needed in relating age to size as newt growth is strongly influenced by environmental conditions. There are differences in sizes even within a population; some individuals may remain small throughout their lives (Halliday & Verrell 1988).

Smooth (or common) newt

The smooth newt is about 60–100 mm long. During the breeding season the male acquires a high crest running along the back from the rear of the head almost to the tip of the tail, with another crest along the underside of the tail (Figure 3). The upper crest has an undulating edge unlike the jagged crest of the great crested newt. The hind toes of the males develop narrow fringes of skin around their edges but they are not webbed. The basic body coloration is brown to olive-brown with dark circular markings. The head has five dark stripes, which are especially noticeable in the male; the outer stripe on each side passing through the eye. The belly is yellow to orange with dark blotches, which are finer in the female. In both males and females there are spots on the throat (this is a valuable means of distinguishing them from palmate newts, which lack the throat spots). Otherwise the female is generally similar in appearance to the palmate newt female. Neotenous smooth newts have been recorded (and are illustrated in Smith (1973)); these are individuals that reach sexual maturity as large larvae without metamorphosing into the adult form.

The size of a sample of newts of different age, given in Frazer (1983), are: year 1, 34–45 mm; year 2, 48–60 mm; year 3, 58–70 mm; and year 4, 78–90 mm. The average size of males was 79 mm and females 76 mm. In

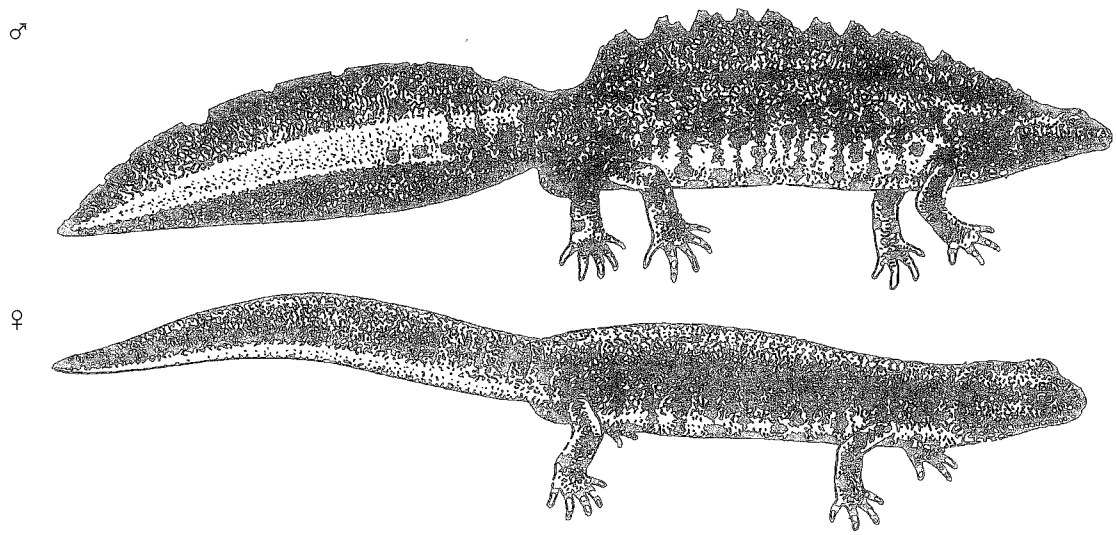


Figure 2 Male and female great crested newt.

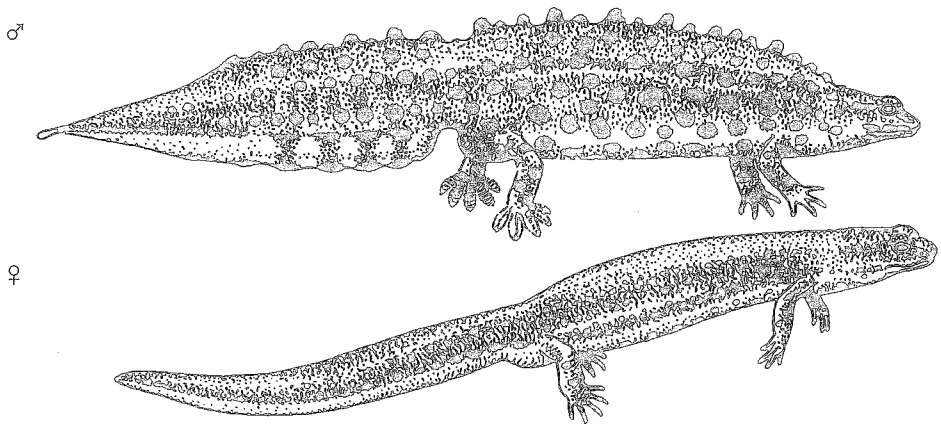


Figure 3 Male and female smooth newt.

captivity this species has been known to live 20 years but skeleto-chronological studies have shown that wild specimens can live at least 6 years and the earliest age at first reproduction is 2 or 3 years.

Palmate newt

The palmate newt (Figure 4) is Britain's smallest native species. Full-grown males are up to about 70 mm long and females slightly more. During the breeding season the male develops complete dark-coloured webs between the toes of the hind feet, and a short thread-like tail filament (1–7 mm in length) extends from an otherwise abruptly truncated tail tip. A glandular pad that runs the whole length of the back increases in size at this time to give a flattening of the back and an angular edge between the back and the side of the body. The general body colour is pale olive-brown to dark brown and the belly is pale straw to mid-orange in colour. Markings on the tail consist of a central stripe with a row of prominent dark spots above and below it. A dark line on each side of the head runs through the eye. The top of the head has a marbled pattern.

In their first year palmate newts reach a length of 25–30 mm and at maturity they are about 60 mm long. An average size for males is 69 mm and females 76 mm. The female palmate newt is very similar in appearance to the female smooth newt but they can most easily be distinguished by careful examination of their undersides. The throat of the female palmate is translucent pink and hardly ever has a dark spot on it. The female smooth newt, on the other hand, has a whitish throat with on average about 20 spots (Figure 5). The tail tip of the female palmate newt may have a short dark filament that is usually about 0.5 mm but can be up to 1.5 mm in length. The female smooth newt never has such a feature. The belly colour of the palmate newt is usually light yellow to mid-orange and that of the smooth newt pale to mid-orange. There are fewer belly spots (on average 12.8, range 0–48) on female palmates than on female smooth newts (on average 46.0, range 0–100) (Roberts 1989). By using a combination of characteristics it is possible to determine the identity of a female palmate or smooth newt.

Young of the year ('efts', 'newtlets')

The newly metamorphosed stages, often called 'efts', can be distinguished in the field by careful examination. Great crested newt young of the year present no

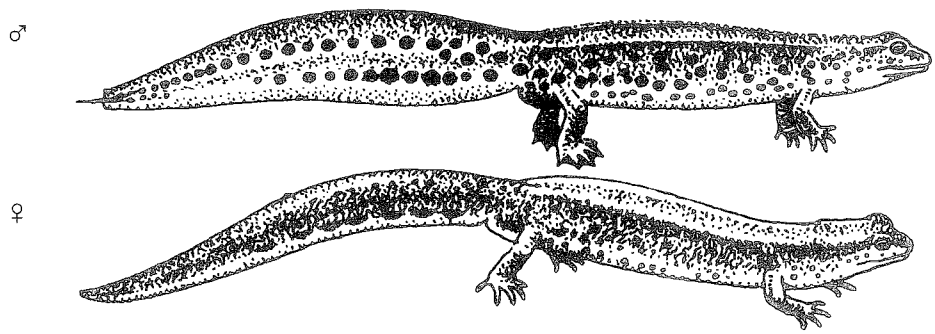


Figure 4 Male and female palmate newt.

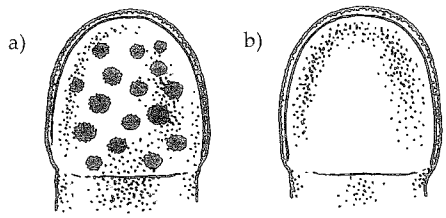


Figure 5 Throats of a) smooth and b) palmate newt females.

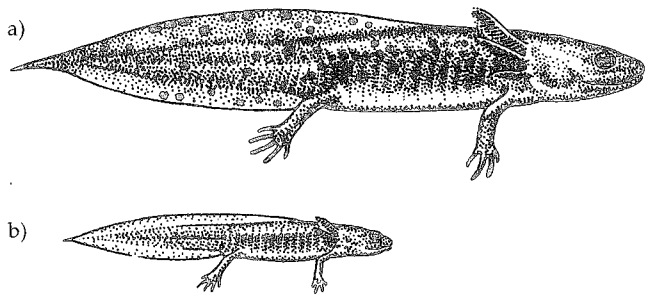


Figure 6 a) Great crested newt larva compared with b) palmate newt larva.

problem since they look like minute versions of the adult female. They often have a yellow/orange dorsal stripe. The young of the year of the other two species can often be distinguished within a few weeks of metamorphosis by the method developed by Roberts & Griffiths (1992). The vertebral stripe of the newly metamorphosed smooth newt begins high on the head and usually ends near to or at the pelvic girdle. It is more intensely pigmented at the anterior end and becomes weaker towards the posterior end. The stripe colour varies from yellow to deep orange but is commonly pale orange. The vertebral stripe of the palmate newt young of the year, on the other hand, starts at the base of the head or on the neck region and usually extends beyond the pelvic girdle. It is uniformly pigmented along its length and tends to be orange in colour, but the shade may vary from pale to deep orange.

Larvae (tadpoles)

Newt larvae have three pairs of external gills and a crest above and below the tail. The fore legs develop first and then the hind ones; in frogs and toads this is the other way round. Fully developed larvae of the great crested newt can be distinguished by size alone (50–80 mm) from the larvae of smooth and palmate newts (30–40 mm). When it is undamaged, the tail of great crested newt larvae gradually tapers to a long filament, and as the larvae get older there are usually large dark spots on the sides of the body and especially on the tail. The tail of smooth and palmate newt larvae comes gradually to a point but does not narrow into a filament (Figure 6). There is no reliable way of distinguishing between the larvae of palmate and smooth newts in the field; they may also be confused with very small great created newt larvae.

Eggs

Eggs are laid singly by the female usually on the leaf of a water plant or on the blade of submerged marginal grass or herb, which is folded around the egg. When the pond contains little or no vegetation other material may be used. The eggs of the great crested newt can be distinguished by their larger size and colour from those of the other two species. They are about 2 mm in diameter and are surrounded by an oval, clear jelly-like capsule about 4.5 mm long. The eggs of smooth and palmate newts are about 1.5 mm in diameter within a capsule 3 mm long. Smooth/palmate eggs are usually a dirty yellow or cream in colour whereas great crested eggs are lemon-yellow and look brighter/cleaner. It is not possible to differentiate between smooth and palmate eggs in the field.

2.2.2 Non-native newt species

Two European species have established populations in Britain, the Italian crested newt *Triturus carnifex* and the Alpine newt *Triturus alpestris*. Details of their identification are given in Banks (1991).

2.2.3 Native frog species

Adults

The common frog is a well known amphibian (Figure 7). The adult grows to a head and body length of about 100 mm. It has a smooth, moist skin and a distinct glandular fold down each side of the back starting at the shoulders. The back is angular or humped when the frog is sitting. A dark patch covers the ear drum region behind the eye and there is often a dark inverted V-shaped mark between the shoulders.

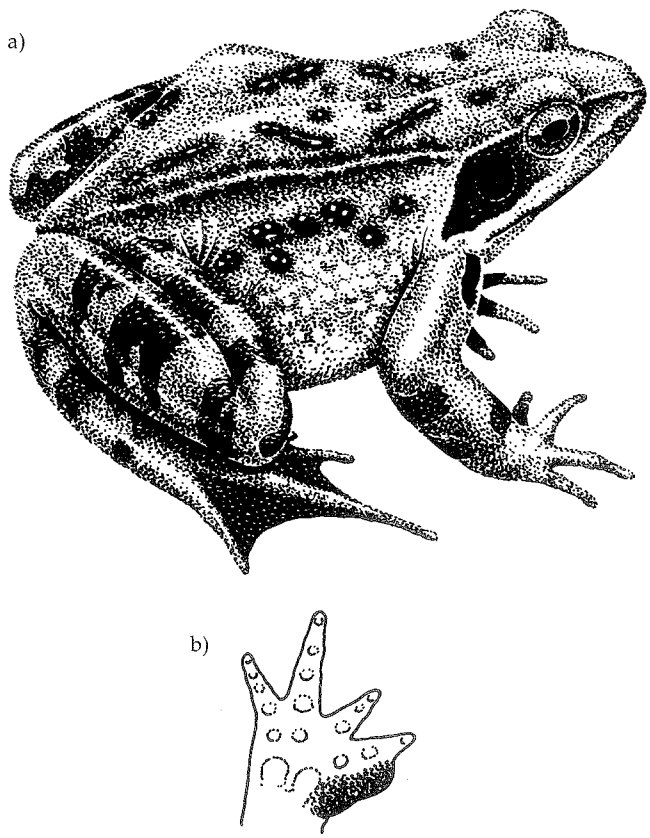


Figure 7 a) Common frog dorso-lateral view and b) fore-limb thumb.

Frogs are highly variable in colour, the upper surface may be green, grey, yellow, reddish to dark brown and mostly blotched with darker shades. Occasionally orange, pink or brick-red frogs are reported, which are simply extreme colour variations in this species. Albino tadpoles and frogs have been recorded (e.g. Mendel 1990). The lower side is typically whitish or grey in the male and brown to reddish in the female. Breeding males have strong forearms which may look flabby due to the looseness of the skin. The nuptial pads on the thumbs of the male are enlarged and black and this provides a good means of telling the sexes apart. In the breeding season the males croak with a dull rasping call which is often inaudible more than a few metres from the pond.

At metamorphosis individuals are 12–15 mm and may reach 20 mm by the end of the year. Animals in the wild may reach a length of 45 mm in their second year. Male frogs mature at two years and females a year later. A male in captivity has lived for 12 years but very few individuals in the wild live more than seven years (Gibbons & McCarthy 1984).

Tadpoles

Common frog tadpoles are able to swim within a few days of hatching . When large enough they can be distinguished from toad tadpoles by their olive-brown colour and the lighter markings, which give a speckled appearance; toad tadpoles have a uniform black appearance. The tip of an undamaged tail is pointed rather than rounded as in the case of toad tadpoles. The tadpoles can also be identified by the number and length of the labial tooth rows (Figure 8).

Eggs (spawn)

Spawn is laid in clumps, each containing about several hundred or low thousands of eggs. These are laid in shallow water in late winter/spring. Each egg is 2–3 mm in diameter within a clear spherical jelly capsule 8–10 mm across. The egg is black with a whitish patch on the lower surface.

2.2.4 Non-native frog species

Frogs of the 'green frog' complex, namely the pool *Rana lessonae* and marsh frogs *R. ridibunda* and their hybrid, the edible frog *R. esculenta,* have become established in parts of England. They can readily be distinguished from the common frog using morphological features explained in for example Arnold, Burton & Ovenden (1978). Tree frogs *Hyla arborea* are small frogs which have been reported from parts of Britain. Small colonies, presumed to have been introduced, have lasted for several years (these are described in Arnold, Burton & Ovenden (1978)).

2.2.5 Native toad species

Adults

The rough, glandular and rather dry skin of toads distinguishes them from frogs. Two species of toad are native to Britain. The natterjack toad is rare, being found at a few coastal dunes and saltmarshes and inland heath localities, but the common toad is widespread.

The body of the common toad is squat and plump and the head is rounded (Figure 9). There is a large distinct gland behind each eye. The eye has a coppery red coloured iris and a horizontal pupil. Males grow to a maximum head and body length of about 70 mm and females about 100 mm. Locomotion is by crawling rather than hopping. The upper surface of the head and body is coloured grey, reddish or blackish-brown with a few indistinct darker markings and is closely covered in small bumpy glands. The underside is off-white, flecked

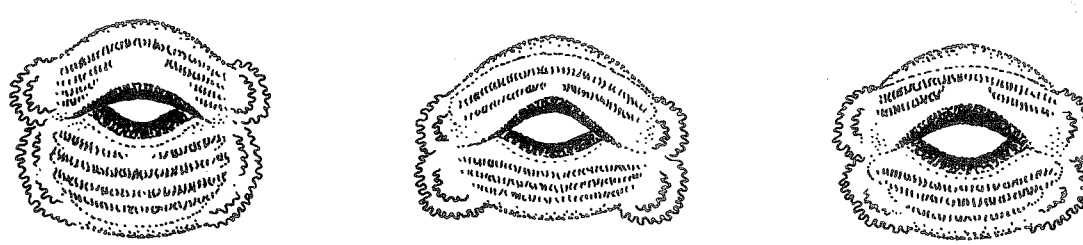


Figure 8 Labial teeth of tadpole: a) common frog; b) common toad; c) natterjack toad.

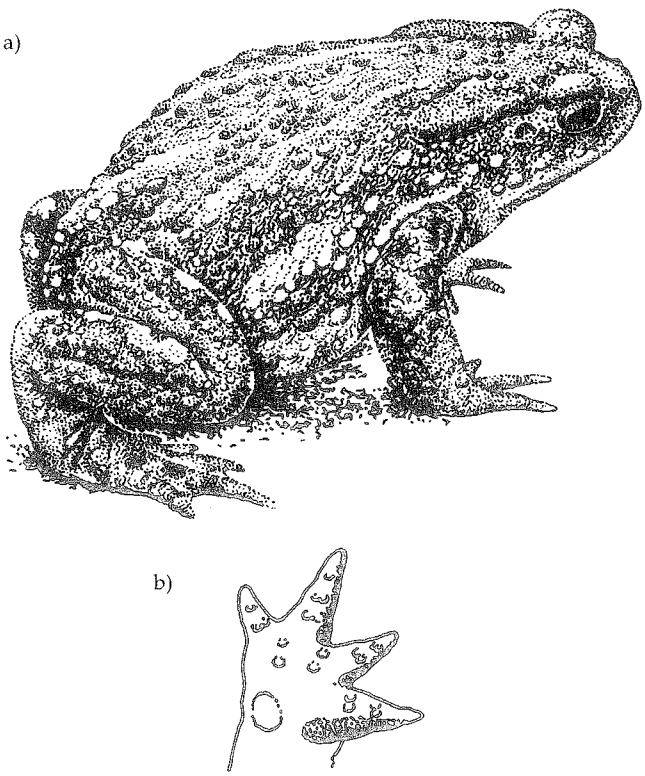


Figure 9 a) Common toad dorso-lateral view and b) fore-limb thumb.

with grey-brown. The dark 'nuptial pads' of the males develop on the thumbs and inner fingers. Sexual maturity has been recorded after at least two years in males and three years in females (Gittins, Kennedy & Williams 1985).

The male natterjack grows to a length of about 70 mm and the female slightly more. The body is compact and the hind limbs are short (Figure 10); this toad runs and crawls rather than hops. The upper side has numerous flat skin-surface glands and is coloured olive-brown or olive-green with grey to reddish markings. A sulphur-yellow line runs down the middle of the back and is probably the most distinctive feature of this species; very occasionally natterjacks are found that do not have this yellow stripe. The underside is off-white, speckled with grey and more darkly pigmented and slightly granular at the posterior end. The eye has a distinctive yellow iris veined with black; the pupil is horizontal. The croak of the male during the breeding season is very loud and rasping, quite unlike the squeaks of male common toads.

Mature males can be identified by darkly pigmented nuptial pads, which are most evident during the breeding season, and by their throats, which are reddish or bluish in colour. Females lack nuptial pads and have white throats with a few black marks. Males can first breed at two years old and females at three years. Females may live as long as 13 years whereas few males live more than seven years (Beebee & Denton 1993).

Tadpoles

Toad tadpoles hatch in a rudimentary state, lacking external gills and the ability to swim. The common toad tadpole grows to a length of about 35 mm. The second row of labial teeth above the mouth has a short break in the middle (Figure 8). When viewed head on, the mouth is as wide as the space between the eyes.

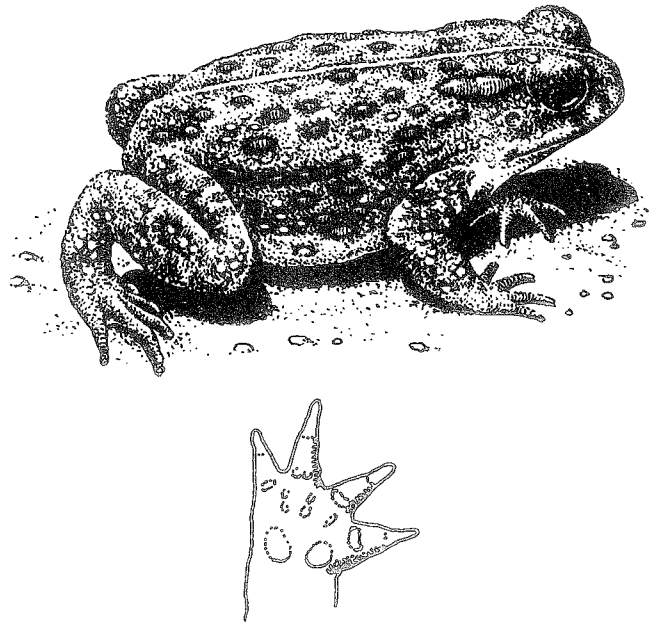


Figure 10 a) Natterjack toad dorso-lateral view and b) fore-limb thumb.

Natterjack tadpoles grow to a length of about 25 mm and legged specimens may have a light stripe down the back. The second tooth row of upper labial teeth has a wide gap in the middle (Figure 8). The mouth is narrower than the distance between the eyes. Older tadpoles may have a white patch beneath the lower lip, a feature never seen in common toad tadpoles. The reliability of these distinguishing characteristics is not 100% and it may be necessary to rear a few specimens to the metamorphosis stage and identify the toadlets.

Eggs (spawn)

Common toads spawn in March/April in deeper water than frogs and the eggs are laid in long gelatinous strings rather than clumps. The females usually produce two strings simultaneously and they are usually entwined around aquatic vegetation. The eggs are 1.5–2.0 mm in diameter. The eggs within the common toad's spawn string appear as a double row rather than a single row; this can be used to distinguish it from natterjack toad spawn. Though useful, this observation might not always be fully reliable and should not be used as the sole criterion for identification.

Natterjacks spawn in shallow water in April/June, usually on unvegetated ground, and the strings are often not wrapped around vegetation. The eggs are slightly smaller than those of the common toad, 1.0–1.5 mm in diameter. Natterjack toad eggs form a single row within the spawn string.

2.2.6 Non-native toad species

There are no non-native species of toad widely established in the UK. Small colonies of the midwife toad *Alytes obstetricans* are established in one locality.

There are some reports of occasional sightings of spadefoot toads *Pelobates* sp. and yellow-bellied toads *Bombina variegata,* and some may be breeding. Arnold, Burton & Ovenden (1978) provide good descriptions of all these species.

2.3 Reptiles

Reptile identification may seem a straightforward process as there are only six species in Britain. It is also clear from even the most basic guides to British wildlife that there are obvious visual differences between the species. However, misidentification is common. Reptiles are often seen from a distance while they are basking; often they are partially obscured by vegetation and retreat quickly, which means that identification must be made by smartly recognising key definitive characteristics.

Normally surveys can be conducted without the need to handle animals (Chapter 1) but sometimes handling reptiles can be necessary especially for sexing them (Chapter 3). If handling of smooth snakes or sand lizards in Great Britain or common lizards in Northern Ireland is anticipated during the course of a survey, licences must be obtained from the appropriate SNCO (Chapter 7).

2.3.1 Common or viviparous lizard

Field identification

With an average total adult length of about 135 mm, and a snout to vent length of about 55 mm, this lizard is significantly smaller and less bulky than an adult sand lizard (Figure 11). Coloration is extremely variable, the vast majority being some shade of brown with fine linear markings and flecks of lighter and darker coloration. The underside varies from orange through yellow to dirty white. Melanistic (black) or very dark individuals are not uncommon; other frequent colour variations include grey, dark metallic green and gingery yellow. The common lizard is a widespread animal and has a considerably wider distribution than the sand lizard.

Juveniles are approximately 40 mm at birth and at this stage are black. By the time they hibernate they have normally grown to approximately 65 mm and will have lightened to a dark coppery brown and be showing some faint linear markings.

Distinguishing features

The definitive characteristics that distinguish this species from the sand lizard are its size and generally slimmer appearance, a distinctly pointed snout and a modestly patterned and striped appearance rather than the bold ocellate patterning of the sand lizard (Figure 11). Juveniles can be more difficult to identify, but those of common lizards are generally darker, with barely visible markings, and have a small narrow pointed head and relatively small eyes. In areas where sand lizards occur, close focus binoculars are essential to confirm field identification of hatchlings.

Sloughed skins can occasionally be found. The skin is shed in fragments which retain the pattern of the lizard. The pattern is the only way to distinguish between sloughs of common and sand lizards. Lizard sloughs can be distinguished from those of snakes by the dorsal scales, which are small and bead-like and the ventral scales (Figure 12), which, unlike the ventral scutes of snakes, are arranged in six longitudinal rows.

Sexing

The two sexes are similar. Females have a narrower and less bulky head (Figure 11), they lack the penial swelling at the base of the tail (Figure 12) and the belly colour is usually a dull yellow or dirty white compared with the bright yellow or orange of the male. At first glance, males appear more uniformly patterned than females. However, males tend to have a fine, slightly speckled pattern whereas females tend to have a more pronounced striped appearance with less fine patterning. The lower edge of the females' flanks are often noticeably lighter, and before the young are born gravid females have very obviously swollen abdomens. If animals are captured, sex can be confirmed by examining with a hand lens the posterior row of scales on the underside of the thigh. In male lizards each of these scales has a tiny pore, the femoral pore (Figure 12).

Ageing

Size is the primary way of determining age, although growth rates are variable. At the second hibernation, total length usually exceeds 100 mm (Smith 1973). Adult size is usually attained in the third or fourth year. Males become sexually mature after their second hibernation and females after their third.

2.3.2 Sand lizard

Field identification

Adults of this species are on average 165 mm in total length, with an average snout to vent length of 70 mm. The normal coloration is an intense pattern of 'ocellate' spots, which are black with white or cream centres, on a background of any shade of brown with two obvious lighter dorsal stripes running the full length of the back and anterior part of the tail. The background colour of the flanks of the male in the breeding season is an intense, almost fluorescent, green which can vary from bluish to yellowish. The intensity of this colour fades outside the breeding season and the background colour of the flanks of some males just before and just after hibernation appears dark brown. Males with more uniform flanks without spots are frequently found. Females are often lighter with a sandy or greyish background colour. The underside is a uniform grey or dirty yellow in the female and in the male it is the same green colour as the background colour of the flanks. Melanistic (black) individuals have not been recorded in Britain. In normal circumstances, sand lizards are unlikely to be found outside Surrey, Hampshire, Dorset, Sussex or Merseyside and are restricted to sandy habitats, specifically heathland and sand dunes, although the species has now been re-introduced into the west country of England and Wales.

Eggs are spherical or oval when laid and approximately 10 mm in length. They are white, often with a pinkish hue, but change shape, size and colour during their incubation. Juvenile sand lizards (Figure 11), often called hatchlings, start to appear in August. They are approximately 40 mm at birth and can grow to

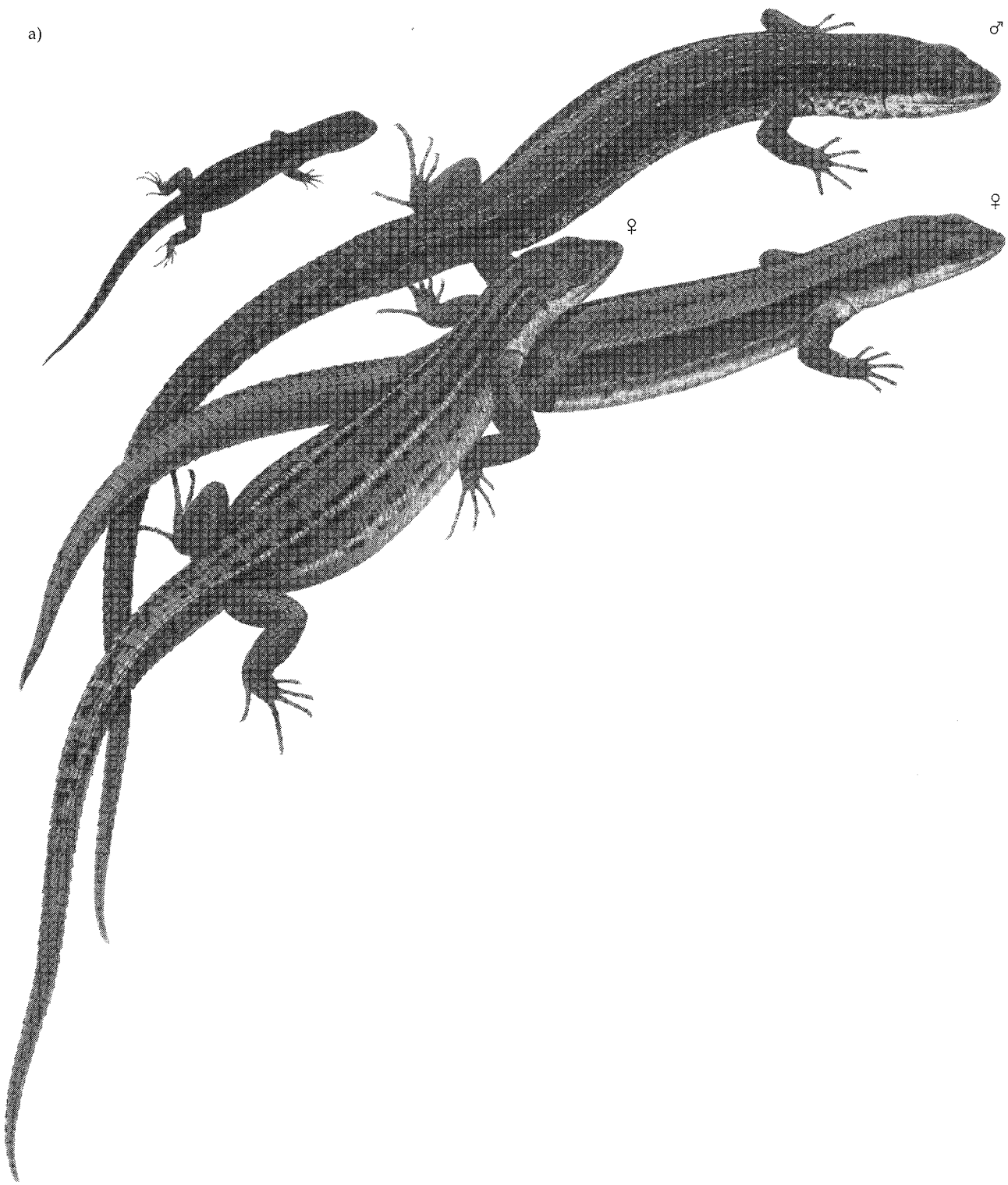


Figure 11 a) Male, two females and hatchling common lizard; b) male, female and hatchling sand lizard. Note the differences in head shape and in size between the species. *(Continued on p. 24)*

70 or 80 mm before they hibernate, but this depends on when they hatch. They are light brown in colour and have the two distinctive dorsal stripes. The intense patterning develops later in life and hatchlings have smaller, more separate ocellate spots on the flanks which are often elongated towards the head. The head is blunt and the eyes appear relatively large.

Distinguishing features

Size, bulkiness, the distinctive pattern with the ocellate spots and the green coloration of the males are the key characteristics that distinguish this species from the common lizard (Figure 11). While common lizards can be greenish, they never match the brilliant green of the breeding male sand lizard. The head is much less

b)

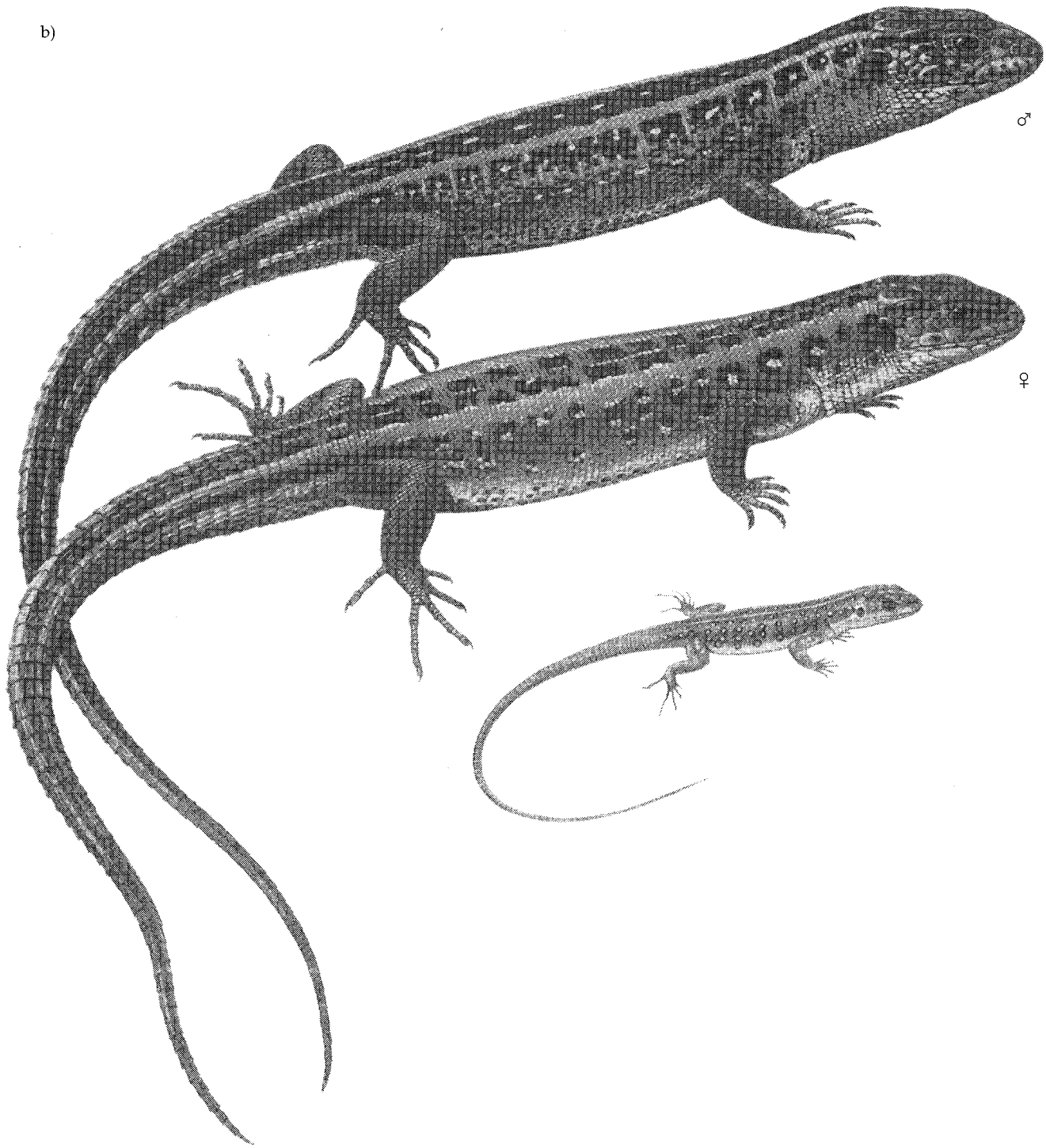


Figure 11 *(continued)*

pointed, altogether more solid in appearance, and often held higher than the common lizard. The bigger size of this species makes its retreat from a basking spot more noticeable and it is often possible to track the animal (visually) through the undergrowth. Misidentifications of dead common lizards are sometimes made owing to the fact that they often turn bright bluish-green several days after they have died. Female and juvenile sand lizards are not green but rather brown to fawn in colour; males are also less well coloured outside the breeding season. The green colour alone is therefore not a reliable identification feature of this species.

Distinguishing between common and sand lizard hatchlings in the field can be difficult (Figure 11). The two dorsal stripes, more patterning, lighter coloration, blunter head and relatively larger eye are the features of the sand lizard to look for. As mentioned earlier, close focus binoculars are valuable for identifying hatchlings in the field.

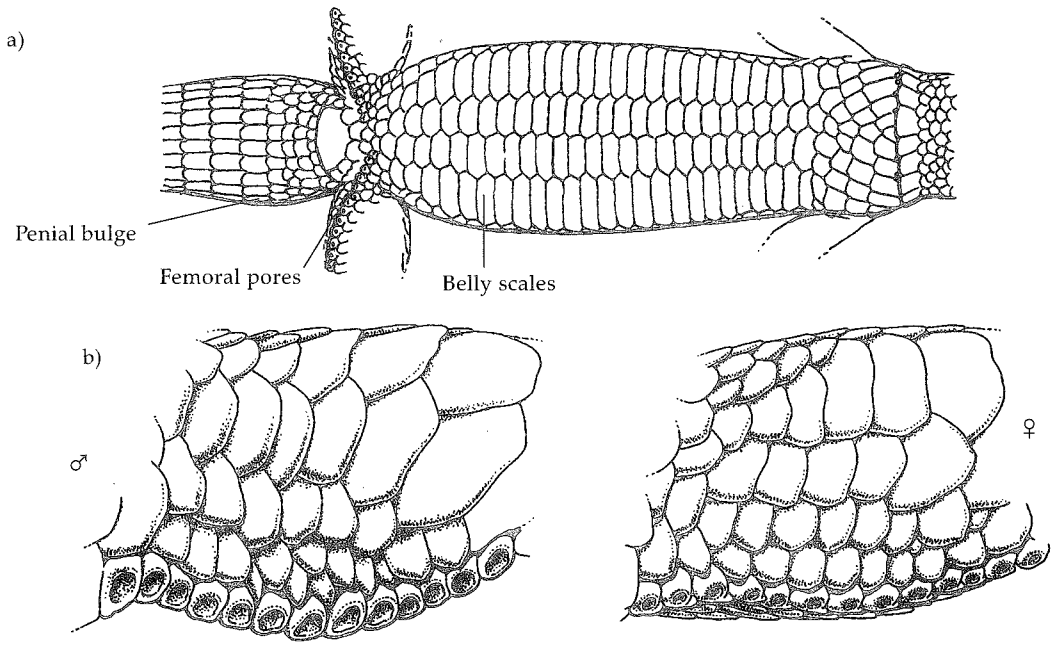


Figure 12 a) Underside of male sand lizard showing femoral pores and penial bulge; b) male and female femoral pores.

Sloughs can be identified only from their pattern. This is usually possible as the patterns can be quite obvious.

Sexing

For adults in the breeding season this is obvious. Later in the year, the general differences of larger male head size and the shape of tail base are more pronounced in this species (Figure 11). The generally lighter background coloration of the female and, before the eggs are laid, the bloated appearance of the abdomen are also distinctive. Sex can be confirmed by the presence of femoral pores in the male (Figure 12).

Ageing

Size is the primary guide. The growth rate slows as the animal gets older but as this species can live at least 10 years animals can get very large and several have been found that exceed 200 mm. At the second hibernation sub-adults measure about 125 mm. The green coloration and sexual maturity for the male is reached after its second hibernation and in the case of the female can occur after the second hibernation (Frazer 1983), but more normally after the third. Full adult size is reached during the fourth or fifth year. Males over the age of five years can be identified by the large head and thick neck.

2.3.3 Slow-worm

Field identification

Slow-worms (Figure 13) that reach adulthood with complete tails attain a total length of approximately 400 mm with a snout to vent length of just under 200 mm. The slow-worm's firm body is distinctly cylindrical and the tiny smooth scales result in a very smooth, shiny appearance. Coloration is typically a uniform grey to brown in the male and in the female brown, often a brass or copper shade, with darker or black sides and usually a very fine dark stripe or zigzag along the centre of the back. Some individuals are found with fine longitudinal markings (usually females) or with small blue spots. As with many reptiles, colour is somewhat variable and can range from straw-coloured to almost black individuals. The slow-worm can be found throughout Britain in a wide range of habitats. It is the reptile most likely to be discovered in urban and suburban environments.

The young, born live in September, are approximately 70 mm in length. They are light silver or gold in colour with black flanks and underside and a fine black dorsal line (Figure 13).

Distinguishing features

There is some scope for confusion between slow-worms and the snake species, the smooth snake probably being the closest in terms of coloration. However, even the smooth snake lacks the shiny lustre and distinctly cylindrical shape of the slow-worm. Closer examination of the slow-worm will reveal eyelids and a broad flat forked tongue typical of lizards (Figure 13). Although slow-worms can move relatively quickly, unlike snakes, they do not normally attract attention as they retreat from a basking spot.

Sloughs are sometimes found, particularly under debris. When the skin is shed, it often 'concertinas' roughly into a ring of sloughed skin and normally looks quite different from the sloughed skin of either snakes or the other lizards. Closer examination will reveal unkeeled scales (Figure 14) but these are uniform in size the whole way round the body and lack the broad ventral scutes of a snake slough (Figure 16).

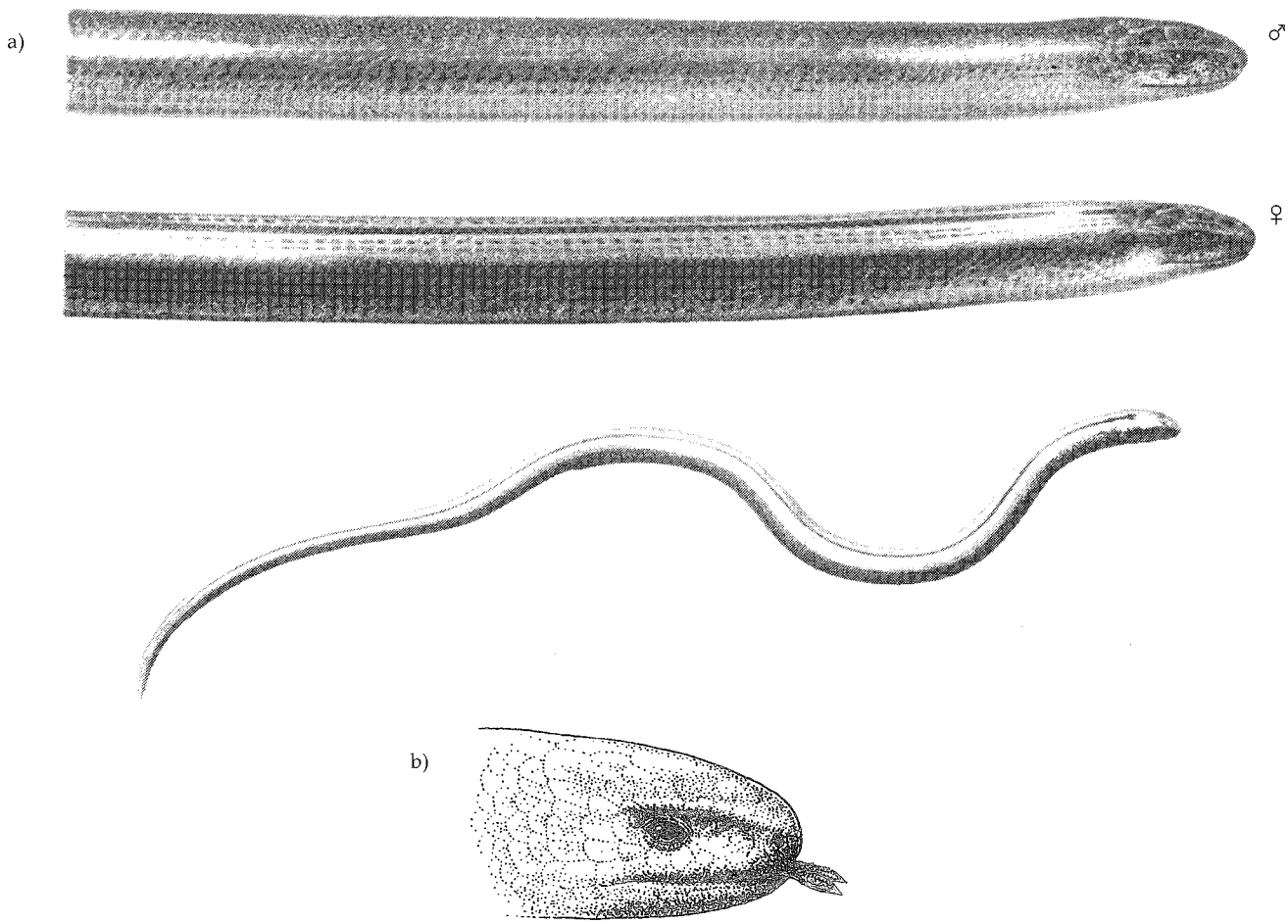


Figure 13 a) Male, female and juvenile slow-worm. (Note difference in head shape between male and female.) b) Slow-worm showing tongue.

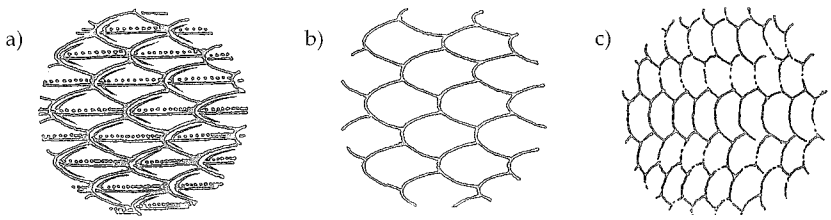


Figure 14 Scales: a) keeled scales; b) unkeeled scales; and c) slow-worm scales.

Sexing

It is usually easy to distinguish between adult males and females because of the difference in colour and the darker flanks of the female. In the rare cases where sex is not clear from coloration, the distinct broader diamond-shaped head of the male is clearly different from the female's head, which is narrower than the anterior part of the body. A small penial bulge is visible at the base of the tail in the male, and the general body shape of the female, particularly when gravid, is similar to that of the female snakes (Figure 18), with a relatively broad abdomen and a narrow tail. It is difficult to determine sex until a slow-worm's third season, by which time the dark underside and flanks of the male will have faded considerably.

Ageing

Slow-worms probably reach an age of 20 years in the wild, but once they have reached their adult size they grow slowly at approximately 20 mm per year. Before their second hibernation, they reach approximately 175 mm, and before their third approximately 220 mm total length. By their fourth hibernation, adult coloration has been attained. Sexual maturity is reached after the second or third hibernation in the male and after the third or fourth hibernation in the female. Adult size is reached during the fifth or sixth year.

2.3.4 Adder

Field identification

The adder is distinctively marked (Figure 15). The bold zigzag pattern which extends the whole length of the

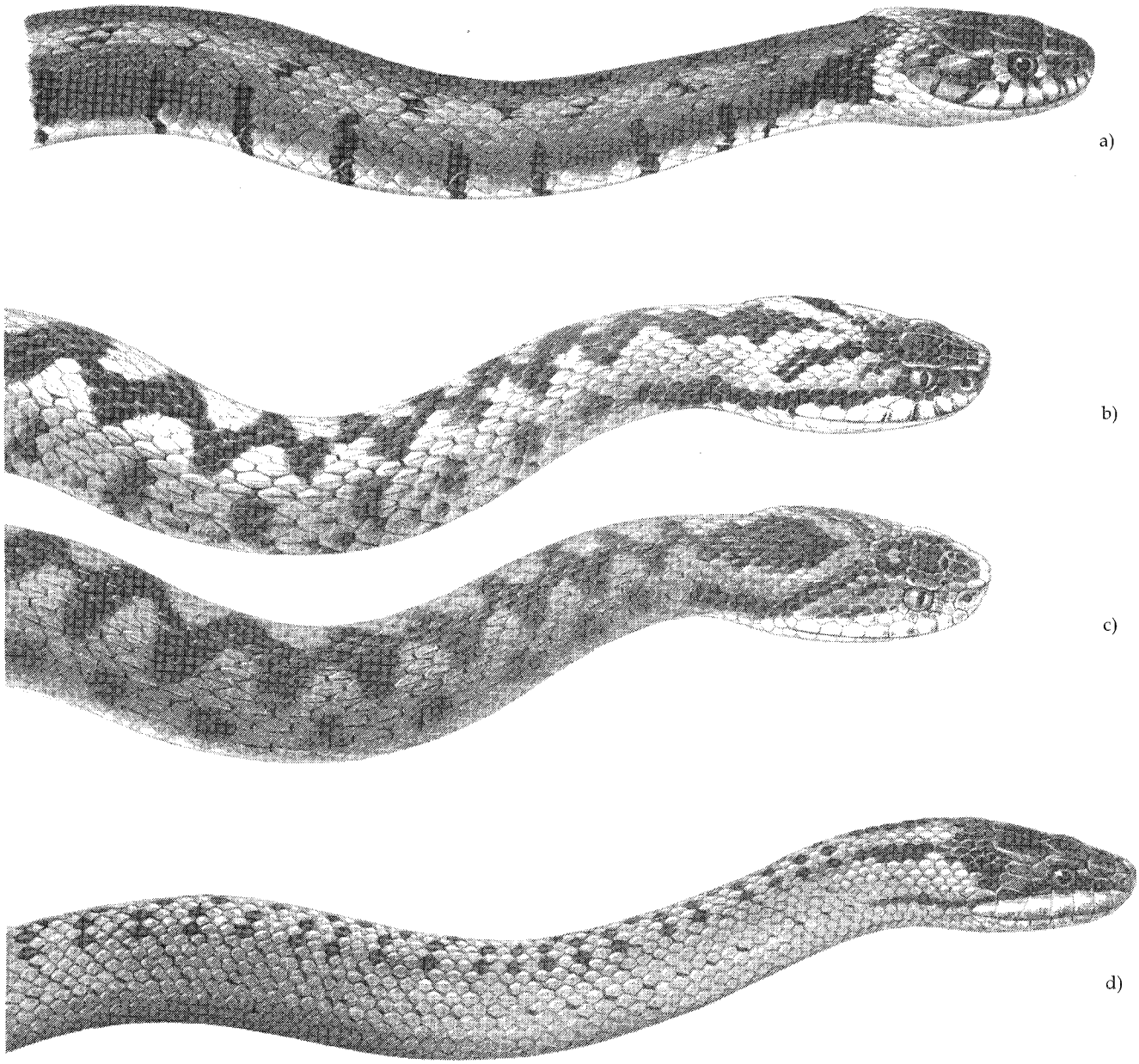


Figure 15 a) Grass snake; b) male adder; c) female adder; and d) smooth snake. Note the typical markings, the collar of the grass snake and the eye stripe and dark crown of the smooth snake.

back and the tail is obvious in animals of either sex, the only exception being melanistic (black) or near-melanistic individuals. Even in these dark individuals, zigzag patterns can usually be seen. Coloration is variable. However, females are typically two shades of brown, from a light sandy colour through to brick red with the markings being a darker shade of the background colour, whereas males tend to have blackish markings against a dirty white, yellow or grey background. There is a row of irregular blotches down each flank which are the same colour as the zigzag. The head carries V- or X-shaped marks but these are not as obvious as the zigzag. The eye is small but noticeably red with a vertical pupil. Adders are small snakes, adult males measuring on average 550 mm and females 600 mm in total length. The general appearance, especially of the female, is of a short fat snake. The underside is usually uniformly dark, either greyish in the case of the male or brownish in the case of the female. The male's coloration is enhanced in the spring when the black zigzag is very bold against a cleaner background colour. Young are born in August and, irrespective of sex, are coloured like the female, very often with a reddish tinge; they are approximately 150 mm in length. The adder is widespread, prefers dry habitats and dislikes disturbance and is therefore rarely found in gardens.

Distinguishing features

Misidentification of snakes by the general public is extremely common and often accompanied by varying degrees of anxiety. However, if a good view of the subject is obtained, adders can be clearly distinguished

from either of the other two British snake species as the zigzag patterning is so distinctive (note that the patterning along the side of grass snakes and the back pattern of smooth snakes can be mistaken as a zigzag by people who are unfamiliar with the species). Melanistic adders are found, and at some sites represent between 10% and 20% of the population. Although melanistic grass snakes have been recorded (Frazer 1983), they are extremely rare.

Snakes normally shed their skins in one piece and the inside-out sloughs are frequently found in the vegetation in good reptile habitats. Adder sloughs can be distinguished from the smooth snake because the dorsal scales are obviously keeled (Figure 14) and from the grass snake by the zigzag pattern, which is usually still visible, or from the head scalation – the adder's head scales are smaller than those of grass snakes (Figure 17).

Sexing

Difference in colour is often clear enough to identify the sex of an adder. However, there is considerable colour variation, and sometimes colour alone cannot allow reliable sexing. As in the other snakes, the typical female shape of a distinctly wider body and narrower tail is noticeable. If it is possible to examine snakes more closely, sexes can be distinguished by counting the ventral scales (sub-caudals) between the vent and the tip of the tail (Figure 16). There are usually more than 35 sub-caudal scales in the male and fewer than 34 in the female adder; Langton (1989b) reports males generally with more than 39 sub-caudals and females generally fewer than 32, but notes that there is an overlap. In the male the tail length is usually more than one-seventh (14%) of the snout to vent length (i.e. one-eighth of total body length), whereas in the female it is usually less than one-seventh of snout to vent length (Smith 1973).

Ageing

Adder growth rates slow down once adult size is reached at five years. Sub-adult animals seem to be particularly elusive, unlike in the other two snake species. By the second hibernation, total length is approximately 230 mm; a year later this will have increased to approximately 350 mm. Sexual maturity, as in lizards, normally comes a year earlier in males, after the third hibernation; females do not normally reach maturity until after the following winter.

2.3.5 Grass snake

Field identification

In contrast to the adder, the grass snake is a long thin snake (Figure 15), females averaging an adult length of 850 mm compared with 700 mm in the male. There are many stories of grass snakes longer than this and individuals over 1.5 m have certainly been recorded in Britain (Smith 1973). Both sexes are similarly coloured with a typical background colour of olive-green, a collar of two black crescents bordering a yellow or orange (or sometimes creamy white) collar and regularly spaced vertical black bars down the flanks with a double alternate row of black spots down the back (Figure 15). The species is very variable, the background colour varies from grey through quite bright green to brown, the bars on the flanks can be more or less conspicuous and the dorsal markings are often completely absent. The collar is also occasionally absent, most frequently in large old females. The eye is conspicuous and has a bright yellow iris and a round pupil. The underside of the body has a black and white 'checkerboard' appearance. Melanistic individuals have been recorded (Frazer 1983) but are extremely uncommon. This is the snake most likely to be found swimming or near water but it is also very frequently found in the dry habitats and heathlands so favoured by the other two snake species. Another distinguishing feature of the grass snake is its behaviour when disturbed: it will normally dash away more quickly and more noisily than the other snakes.

Eggs are often found in compost heaps, manure piles at stables and any other warm rotting vegetation. They are often stuck together in clumps of several clutches. At first they are oval in shape, creamy white with parchment-like shells and approximately 20 mm in length. During the course of their incubation they can swell and become considerably distorted and discoloured. Hatchlings are approximately 170 mm in length and carry the adult markings. They tend to have a darker background colour which makes the light collar stand out.

Distinguishing features

The light-coloured collar (Figure 15) is the most obvious distinguishing feature of the grass snake, particularly for animals seen basking, where there is scope for confusion with the smooth snake. It is important in this circumstance to look for the collar and the vertical black bars along the flanks. However, sometimes grass snakes can be found without this collar. The absence of an eye stripe also distinguishes this species from the smooth snake, as does its behaviour when disturbed. There is less scope for confusion with the adder, although the black markings along the flanks can occasionally be mistaken for a 'zigzag' and the collar be thought to be the 'V' on the adder's head. Melanistic individuals can be confused with adders. Examination of the size and pattern of the scales on the head (yellow in grass snakes, red in adders) or the pupil shape (round in the case of the grass snake and vertical in the case of the adder) can be used to tell the species apart.

Sloughs can be distinguished from those of the smooth snake by examining scales for keels (Figure 14); the dorsal scales should be examined, as the keels on the scales on the flanks can be very indistinct. Head scalation (Figure 17) and the absence of the zigzag pattern will differentiate this from an adder slough.

Sexing

The sexes are very similar. The size and general body shape – a wider body and obviously more narrow tail – distinguish the female, and the penial bulge at the base of the tail is quite obvious in the male (Figure 18). Females are significantly more bulky than males and often have broader, flatter heads. Beyond these features, sub-caudal scales (Figure 16) usually number less than

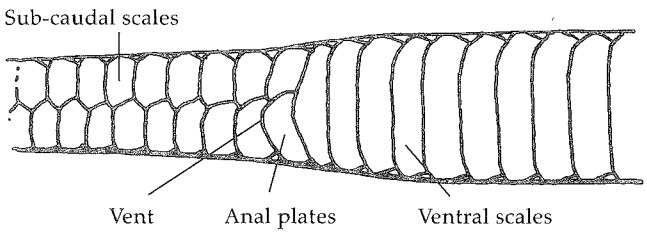


Figure 16 Underside of a snake showing the posterior part of the body and the anterior part of the tail with ventral scutes, anal plate, vent and sub-caudal scales labelled.

62 in the female and more than 62 in the male (Langton 1989b) and the tail length is usually less than 23% (about a quarter) of the snout to vent length (or one-fifth of total body length) in the female and more than 23% in the male (Smith 1973).

Ageing

Grass snakes appear to take five or six years to reach adult size and continue to grow slowly thereafter. Sub-adult snakes are frequently found that measure some 270 mm in total length before their second hibernation and 450 mm before their third. Sexual maturity occurs at roughly the same age as in the adder.

2.3.6 Smooth snake

Field identification

This species is a small slim snake, average adult size being approximately 600 mm total length. It has a uniform background colour of grey or brown with an irregular, and variable, pattern of spots (usually arranged in two parallel rows) or bars down the back and tail. The small head has a black heart-shaped marking on the crown and a distinctive black stripe, which extends from the tip of the nose through the eye and often along the anterior part of the body (Figure 15). The underside is normally greyish, dirty yellow or orange, sometimes with a gingery tint under the chin. Melanistic (black) individuals have not been recorded in Britain. Although the overall impression is of a rather dull snake, the smooth, unkeeled scales (Figure 14) often give the animal an iridescent sheen, especially in animals that have recently shed their skins. The eye has a noticeably yellow/orange iris and a round black pupil.

The smooth snake has been recorded recently only from the heaths of Dorset, Hampshire and Surrey.

Juvenile snakes, born in September, are identical in coloration to their parents and measure approximately 150 mm.

The features that distinguish this snake from the other two native species are the black crown, distinctive eye stripe and double row of spots or bars down the back (Figure 15). Identification is easy if close examination is possible by checking the dorsal scales for the absence of keels (Figure 14). The smooth snake relies on its camouflage when basking and takes flight more slowly than the other species.

Sloughs can be identified as every scale is unkeeled (Figure 14). Whenever possible, identification of smooth snake sloughs should be confirmed by examination of head scalation (Figure 17).

Sexing

Sexes are very similar in size and coloration. Body shape is a good clue, especially when females are gravid, and the penial bulge in the male is quite distinct (Figure 18). Also the head of the male is often more distinct and relatively larger than that of the female. If closer examination is possible, the sub-caudal scale count (Figure 16) is usually below 52 in the female and above 55 in the male (Langton 1989b). However, other workers have reported females with up to 57 and males having as few as 50 sub-caudal scales (Gent 1988). The difference in relative tail length is also quite pronounced in this species; in females the tail is usually well below one-quarter of the snout to vent length (one-fifth of total body length) and in males it is well above this figure.

Ageing

The smooth snake is a long-lived animal. Individuals can be monitored by recording their head pattern and the pattern on the anterior part of the back. Smooth snakes are known to have survived for 20 years in the wild. Sub-adult smooth snakes are found relatively frequently and measure approximately 250 mm at their second hibernation and 370 mm at their third. Adult size is reached after approximately five years and sexual activity begins after the third or fourth hibernation. Older snakes can grow to as much as 700 mm but tend to add more bulk than length as their age increases.

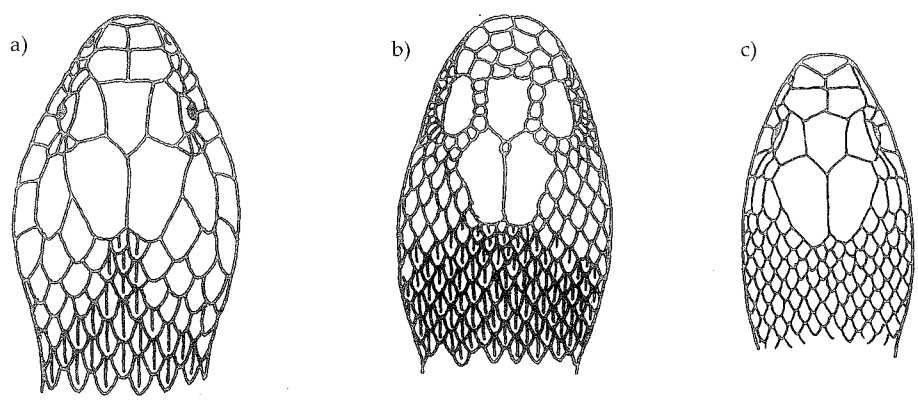


Figure 17 Snake head scalation: a) grass snake; b) adder; and c) smooth snake.

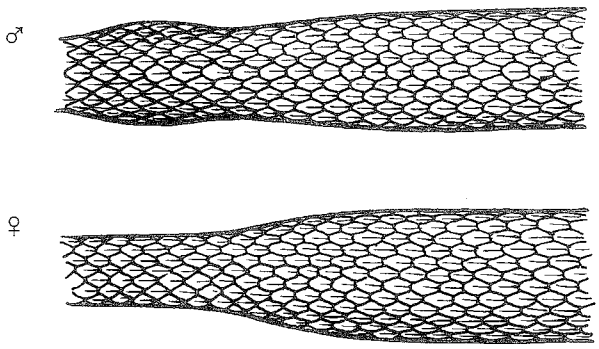


Figure 18 Dorsal view of the posterior part of the body and anterior part of the tail of a) male and b) female grass snake showing the uniform taper of body into tail interrupted by the penial bulge in the male and the more abrupt change from a

2.3.7 Introduced species

The keeping of reptiles in captivity is widespread and the range of species that escape and could possibly be encountered in the 'wild' is too long to list.

The only introduced reptile species which thrives in Britain is the European wall lizard *Podarcis muralis*. This lizard (Figure 19) is on average 180 mm in length, and its well patterned coloration is a mix of green or brown and black. Females, which are smaller and have a less distinct head, often have less intense and more stripy patterning than the males. The snout of both sexes is pointed. This slim, alert, bold and lively lizard is strongly associated with walls or bare rocks. Pattern, shape, behaviour and preferred habitat differentiate the wall lizard from the other two species. A colony thrives

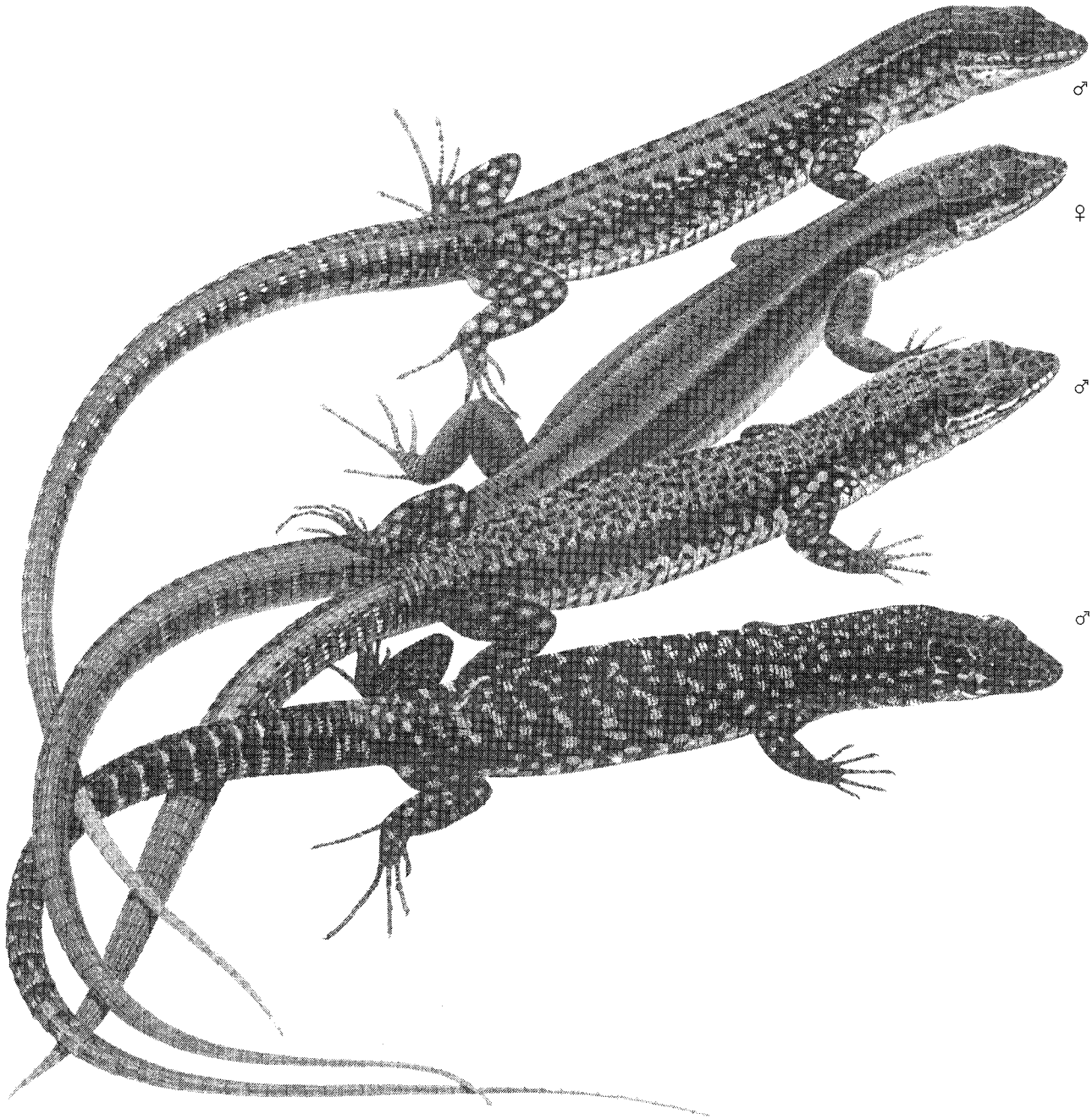


Figure 19. Wall lizard males (×3) and female.

on the southern coast of the Isle of Wight and other colonies exist in Dorset, Sussex, Somerset and London. Though the origins of some of these colonies are known, others are long-established and some people have considered them as possibly being native.

The wall lizard is native to the Channel Islands, as is the large and distinctive green lizard *Lacerta viridis*. The green lizard grows to approximately 350 mm and its size and bright green coloration distinguish it from the other British species. This species was released to mainland Britain and survived for some time. Neither the common nor the sand lizard occurs in the Channel Islands.

Terrapins may be seen quite frequently in ponds throughout Britain. These are mostly red-eared terrapins *Trachemys scripta elegans* imported from the United States. A red 'flash' behind the eye is quite noticeable in this species (but may also be found in some other terrapin species). Other terrapins do occur, notably common snappers *Chelydra serpentina*. The European pond tortoise *Emys orbicularis* may be found in some areas.

Acknowledgements

John Buckley thanks Richard Griffiths for supplying information on newt skeleto-chronology.

Chapter 3 Catching and handling

Richard A. Griffiths and Tom Langton

3.1 Introduction

The process of capturing and handling will cause some degree of stress to any wild animal and must be clearly justified. Most conservation activities will involve simple observation with as little disturbance of reptiles and amphibians as possible. If capturing amphibians or reptiles is necessary, however, it is important to weigh the benefits of the project against the stress and other negative factors involved. Some methods, such as bottle traps and pitfalls for amphibians, require skill and training to avoid killing or injuring the animals captured. Field workers are responsible in law for the welfare of trapped animals, including those captured incidentally, such as small mammals, and there are also legal constraints on capturing and handling certain species (Chapter 6 and Section 3.4). Catching and handling reptiles also requires skill and experience. In general, it is advisable that an experienced worker accompanies those who are inexperienced in the use of such methods and maintains close supervision for at least the duration of the first project. Traps that concentrate animals together may result in increased predation, including cannibalism, and this should be considered carefully. In sum, any project for which catching and handling are essential should be designed to minimise the possibility of death, injury or stress and the time animals are removed from their natural habitat. It should ensure that while they are removed they are not subject to any procedures that will influence their long-term chances of survival.

There are four reasons why animals may need to be captured:

- to allow definite identification of the specimen concerned;
- to register the individual for later recognition (Chapter 4);
- to make measurements or take samples for scientific purposes;
- to transfer them to another location as part of a translocation programme (Chapter 9) or for projects such as 'Toads on Roads' campaigns (Chapters 10 and 11).

In many surveys (Chapter 1) it is therefore not necessary to handle animals at all.

3.2 Amphibians: recommended methods

3.2.1 Catching

Torches

Much amphibian field work is performed after dark, and a torch is required for performing torchlight counts, making field notes, and for safety reasons. A torch attached to a headset allows both hands to be free for making notes, handling animals and for moving about the bank. Where the brightness of a torch is likely to cause disturbance to fully protected amphibians, a licence will be needed (1.4.1).

Though counting newts by torchlight is a simple procedure, it is impractical in murky or thickly-vegetated ponds (Chapter 1). Moreover, if a pond has both smooth and palmate newts, the two species may be difficult to identify at a distance. This is particularly the case for females, and it may be necessary to catch the animal concerned to ensure accurate identification (Chapter 2).

Nets

Dip-nets come in a range of sizes and designs; some are more suitable for amphibian field work than others. All comprise a net bag mounted on a frame, which is fastened to a pole. The mesh size of the bag must not be so coarse that animals can slip through; on the other hand, too fine a mesh will slow the speed of net movement through the water, get blocked with silt and vegetation and become unwieldy. A mesh size of 2–4 mm is a useful compromise that is suitable for catching adult and juvenile newts and the well developed larvae of most species. The net should be constructed of a strong, non-perishable material that will not easily tear if snagged on submerged branches or rocks. The net should be mounted on a metal or plastic frame that provides protection against abrasion as the net is swept through vegetation. The area of the pond that can be sampled in a single sweep depends, to a large extent, on the length of the pole. However, a long pole can be heavy and unwieldy. A collapsible pole, or one divided into two sections, may make transport easier. Weight can be reduced by using a lightweight aluminium pole, but wet metal poles can be uncomfortable to handle in cold weather. Wooden poles are heavier but more comfortable to use in cold conditions. The Institute of Freshwater Ecology produces a wide range of nets, poles and frames for sampling ponds and lakes. The Institute's address is Windermere Laboratory, Far Sawrey, Ambleside, Cumbria LA22 0LP, telephone 015394 42468.

In addition to a large dip-net, a set of small aquarium nets is useful for handling animals once they have been captured or for transferring them between containers. The nets come in a range of sizes, the smallest of which is suitable for larval stages, and can be purchased from most aquarium retailers. Plastic tea-strainers can also be useful for handling larvae.

Funnel traps/bottle traps

A variety of funnel trap designs are used in amphibian field work (Figure 1). All designs consist of a funnel-shaped structure, which guides amphibians through a narrow opening into a large receptacle, from which they are later retrieved. The simplest and cheapest device is made from a plastic drinks bottle. The bottle is cut into two sections, so that the top half forms the funnel and the bottom half the receptacle (Figure 1a). The top half is inverted and fitted into the bottom half to form the trap (Griffiths 1985). Funnel or bottle traps are usually submerged around the edges of a pond, and their positions must be clearly marked and numbered on a sketch map so that they can easily be retrieved. All traps *must* be collected up at the end of the trapping period. The length of time that they can be left in place depends on weather conditions and whether the captured newts can surface for air. If the trap is equipped with a 'chimney' which allows newts to gulp air from the surface, then leaving traps overnight should produce no problems.

Newts can absorb a certain amount of oxygen from the water through their skins. In hot summer weather bottle traps should be used with extreme caution. Dissolved oxygen levels will fall and newts are more susceptible to asphyxiation in traps if no air exchange is possible. Because of this, where bottle traps are set without an air supply, different *maximum* periods between checking traps have been given for different months, although more frequent checking is recommended. English Nature's guidelines for trapping great crested newts are as follows, and apply to all species. When the weather is cooler, in March and April, traps can be left for up to 12 hours. This is reduced to 10 hours in May, 8 hours in June and 7 hours in July and August. In September traps should be checked at least every 8 hours.

It is, however, relatively easy to incorporate an air bubble in a bottle trap, as shown in Figure 1b. If the trap is angled slightly downwards a bubble of air can be maintained in the receptacle, even if the complete trap is submerged. Some fieldworkers prefer to set traps just below the surface, but with an air space at the end of the trap raised just above the water lines in continuous contact with outside air by means of a small hole or holes, punctured in the bottle, as shown in Figure 1c. Traps can be held in position by passing a garden cane through the body of the trap into ground at the bottom of the pond or by using stiff wire to hold the trap at the desired position. Indeed, if large bottles are used, the cane may also ensure that the funnel is securely fitted into the trap receptacle. Where traps allow air-breathing, they still must be checked at least once every 17 hours; this should be between 0600–1100 hrs.

Funnel traps are used primarily for capturing adults of all three species of newt, but they are also effective in catching the larvae of all species of amphibian as well as a variety of invertebrate life. No bait is required to catch newts, and they seem to enter traps as part of their general activity.

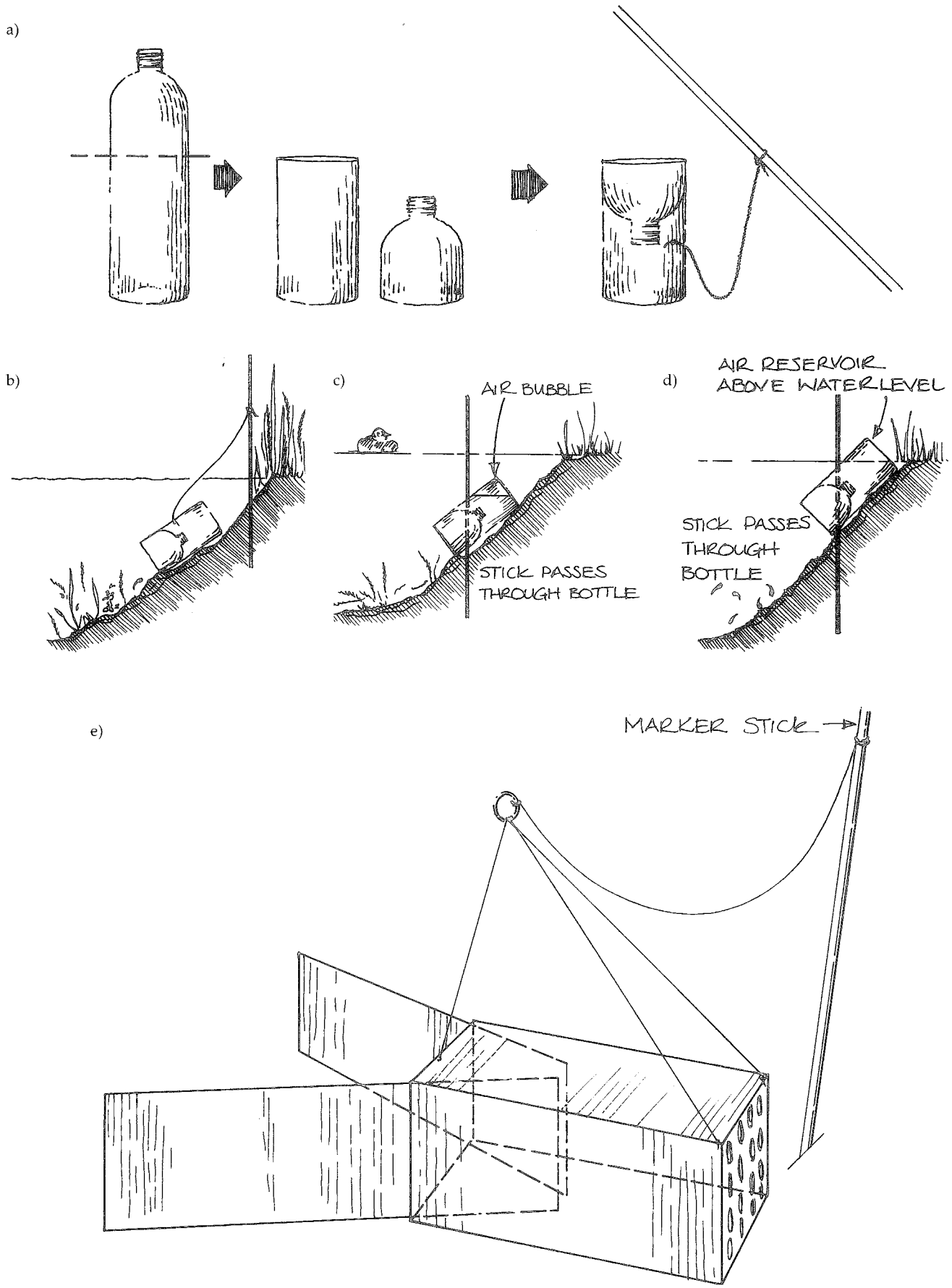
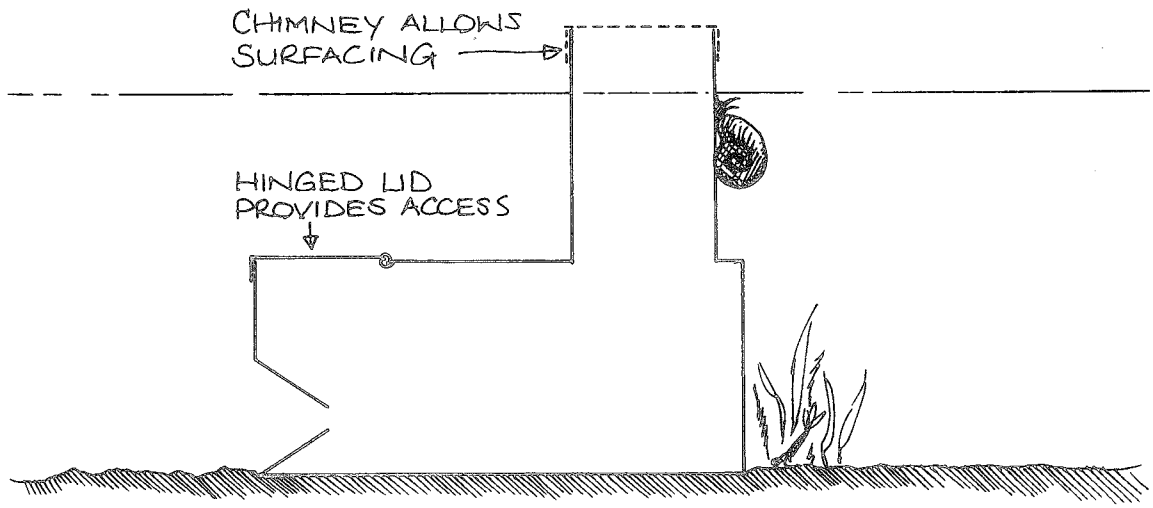


Figure 1 Various designs of funnel traps for adult newts and larval amphibians: a) construction of a simple bottle trap (after Griffiths 1985); b) bottle trap *in situ*; c) bottle trap with air bubble *in situ*; d) bottle trap with air reservoir above water level; e) Plexiglass fish trap (after Dolmen 1983); f) metal funnel trap (Baker pers. comm.); g) cylinder funnel trap (Strijbosch pers. comm.).

f)



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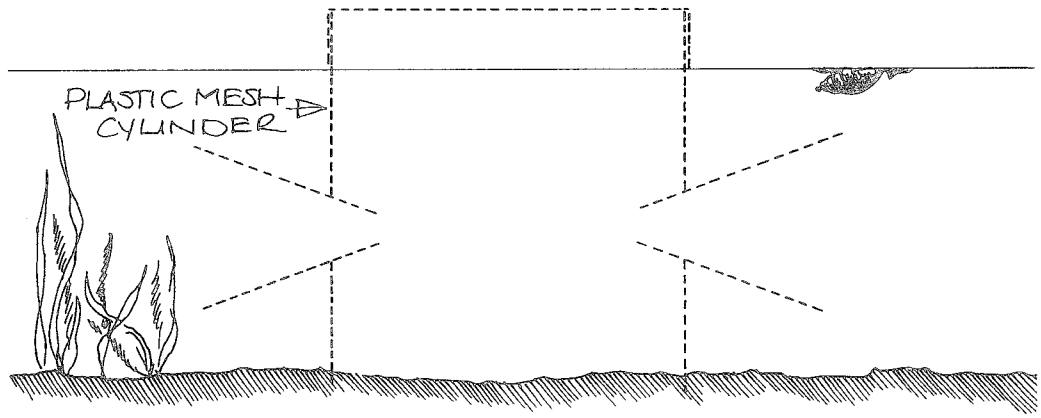


Figure 1 *(Continued)*

Pitfall traps

Pitfall traps are normally constructed from plastic containers sunk into the ground (Figure 2) and are used in association with drift fencing. Pitfall traps are particularly useful for capturing amphibians as they migrate towards or away from their breeding ponds. They can also be used to capture non-breeding animals moving in their terrestrial habitat.

Pitfall traps need to be designed to take account of the welfare of the species they are designed to capture and other 'non-target' species that may fall into them (Figure 2). Vegetation should be provided as cover in the bottom of the buckets. In wet weather drainage holes should be put in the buckets to prevent them from filling with water. In some areas that are prone to flooding, bark or wood platforms should be placed in the traps to act as floating islands to reduce the chance of drowning.

'Mammal ladders' should be provided to allow small mammals to escape. These must be provided if shrews are likely to be caught (otherwise separate provision must be made for shrews, including acquiring the necessary licence to trap shrews). 'Mammal ladders' are usually narrow pieces of wood or thick plant stems with a rough texture (such as dried hogweed stems) that rest on the bottom of the bucket and reach to the top.

Other measures to protect the trapped animals or to prevent 'non-target' species falling into the trap may need to be considered. Large-gauge chicken wire, or a board raised on stones, can be placed over traps to stop predation by crows, or to prevent large species, such as hedgehogs or moorhens, from falling into them. In some cases it is not practicable to prevent predation. In one study there was such a large mortality as a result of rat predation that the study had to be stopped.

Pitfall traps need to be checked regularly, and at least once every 24 hours. This should be between 0600 and 1100 hrs.

Animals captured while migrating to breed can be placed directly into the nearby pond, but those emigrating should be carefully released into areas of cover away from direct sunlight. Pitfall trapping for protected species needs to be licensed (Chapter 6 and Section 3.4). For all vertebrate species, there is a legal requirement to take account of animal welfare. For this reason it is vital that all workers are properly trained and are aware of their legal responsibilities when trapping animals using this method.

Drift fences are usually made from thick polythene sheet buried into the ground to a depth of 10–15 cm to prevent animals moving under the fence. The ground

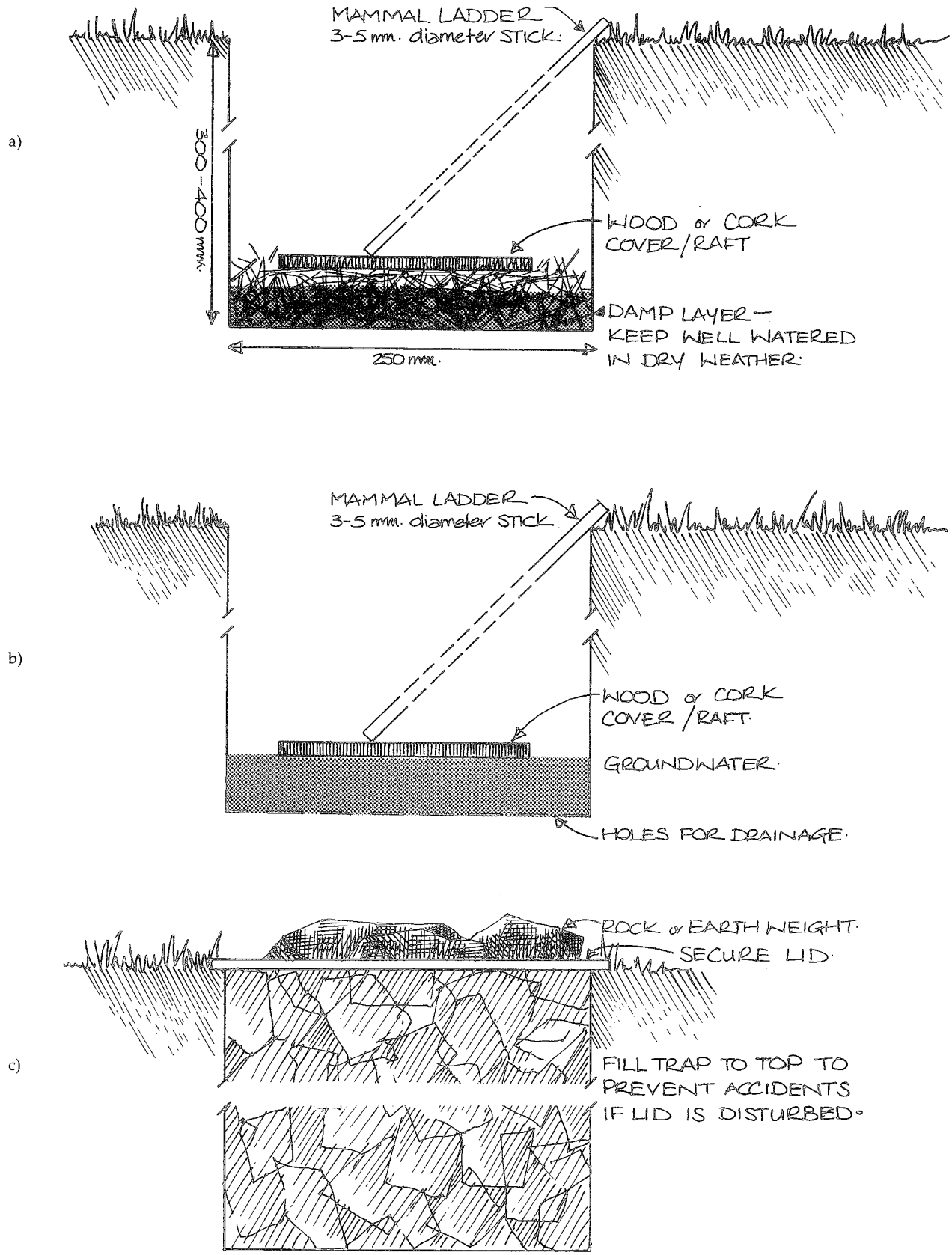


Figure 2 Design of pitfall traps for the safe capture of small amphibians: a) dry soil conditions in the bottom; b) wet soil conditions; c) closed pitfall trap (recommended when not in use for more than one week).

needs to be compacted around the fence since amphibians can easily pass under the fence where the soil is disturbed. The fence should be at least 40–50 cm high and is generally held in place with wooden or metal stakes. Designs vary; some fences are simply made from polythene sheeting; others are backed by chicken wire or have overhanging lips of polythene to prevent animals climbing over the fence. It is often necessary to keep vegetation short around drift fences to stop the amphibians climbing up the vegetation and over the fence.

Drift fences can be used to surround a breeding pond to capture animals going to or leaving it. Pitfall traps should be placed on both sides of the drift fence. It is important to be able to close the traps when they are not in use. This is why plastic buckets with tightly fitting lids are most commonly used. Otherwise traps can be closed by filling them with soil.

Terrestrial refuges

Another method of finding amphibians on land is simply to look under things. These can either be naturally occurring or, in some cases, deliberately brought to an area to give a greater chance of locating animals. Logs, large stones, planks of wood, old carpets, roofing tiles, paving slabs, plastic sheeting and corrugated cardboard can all be turned over to reveal amphibians hiding beneath. Because such items offer suitably humid conditions and protection from the heat of the sun, they are known as 'refuges'. The more refuges placed, the greater the chance of finding animals. Different materials will work with different levels of success in different weather conditions. Also the siting of the refuges is important: they should be placed in areas most likely to contain amphibians.

Before putting refuges into position, thought needs to be given to any problems they may cause. They may be unsightly or attract undue attention to an area. In all cases where refuges are put out in an area, they should be removed at the end of the trapping period. If refuges are deliberately being turned over to look for protected species, a licence is needed.

3.2.2 Handling

Eggs

Amphibian eggs comprise a central embryo surrounded by a proteinaceous jelly, which serves a protective function. For handling purposes during surveys, it is often best to examine a plant leaf with a suspected newt egg rather than uproot a whole plant that may hide dozens of eggs that could then suffer damage or dehydration. It may sometimes be necessary partly to unwrap newt eggs from the leaf of a water plant to distinguish great crested newt eggs from those of the smaller species. Bear in mind, however, that unwrapped eggs are more likely to be predated in nature (Miaud 1994). If eggs need to be collected or transported they should therefore be handled with care to minimise the risk of damaging the embryo or jelly. Clean water (from the water body in which the eggs or larvae originated) is the preferred medium for holding or transporting eggs or larvae, although tap water that has been allowed to stand for 24 hours is usually acceptable. Generally there is no need to handle frog or toad spawn during survey. Exceptions may be gently separating discrete clumps or strings, or confirming species by examining embryos.

Egg surveys will require licensing for protected amphibians where eggs or the materials they are laid on are handled, where the eggs may be disturbed, or where reduced survival may result. So egg-searching will generally need to be licensed for the protected newt species but not for the anurans.

Larvae

Larval stages of all amphibian species are readily captured by dip-netting or funnel trapping. All larvae are rather delicate and are easily damaged when removed from water. Small aquarium nets are ideal for handling these small stages, and larvae should be transferred to vessels of clean water or returned to the pond as soon as possible.

Juveniles and adults

Amphibians have moist skins, which are very sensitive to heat and chemicals. In general, the time any animals are held in the hand should be minimised; if held for too long, small frogs or newts can die simply from the heat generated by the human hand. Frogs, and to some extent toads, can be difficult to handle, especially when wet. Although fairly robust, they can be injured if dropped. Figure 3 shows how a frog or toad can be easily restrained in one hand by holding the knee joint firmly between thumb and forefinger while supporting the weight of the animal on the rest of the hand. This allows close inspection of the animal. Animals should not be held like this for more than a few minutes at a time. It is considered good practice to wet hands with pond water before handling amphibians. If it is necessary to keep amphibians in plastic boxes or other vessels while surveying, these should be equipped with a damp substrate (for example moss, grass, hay or chemical-free sponge, paper towels or tissues), have a secure lid with ventilation holes, and never be left in direct sunlight or allowed to get too warm. Most aquatic newts will wriggle vigorously when picked up, and may emit a short, sharp squeak. Unlike lizards, newts cannot drop their tails when captured. However, they should still not be picked up by the tail as this may damage them. Newts should be lifted by placing your fingers underneath the central part of their body. If they need to be restrained between the forefinger and thumb their soft bodies must not be squeezed too tightly. Terrestrial newts are rather easier to deal with as they usually remain immobile when first captured.

Figure 3 Single hand restraint method for frogs and toads.

3.3 Reptiles: recommended methods

3.3.1 Catching

Surveying and monitoring reptiles depends largely on observational skills; practice greatly improves the ability to find animals. Most animals are caught by hand either when basking or moving in the open or when seen underneath refuges. Other trapping techniques include the use of nooses, and a variety of traps can also be made.

Hand capture

Many animals can simply be stalked and captured by hand. However, this creates risks to both the animal and the capturer. Lizards can be trapped by pouncing on them with a cupped hand, but this can be very 'hit and miss' and can lead to animals being killed or injured. Equally, grasping a snake or pinning it to the ground may well cause injury. However, it is possible to capture animals firmly but not grasp them tightly and to restrain them by hand.

The use of clean, thin but bite-proof gloves is recommended when capturing snakes. Motorbike or welding gauntlets will offer some protection, and professional gloves designed for handling rattlesnakes can be purchased from the US, although they tend to be expensive. Gloves will also give protection from bites from adders that may occur if one is disturbed alongside other snakes and lizards; they also protect the hands from cuts on vegetation or sharp edges of tin refuges.

The use of gloves is not universally popular. With the exception of gloves designed for the purpose, gloves cannot be guaranteed to be bite-proof and they may lure the wearer into a false sense of security. Gloves can reduce the hands' sensitivity and grip, and can lead to snakes being handled too roughly or escaping because they cannot be held firmly enough. If gloves are to be worn it is important that the fieldworker practises picking up small objects in the gloved hand before attempting to capture animals, to become familiar with how much pressure is needed to restrain the animals safely. Many fieldworkers therefore prefer not to wear gloves, even when handling venomous snakes. However, gloves are very valuable for fieldwork when adders may be present on site and the aim is to capture as many animals as possible.

Health and safety considerations need to be fully thought through before snakes are handled in the field and the method chosen must give them due regard. Melanistic (black) and albino (colourless) reptiles occur from time to time; this, together with colour variations in snakes, may mean it is not possible to identify the snake until it is in the hand. Clearly there are risks in handling unidentified snakes and anyone considering this needs to be extremely cautious.

Snakes should not be pinned down with a stick or a foot, as bruising to the body or throat may occur and this could prevent them from feeding for weeks. The mouth, internal organs, ribs and windpipe could also be damaged. In late summer and autumn, pregnant snakes (and lizards) are particularly vulnerable to any rough handling, as are the developing eggs or young.

Artificial refuges

The most efficient way to catch reptiles is to use the artificial refuges that are often used for surveys (Chapter 1) and under which reptiles can be easily located. It is important to remember that other people may have access to the areas in which you are working. For this reason it is sensible to disguise artificial refuges well and to place them away from pathways. Refuges can be painted for camouflage on the upper side and lightly covered with grass and bracken or other vegetation to make them hard to see even from a few metres away. A map of their location will enable the refuges to be found easily when they need to be checked. All refuges should be collected and removed at the end of the trapping period.

Pitfall and other traps

These can be used with drift fencing to catch lizards and young snakes. They are less suitable than refuges, as the daytime activity of reptiles renders these animals vulnerable to predation from birds and mammals and to extremes of heat, being otherwise unable to control their body temperatures. How much of a problem this may be at any one site is hard to predict. Great care is needed if pitfall traps are going to be used and they must be inspected twice daily. Other forms of trap can be used in association with drift fencing but these are very conspicuous and only suitable for more remote locations or those with no public access. At sites with public access, a notice can be left near to traps to explain the general purpose and discourage interference.

Noosing

Noosing is a good method for capturing common and sand lizards. This method again requires special training (and a licence in the case of sand lizards) and involves the use of a slip-knot noose made from fishing line attached to the end of a thin, flexible pole. Although lizards may become aware of a nearby observer, they may not flee if approached slowly. A noose dangled in front of them is usually ignored, or sometimes inspected more closely by raising the head. This can assist in the noose being manoeuvred into place. Once the noose is around the neck, a quick tug secures the slip-knot and in the same movement the lizard is lifted swiftly into the hand. This technique, when applied carefully, reduces risk to the lizard to a minimum while preventing disturbance to the microhabitat in the vicinity of a lizard.

Adders: special considerations

Catching, handling and transporting adders need special consideration. Because they are venomous, particular care is needed when catching them and this should not be attempted without expert guidance and familiarity with non-venomous species. There are also additional legal implications that need to be taken into account (e.g. the significance of the Dangerous Wild Animals Act 1976, Chapter 6) and other

legislation such as The Transport of Animals (General Order) 1973. There may also be special insurance considerations when handling adders. Training courses are run from time to time to develop safe practices for situations where adders may be perceived as a problem. Figure 4 indicates recommended methods for catching adders.

3.3.2 Handling

As with the handling of birds and bats, the handling of reptiles requires practice, care and confidence. Firm but gentle handling and the avoidance of squeezing or pinching will put many lizards and snakes at ease and they may become quite calm and easy to handle. This can be achieved by very gradually reducing the initial

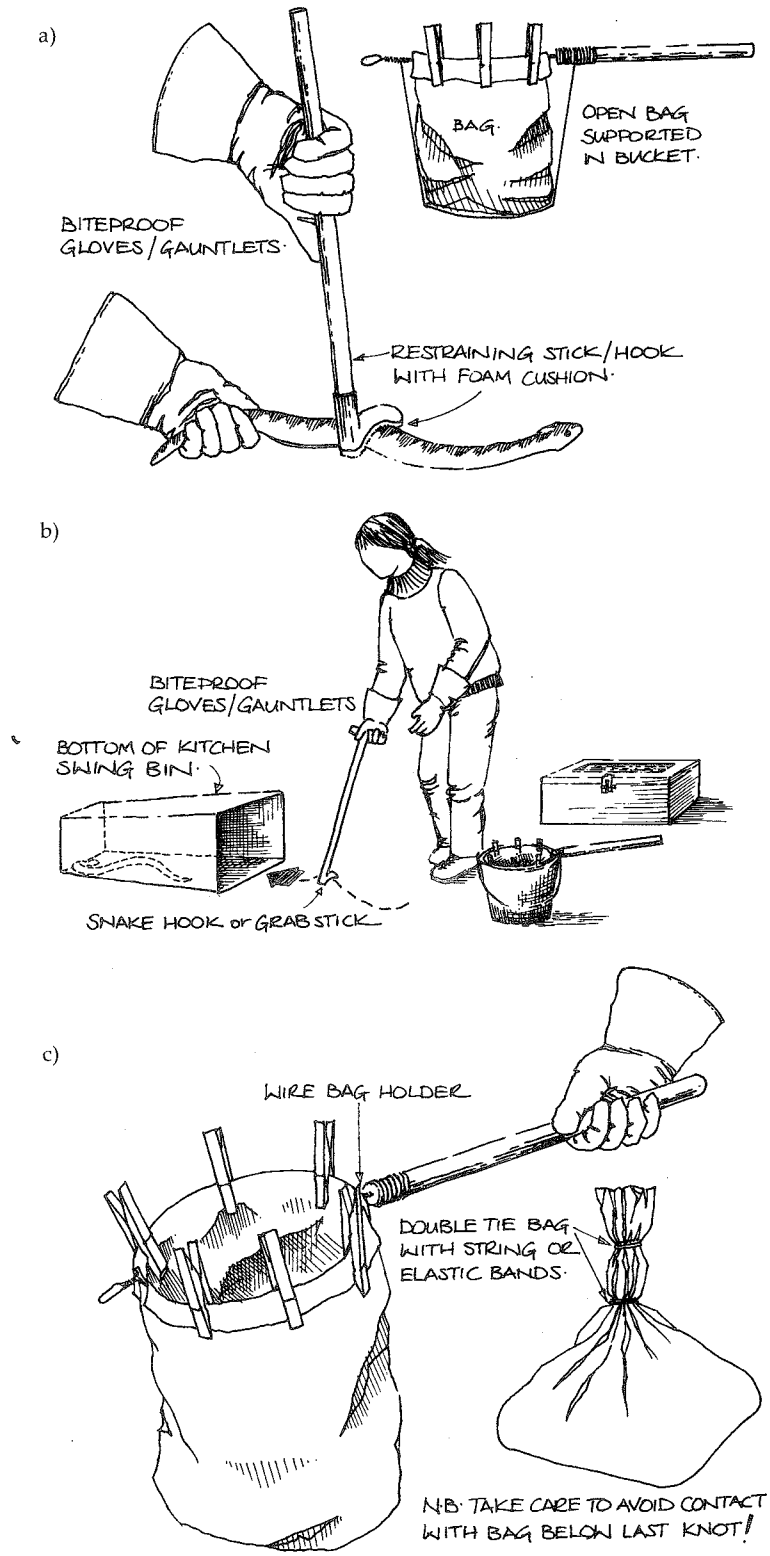


Figure 4. Safe methods for the capture of adders.

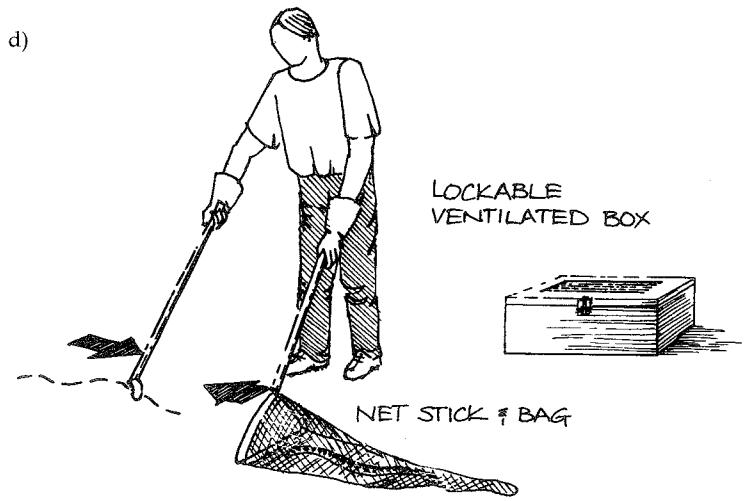


Figure 4 *(Continued)*

hold to the minimum that is required to prevent them from escaping. Clean cloth bags may be used to hold snakes and lizards for short durations and the neck of the bag should be carefully tied to prevent escape. With snakes and slow-worms it is often a good idea to fold the neck of the bag over and tie it; since these species can escape through very small gaps. Containers with good ventilation, a secure lid and plenty of bulky material such as hay can also be used.

Snakes

When handling snakes it is usually a good idea to wear thin but bite-proof gloves. Even when wearing gloves it is still important to try to avoid being bitten. Snakes can damage their teeth and mouths quite easily and this can lead to infections. Animals need to be handled carefully when gloves are worn since gloves can reduce grip and sensitivity, and for these reasons their use is not universally popular. It is best to support as much of a snake's body as possible with both hands to avoid straining its backbone or muscles. Snakes should not be held by the tail for more than a few seconds as this may also cause strain and damage.

Once in the hand, a snake (or slow-worm) will often thrash around, voiding faeces and pungent secretions from the anal gland. However, if handled gently, they usually calm down and become placid fairly quickly. It is important to avoid or minimise the handling of snakes that have just eaten as they are likely to disgorge their food. The snake may have spent considerable time finding its food, and, in some circumstances, disgorging could represent a significant loss of energy. Particular care is also needed when handling pregnant snakes and lizards in late summer and autumn; rough handling may cause damage to the developing eggs or young.

Snakes will often move quickly towards cover and seek to lock their heads into deep heather or grass stems in order to pull themselves more swiftly away. This can make capture more difficult. However, in doing this they often uncoil and straighten out, and in this short time it is usually quite easy to grip the tail with (gloved) fingers to prevent their escape. Following this it may take a minute or two for the snake to relax and be gently removed without harm. When handling adders, the head and first few inches of the snake may be restrained for examination in transparent tubing of an appropriate diameter, although once they have calmed down adders can become relatively easy to handle for the purposes of making detailed observations. Grass snakes in particular are very quick to move off when they detect the movement of nearby observers. They must therefore be stalked and spotted before a swift final approach in which the animal is carefully grabbed; grass snakes have occasionally been known to bite. The smooth snake is generally the quietest, most passive of the three snakes, rarely expending much effort escaping although occasionally biting when handled.

Lizards

As with snakes, lizards can move very rapidly and also do not like to be squeezed or pinched. Holding a wild-caught lizard behind its vent almost always leads to the shedding of its tail. Losing a tail is an expensive loss of energy to a lizard. The slow-worm, sand lizard and common lizard should not be held or caught by their tails. A lizard should be held with your thumb and first two fingers on its upper body and shoulders. The rest of the body can be held between the last two fingers and palm. A lizard can be held in a clear plastic bag for a very short while to allow close inspection and measurements.

3.4 Legal considerations

Great crested newts, natterjack toads, sand lizards and smooth snakes are fully protected in Great Britain and are listed in Schedule 5 of the Wildlife and Countryside Act (1981) and Schedule 2 of the Habitats Regulations 1994. Smooth newts and common lizards are protected in Northern Ireland and are listed in Schedule 6 of the Wildlife (Northern Ireland) Order 1985 (Chapter 7). This means that the capture or handling of any life-stage is normally lawful only if a licence has been granted by the appropriate licensing authority. In practice this means that a licence is needed if bottle or pitfall trapping or netting is to be used to catch great crested newts, where smooth snakes are to be handled or where refuges or egg searches are carried out. A licence is not needed, however, for methods that cause no disturbance or involve no physical contact with animals. No licences are needed to capture and handle the four commoner amphibians or the four commoner reptiles in Great Britain, or the common frog in Northern Ireland. However, adders are listed on the Dangerous Wild Animals Act 1976. The implications of this are unclear, since a licence must be obtained from the Local Authority to keep listed animals in captivity. Potential problems can be avoided by releasing the animals as soon as practicable after capture, and certainly within a few days. As licensing regulations are subject to slight changes from time to time, you are recommended to seek the advice of the appropriate licensing authority before applying for a licence. Workers are reminded that in addition to licences, permission from landowners and managers must be sought before catching or handling amphibians and reptiles.

All of the amphibians, reptiles and other vertebrate animals that are captured in traps are subject to legislation that protects them from ill treatment under animal welfare legislation (notably the Protection of Animals Act 1911 and the Protection of Animals (Scotland) Act 1912). Even if the intention is not to harm animals, negligence, such as not emptying traps with sufficient regularity, may be illegal. Workers are therefore under a legal, as well as a moral, duty to ensure that high standards of animal welfare are practised when catching herpetofauna.

Chapter 4 Marking and recognition of animals

John Baker and Tony Gent

4.1 Introduction: the need for marking and recognition

To answer questions about specific populations or about the ecology of reptiles and amphibians in general, it is sometimes necessary to be able to mark and/or recognise individual animals. For example, the size of a population can be estimated using techniques such as the Lincoln-Peterson (capture-mark-recapture) index (see Krebs 1989; Heyer *et al.* 1994) that rely on being able to recognise animals from one trapping period to the next. Further questions, such as how far individuals travel from a breeding site, how large the home range is, or how long animals are living, can also be answered by being able to recognise individual animals. Natural features of an animal, such as pattern, coloration, scarring or a combination of these together with other information such as sex or size, can allow individuals to be distinguished from each other. In other cases though, perhaps owing to the need to capture large numbers, the difficulty of selecting unique characteristics or the need to be absolutely certain of identification, an artificial means of marking is needed. Marks may be simple, allowing a worker to, for example, distinguish a recaptured from a newly captured animal, or they may be coded. Codes of varying complexity have been developed to mark each individual uniquely.

The need for marking animals should be carefully assessed. Collecting and processing this sort of information can be time-consuming. An even more important consideration is the impact on the animals being studied. Disturbance, handling and the application of intrusive marking methods can disorientate, injure and even kill individual animals and cause problems even for populations. Consequently, when designing a study, conservation and welfare considerations must be weighed against the need for marking.

There are several options for marking and individual recognition. These will depend on the species concerned, the duration of the study, the likely population size, the precision required and the budget available. The use of natural markings is clearly preferable where appropriate. In other cases the use of artificial marks can be considered. Marking systems that make animals easier to relocate can also be used.

4.2 Licensing requirements

Wildlife conservation legislation – Wildlife and Countryside Act 1981 and the Conservation (Natural Habitats &c.) Regulations 1994 in Great Britain and the Wildlife (Northern Ireland) Order 1985 – requires that before any work on the fully protected species is done that involves handling, disturbing, killing or injuring them, a licence must be obtained (Chapter 7).

In Great Britain all native reptiles are protected against injuring, and any marking technique that could be considered injurious needs to be licensed. These licences are obtained through the Statutory Nature Conservation Organisations (SNCOs). Any work on non-native species that also involves releasing them (back) to the wild needs to be licensed by the Department of Environment, Transport and the Regions, Scottish Office Agriculture, Environment and Fisheries Department or Department of the Environment Northern Ireland.

In addition to the wildlife conservation legislation, a marking project must consider the need for Home Office licensing. Some marking techniques will fall into the category of 'regulated procedures' as defined under the Animals (Scientific Procedures) Act 1986 (Chapter 7); this applies to all countries in the UK. 'Regulated procedures' are any experimental or scientific procedures which may have the effect of causing the animal pain, suffering, distress or lasting harm. The use of such procedures is regulated by the Home Office, which administers a licensing system. Section 2(5) of the Animals (Scientific Procedures) Act 1986 is of particular relevance: "The ringing, tagging or marking of an animal, or the application of any other humane procedure for the sole purpose of enabling an animal to be identified, is not a regulated procedure if it causes only momentary pain or distress and no lasting harm."

However, some procedures for marking reptiles and amphibians may fall into the category of regulated procedures, namely toe-clipping and implantation of radio transmitters, and will be further discussed below. If it is deemed that a Home Office licence is required for a marking procedure, then most workers who are not part of a scientific establishment will have to accept that the technique is not available to them. It is not easy to obtain such a licence, and almost impossible for the private individual to do so. Licences may only be granted to individuals who are working for, or with, a licensed or designated establishment holding a project licence. Hence a worker would need to work in liaison with a designated establishment, such as a university or other research unit. In addition, a worker may have to attend Home Office training courses before a licence can be granted.

For anyone considering becoming involved in a project that may necessitate regulated procedures, *Guidance on the Operation of the Animals (Scientific Procedures) Act 1986* is available from (HMSO Publications Centre, PO Box 276, London SW8 5DT, telephone enquiries 0171 873 0011). Alternatively, the Home Office can be contacted directly: Home Office E Division, Room 976, 50 Queen Anne's Gate, London, SW1H 9AT (telephone 0171 273 2898/2276).

4.3 Natural markings

Within a species of reptile or amphibian there is variation in coloration and patterning. In some cases this variation is sufficient to allow workers to use it as a convenient means of identifying individuals. These features can be drawn, photographed, photocopied or simply described to allow animals to be identified subsequently. Details of sex, size, time and location of capture are usually recorded at the same time to allow these factors to be considered when reviewing the information.

The use of natural markings may require some caution. They may change with age, and even where there is consistency within an individual, markings can be similar between different animals.

4.3.1 Newts

The belly patterns of smooth and great crested newts have been successfully used as a means of individual recognition (Hagström 1973), although most work of this nature in the UK has focused on the latter species. Drawing belly patterns is not recommended, except perhaps when identifying individuals from a limited number, for example animals in an enclosure. In the field, even in a relatively small population, this method is likely to be too inaccurate to be certain of being able to differentiate between individuals. In such instances, records can be made either by photography or with the use of a photocopier. The relative merits and welfare issues associated with the different methods need to be considered. Photocopying generally requires transporting animals and taking them indoors, and the light used may also adversely affect them. For these reasons some feel this method is not acceptable (e.g. Countryside Council for Wales will not issue a licence to allow this, and use will be reviewed in other countries). Using either method suffers from the problem of wriggling animals distorting the belly pattern. The most effective records are made from individuals lying as straight as possible. Newts can be anaesthetised using MS-222 (Sandoz), but this is time-consuming, requires protective measures for the fieldworker and would also necessitate a Home Office licence. It is more practical to work with non-anaesthetised animals. For photography, newts really need to be restrained. One technique is the use of a specially made camera rig (Figure 1). This rig can be constructed so that half a dozen or so newts can

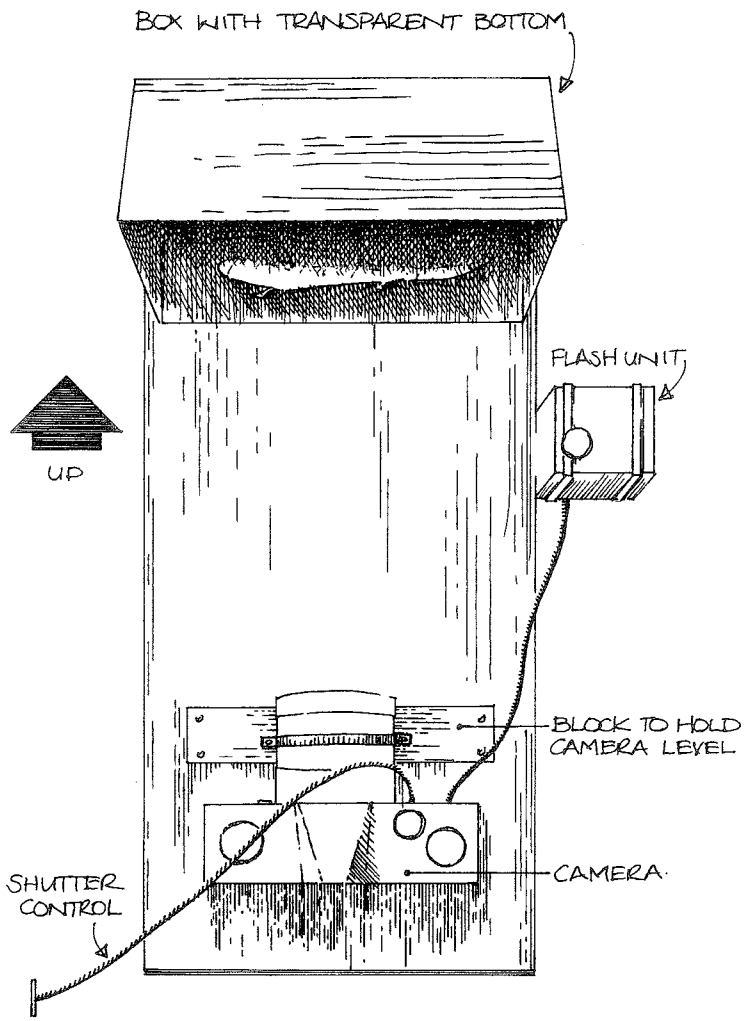


Figure 1 Camera rig for photographing newt bellies.

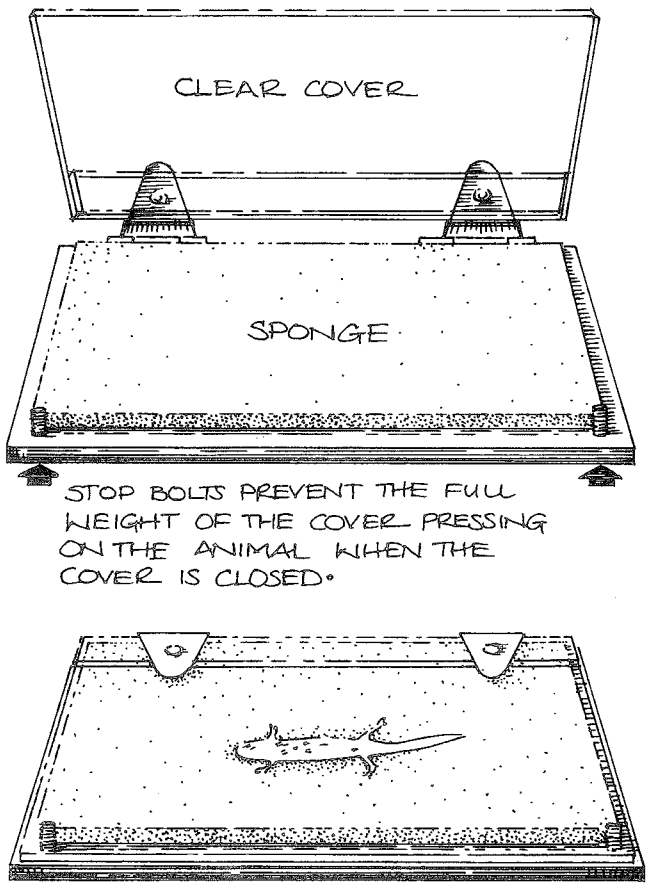


Figure 2 'Mander masher' (see text). The stop bolts prevent the newt from being crushed.

be held in the individual compartments of a transparent platform. A camera and flash unit are held by the rig under the newts, so that the belly patterns of many newts can be photographed at the same time.

Another restraint that could prove useful is the 'mander masher' (described by Wise & Buchanan 1992). This consists of two hinged plates, one of perspex, the other faced with a layer of sponge or similar (Figure 2). A single animal is allowed to walk across the lower perspex base, and is then gently held in place by closing down the sponge-faced lid. The 'masher' is then turned over, so that the newt belly can be viewed and recorded through the perspex.

If photocopying newt bellies, restraint of the newts is not so critical. The newt can be placed directly on to the copier, or on a transparent tray. Wait until the body is relaxed and reasonably straight, shield the head at one end and copy. With a little practice good copies of fairly straight torsos can be made. Experiment with the copier contrast to find out which setting gives a good contrast between the belly spots and the background coloration. The lightest setting generally seems to give the best results. One advantage of using a photocopier is that records, such as date and location of capture, can immediately be written on to the same sheet of paper as the photocopied record. The effects of the bright light of photocopiers on newts is unknown and therefore it is considered good practice to place a piece of black card under the newt's head and neck to give some protection to the head and eyes.

Although belly patterns are a good means of recognising individuals, field workers attempting studies that span more than a single season should be aware that these patterns are not completely fixed. The belly spots tend to increase in size and number with age (Arntzen & Teunis 1993). In adult newts the changes are so slight as to be almost imperceptible, even over several years. In juveniles the changes are more dramatic, with the consequence that it may be difficult, if not impossible, to recognise an adult newt from its belly pattern as a metamorph. Although it is possible to do this in some cases, it is not known what percentage of matches can be expected to be missed. A record made of an individual several months after metamorphosis is much easier to match up with a later adult record. It seems likely that the potential for matching metamorphs and juveniles to adult patterns will vary between populations.

The natural markings of palmate newts are almost certain to show individual variation; however, there is no published work describing the use of photographs to distinguish individuals of this species. In practice, the more subtle markings of this species may limit its use to distinguishing individuals within a small group, for example in a captive situation, rather than allowing individual recognition in the field.

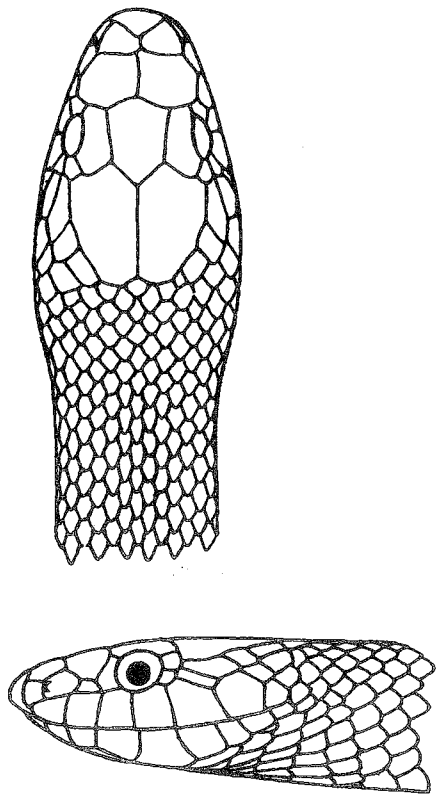
4.3.2 Frogs and toads

Frogs and common and natterjack toads carry complex patterns. To date these have been exploited only in the natterjack toad. Denton (1991) was able to sketch the spot patterns of natterjack bellies to enable individual recognition. Worldwide, photographic records are being used to identify individuals in an increasingly large number of amphibian species. Investigation of the patterning of the dorsal surface of the common frog may yield a suitable basis for individual recognition.

4.3.3 Snakes

Head and neck patterns

Using these markings (and also scars and any unusual markings on the rest of the body) it is possible to identify individual snakes without disturbing them. Head and neck markings have been used to identify smooth snakes during a British Herpetological Society survey (Braithewaite *et al.* 1989). In this study snakes were captured and the crown and upper neck markings, together with the markings on the side of the face, were transcribed onto predrawn cards (Figure 3). Grass snakes (Franklin pers. comm.) and adders (e.g. Sheldon & Bradley 1989) have also been recognised by their head patterns. In the latter study, markings of adder head patterns were described using three components: the eye-lines; the inverted V; and the apex of the dorsal zig-zag. Each of these features was virtually unique and allowed identification of the majority of animals observed. The combination of all three features proved adequate to separate all the individuals definitively.



TIN No.	GRID REF.
CLIP No.	SITE
O.A.LENGTH (mm)	DATE
V.T.LENGTH (mm)	TIME
WEIGHT (g)	SUN: STRONG/OCC'/NONE
MALE/FEMALE/JUVENILE	SHADE TEMP (DEG.C)
FIRST CAPTURE/RECAPTURE	CLOUD / 8
PRE SLOUGH/POST SLOUGH	WIND: STILL/LIGHT/STRONG
	WIND DIRECTION
	RAIN Y/N
	PREVIOUS RAIN Y/N
NOTES	

Figure 3 British Herpetological Society Conservation Committee smooth snake survey form showing pre-drawn proforma for transcribing head, neck and facial markings (see Braithwaite *et al.* 1989).

Belly patterns

Marks on the ventral (belly) scales of grass snakes have been used to identify individuals. Brown (1991) copied the markings on each of the first ten ventral scales, counting up from the cloaca, onto predrawn templates. Snakes were held in a perspex tube while the belly patterns were being recorded. These plates were compared by eye. Hailey & Davies (1985) photographed ventral scale markings to identify individual viperine snakes in a Spanish population. These they described using a coding system. In both of these studies the patterns allowed accurate identification of individuals.

4.3.4 Lizards

Back patterns

Sand lizards have been studied by recording the back patterns of animals seen in the field (Dent 1986). Photography allowed animals to be identified without the need to handle them. The complex back patterns meant that the individual photographs had to be compared by eye.

Throat patterns

Smith (1990) photographed the throat patterns of slow-worms using a macro-lens while the animals were restrained in a 'clamp' of perspex and foam rubber similar to the 'mander masher' in Figure 2. Photographs were stored together allowing use in the field; patterns were compared by eye.

Head patterns

Patterns on the back of slow-worm heads seem to vary quite widely between individuals (Riddell 1996). They seem to be more distinctive than throat patterns. How they vary over time is unclear, although it is possible that they do change with age.

Anal scale patterns

Male common lizards can be identified by spot patterns on the anal scale (Riddell 1996). Females do not always show this patterning but may then be recognised by belly patterns.

4.3.5 All species

Other marks – damage/scarring

Amphibians and reptiles may show quite noticeable damage or scarring following injury. Snakes often show damage to their tails; lizards will autotomise their tails and also lose digits. Description of the position of the scar and nature of the scarring, or a note of a regenerated lizard tail, can provide an aid to the identification of individual reptiles, so such notes should be made when preparing a record card. Amphibians may also lose limbs or digits but their considerable regenerative powers mean that these are not always

permanent marks. In particular, newts can regenerate lost digits and amputated tails.

4.3.6 Natural marking record management

Records of individuals have to be stored and compared to assess whether a particular capture is a new record or a recaptured animal. This can be a time-consuming process. Comparing any single record with a catalogue of several hundred can be tedious. Workers at De Montfort University have developed an automated newt identification system, which uses image analysis techniques to speed up this task in the case of great crested newts (Sweeney *et al.* 1994). Other simple techniques have been developed. For example, Hailey & Davies (1985) coded the markings of viperine snakes *Natrix maura*. Alternatively, the job can be simplified by filing records of individuals in easily recognised categories. Records can be split by site and then by sex. Then, within each sex, records can be further subdivided by particular pattern features or background coloration. For example, newt belly pattern categories could be based on whether the spots form a ventral band or not, or how far the band extends. The purpose of such a filing system is to decrease the need to look through full sets of records each time an animal needs to be identified.

4.4 Marking techniques

4.4.1 General considerations

The external attachment of visible tags or making permanent marks can be difficult for all herpetofauna. The moist and highly sensitive skin of amphibians makes marking with paint difficult. All species shed their skins and many have elastic bodies which make attachment of ties or use of lacquers difficult. The stream-lined shape of the snakes and slow-worm makes the attachment of tags difficult. Nonetheless, working within the constraints imposed by the morphology of these animals, systems have been developed for marking reptiles and amphibians.

4.4.2 Paints, lacquers and dyes

Reptiles can be marked using paints or lacquers. Such marks will last only a short time since they will be lost when the animal sheds its skin. Paints will also be rubbed off as animals move through vegetation and soil. In addition, non-elastic paints such as lacquers can be lost when skin stretches, detaching the hardened mark, for example when large items of food are eaten by a snake.

Tags, and similar, can be glued to an animal's skin, but again these are lost when the animal sloughs. For some species, such as slow-worms, the nature of the skin and their behaviour makes most forms of external marking impracticable.

Amphibian larvae are difficult to mark, although dyeing, by immersion in a neutral dye, has been used in the US (Heyer *et al.* 1994). Such techniques are of dubious value to a fieldworker, owing to the unknown effects on subsequent larval survival. As an alternative, anuran larvae have been marked by clipping tail fins, cutting a V-shaped notch in the tail fin, using surgical scissors. The Home Office should be consulted about specific projects before using this technique since it is likely to require licensing.

4.4.3 External tags, bands and rings

Attachment of leg bands or rings is generally inappropriate for British herpetofauna. However, knee tags have been successfully used on common frogs in Sweden (Elmberg 1989) and would seem to present a suitable technique. The tags, originally intended for marking fingerling fish, are plastic, about 5 mm in length and stamped with code numbers. These tags have been tied around the knee using the vinyl thread supplied. Any attachment thread should be smooth surfaced and should stretch to allow for growth. Even so, this technique is suitable only for adults, which will not increase much in size. Fingerling tags can be supplied in various colours, including green. They can be purchased from Floy Tag and Manufacturing, Inc., 4616 Union Bay Place N.E., Seattle, WA 98105, USA, phone: 800-843-1172 or 206-524-2700. They cost US$330 for 1,000 tags (1995 price). Floy Tag has no distributor in Europe, but there may be more local alternative sources supplying fish farms in the UK.

Identification bands strapped around the waist have been used frequently in behavioural studies of anurans. Numbered elastic bands have been used for male common toads (Davies & Halliday 1979). This type of identification is generally suitable for anurans only during the breeding period. Loose-fitting bands tend to fall off once animals leave the water. More closely fitting bands may not allow for growth, and additionally, the effects of waistbands on survival have not been evaluated. They would seem to offer potential for becoming snagged and constricting the wearer. Hence they are generally best avoided. Paper bands may last for a few hours or days in dry weather.

Small bent aluminium plates have been sewn, using aluminium thread, through the tails of adders (Vittanen 1967). Although these proved highly visible they caused local injury and their use is not recommended. Studies of garter snakes *Thamnophis sirtalis* have successfully used plastic tags, designed for attaching buttons to clothing (Pough 1970). The tags have a bulb at one end of a stem and a plastic cross bar at the other. The cross bar is inserted by a needle-like applicator through the scales of the tail and into the underlying muscles to a depth of about 0.5 cm. The tags caused no necrosis and did not affect sloughing. This form of marking would be considered to cause injury and a licence would be required from the SNCO before it could be used on reptiles and fully protected amphibians. It is important to consider the need for a Home Office licence.

Numbered tags are attached to the flippers and rear carapace of marine turtles. These are applied when the animals are on the breeding beaches or caught in nets (see, for example, Wood & Wood 1993).

4.4.4 Toe clipping

Toe clipping has been widely used on amphibians and legged lizards. Usually this involves the removal of one or two joints from the end of a digit, using either sharp surgical scissors or a scalpel (if there is a safe surface to support the animal and cut on to). Individuals are marked by removing a unique combination of toes. Among workers on amphibians toe clipping is becoming a controversial technique. From a practical angle, it is of limited use in newts, due to their ability to regenerate tissue. Toe clips in smooth newts can grow out, almost to the point of being undetectable, within a single aquatic season. From an ethical point of view, it almost certainly causes at least momentary distress to the animal. Workers who use the technique argue that the distress is short-lived and does not appear to be severe, or even evident in some cases. However, toe clipping may also have more serious adverse effects in the long term. Digit removal may affect normal behaviour and has been shown, in the case of natterjacks, to result in infection (Golay & Durrer 1994) and in an American species, *Bufo woodhousei fowleri*, to reduce survival (Clarke 1972). Conversely a study of toe clipping on common toads indicated the method had no detrimental effects and so proved to be a valuable technique (van Gelder & Strijbosch 1996). However, these authors reported experience of tissue infection occurring in other anuran species. Similarly no detectable effects

were observed on one species of Australian frog, *Crinia signifera* (Lemckert 1996). Certainly generalisation about the effects of toe clipping on anurans are difficult to make, and more rigorously controlled studies are still needed to determine whether long-term survival is affected in other species.

Any worker who does finally decide to use toe clipping will find a useful summary of different toe coding schemes in Heyer *et al.* (1994). However, it should be noted that not all of the possible number codes should be used. Workers should remove at most two, and preferably only one, digit per foot, taking care not to remove inside digits from the fore-limbs of male anurans, used in amplexus, or the longest digits, which may be crucial to locomotion in any species, or specifically to gaining purchase in courting male newts.

It is likely that some amphibian ecologists will continue to use toe clipping, not necessarily to mark individuals, but because some studies also require information on age and growth of individuals. This information can be gained from examination of 'growth rings' in bone tissue using the technique of skeleto-chronology (see, for example, work on Italian frogs (Guarino, Angelini & Cammarota 1995) and Spanish lizard species (Castanet & Baez 1988). Such workers may decide that the usefulness of the information gained outweighs any risks. However, as far as the users of this manual are concerned, toe clipping of amphibians may not appeal on ethical grounds, and it has practical limitations and consequences that have not been fully evaluated.

Observations of toe-clipped common and sand lizards suggest that toe clipping does not cause them any particular harm (e.g. Simms 1970). However, due to fairly high natural losses of digits (around 8% in one four-year study), it is advisable to collect other data as well to ensure reliable identification (Middelburg & Strijbosch 1988).

Toe clipping of both amphibians and reptiles requires a Home Office licence, which puts it beyond the scope of many field workers. If in any doubt, contact the Home Office. Toe clipping any life-stage of reptiles will also need to be licensed by the SNCOs.

4.4.5 Scale clipping

Snakes have been marked by clipping the free edge of their ventral scales (Prestt 1971; Spellerberg 1977). These are usually clipped in pairs, by cutting away the posterior edge of scales with fine, sharp scissors. The cut edge should extend to no more than half the body width and ideally consist of just short notches. This is to minimise the possibility of damage both while marking the animal and subsequently. Scales may regrow but often retain a notably different coloration, allowing identification for several years afterwards. Only snakes where the scales are large enough to allow clipping without causing harm should be marked in this way; usually these are snakes over one year old. The possibility of infection and subsequent scale damage has meant that this method is not popular. The animals will obviously have been disturbed and therefore any necessary licence should be obtained from the SNCOs.

If scales are clipped so that underlying skin is not damaged and blood not drawn, it is unlikely to be considered 'injurious' as far as licensing under conservation legislation is concerned. However, the need for a Home Office licence should be checked, giving details of exact methodology, if scale clipping is considered in any study.

4.4.6 Branding and tattooing

Various techniques of branding and tattooing have been applied to amphibians (Heyer *et al.* 1994). Such techniques can damage underlying muscle and organs, so must be used with care and preferably learned from someone familiar with the technique. These methods have not been used frequently in the UK and may need Home Office licensing, for which guidance, detailing specific methods, should be sought. One variation on this theme that has proved very effective is the use of a Panjet (Wisniewski *et al.* 1980). This device is used to eject a small quantity of liquid under high pressure, so that it penetrates skin. In the past it was used by dental surgeons as a needle-free means of delivering anaesthetic, and it is now used by fisheries workers to mark fish. It has also been used to force biological stains, such as alcian blue or methylene blue, into the skins of amphibians, to leave a permanent mark. It has successfully been used on natterjack and common toads. It can be used as a single mark, or to give a limited combination of codes, by coding marks on different body locations (Figure 4). Its major limitations are that the pressurised delivery system is powerful enough to damage small animals, such as metamorphs or juveniles, and it delivers liquid over a relatively wide area. Caution should be exercised, as it will also mark human skin. Panjets are supplied by Wright Health Group Ltd.,

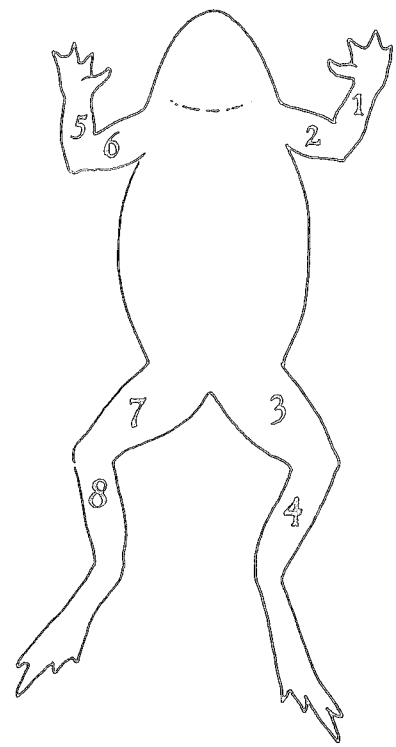


Figure 4 Marking position on underside of toad, used by Wisniewski *et al.* (1980).

Kingsway West, Dundee, DD2 3QD, telephone 01382 833866, fax 01382 811042. As a guide to cost, a Panjet costs £281.84 (excluding VAT) (1997 price). Alcian blue or methylene blue can be purchased from biological or chemical suppliers.

Fluorescent dyes have been sprayed into the skins of amphibians (Heyer *et al.* 1994), but their effects have not been assessed on herpetofauna in Britain.

The effects of the branding of marks on reptiles have not been evaluated.

4.4.7 Passive integrated transponder (PIT) tags

PIT tags are small electronic devices encapsulated in glass. These measure about 12 mm by 2 mm and are the system used increasingly widely to mark dogs and other domestic, farm, zoo and laboratory animals. The tags do not have their own power supply but are read by an electronic scanner. Each tag has a unique number, which is read by the scanner; the scanner can also store date and time information for subsequent reading to a computer. Tags are implanted by a syringe (they come packaged inside sterile hypodermic needles) either subcutaneously or into the peritoneum.

The technique has been used successfully on small newts in continental Europe (Fasola, Barbieri & Canova 1993; Faber pers. comm.), and in the UK promises much potential for use on newts, provided they have attained the size of adult smooth newts. However, so far the tags have been injected into anaesthetised newts, which in the UK necessitates Home Office licensing. Smaller PIT tags may be produced in the future, which may facilitate easier injection (no anaesthesia required) into small and medium-sized newts. The long-term effect of PIT tags on newt mortality in the wild is not known.

PIT tags have also been used on toads, great crested newts and the three snake species in Britain (Reading 1996; C. Cummins pers. comm.). The nature of the skin and musculature of slow-worms suggests they should not be used on this species. Injecting PIT tags is considered 'injurious' and therefore a licence is required from the SNCOs to use this technique on any reptiles or protected amphibians. When using PIT tags consideration must be given to the welfare of the animal – especially as the long-term effects on animals are unknown. Another practical consideration is the possibility of PIT tags becoming dislodged and lost from the animal.

PIT tags are marketed in Britain by Trovan, U.K.I.D. Systems Ltd., Riverside Industrial Park, Preston, Lancs PR3 0HP; Fish Eagle Co., Lechlade, Glos, GL7 3QQ; and Labtrac Ltd., Holroyd Suite, Oak Hall, Sheffield Park, Uckfield, East Sussex TN22 3QY. Different systems are not compatible. The PIT tags are approximately £3–£5 each, but scanners can cost £300–£1,000 (1997 prices).

4.4.8 Relocation techniques

Radio-tags: both reptiles and amphibians have been radio-tracked in Britain. Transmitters used on these species tend to have quite short battery lives – anything from 10 days to a maximum of 3–4 months. The range of the transmitter will depend on the size of the aerial and the nature of the terrain. Generally ranges are less than 200 m. These limitations are consequences of attaching small batteries to keep the weight of the units to a minimum. These transmitters, with waterproofing and battery, usually weigh at least 2.5 g. As a guide, transmitters should be less than 10% of the body weight of the study animal. The permitted wavelength for radio-transmitters in Britain is 173.20–173.45 MHz. Receiving systems usually consist of a hand-held aerial and portable receiver. Attaching low power devices does not require a licence from the Radio Communications Agency but high power devices may need licensing. Advice on this should be sought from the manufacturers of radio-tracking equipment.

Transmitters can be force fed (e.g. to common frogs and toads (Oldham & Swan 1992) and smooth snakes (Bont *et al.* 1986)), fitted externally with surgical adhesive tape (e.g. sand lizards (Dent 1986), smooth snakes (Gent & Spellerberg 1993) and for all three British snakes with cloacal lead and thermistor attachment (Gaywood 1990)), mounted on a harness (e.g. toads (Nuland & Claus 1981)) or surgically implanted (e.g. natterjack toads (Denton 1991); grass snakes (Brown 1991)). All of these methods have their difficulties and limitations; their success may depend upon the activity of the animals, the habitat in which they live and the frequency with which animals are observed. A Home Office licence will be required if transmitters are to be implanted surgically or anaesthetics used during attachment. The effect of attachment/implantation of transmitters on the animals must be considered. This may affect the validity of results and, importantly, may injure the animals or make them more vulnerable to predation.

Radio-tags cost around £73 ex. VAT each; the receiving equipment will cost approximately £490 (1997 prices). Radio-tracking equipment can be obtained in Britain from Biotrack Ltd., Stoborough Croft, Grange Road, Stoborough, Dorset BH20 5AJ.

4.5 Conclusions and recommendations

For the majority of studies, animals are best identified using their natural body markings. In most cases individual animals can be recognised by recording natural marking patterns and scarring.

Marking by paints and dyes is likely to have a value only for very short-term studies.

Toe or scale clipping is simple and cheap, but the possibilities of adverse short and long-term effects and the need for licensing make this less popular.

Where large populations are being studied, or where intensive research makes individual identification imperative, PIT tags seem to offer considerable potential for many but not all species.

Acknowledgement

John Baker wishes to acknowledge the helpful advice of Rob Oldham in preparation of this chapter.

Chapter 5 Prevalent threats to conservation status

Trevor Beebee and Keith Corbett

5.1 Introduction

This chapter describes the range of threats that amphibian and reptile populations face in Britain. It does not cover each threat in great detail, but instead describes the issues that a 'herpetofauna worker' will encounter when pursuing local conservation issues. Threats to sites are explained in more detail in Chapter 8.

Conservation status in the current context means the size and likely persistence of populations of animals and their habitats. Thus, threats to conservation status are those factors which currently reduce either the animal populations or their habitats, or have the potential to do so in the future. It is worth noting that the EC Habitats Directive also employs the term 'conservation status' to guide conservation action for the species and habitats that are listed on the Annexes to that legislation. The conservation status of a habitat means the *"sum of all influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and function"*; the equivalent definition for the conservation status of a species is *"the sum of influences acting on the species concerned that may affect the long-term distribution and abundance of its population"*. Significantly, the conservation objectives of the Directive are to ensure that the conservation status of the listed species and habitats are maintained at a 'favourable' level; the concept of 'favourable conservation status' therefore looks to ensure that the species and habitats are not suffering significant reductions in range or viability or are improving in status.

5.2 Amphibians

5.2.1 General threats to conservation status

Threats to amphibian populations can be categorised as shown below, although the boundaries between each category are not always clear and a degree of subjectivity arises, for example, when deciding whether afforestation constitutes habitat loss or habitat modification. The categories are nevertheless convenient and are given in descending order of importance.

- Habitat loss
- Habitat change
- Pollution
- Direct effects of humans
- Other factors

Habitat loss

Amphibians are particularly vulnerable to habitat destruction because they require two distinct and sometimes geographically separated habitats, notably water for breeding and terrestrial habitats for foraging and hibernating. Loss or serious damage to either results in decline or local extinction of the amphibians dependent upon them.

Ponds have disappeared from the countryside at an alarming rate, and for a number of different reasons.

- Deliberate infilling to accommodate other land uses, such as the construction of new roads, housing estates and factories or to enlarge agricultural fields, has been a continuing cause of habitat loss for many decades. More recently, the pressure to acquire landfill sites for the disposal of domestic rubbish has led to the destruction of ponds in old quarries, pits and mineworkings.
- The increased demand for water has, in some parts of Britain, resulted in increased abstraction from ground aquifers and the loss of ponds by consequent lowering of the water table. Some ponds have also been lost when water tables have been lowered locally for other reasons, for example as a consequence of quarrying or mineral extraction.
- Arguably the most serious threat, however, has been neglect. Today, watering troughs have largely replaced the traditional managed ponds for the watering of livestock. Farm and village ponds have become lost as a consequence. In the absence of positive management, ponds will disappear through the natural processes of ecological succession.
- Finally, ponds are occasionally lost during coastal erosion. This problem affects particularly interesting types of ponds (such as dune slacks) and may increase if sea levels rise as a result of global climate change. Ironically, in some cases the loss of dynamic marine processes (e.g. creation of sand dunes or sand bars), perhaps as a consequence of coastal protection, can mean that natural processes that create ponds are lost. Fewer ponds are created now than would have been the case prior to World War II. They are neither required as a water source nor created as a consequence of small-scale mineral extraction (e.g. marl pits).

Terrestrial habitat destruction is also important in threatening both amphibian and reptile populations. Direct habitat loss through development, for example for roads, housing or industry, clearly reduces the availability of habitat for amphibian species. Other land-use changes, especially the conversion of heathland or sand dune into conifer plantation and the turning over of pasture to arable land, may be equally damaging. Natterjack toads in particular suffer as a consequence of afforestation because of their requirement for open, unshaded habitats; and all the five commoner species are threatened by arabilisation, as the intensity of land use (mechanical ploughing, reaping and agrochemical applications) precludes the development of a stable ecosystem in which they can thrive. Both of these types of terrestrial habitat destruction have been very widespread in Great Britain for 50 years or more. The direct conversion of countryside into urban districts creates difficulties for amphibians; however, at least four species (common frogs and toads, smooth and palmate newts) do well in gardens and have benefited from the vogue for garden ponds. Urbanisation poses a continued threat to both terrestrial and aquatic habitats of the other two, more endangered, amphibian species and all species of reptile. A more subtle impact of habitat loss is the reduction in size of the remaining areas. These smaller 'fragments' are more vulnerable to habitat change, and the populations of reptiles and amphibians, being both smaller and more isolated, are at greater risk of extinction.

Habitat change

Habitat alterations less drastic than complete destruction can nevertheless have serious consequences for amphibians. Particularly undesirable is the addition of fish, of any species, to ponds used by newts or frogs. Tadpoles of these amphibians are very vulnerable to fish predation and populations can be exterminated in this way, although toads are unaffected because their larvae are unpalatable to most vertebrate predators. Equally bad is the overstocking of ponds with ducks or other wildfowl; some, such as mallards, prey on amphibians directly or damage or remove vegetation, but they also can cause gross eutrophication as a result of the burden of their excreta. Tadpoles can be killed by the consequent state of oxygen depletion. These problems are widespread in Britain.

Overdeepening of previously shallow temporary ponds also has substantial effects on pond ecology and can tip the balance against successful reproduction by natterjack toads. Invertebrate predators of natterjack

tadpoles become more abundant in permanent ponds, to the extent that few or no tadpoles survive to metamorphosis. Conversely the lack of management of ponds will result in a deterioration in their quality. For example, ponds may become silted up, or shaded by the growth of trees around the pond.

Some changes will be detrimental for some species, but less so, or even beneficial, for others. For example a subtle but dangerous change is the simple cessation of grazing by domestic livestock. In consequence terrestrial habitats become much more rank and densely vegetated, and are thus rendered unsuitable for use by natterjack toads. Such consequential changes can benefit species such as the common toad, at least in the short term. Even subtle changes can tip the competitive balance in favour of some species to the detriment of others.

Pollution

Having absorbent skins, as well as aquatic larvae, amphibians may be at particular risk from some types of pollutants. A number of chemicals are known to affect them, though in most cases problems are likely to arise as isolated incidents rather than as more general threats. Examples include oil spills on ponds and waterways, which are highly toxic to both adults and larvae; excreta, when present in large quantities, from domestic animals grazed at high densities around breeding ponds; agrochemicals; and acid rain.

Extensive studies with insecticides and herbicides have shown that at least some (such as DDT) can have effects on larval and adult amphibians, but except at very high doses these effects are usually sub-lethal; they may affect behaviour, or cause developmental abnormalities, but do not kill the animals directly. Only one or two chemicals used in freshwater fisheries (TFM and formalin) have been shown to cause high mortality in amphibians (Hall & Henry 1992). It is therefore very difficult to say what the consequences of pesticide applications on amphibians in the wild are likely to be, but since they are usually used in areas of intensive arable farming the question may be largely an academic one. Other aspects of arable farming are usually enough to eliminate or severely reduce amphibian populations in any case. It has been shown that nitrate fertilisers can be highly poisonous to adult and larval amphibians and these widely used chemicals may pose a more serious threat than pesticides.

Acid rain affects considerable areas of England, Wales and Scotland. There is little direct evidence that the five common amphibians have suffered significantly from it, but there is every reason to remain vigilant, especially in hard rock areas, which are the most susceptible to acidification (Fry & Cooke 1984). Mortality of frogspawn, probably due to episodic acidification, has been seen in south-west Scotland (Cummins & Ross 1986; Cummins 1994), but frog populations have persisted even in the worst-hit areas, perhaps because there are a wide variety of breeding sites in such wet places and fortunately not all suffer from acidification. Acidification of some heathland ponds in England, however, has probably been partly responsible for natterjack toad declines and continues to pose a threat to some extant heathland populations (Beebee *et al.* 1990).

Direct effects of humans

Some human activities affect amphibians in very direct ways. The problem of toads on roads is well known, and motor traffic must kill hundreds of thousands of amphibians (mainly common toads) annually. Road gully pots trap and kill large numbers as well. The increasing levels of traffic may be putting the most exposed populations at risk. Another direct effect of humans is the taking of eggs, tadpoles and adults every spring, either casually for personal interest or occasionally on a commercial basis to supply research and education establishments. There is no evidence to suggest that these depredations have had significant impacts on amphibian populations (Cooke, Morgan & Swan 1990), though intense exploitation could have local effects even on these reproductively prolific creatures.

Other factors

Disease, particularly of common frogs, has ravaged some populations (mainly in gardens) in recent years. Although bacteria and viruses have been isolated from afflicted animals, the primary causative agents remain unknown. If pathogens are directly implicated, it is unclear whether disease outbreaks are a natural population-regulatory mechanism, or new, more virulent strains, or one factor in a cumulative effect with several causes. The effects so far have been local (mainly in south-east and central England) and some individual frogs at least seem to survive outbreaks.

A problem discovered recently in North America is the effect of increased ultraviolet light intensity, following damage to the ozone layer, on spawn mortality in species living at high altitudes that lay eggs in shallow water exposed to the sun (Blaustein *et al.* 1994). Whether UK species have been affected is not yet known, but both the common frog and the natterjack toad could be particularly vulnerable.

5.2.2 Species-specific threats to conservation status

Smooth newt

No agents selectively affecting this species are known, and it remains among the most successful and widely distributed of all European amphibians. It is of course vulnerable to pond loss but can breed successfully in surprisingly small water bodies and seems marginally less vulnerable to fish predation of its larvae than the other newt species.

Palmate newt

No agents acting specifically against palmate newts are known. This species does fare particularly well on heathland, however, and continued loss of this habitat is likely to reduce its numbers in parts of southern England. Its larvae are also vulnerable to fish predation.

Great crested newt

Great crested newts are more vulnerable than the other two newt species to urban development, because they rarely adapt to small garden ponds. They are especially at risk from the addition of fish to ponds because their larvae are highly vulnerable to fish predation as they are active swimmers, rather than staying unobtrusively in weed or at the bottom of the pond. Finally, large populations of great crested newts often occur in old sand and clay pits and coal and chalk quarry ponds, and are therefore threatened by landfill and other activities that destroy these habitats.

Common frog

Frogs may be at special risk from nitrate applications, which are frequently carried out at the time of year in which frogs are migrating to their breeding ponds. The addition of waterfowl or fish to frog ponds is also likely to be problematic, and frogs (adults and spawn) are collected by humans on a larger scale than any other amphibian species. Disease, especially in garden environments where frog population densities are high, is also a special problem.

Common toad

Road traffic mortality is the threat most specific to this species, which often migrates long distances, in large numbers, to breeding sites in spring. Because toads are more selective than frogs with respect to choice of breeding pond, and possibly more 'site faithful', they are also more at risk from pond loss; destruction of a toad breeding site can eliminate the species over a relatively large area.

Natterjack toad

Natterjacks are at special risk from overdeepening of ponds and, at the other extreme, from premature pond desiccation if water abstraction lowers groundwater aquifers. Acid rain on heathland sites is considered to be a particular problem. A major problem is reduction in quality of terrestrial habitat, notably following the cessation of grazing, and such changes in management can render areas totally unsuitable for this species. Competition from the more widespread species, notably the common toad, poses a significant difficulty that is frequently associated with the terrestrial habitat becoming more vegetated.

5.3 Reptiles

5.3.1 General threats to conservation status

Reptiles need a diversity of habitat structure: providing cover and food, yet open enough to allow a variety of basking areas adjacent to refuges, for example lightly bushed grassland, tussocky vegetation, deep and leggy heather. Changes in agricultural practices, forestry planting, urbanisation and recreational pressures can all alter, fragment or destroy such habitat, but there are many other, less obvious, threats to reptile habitat that can result in local and more widespread declines.

As well as the overall loss of habitat, the loss of linear features that act as corridors between areas occupied by reptiles exacerbates the threats to reptile populations. Reptiles are poor colonisers across unsuitable terrain. The effects of a fragmented landscape are that there is a greatly reduced movement of animals between populations and that there is less likelihood of local extinctions being redressed or of recolonisation of areas once suitable conditions return.

Natural habitat succession is a threat to reptiles. Growth of shrubs and trees on open and early successional habitats such as heathland and grassland result in shading-out of basking areas and the loss of the varied structure of the ground vegetation that is so important for these animals. While such succession is a natural process in unmanaged or neglected habitats, it can also be the result of inappropriate planting of landscape or amenity areas, for example associated with urban development or new roads. Equally, 'over management' of landscape features can be a problem. Mechanical flailing and mowing can pose direct threats to reptiles, particularly slow-worms and gravid female snakes, when done on warm days in spring or summer. It is likely that such management is an important reason why many road banks, verges and forest rides fail to become the reptile reservoirs they are reported to be in other countries (Zuiderwijk, Smit & Kruyntjens 1992).

Perhaps ironically, some nature conservation management measures can be detrimental to reptiles or to the habitat features on which they depend. For example, some methods employed for re-establishing botanical diversity, such as grazing, mowing or burning of heathland or grassland, may have an adverse impact on reptiles. Grazing may result in disturbance of reptiles or, in the case of the sand lizard, trampling of its eggs. It is more likely to be a problem when vegetation is over-grazed or trampled and the structure is lost, or where soil enrichment through dung causes an adverse change in vegetation. Both mowing and burning can directly kill reptiles or result in the loss of suitable habitats. While such methods may be justifiable in some cases, it is important that the needs of reptiles are considered and that the extent and timing of the operation is sympathetic to the needs of these species. For this reason a habitat management 'calendar' has been produced (by the Dorset Heathland Forum) (Chapter 6) to guide heathland management and to reconcile the needs of the different groups of wildlife. While specifically produced for heathland, this 'calendar' could provide a useful model for other habitats.

Another threat to reptiles arises from gassing burrows for rabbit control. This is especially so if carried out in winter, since reptiles will use rabbit burrows as hibernation sites. The practice of stopping burrow entrances during fox-hunts can also put any reptiles using the burrow at risk. While fox-hunting rules require that stopped holes are usually unstopped after the hunt, this need not apply to holes that are loosely stopped with earth. However, even loosely stopping holes and burrows, from which mammals can usually burrow, will prevent hibernating reptiles that are using these features from emerging the following spring.

Secondary effects of urbanisation also pose a threat. Domestic cats are a major predator on reptiles, not just within the garden but more significantly on all adjacent 'rough habitat'. All reptile species are known to be preyed on by the pet cat. The combination of a cat's hunting instincts and the relative ease with which reptiles can be caught reduces the status of any neighbouring reptile population.

Young children can also be very good at catching and collecting reptiles and could potentially remove significant numbers. Fortunately, such hobbies tend to be short-lived and provided that the site is not too small, reptile populations can usually recover. Where this is a problem there may be scope for schools to encourage activities more appropriate to reptile conservation.

Post-extraction use of quarries and other such workings may also be a threat. While in time these would often naturally develop into ideal reptile habitats as vegetation cover develops, increasingly these features are 'restored' to agricultural use or used for landfill; in the past 'restoration' to agriculture was often required as a condition of the mineral extraction licence. More recently, however, the subsequent use of these sites as nature reserves is becoming more common.

Whatever the causes, or combination of causes, reptiles are becoming less common in many areas. The sunny sides of hedgerows, field banks and stone walls have long been known as the haunts of the more common reptiles and in particular the common lizard and the slow-worm. In many places this no longer appears to be the case. It is therefore important that the reasons for these local declines are identified and addressed, otherwise there is a danger that these once widespread animals will simply disappear from a large part of their ranges.

5.3.2 Species-specific threats to conservation status

Sand lizard

The sand lizard is restricted to two habitat types, lowland dry heath and coastal sand dunes. Both these habitat types are themselves under threat and the sand lizard is therefore vulnerable to the many adverse

pressures from their loss and degradation. Within these habitats sand lizards are associated respectively with the older, more mature stands of heather, and the deeper tangled marram grass zones. The animals and these habitats are directly at risk from fire. After a fire the vegetation structure may take many years to recover, while repeated fires threaten permanent degradation from the fast-growing competitors of both heather and marram grass. Both habitats are also liable to damage from recreational uses or grazing by horses or cattle, which cause many problems such as the trampling of vegetation and egg-laying sites.

The sand lizard's need for insolated sand exposures for egg laying and incubation is often met by way of paths, tracks or erosion features. Although foot pressure alone does not appear to threaten the shallowly buried egg clutches, there is no doubt that eggs and female lizards searching for egg laying sites or in the process of laying are seriously jeopardised by hooves and wheels. The recent rapid growth in mountain biking poses a notable threat.

The loss of the older female lizards, through predation by cats or as a result of collection or recreation/trampling pressures, is now recognised as having an important impact on the survival of populations (Strijbosch 1988).

Smooth snake

The smooth snake, like the sand lizard, is confined to lowland heath. The fact that it is longer lived and farther ranging is thought to explain the better survival of individuals following fires. However, the losses of individuals, favoured habitat and reptile prey through fire are clearly adverse factors that may affect the long-term survival of populations. As a comparative rarity and an attractive snake it is possible that it may be subject to illegal collection and keeping. Rubbish can present artificial but reptile-friendly refuges in the shape of discarded or placed metal, wood, or plastic boards under which inquisitive children, collectors (and surveyors) can find smooth snakes, thus making them more vulnerable to disturbance or collection.

Adder

Adders tend to exhibit summer migrations from drier ground to damper feeding areas such as water meadows, ditch sides, wet heath and bogs. Tussocky vegetation such as sedge, rush or *Molinia* clumps then become integral components of their habitat. Viviparous lizards are now known to hibernate within such tussocks even when apparently water-logged. Any uncompromising management to clear such 'unwanted' vegetation is a threat to these species. Fragmentation through loss or unsympathetic management of adder habitats may provide direct threats to adders and affect their migration behaviours.

Grass snake

The grass snake is an egg-laying species which in temperate climates is dependent upon the heat generated by decomposing vegetation for incubation. Before the taming of lowland rivers, this would have been provided naturally by floods depositing weeds, emergent vegetation and associated debris. Historically, humans had then coincidentally but successfully replaced such incubation sites with dung, compost and saw-dust heaps, most of which have more recently become obsolete. On farms, especially as a consequence of increasingly intensive livestock rearing systems, manure is more frequently kept in concrete tanks and is therefore not piled into heaps that can be used by grass snakes. These relatively recent losses of breeding habitats can be seen as contributing significantly to this species' reported decline. Compost heaps in gardens and allotments can be of use where they are in reach of grass snake populations. However, sometimes the positioning or construction of the heaps makes them inaccessible to grass snakes; in other cases where the heaps are used they may be spread during the summer, eggs and all, on to gardens and vegetable plots.

Declines in rural amphibian populations and their important but now obsolete field and farm pond habitats must also be a factor in the decline in grass snakes. This situation could be exacerbated by the removal of the close fishing season for coarse fish on inland waters. Grass snakes tend to congregate around such waters in the spring to coincide with amphibian breeding. This crucial hunting and basking period may be put at risk by increased disturbance. There could also be an increase in stocking and fishing of waters as yet undisturbed.

Recent legal protection for the adder at last removed the excuse for killing or injuring of snakes and slow-worms 'in case they are adders!'. However, old habits die hard and snake killing certainly continues (Foster 1994), and without intensive effort it may take a generation or so for this practice to die out.

Chapter 6 Habitats and their management

David J. Bullock, Rob Oldham (Amphibians)

Keith Corbett (Reptiles)

6.1 Amphibians

As a general rule, but excluding the natterjack toad, the greater the number and variety of water bodies and terrestrial habitats in the landscape, the greater the chance of successfully managing for an appropriate local assemblage of amphibians. However, no single habitat management prescription is likely to benefit all of the five widespread species to the same extent. For example, breeding sites for the great crested newt tend to be small, nutrient-rich ponds that occasionally dry out and are consequently free of fish, which are important predators of their larvae (Oldham & Nicholson 1986). In contrast, the common toad successfully breeds in large permanent water bodies, which often contain fish and can vary greatly in their trophic status. Similarly, terrestrial habitat requirements may differ markedly between species. In the past, habitat management for amphibians (including translocations in the face of development – Chapter 9) has focused on the aquatic breeding sites of local populations. However, in managing habitats for single (isolated) populations, or a group of local populations that possibly comprise a metapopulation, aquatic and terrestrial elements cannot be treated separately: their management must be integrated.

In this review, the quality and relative position of water bodies and their surrounding terrestrial habitats that underpin successful breeding and population persistence of amphibians are described (Figure 1). Consideration is given to the planning of habitat management for amphibians, followed by information on general and species-specific habitat requirements. Further sources of information are Swan & Oldham (1993a) and Bray & Gent (1997).

6.1.1 Planning habitat management

There are several essential prerequisites to habitat management, especially where colonisation/ recolonisation or translocation of amphibians is envisaged.

The objectives of management should be unambiguous. At the landscape level, amphibian habitats can be identified during the preparation of structure plans or part I of unitary development plans. Statutory organisations are currently developing management objectives for areas on the landscape scale (e.g. English Nature's Natural Areas). In the UK, the problem of the fragmentation and isolation of habitats required by amphibians and other taxa is well documented (e.g. Dover 1994 and Chapter 5), and a landscape scale of approach should, in the long term, be beneficial. An alternative approach is to use river catchments as a management unit. The Environment Agency is developing local Environment Agency catchment management plans in all their Regions.

The draft plans, which may include setting water quality targets and identifying water bodies that are vulnerable to leaching/run-off from agricultural fields, can be consulted and management for amphibians incorporated at an early stage.

For all large-scale management schemes, or when amphibian interests form part of a larger programme, it is advisable to prepare and adhere to a management plan. The basic format of a management plan for a site of nature conservation interest (Nature Conservancy Council 1988) has been adapted to suit local needs by many organisations, such as the Wildlife Trusts and Local Authorities, including those managing urban environments. Most management plans run for five years and have three main parts:

- General information, which includes location, ownership and designation (e.g. SSSI status) of the site;
- Conservation status, in which the nature conservation interests are described, evaluated and used to produce ideal management objectives. Constraints on ideal objectives are identified and operational (realistic) objectives produced, together with outline prescriptions as to how these can be met;
- Prescription, where details of projects and an annual work programme are provided.

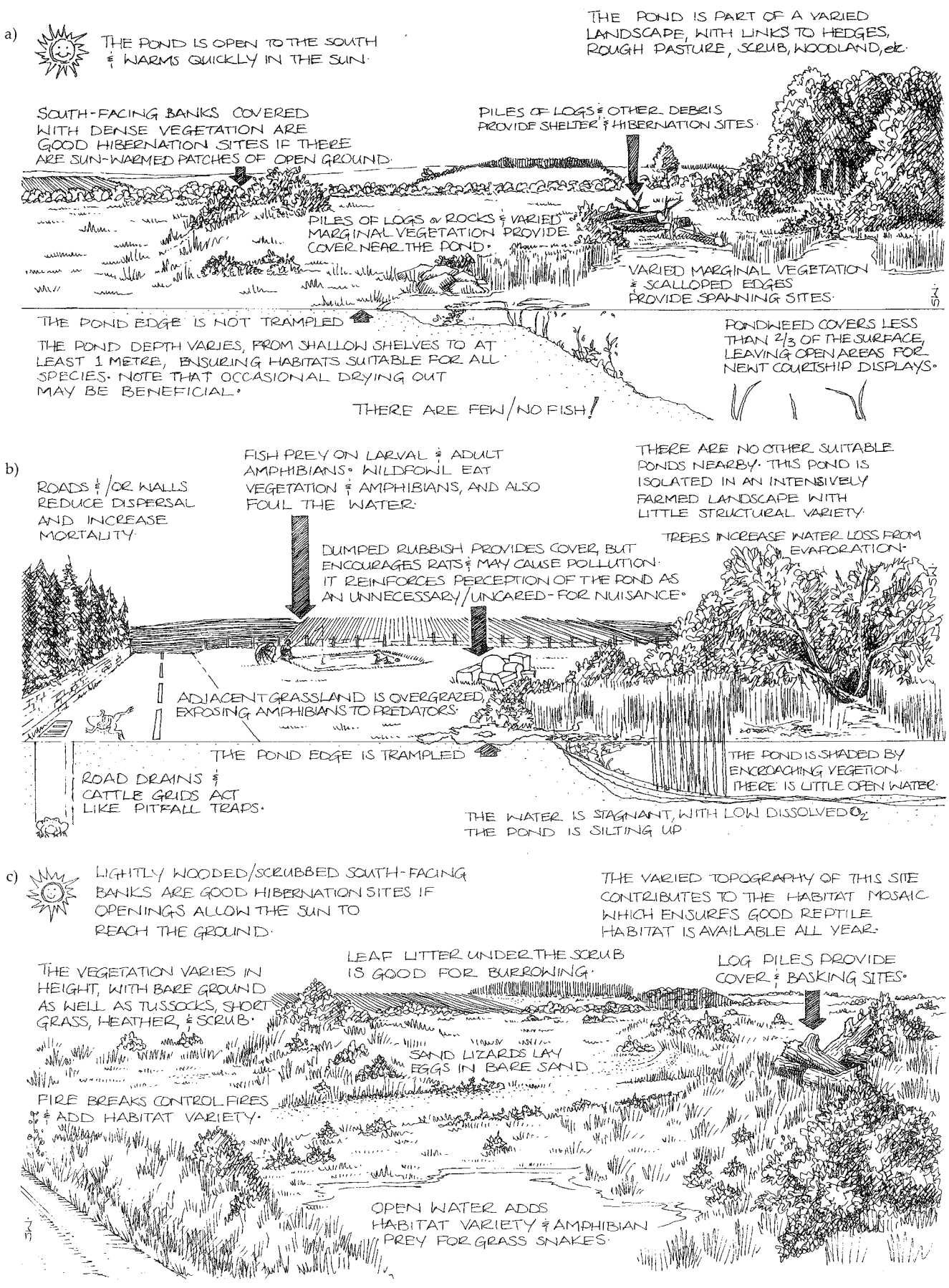
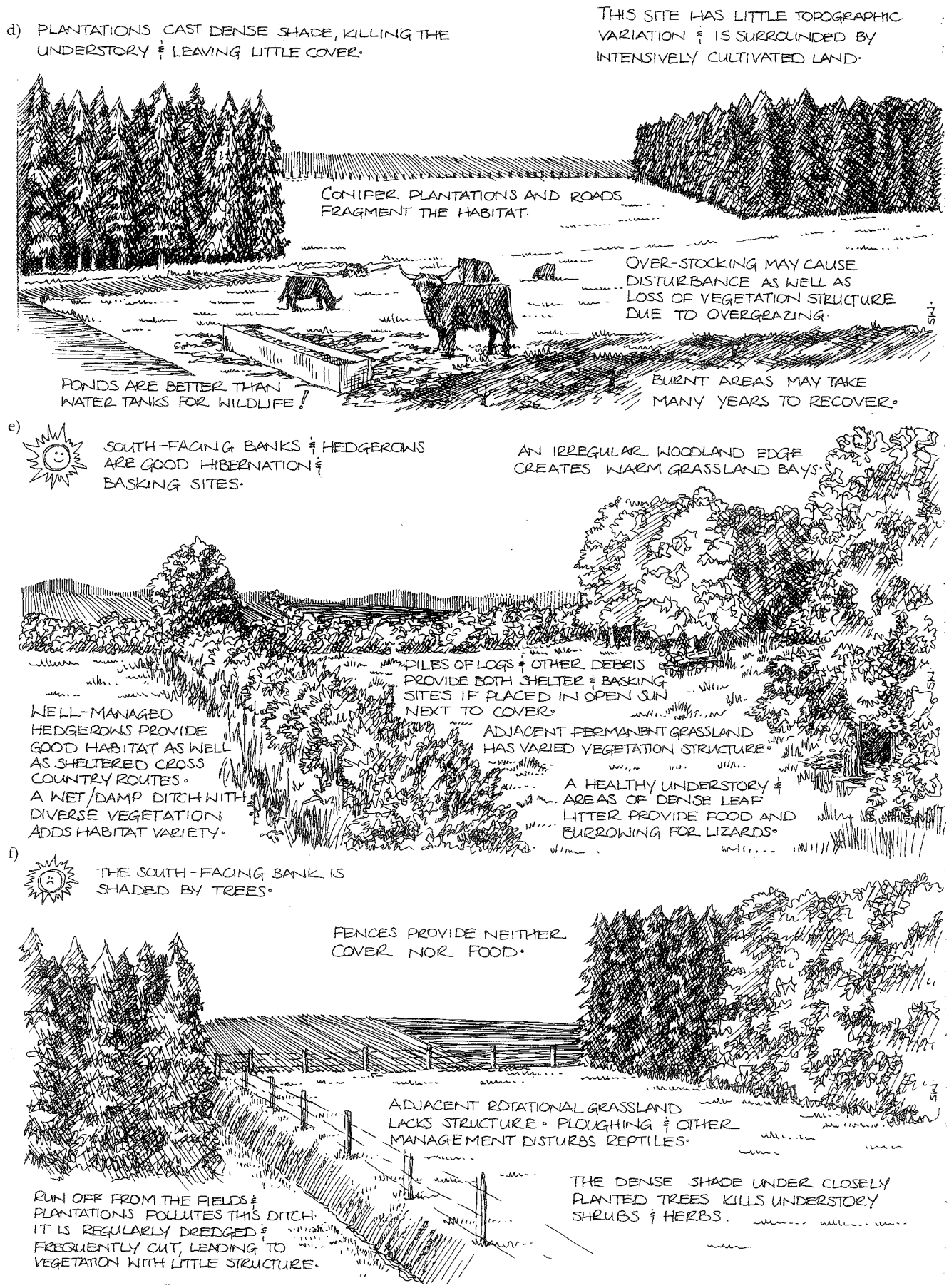
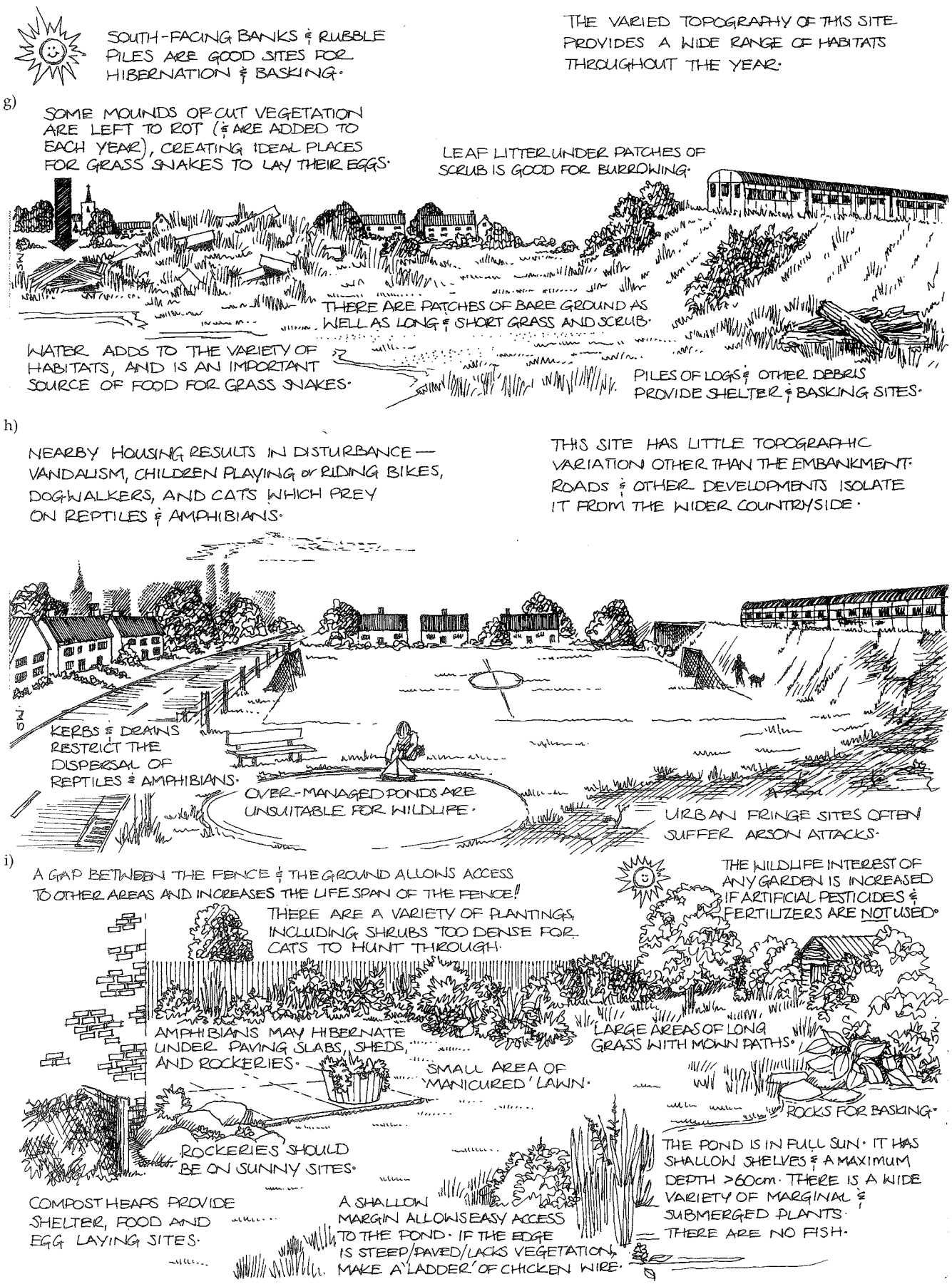


Figure 1 Habitat management for reptiles and amphibians. a) Site in countryside showing a series of positive features for amphibians. b) Site in countryside showing a series of negative features for amphibians. c) Site in countryside showing a series of positive features for reptiles.

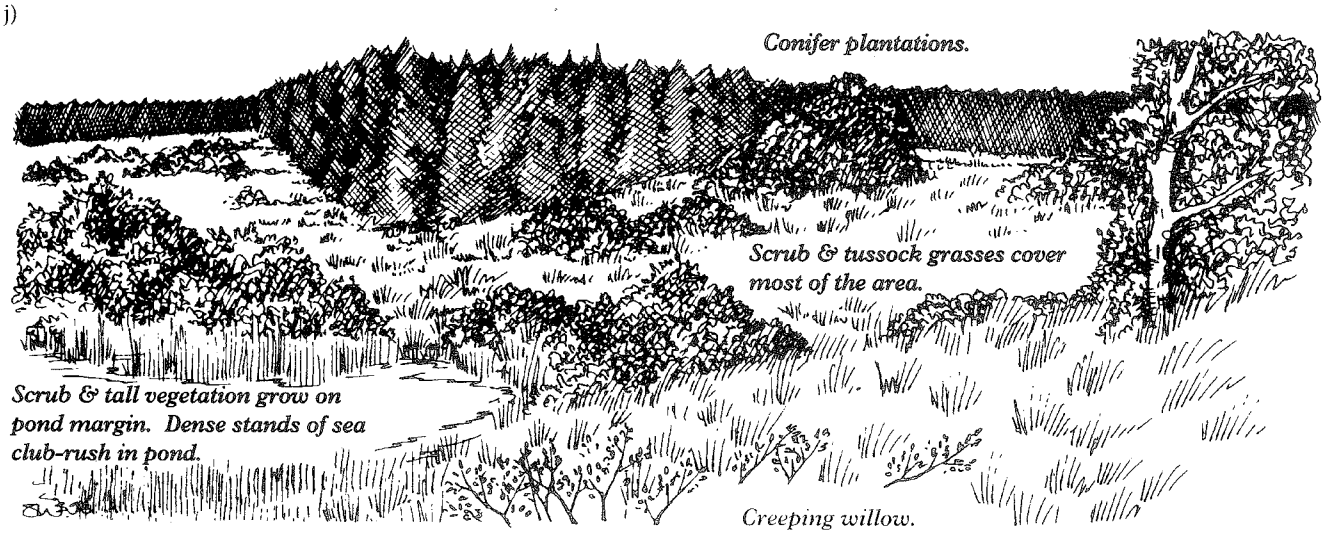


d) Site in countryside showing a series of negative features for reptiles. e) Wood margin site in countryside showing a series of positive features for reptiles. f) Wood margin site in countryside showing a series of negative features for reptiles.



g) Urban site showing a series of positive features for amphibians and reptiles. h) Urban site showing a series of negative features for amphibians and reptiles. i) Garden showing positive features for amphibians and reptiles.

j)



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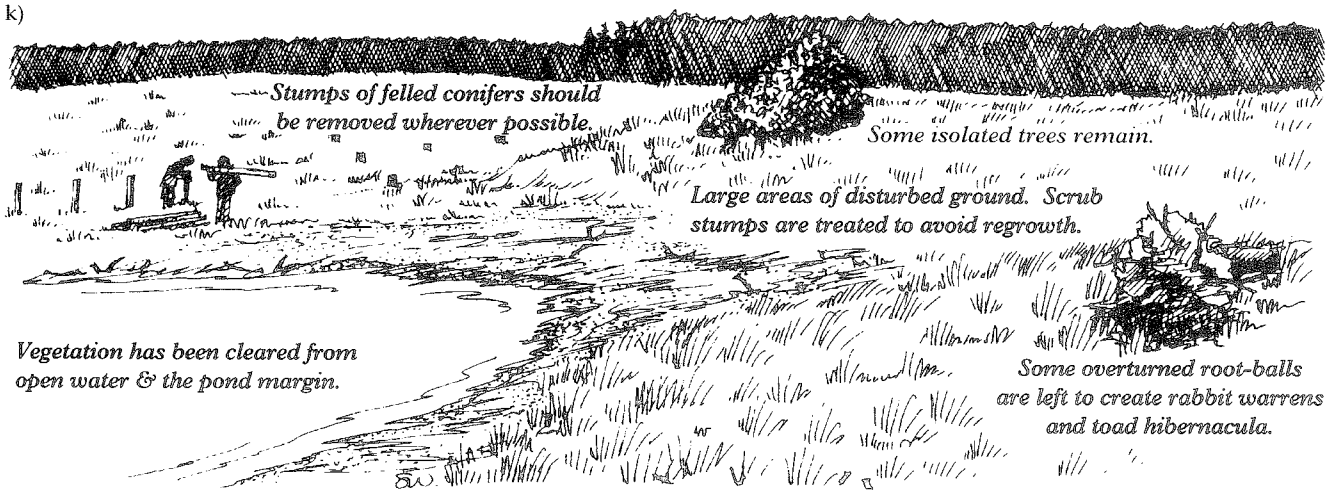

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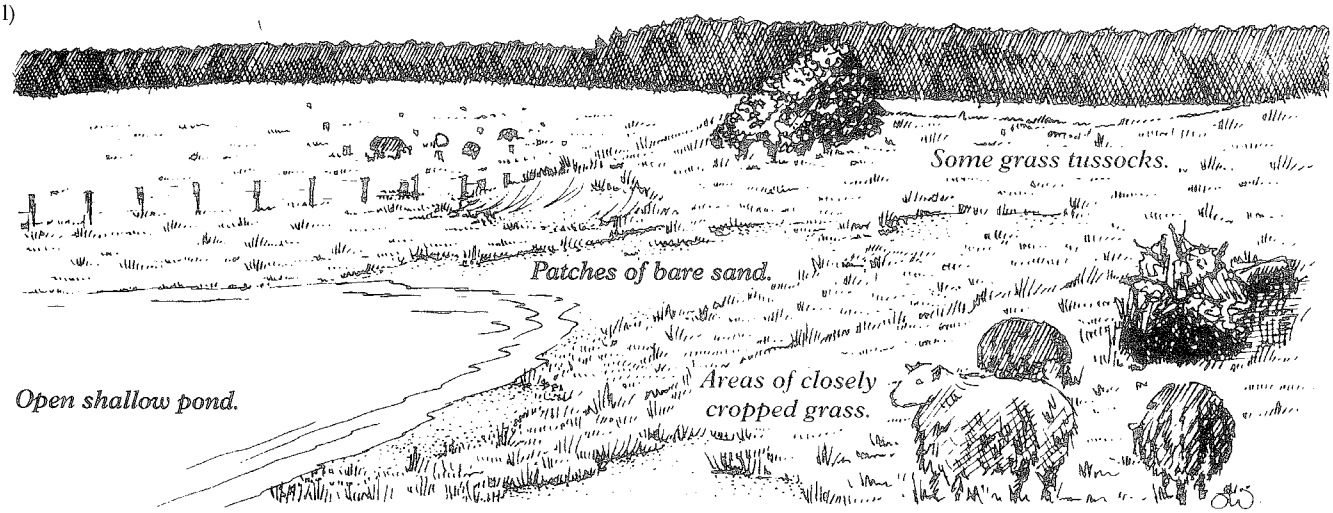
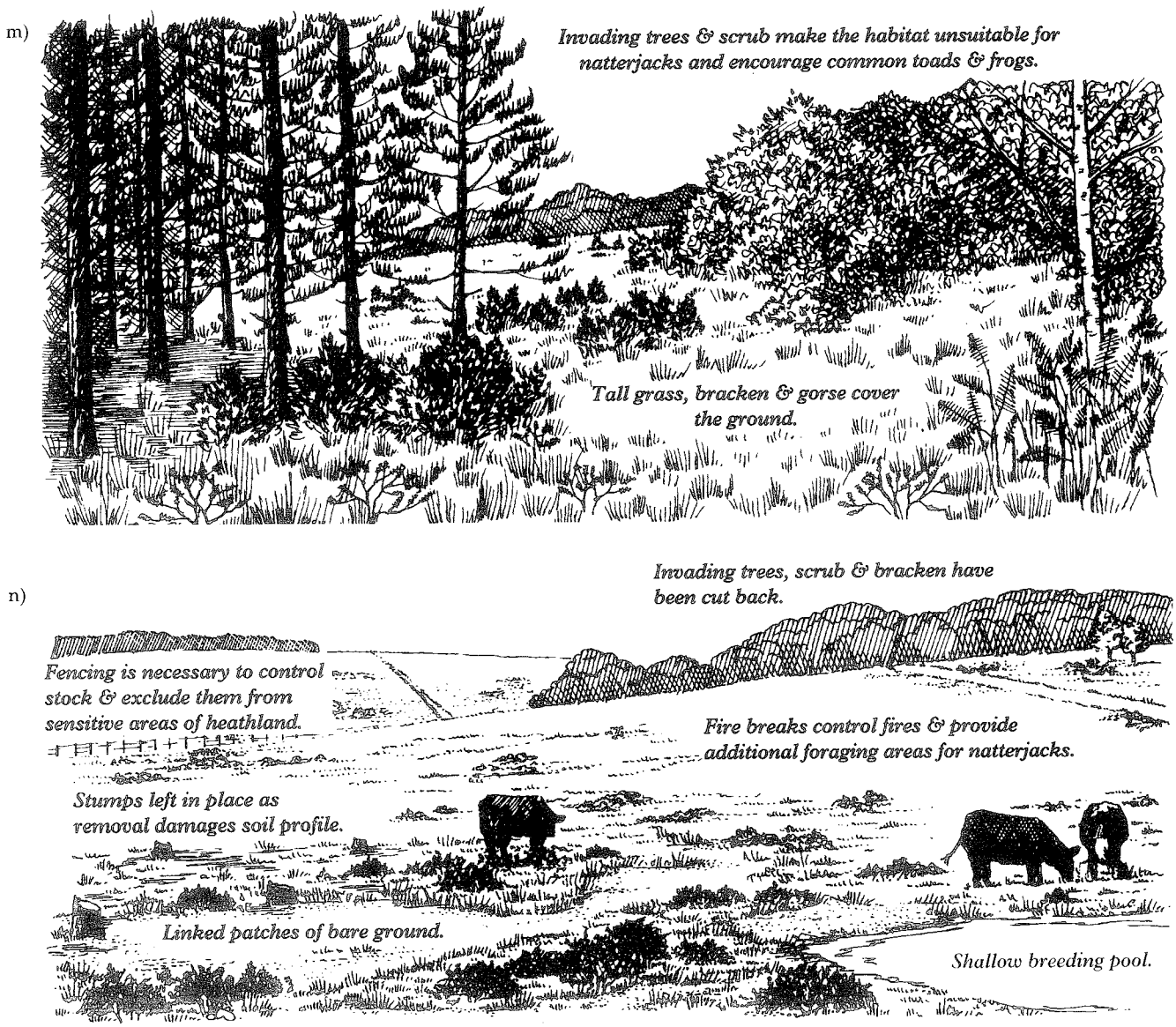


j) Dune habitat showing negative features for natterjack toad. k) Remedial management of dune habitat for natterjack toad. l) Sustainable management of dune habitat for natterjack toad by grazing.



m) Heath habitat showing negative features for natterjack toad. n) Sustainable management of heathland site for natterjack toad by grazing following tree removal.

The Biological Records Centre (BRC) holds a national database on the five widespread British species, and distributional data on the natterjack toad are also available (Beebee 1990). In addition, local recorders can be contacted through the *Herpetofauna Workers Guide* (Becket & Foster 1997) or through the Common Species Co-ordinator based at Froglife. Evidence of sites of former ponds, and pond loss rates, can often be found by comparing first series Ordnance Survey and other old maps with up-to-date ones. If it is known that a species was present but has declined or become extinct, it is important to know the factors that caused its demise and whether there are local populations nearby that can provide colonists to a restored or new breeding site. Details of status, including protective legislation, are given in Gent (1994a) and in Chapter 7. Survey methods are described in Gent (1994b) and in Chapter 1. Further details of the management of garden ponds for amphibians are dealt with in Chapter 11.

Water bodies and their position in the landscape

Amongst the five widespread species, the common toad can be expected to migrate farthest from the breeding sites, although the maximum straight line distance travelled on land is unlikely to exceed 1,000 m. For the newts, distances are less. The great crested newt usually uses terrestrial habitats within 500 m of the breeding site and the optimal density of breeding sites (such as ponds) should be between 5 and 10 per km^2 with a minimum of 1.0 per km^2 (Oldham 1994); this could be used as a guide for other less specialist species. However, it should be emphasised that pond occupancy may depend on the quality of the terrestrial habitat between ponds. Where this is sub-optimal, a higher pond density may be needed. Where pond densities are in excess of 10 per km^2, the availability of terrestrial habitats may become limiting even if their quality is high.

In terms of the terrestrial habitat, the landscape within 1,000 m radius of the breeding site should ideally contain a high proportion of semi-natural habitats such as woodland, scrub and unimproved pasture (Figures 1a and 1b). In arable landscapes, which in general support relatively low densities of amphibians, unimproved habitats of high structural diversity such as gardens, woodland, scrub and rough grassland plus ditches are important habitat elements (Swan & Oldham 1994). Hedgerows vary greatly in their structure and consequently their suitability for feeding and hibernating amphibians, and many in arable landscapes may not be used.

Linear features as routes for dispersal

Specially constructed habitat corridors may increase the rate of either colonisation by amphibians of newly constructed ponds or their dispersal movements between established ones. However, there is currently no evidence to demonstrate that they do. Migration of amphibians between terrestrial and breeding sites is not always along set routes and most agricultural terrain is traversable by adults in suitable weather conditions (Swan 1986; Franklin 1993). Common toad metamorphs emerging from the breeding sites show no affiliation to particular habitats including linear features (Oldham 1985), which in any case vary greatly in their suitability for amphibians. For example, many hedgerows in arable landscapes are of low value even as feeding habitats. However, many paths, ditches and roads provide good feeding habitats and migration routes (Figures 1g and 1h). Acknowledging that they can be useful habitats in their own right, linear features are potentially beneficial in arable or urban landscapes where there are relatively low densities of suitable water bodies and terrestrial feeding sites. However, the provision of suitable habitats within a mosaic of terrestrial habitats in the landscape will generally mean that there is little need for construction of linear features.

In situations where road developments have separated aquatic and terrestrial habitats, specially constructed migration routes such as tunnels or culverts that permit safe passage of amphibians across roadways and other physical barriers may be necessary (Langton 1989a).

6.1.2 Species-specific aquatic and terrestrial habitat considerations

Great crested newt

Great crested newts spend more of the year in water bodies than the other species; and, rarely, populations in steep-sided ponds appear to be permanently aquatic. In agricultural landscapes, they are found in well vegetated ponds that are relatively nutrient-rich, and they are apparently more tolerant of organic enrichment than the other newt species. However, some great crested newts breed in (apparently) nutrient-poor water bodies in mineral quarries and on sand dunes. Fish predation on larvae is a major limiting factor, as is regular drying out of the breeding site (Swan & Oldham 1993a). However, ponds that occasionally (i.e. once every few years) dry out (which kills fish populations) are acceptable. Great crested newts are poor colonisers of garden ponds, and rarely persist, owing to one or more of the following factors: the ponds are too small; fish are present; the surrounding terrestrial habitats are unsuitable. However, gardens may provide important terrestrial habitats when adjacent to breeding sites in fields or similar open areas, e.g. golf courses. Newly created ponds may be colonised rapidly, provided that established breeding sites occur within 350 m of them (Franklin 1993).

On land, great crested newts are associated with rough grassland, scrub and woodland. Arable land within 100 m of breeding sites is associated with low levels of occupancy. Woodland in the vicinity of the water body is beneficial (although it may be detrimental when it abuts the water's edge or shades the pond), and predominantly wooded landscapes can support very high densities of great crested newts (e.g. Franklin 1993). Tree and scrub growth to the south of a pond has a greater effect through shading than in other areas. A limited amount of scrub around the pond margin may be beneficial to great crested newts. Up to 5% shading of the pond surface is valuable, but above that, and certainly as it exceeds 20%, ponds become less useful as breeding habitat for great crested newts (Cooke, Cooke & Sparks 1994).

Smooth newt and palmate newt

The two small newt species use the full range of water bodies and are frequent colonisers of, for example, garden ponds and the shallow edges of lakes. Predation on the larvae by fish may account for their absence in some garden ponds (Beebee 1979); in field ponds, both fish and occasional drying out appear to be tolerated. Landscapes dominated by rough grassland contain the highest proportion of breeding sites occupied by smooth newts. Palmate newts are particularly associated with heathland and moorland sites of low fertility and low soil pH. They are not generally found in lowland agricultural landscapes, where smooth newts are more common, but otherwise the general habitat requirements for the palmate newt are similar to those of the smooth newt and great crested newt. Further information is available in Foster (1997).

In general, the characteristics of water bodies in which palmate and smooth newts breed are very similar, except that the former tolerates much more acidic water than the latter. Some of the features of water bodies and terrestrial habitats used especially by the palmate newt are probably related to its distribution, which is more northern, western and so upland than that of the smooth newt. For example, it tends to be found in deeper water bodies with less shade and less emergent vegetation than the smooth newt, probably reflecting the nutrient-poor status of many upland water bodies.

Common toad

In general, toads breed in large (>500 m^2) water bodies including lakes and slow-moving rivers (especially behind weirs). Although they readily colonise large new field ponds in arable landscapes (J. Baker pers. comm.), this may be more frequent when an established breeding

site of a population has become unsuitable or has been destroyed. Where the main breeding site is still suitable, colonisation of new ponds situated only a few hundred metres from the original one may not occur (R.S. Oldham unpub.).

Heavily shaded sites tend to be avoided, but some pond edge cover that casts shadows may be beneficial in making toads less visible to predators. Emergent and submerged vegetation are necessary for spawning, but ponds should not be overgrown. Fish are tolerated (toad tadpoles are distasteful to fish) and management for fish usually benefits this species. Associated with this, permanence of the water body is often a feature of toad breeding sites. Toad populations can tolerate temporary prevention of breeding. For example, road construction that prevents them from migrating to their breeding site may have little effect on the number returning when conditions improve (R.S. Oldham unpub.).

Provided that the water quality is appropriate, common toads tend to occur where mixed farmland, woodland, flowing and still water, scrub and worked out mineral extraction sites are features of the landscape. On land, toads bury themselves within soil or leaf litter or hide beneath dead wood and vegetation. Provision of scrub and other cover within the vicinity (especially to 100 m) of the breeding site is particularly important in arable landscapes and is especially important in sand dune systems (Denton & Beebee 1994a).

Natterjack toad

This is the most specialised of the British amphibians in terms of its breeding requirements, with a protracted breeding season and a preference for water bodies in the earliest stages of succession, which are relatively devoid of plant and animal life. Natterjack spawn and larvae are adapted to rapid development within the warm water of shallow or temporary pools. Natterjacks tend to avoid pools with low pH (circum-neutral pools of pH 6.0–8.0 are optimal and there is very low survival of eggs or larvae below pH5), and in coastal pools breeding site choice is influenced more by the maximum water temperature achieved the day before spawning (which must be at least 13 °C) than by any other factor (Banks & Beebee 1987).

Natterjack breeding pools in upper saltmarshes may be subject to salt spray and occasional inundation. Although the natterjack is no more tolerant of salt toxicity than the common toad or other British amphibians, regular saline flooding may be important in preventing the development of freshwater communities that contain significant tadpole predators such as some *Dytiscus* beetles (Beebee, Fleming & Race 1993). Another important feature of natterjack breeding pools is the low percentage cover of both emergent and submerged vegetation. Again this may restrict available habitat for predatory invertebrates and, in addition, make the pool less suitable for common toads and common frogs, which are competitively superior and whose tadpoles will eat natterjack spawn and inhibit natterjack tadpoles. Natterjacks tend to avoid pools containing high populations of these other anurans (Banks & Beebee 1987). The natterjack species is apparently tolerant of most species of fish (although the two occur together relatively rarely) and its rapid colonisation of new pools is consistent with a tolerance of the drying out of its breeding sites. Continual loss of breeding sites to succession is part of the metapopulation dynamics of this species (Sinsch 1992).

In the UK and Ireland natterjack toads are associated with three main landscapes: coastal dune systems; lowland heaths; and upper saltmarshes. The breeding site recently documented in an upland blanket mire is considered to be exceptional (J. Hooson pers. comm.). All these provide habitats characterised by openness and a predominance of low-growing vegetation such as grasses, sedges, rushes and dwarf shrubs. An open structure to the vegetation is important for feeding and hibernating natterjacks, and restricts the available habitat for the common toad and common frog, which are potential competitors but less well adapted to exposed, desiccating environments (Denton & Beebee 1994a). Natterjacks excavate their own burrows or use existing ones in soft substrates, e.g. sand. Active management to maintain open landscapes in both coastal and heathland sites is usually necessary (Figures 1j, 1k and 1l). On lowland heaths, scrub management (see Edgar 1993) is essential and a reduction of factors causing acidification of ponds is desirable; in dune systems, scrub control and creation of pools (using liners or scrapes) and their periodic inundation by seawater provides breeding pools in the earliest stages of succession.

The current trend of relaxing 'hard' engineering coastal protection such as sea walls in favour of 'soft' approaches such as restoration of saltmarsh (e.g. English Nature's Managed Retreat programme) and the promotion of unstable dune systems is likely to increase availability of natural habitat for the natterjack.

Common frog

Common frogs breed in the shallows of the full range of water body sizes. They tend to use small (<100 m^2), unshaded ponds with some emergent and submerged vegetation and are tolerant of fish, reflecting their high occupancy rate of garden ponds, many of which are stocked with fish (Figure 1i). Acidic-to-alkaline water is tolerated, although spawn mortality can be very high in water bodies subject to acid precipitation and with poor buffering capacity (Cummins 1988). In breeding sites, water temperature, especially the availability of warm spawning sites, is probably more important than the size or shape of the water body. For example, cold, deep ponds are avoided if warmer ones are available. Drying out of water bodies can be detrimental if it occurs at any time in the aquatic phase.

Frogs tend to shelter in water and often hibernate there (although many do so on land in places such as beneath grass tussocks), so wetlands with a permanently high water table provide important habitats for this species. Dry habitats such as chalk grassland (Beebee 1977) and many arable landscapes (Swan & Oldham 1994) are unfavourable.

6.1.3 General habitat requirements

Breeding sites

It will be clear from the foregoing that aquatic habitat requirements of individual species can differ greatly. For example, breeding sites vary from small garden ponds to large lakes and slow-flowing rivers. However, some general guidelines can be given. Water bodies with a surface area in excess of 500 m^2 can potentially provide breeding sites for all five widespread amphibian species. The common toad selects larger water bodies with a surface area of around 2,000 m^2 (which would include many farm ponds stocked with fish or wildfowl), and the common frog and two small newt species prefer smaller ones of around 100 m^2 surface area. In order to accommodate the great crested newt, a pond size of *c.* 250 m^2 surface area is recommended. In terms of depth, the common frog successfully breeds in shallow ponds (*c.* 0.5 m deep), the three newt species prefer deeper water (*c.* 1.0 m deep) and the common toad deeper still (*c.* 2.0 m deep). All the species may benefit from aquatic vegetation as spawning substrate and it is essential for newts and common toads. Cover of submerged and emergent vegetation should, ideally, be around 25% for newts and 10% for common toads respectively. Some shade (<25%) from overhanging trees or shrubs is tolerated by all species and may be beneficial in preventing excessive growth of aquatic vegetation. Further information is available in Foster (1997).

Construction, restoration and maintenance of water bodies for amphibians

Practical details on the management of ponds and other water bodies are available in several publications (e.g. British Trust for Conservation Volunteers & Brooks 1981; Furniss & Lane 1992). The recent history of pond restoration has centred upon regular dredging, desilting and clearing of aquatic and overhanging vegetation to produce an open water body fringed by shallow sloping sides with marginal vegetation. New approaches to the management of existing ponds for their wildlife (Biggs *et al.* 1994) have emphasised the need to maintain a diversity of water bodies in the landscape (rather than, for example, one large pond) and a more measured approach to clearance so that a diversity of aquatic habitats is maintained. In this way, aquatic communities (as opposed to just the amphibian element) can be conserved.

In order to reduce disturbance to amphibians, restoration works should take place after metamorphosis but before the first frosts (so that amphibians can escape to land and workers will avoid disturbing hibernating frogs). Thus autumn or early winter is often best. The degree of restoration will vary from pond to pond, but generally no more than one-third of the water body should be cleared every few years. In terms of the terrestrial habitat, buffer zones of unimproved (or unmown) grassland/scrub/woodland around the pond should be included in the restoration.

In pastures, the structural diversity of vegetation in and around ponds can be increased by allowing stock access to part of the edge. This may benefit amphibians by increasing food availability and the range of aquatic environmental conditions. Stock grazing also tends to reduce scrub and tree encroachment (and so shade) around ponds, and their dung may increase the availability of invertebrate prey in the surrounding pasture.

Terrestrial sites

The ideal terrestrial landscape for amphibians is a mosaic of semi-natural and unimproved habitats, including rough grassland, woodland, gardens and wetlands extending to at least 1,000 m from the breeding site (Figures 1a, 1b, 1g, 1h and 1i). In farmland, where there are often few opportunities to manage terrestrial habitats for amphibians, research has indicated that a mosaic of woodland or scrub totalling 5 ha in every 75 ha of land is sufficient for persistence of populations of great crested newts and common toads, and by inference the other three more widespread species. Some permanent cover, such as woodland, including hibernacula of rock/brick piles, stone walls and deadwood, and other sites that are permanently moist with cool stable temperatures, should be available within 100 m of the breeding site. Arable and improved (including mown) grasslands should not extend to the edges of breeding sites.

The larvae of some species such as the smooth newt, palmate newt and the common frog (and possibly other species) are adversely affected or killed by dissolved agricultural fertilisers applied to water bodies (Oldham 1994; Watt & Oldham 1995; P. Watt unpub.). In order to reduce agro-chemical run-off and spray drift and increase the availability of refuges, ponds should be surrounded by rough grassland/scrub buffer zones of at least 10 m or one spray boom width. On land, agricultural fertilisers (especially pelleted inorganic nitrogen) at normal application rates can be toxic to adult frogs (Oldham *et al.* 1993). In arable landscapes, fields with ditches, headlands and other areas where agro-chemical use is low (such as copses) are probably important for the persistence of the frog.

6.2 Reptiles

A number of general recommendations for management can be made to improve a wide range of habitats for reptiles (Figures 1c, 1d, 1e and 1f). They include ensuring the development and persistence of a varied structure to the ground and scrub vegetation and making sure these do not become shaded, maximising the degree to which areas of good habitat are connected and ensuring areas are left that are relatively free of disturbance. When considering management of known reptile sites, it is important to gain a good understanding of the way in which reptiles use a site and why they do so. An important day to day behavioural requirement is the ability to regulate their body temperatures and this requires a range of different 'thermal environments' (see e.g. Gaywood 1990). At other times there may be an over-riding need to search for food or mates, or to find shelter from predators. Features to accommodate these requirements are therefore necessary in areas in which reptiles are found. Very often reptiles will be found most frequently associated with certain localised features ('foci'), perhaps southerly slopes, banks or man-made features such as boundary banks, tumuli or wood piles. This knowledge will allow a more focused approach to habitat management, so that conservation resources can be used to best effect. However, it is equally important when considering other forms of management to understand how reptiles use a site, especially if these methods may be detrimental to reptiles, so that their needs can be accommodated. For this reason a habitat management 'calendar' has been produced (by the Dorset Heathland Forum) to guide heathland management, taking into account the needs of different wildlife (see Box 1). A source for further reference when looking at developing opportunities for reptiles in the designed landscape is Bray & Gent (1997).

6.2.1 Planning habitat management

Reptiles frequently spend winter in a particular part of a site. Some animals return to the same burrows year after year; in some cases many reptiles, and especially snakes, will use the same area, hibernating communally with others of the same species. Concentrations of reptiles in the early spring will reveal the location of such areas. Particular attention should be paid to large mammal burrows, in use or disused, and sunny areas for lying out in spring sunshine – very important for post-hibernation recovery and for gonad maturation. Shrub or tree shade should therefore be controlled, but not entirely removed, within the immediate environs of any known or suspected hibernaculum.

The sunny edges of woods, copses, hedgerows and other cover are potentially good reptile habitats (Figures 1d, e and 1f). However, to be valuable they require structural diversity. Ideally, this is via a gradation from trees, through coppice or bushes, to longer grass and herbs, which may be cut each autumn or in alternate years and the cuttings removed from the site. A ground cover of ivy (*Hedera* spp.) presents a good structured habitat for lizards and their invertebrate food, and where it is found in sunnier locations it should not be destroyed.

In more open habitats, birch trunk bases and coppice are known to be associated with lizard territories, and their root systems are used by snakes as hibernacula. The best reptile habitats on chalk downland are not the expanses of short, open grassland but slopes with tussocky grass and a light scatter of low bushes. Deciduous bushes and small trees such as hawthorn or blackthorn may be used in other habitats. There is thus a need to strike a balance between complete removal and retention of scrub to retain the structural diversity of the habitat.

On lowland dry heath the situation is somewhat different. This habitat is composed of dwarf heather shrubs where the mature stands develop an inherent structural diversity, characteristically with patches of bushy heather, open areas, deep litter, and central pads of bryophytes and lichens. This habitat complex also supports a rich invertebrate food source for reptiles.

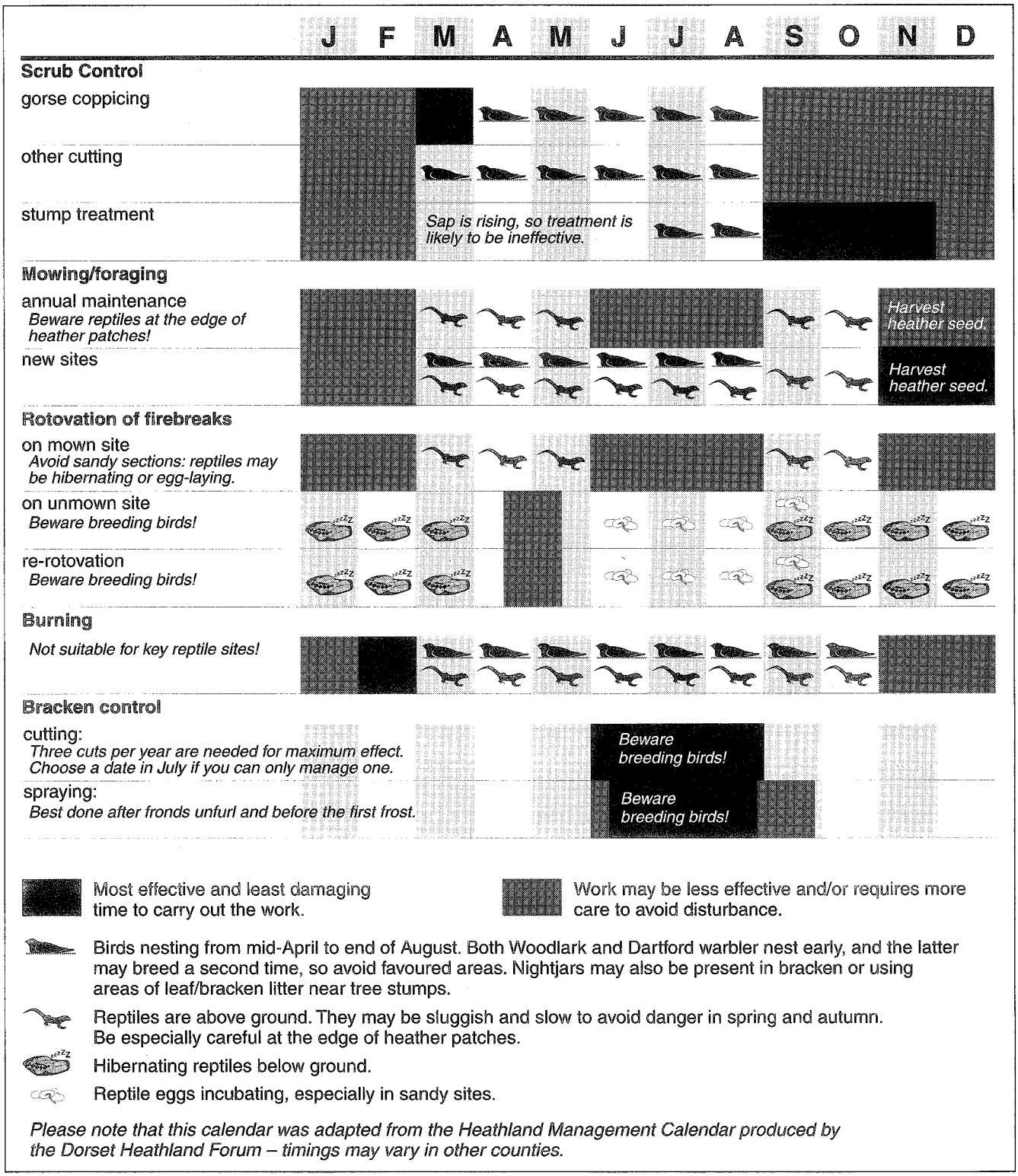
Dry heath management for reptiles should be focused on their key features, such as boundary banks, gullies, habitat interfaces and edges. While some birch (of all ages) should be left, most management should concentrate on the control of invasive species, including pine, bracken, rhododendron and, locally, the more recent shallon *Gaultheria shallon* invasions. Many of these species, together with some grasses, are able to encroach considerably after fire. Because of this, and as reptiles are threatened directly by fire, practical input is required for fire control, which should include fire-breaking measures. Apart from the ecological value of rejuvenating European gorse by a coppicing cycle, it is important to clear it back from paths with public access and to control areas of particular leggy gorse to lessen fire risks.

It follows from the above that burning as a heathland management tool is not recommended for reptile sites, unless on very small areas at appropriate times of the year (November–January, and non-sunny days in February and March), with correct weather conditions, and never on key habitat features. Similar restrictions should be applied to mowing, cutting and flailing, both with and without removal of debris, although there may sometimes be grounds for some small-scale cutting to rejuvenate strips of heather on areas with good concentrations of reptiles.

On any reptile habitat, bracken should be controlled with the sensitive spot spraying of Asulox at appropriate concentrations detailed on the product label (and following other requirements in force at the time) that avoid, as far as possible, resistance developing in the bracken. Removal of the deep litter layer may then be necessary in order to restore reptile habitat. Investigations are still under way into the most efficient means for dealing with shallon.

In marram dunes, sea buckthorn, rhododendron and poplar encroachment may need to be controlled. Trampling and erosion caused by public access may

Box 1 Heathland management calendar.



require fencing to direct pressure away from vulnerable areas at least for a few seasons.

Where grasslands (including road and rail verges and banks) are important for reptiles they should not be cut more than once a year, in late autumn. Grazing can be a valuable habitat management tool; however, its effects on reptile populations are difficult to quantify as they will vary enormously depending on the potential blends of stock types, density and duration, and the effects on the structural and plant species diversity of any reptile habitat. Any grazing that removes tussocky vegetation leading to a more uniform structure on any scale must be considered damaging. Certainly grazing on reptile habitats or grasslands must never create a close sward or

a sward of trampled vegetation. There seems little benefit to be gained from grazing key habitats on dry heath or marram dune, which tend in any case to be unpalatable, since damage particularly to heather is liable to result from trampling and nutrient enrichment from dunging.

The stopping of mammal burrows in fox-hunting areas with anything other than straw bales and plastic bags should be prevented and stops should be removed as soon as possible after being placed, certainly within 24 hours. Similarly, where gassing for rabbit control may harm reptiles using burrows, this method should not be used. Other chemicals may have both direct and indirect effects on reptiles. As well as the possibility of direct toxicity (slug pellets, for example, are considered to be a danger to slow-worms), other pesticides may affect the availability of food (e.g. insecticides) or damage the vegetation structure which is important for reptiles (e.g. herbicides).

Public pressure should be diverted away from any known snake concentrations because of disturbance to their basking behaviour and possible negative interaction between animals and humans. Site managers should be vigilant to cases of snake (or slow-worm) killing or injuring. In such cases education may be beneficial. 'Beware Snakes/Adders' signs should in any case be removed and the placing of them resisted. Where public access and pressure is appreciable, attention should be given to minimising the potential collection of animals by the removal of appropriate debris, under which animals might be easily located.

A local hazard for lizards and, to a lesser extent, young snakes can be presented via the use of pit-fall trapping that is used to assess invertebrates; this should not be allowed within localities or foci known to support these reptiles.

6.2.2 Species-specific considerations for management of reptile habitat

Sand lizard

Most specific management effort for reptiles has so far been directed towards Britain's most endangered reptiles. That for the sand lizard has been presented by Corbett (1988), with priorities currently directed at mature dry heath, the provision of adequate open sand, fire prevention and the re-establishment of its sand-dune range. An open sand component increases the efficiency of fire-breaks (in particular stopping side and back burns) and can also enhance sand lizard breeding and invertebrate diversity. Damage to such sandy areas, for example from their use by cyclists on mountain bikes or by measures against erosion, can be recognised as a problem that may need to be addressed. Similarly, driving, whether by the public or site managers and wardens, over important sand tracks during the short prospecting and egg laying period should be minimised.

Common lizard and slow-worm

Both common lizards and slow-worms occupy a very wide range of habitats and so it is difficult to prescribe a management regime that is applicable generally. However, it appears both these species characteristically occupy relatively small home ranges. This means that sensitive management of the areas in which they live (and they can be quite small areas on occasion) is needed. It is therefore especially important that these areas are not allowed to become shaded, e.g. by tree growth, or seriously disturbed.

Common lizards are active in and amongst vegetation and frequently need to bask in the open. Good, structurally varied vegetation, with open patches allowing basking spots but at the same time providing physical cover from predators, is essential. Common lizards often take advantage of wood piles, fence posts and similar structures for basking. By positioning such features in common lizard habitats the habitat manager benefits both the common lizard and provides himself with a useful means of observing this species.

Slow-worms, on the other hand, are harder to observe since they bask in the open comparatively infrequently. Their behaviour is more associated with life 'below ground' or in thick vegetation. Consequently, it is likely to be much harder to monitor the impacts of any management (or lack of it), and survey using tins may be needed to evaluate management needs.

Grass snake

The most positive management measure for grass snakes is the provision of egg laying sites. Consideration should be given to providing suitable features for egg laying areas, in the form of compost heaps, dung piles or similar, in all areas where grass snakes are found and in particular on nature reserves known to have the species. Farms and stables can often provide both locations and materials for egg laying sites; however it is possible to construct suitable features using a wide range of vegetable material (see Buckley 1994; Foster 1996). Heaps should be positioned in a sunny position and close to cover, such as hedgerows or in long grass or shrubby vegetation. While simply placing a pile of grass cuttings, cut reeds, leaves, manure, kitchen vegetable waste (though be careful not to use materials that will attract rats) or wood chippings on the ground may be effective, purpose-built egg laying sites for grass snakes can be made by placing a criss-cross pattern of branches on the ground first. This provides a base on which to build the heap, gives a degree of ventilation to the heap and a means of access for grass snakes. The bigger the heap, as a rule, the better, and the heap will need to be replenished annually as the vegetation rots down. Placing a sheet of corrugated metal (or similar) on top of the heap may improve its value, since this helps retain warmth and humidity and snakes will take refuge underneath. If the compost is going to be used, for example as a garden mulch, it should not be dug out or turned over between early May and later September when the grass snakes will be using the heap.

Amphibians need to be maintained on site, since these form a major prey item of the grass snake, and management for these species, as indicated earlier in this chapter, may be necessary. Because of the affinity of grass snakes for water and associated habitats, care needs to be exercised when managing pond and lake-side vegetation. Mowing sunny banks in these

areas should generally be avoided since this reduces cover and therefore safe basking areas for grass snakes. The further disturbance this may present needs to be considered and the creation of sanctuary areas to offset this threat may be appropriate.

Grass snakes are very mobile animals and generally occupy large home ranges, travelling perhaps over 100 m per day and having ranges tens of hectares in size (Madsen 1984; Brown 1991). Maintaining a healthy grass snake population may therefore be dependent on suitable management over a fairly large area of land, which for a population of snakes may cover several square kilometres, and ensuring good connectivity between key areas.

Adders

Adders seem to be very sensitive to disturbance, and this is perhaps one reason why they do less well in suburban or urban fringe areas. Some adder populations are known to show seasonal movements, generally occupying drier areas (perhaps lightly wooded southerly slopes, or dry heathland) between autumn and spring, and spending summer months in wetter habitats (Prestt 1971; Phelps 1978). These seasonal movements should therefore be taken into account when considering site management options. It is important to maintain good connectivity between different areas used by adders at different times of year. When considering other management needs, especially where these involve public access, public concerns about (and indeed, hostility towards) adders must be taken into account. Positioning of access routes, playgrounds and picnic areas, for example, should avoid areas where conflict with or disturbance to adders (and especially their over-wintering areas) is likely to occur.

Smooth snake

This is a rare and localised species, associated almost exclusively with dry heathland (Nature Conservancy Council 1983; Braithwaite *et al.* 1989). It is also known to use woodland margins, wet heath and bogs adjacent to heaths (Goddard 1981; Gent 1988). This species seems to be most attracted to features with sunny slopes, typically with a southerly aspect, and mature vegetation. Smooth snakes seem to show less distinct seasonal movements (Phelps 1978) than either of the other two snake species and are generally less mobile and probably occupy a much smaller home range (Gent & Spellerberg 1993). Management therefore needs to be sensitive to the presence of this species and to ensure the persistence of a good, diverse vegetation structure. It is important for the long-term survival of populations to ensure good connectivity between areas known to contain smooth snakes.

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Amendments to Chapter 7 Amphibians and reptiles and the law

Since publication of the Herpetofauna Workers' Manual in 1998 there have been, or are proposed, a number of changes to legislation and planning guidance that affect amphibians and reptiles. Please read this page in conjunction with the original Chapter 7 that follows.

1. The Wildlife and Countryside Act 1981 has been amended by the Countryside and Rights of Way Act ['CRoW'] (2000) which applies to England and Wales only.
The key changes relevant to herpetofauna conservation are:

Section 9(4) is amended to create an additional offence of reckless damage to, destruction of, or obstruction of access to, any structure or place used for shelter or protection, and reckless disturbance whilst occupying such a structure or place.

Through amendment to the Police and Criminal Evidence Act [PACE] 1984, CRoW makes all section 9 offences (i.e. those relating to taking, killing, disturbance, etc) "arrestable".

Time limits for bringing prosecutions under Part 1 of the Act are now unified: prosecutions must be brought within six months from the date on which sufficient evidence of the offence became available to the prosecutor, subject to a limit of two years of the commission of the offence.

The penalties for some offences have been modified. For section 9 offences, the maximum fine per offence remains at £5,000 (as at January 2003) but there is, in addition to a fine, the potential for a custodial sentence of up to six months.

There are a number of considerable improvements to the protection afforded to Sites of Special Scientific Interest.

2. Current land use planning policy in Wales is described in Planning Policy Wales (2000). It is supplemented by 20 topic based Technical Advice Notes (Wales) (TANs), including TAN 5 Nature Conservation and Planning.

3. The current land use planning system in Scotland is described in Scottish Planning Policy [SPP1] The Planning System (2002). A second document,.Planning for Natural Heritage: Planning Advice Note 60 [PAN 60] (2000) gives more specific advice and complements the National Planning Policy Guideline on Natural Heritage (NPPG 14).

4. The current land use planning system in Northern Ireland is described in Planning Policy Statement – General Principles (PPS 1). Planning policy specifically for nature conservation is described in Planning Policy Statement – Planning and Nature Conservation (PPS 2).

There may be further changes. There are proposals to:

- integrate European protected species (i.e. those on Habitats Directive Annex IV) licensing with the planning regime in England and Wales;
- amend the Conservation (Natural Habitats &c.) Regulations 1994 in England and Wales;
- revise Planning Policy Guidance: Nature Conservation (PPG9) in England;
- revise Technical Advice Note (Wales): Nature Conservation and Planning (TAN 5) in Wales;
- revise National Policy Planning Guidance: Natural Heritage (NPPG 14) in Scotland.

Please consult further for up to date information. Suggested sources include:

The Countryside Council for Wales – www.ccw.gov.uk
Welsh Assembly Government – www.wales.gov.uk/subiplanning
Scottish Natural Heritage – www.snh.org.uk
Scottish Executive – www.scotland.gov.uk/Topics/?pageid=3
English Nature – www.english-nature.org.uk
Office of the Deputy Prime Minister – www.planning.odpm.gov.uk/index.htm
The Environment and Heritage Service (Northern Ireland) – www.ehsni.gov.uk
The Planning Service – www.doeni.gov.uk/planning

Chapter 7 Amphibians and reptiles and the law

Tony Gent and William Howarth

7.1 Introduction

All amphibians and reptiles receive some legal protection in the United Kingdom, though the degree to which different species are protected varies. The native species in the wild are given protection through nature conservation legislation. Animal welfare legislation covers animals that are captive or when they are the subject of scientific research. It is important that everyone who is involved in conserving or keeping herpetofauna has a general understanding of this body of legislation so that their activities are properly conducted within the requirements of the law. Herpetofauna workers may also be asked to give others advice about the law. Although giving such advice can be fraught with legal difficulties, having a good understanding of the legislation can help you guide other people to understand and operate within the letter and the spirit of the law.

Unfortunately, the law in the United Kingdom is rather complex. Although we have tried to give a good account of the wide range of legislation relating to amphibians and reptiles, this chapter can only give general guiding principles. It may sometimes be necessary to refer back to the actual text of the legislation to see how it relates to any specific set of circumstances. It can also be a good idea to seek further advice to sort out problems encountered in practice. From time to time legislation is changed or the lists of protected species are altered. Keeping track of these changes can be difficult since they are generally the subject of additional legislation and are not all collated together in one place. Sometimes older legislation is repealed. It has also been difficult to give a comprehensive overview because of the distinct legal jurisdictions in the different countries that make up the UK; because of this both the administrative arrangements and the legal provisions may vary depending on whether you are in England, Northern Ireland, Scotland or Wales. This account concentrates on the law in Great Britain; that is England, Scotland and Wales. We have included a separate section on Northern Ireland. Separate legal provisions are made for the Isle of Man and the Channel Islands; we have not considered these further in this account.

7.2 Conservation legislation in Great Britain

In Great Britain (England, Scotland and Wales) the most important body of legislation concerning the conservation of amphibians and reptiles is the Wildlife and Countryside Act 1981. More recently, further protection was afforded in Great Britain to species listed in the annexes of the European Council (EC) Directive 92/43/EEC of May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora, otherwise known as the 'Habitats Directive' (the so-called 'European protected species') through the Conservation (Natural Habitats &c.) Regulations 1994 (from here on these will referred to by their shorter name, the 'Habitats Regulations 1994'). Both the Wildlife and Countryside Act 1981 and Habitats Regulations 1994 provide mechanisms to protect species, their habitats and sites occupied by the species.

7.2.1 Species protection legislation

The legislation

Species protection provisions are contained in Part I of the Wildlife and Countryside Act 1981. This Part is made up of 27 Sections which in turn divide into specific sub-sections. These sections relate to protection of birds, 'other animals' (including amphibians and reptiles) and plants, describe situations where there are exceptions to the legislative protection ('defences') and cover other aspects such as licensing and definitions of terms used in the Act. There is also a section that prohibits the release of non-native species. Part I of the Wildlife and Countryside Act 1981 came into force on 28 September 1982. Section 9 is an important section since this is the list of actions that are prohibited. The different sub-sections may be summarised as follows:

- Section 9(1): prohibits intentionally killing, injuring and taking;
- Section 9(2): prohibits the "possession or control" of any live or dead specimen or anything derived from a protected animal;
- Section 9(3): says that possession or control is not an offence if the animals had been taken or killed in a manner that is not prohibited by other parts of Section 9 or if they had been legally acquired or purchased;
- Section 9(4): prohibits intentionally damaging or destroying a place or structure used for shelter or protection, obstructing access to or disturbing an animal while occupying such a place;
- Section 9(5): prohibits selling, offering for sale, possessing or transporting for the purpose of sale or publishing advertisements to buy or sell a protected species.

Attached to the Act are lists of species; these are the Schedules to the legislation. Schedule 5 is the list of protected animals that includes the amphibians and reptiles. This list and the level of protection associated with each animal (indicated by stating the elements of Section 9 that apply) can be changed; these changes are not changes to the law itself, merely changes to the species to which the law applies.

Since 30 October 1994, the wildlife conservation provisions of the Wildlife and Countryside Act 1981 have to be read alongside the Habitats Regulations 1994. Both the Act and the Regulations are in force and the protection given is a combination of the two. The function of these further regulations was to ensure that the UK fully complied with the requirements of the EC Habitats Directive and so the further provisions in this legislation relate only to the species listed in the Annexes to that Directive. The species listed in Annex IV of the Habitats Directive are termed "European protected species of animals" in the Regulations and are listed in Schedule 2. The protection afforded to these species is given in Regulations 38 and 39 (a Regulation is similar to a Section in the Wildlife and Countryside Act 1981 and, in fact, the wording is very similar to the earlier legislation). Regulation 39 can be summarised as:

- Regulation 39(1): prohibits for any "European protected species": deliberately capturing or killing; deliberately disturbing; deliberately taking or destroying eggs; damaging or destroying a breeding site or a resting place;
- Regulation 39(2): prohibits keeping, transporting, selling or exchanging or offering for sale any animal or anything derived from a "European protected species";
- Regulation 39(4): says that possession or control is not an offence if the animals had been taken or killed in a manner that is not prohibited by other parts of Regulation 39 or that had been legally acquired or purchased.

Both the Wildlife and Countryside Act 1981 and the Habitats Regulations 1994 apply to all life stages of the protected species: eggs and spawn, larvae, juveniles and adults are all protected.

The combination of these pieces of legislation means that the native reptiles and amphibians fit into three different bands of protection. These differences are brought about by different sub-sections of the Act applying to different species, and the addition of the protection from the Habitats Regulations 1994 in the case of the 'European protected species'.

It is important to note that the protection relates only to wild animals. These are those animals that are, or "were before being captured or killed", living wild. This provision means that captive-bred animals are not covered by the provisions of either the Wildlife and Countryside Act 1981 or the Habitats Regulations 1994. However, in either case there is a presumption that the animal in question is 'wild' unless the contrary can be shown.

Other sections in Part I of the Wildlife and Countryside Act 1981 are important for the herpetofauna worker, notably Section 14. This Section

prohibits the release of non-native species to the wild. In fact the words used are: "release animals of a kind not ordinarily resident in and not a regular visitor to Great Britain in a wild state". This does not specify species, but *kind*. Consequently it may apply to different taxonomic levels, such as sub-species, races or even different genetic types of the same sub-species. There are some non-native species already established in Britain, for example marsh frogs *Rana ridibunda* and wall lizards *Podarcis muralis*, which could be considered 'ordinarily resident'. To overcome this anomaly there is a schedule of species that have been specifically listed to prohibit their release. This is Schedule 9 of the Act. Most species on the list are established non-natives; however there are some exceptions, e.g. the barn owl *Tyto alba*, that have been added to the Schedule to control releases to help conservation objectives.

Section 11 also has limited application to amphibians and reptiles. Killing or taking *any* wild animals using self-locking snares, bows, cross-bows or any explosives (other than ammunition for a firearm) is illegal. This may allow some scope for action in some cases of animal cruelty. There are similar restrictions contained in Regulation 41 of the Habitats Regulations.

Levels of protection for British reptiles and amphibians

European protected species

- Great crested newt *Triturus cristatus*
- Natterjack toad *Bufo calamita*
- Sand lizard *Lacerta agilis*
- Smooth snake *Coronella austriaca*
- All marine turtles: families Dermochelyidae and Cheloniidae

These animals are often termed 'fully protected', since all elements of Section 9 of the Wildlife and Countryside Act 1981 apply, as does Regulation 39 of the Habitats Regulations 1994. This legislation, taken together, prohibits the following on any of the species:

- deliberately or intentionally killing and capturing (taking) or intentional injuring;
- deliberately disturbing;
- deliberately taking or destroying eggs;
- damaging or destroying a breeding site or resting place or intentionally damaging a place used for shelter and protection;
- intentionally obstructing access to a place used for shelter; and
- keeping, transporting, selling or exchanging; offering for sale or advertising.

Consequently not only are the animals themselves protected, but so is their habitat, and activities that damage the habitat or impede their use of certain parts of it are prohibited. The inconsistent use of terms such as intentionally or deliberately (or the omission of either of these) is a consequence of the two pieces of legislation being collated for this summary.

Protection against killing, injuring and sale etc. only

The other native species of reptiles are protected only by the Wildlife and Countryside Act 1981. Part of Section 9(1) and all of Section 9(5) apply. This means that they are protected against intentional killing and injuring (but *not* 'taking') and against sale, transporting for sale etc. These species are:

- Slow-worm *Anguis fragilis*
- Common or viviparous lizard *Lacerta vivipara*
- Adder *Vipera berus*
- Grass snake *Natrix natrix*

These received a greater level of protection following reviews of the schedules published in 1988 and 1991. When the Wildlife and Countryside Act 1981 first came into force, these species were protected only against sale (defined as sell, offer or expose for sale, have in possession or transport for purpose of sale, or advertise) (Section 9(5)).

Protection against sale only

The four commoner species of amphibian are protected by Section 9(5) of the Wildlife and Countryside Act 1981. This means that the protection for wild animals extends only as far as prohibiting sale, transporting or advertising for sale. This is intended to allow regulation of any trade in these species. Consequently catching them, or keeping them as pets, or even killing them, is not prohibited (subject to controls relating to animals welfare). The amphibian species covered only by Section 9(5) are:

- Smooth or common newt *Triturus vulgaris*
- Palmate newt *Triturus helveticus*
- Common or grass frog *Rana temporaria*
- Common toad *Bufo bufo*

Exceptions ('defences')

There are important exceptions to protection, commonly termed 'defences', and circumstances where these apply are given within the legislation. There are similarities between the defences offered in the Wildlife and Countryside Act 1981 and the Habitats Regulations 1994, and these can usefully be described at the same time.

Possession of fully protected animals is not an offence if these have been acquired or purchased legally (see Section 9(2) of the Wildlife and Countryside Act 1981 and Regulation 39(4) of the Habitats Regulations 1994). For example, animals that have been found dead can usually be kept (but not sold).

Most of the defences set out are given in Section 10 of the 1981 Act or Regulation 40 of Habitats Regulations 1994. Certain agricultural or animal health requirements will over-ride the protection of the species (i.e. actions required under the Agriculture Act 1947 or the

Agriculture (Scotland) Act 1948, or as a consequence of actions carried out under the Animal Health Act 1981).

The protection that prohibits damage or destruction of breeding or resting places or structures used for shelter and protection, and that which prohibits obstructing access to these places or disturbing animals, does not apply when inside a dwelling house. There are provisions that allow injured and disabled animals to be taken for treatment (provided they are released as soon as they are fit to be let go again), and mercy killing of severely injured animals may be allowed.

One defence that is especially important, and which requires careful interpretation, is given in Section 10(3)(c) of the Act and Regulation 40(3)(c) of the Regulations. These say that anything prohibited by Section 9 or Regulation 39 is not illegal if "the act was the incidental result of a lawful operation and could not reasonably have been avoided". An obvious application of this is that if, for example, an animal is killed by a car while crossing the road then, provided that it was an unavoidable accident, the driver of the car would not be breaking the law. But it also has much wider applications. Development of land with planning permission that would otherwise be protected by virtue of the presence of a species protected under Part I of the Wildlife and Countryside Act 1981 or Habitats Regulations 1994 can go ahead only because of this clause. We talk about this subject a little more in section 7.2.1(d) below.

Other defences allow 'authorised persons' (that is the land owner, a tenant or an agent appointed by him) to protect his livestock, crops, timber or other property in an emergency. The scenario is really borne out in cases where a farmer finds his chicken coop being raided by a protected animal, for example a pine marten, and to protect his livelihood he can shoot the offending animal. However, the legislation is clear that this is an emergency measure; to go back to the pine marten example, if this form of damage is predictable then the farmer should apply for a licence in advance to allow killing. Exactly when something is an unexpected emergency or a predictable problem may appear rather vague when dealing with abstract cases. Quite often, in reality, the difference is quite clear; Section 10(6) of the Act or Regulation 30(6) of the Regulations should be consulted for the actual wording of the legislation.

Sections 16(3) and 16(4) of the Act and Regulation 44 of the Regulations allow licences to be issued for specific purposes. Actions prohibited by the legislation are allowed if a valid licence is obtained in advance from the proper authority. These can be given for different reasons (see section 7.7 below).

Interpretation

A knowledge of what the legislation says is valuable. However, very often it is hard to interpret exactly what it means for a given set of circumstances. There are clearly some very black and white cases; but more often significant shades of grey exist. Ultimately interpretation of legislation is a job for the courts. Judgements and rulings that have the status of 'test cases' or precedents are made by higher Courts (e.g. Crown Court); however, usually wildlife cases will be heard by Magistrates' or Sheriffs' Courts. Consequently there is very little legal precedent to help interpretation.

However, conservationists can help to develop good practice and get it widely accepted, to help others understand what is reasonable behaviour. The Statutory Nature Conservation Organisations (SNCOs) give guidance to aid in the interpretation of the law. A discussion of some issues, and the way they are commonly applied on the basis of an understanding of the wording and the spirit of the legislation, and the intent of Parliament when the legislation was enacted (where this is recorded) may help everyday understanding of how the law can be used to promote amphibian and reptile conservation.

There have been some difficulties in understanding how the word 'intentionally' affects the protection given in the Wildlife and Countryside Act 1981; its omission from the Habitats Regulations 1994 is probably significant. It is obvious that if someone actually goes out, for example, with the sole purpose of killing a snake, this would be illegal (unless, of course, it is covered by any of the defences in the legislation); equally, it is obvious when an action really is an accident and therefore not an offence. However, interpretation is problematic if someone chooses to plough up a field, knowing that it will kill reptiles, but where the person's objective is to achieve some other end, for example to build houses or plant trees. Is this against the law? In such cases we would advise a cautious interpretation; that is, if the killing can *reasonably be avoided* then it *quite probably* is illegal. Consequently measures should be put in place to avoid this happening. In part we would draw our guidance from the intent of the legislation and how it relates to fulfilling the obligations placed on the UK Government under international treaties. A Resolution passed by the standing committee of the Bern Convention (see section 7.6.1 below) said that predictable killing as a consequence of other activities should be considered deliberate. What is more, this cautious approach best fulfils the conservation objectives behind the Wildlife and Countryside Act 1981. It is a safe and sensible stand but, be warned, it could be open to challenge.

A second area of uncertainty is working out how the defence in Section 10(3)(c) or Regulation 40(3)(c) applies (see section 7.2.1(c) above). Some have called this a 'universal let-out clause' and have claimed that this means that planning permission, for example, over-rides the species protection. Certainly it is true that the defence says that incidental consequences of legal actions are not an offence. But there is a very important caveat: that is, that this is so *only* if it could not *reasonably have been avoided.* For example, the 'lawful operation' of building houses needs to be able to show that the habitat damage and any killing or injuring of the protected species on site cannot reasonably be avoided. Similarly, habitat management should also avoid injuring reptiles in so far as is reasonable, and surveys not covered by special licences must avoid disturbing or capturing fully protected animals. It is this interpretation of what is reasonable, and to whom, and to what degree people could be expected to take avoiding action (or not do the activity at all) that so

often needs very careful thought. This is frequently the crux of decisions about the very nature of conservation packages or mitigation proposals that result from development or site management proposals. It is also the reason why SNCOs and legal advisers are unhappy about giving general advice about what constitutes a legal or an illegal activity.

As an example, generally a piece of land with planning permission will, quite reasonably, be built on; it would not be reasonable to expect to safeguard habitat when a house is going to be built straight on top of it. Yet at the same time it is generally quite reasonable to expect effort to be made to capture protected animals and to provide them a suitable alternative place to live, and to avoid damaging other parts of the animals' habitat not directly affected by development.

So everything depends upon an interpretation of what is reasonable for any given set of circumstances and what can and cannot be avoided. As a guiding principle the actions must be reasonable to an average person – someone who has no vested interest, is not obsessed with amphibians and reptiles and who does not stand to lose money from delays in development proposals. Often in legal textbooks this fictitious, 'average' ordinary person is referred to as "the man on the Clapham Omnibus" (All England Law Reports 1932). It may appear to be a bizarre concept, but simply applying this 'test' works quite well to ensure that what is being asked isn't on the one hand excessive or on the other hand paying too little attention to the conservation of protected species.

Penalties

Since the Wildlife and Countryside Act 1981 was passed there have been several changes to the system of penalties imposed through Courts; these have been affected through a combination of the Criminal Procedures (Scotland) Act 1975 and Criminal Justice Acts of 1982 and 1991 and resulting Statutory Instruments to bring in new levels of fines, etc. Maximum fines are now set on a five point Standard Scale. Lower levels of maximum fines are set for Young Persons (14–16 years old) and Children (10–13 years old).

Offences under Section 9 of the Wildlife and Countryside Act 1981 and Regulation 39 of the Habitats Regulations 1994 would be tried in a Magistrates' or Sheriffs' Court. Maximum penalties for these are set at Level 5, the highest level on the Standard Scale. Currently this is £5,000 per offence. In cases where a number of animals (live or dead, or any part of or anything derived from such animals) are involved, then each can be counted as a separate offence and each can attract the maximum penalty. Potentially offences involving many animals could add up to very large fines. There is no scope for custodial sentences (i.e. imprisonment) under this wildlife legislation, except, for example, for failure to pay fines.

Offences relating to the release of non-native kinds under Section 14 of the 1981 Act can be tried in a Magistrates' or Sheriffs' Court or, for more serious offences, in a Crown or High Court. If tried in a Magistrates' or Sheriffs' Court the maximum penalty on summary conviction is a fine up to the 'Statutory Maximum' (£5,000) per offence; if tried in a Crown or High Court then the fine, on conviction on indictment, is potentially unlimited.

Penalties may also include confiscation of goods and a requirement to repair damage (see Section 31 Wildlife and Countryside Act 1981). In all cases the Statutory Maximum fines that can be imposed by a Magistrates' or Sheriffs' Court are for a Child £250 and for a Young Person £1,000.

Review of the Schedules

Provision is made to allow the Schedules to the Wildlife and Countryside Act 1981 to be reviewed from time to time to allow species to be added or deleted or their level of protection altered. In fact there is a legal requirement under Section 22(3) to review Schedule 5 (and Schedule 8 – the protected plant list) every five years. This statutory five-yearly review is called the Quinquennial Review. The schedules are changed by issuing a Statutory Instrument (SI) called a Variation of Schedules Order. These orders are issued under the Wildlife and Countryside Act 1981 and do not represent a change to the primary legislation itself, merely a change to the lists associated with the legislation.

There have been two changes to Schedule 5 since 1981 that have had consequences for amphibians and reptiles. In 1988, SI 1988 No. 288 added all species of marine turtle to Schedule 5 and upgraded the protection for the slow-worm, common lizard and grass snake to prohibit killing and injuring (previously only covered for sale). In 1991 (SI 1991 No. 367) the adder was upgraded to a level of protection equivalent to that given to the other three widespread reptile species.

7.2.2 Site protection legislation

Direct protection of herpetofauna and their immediate habitat is useful. However, a further method of protecting the animals is by assigning particular levels of protection to some sites occupied by the species. These site designations operate in addition to any 'species protection' afforded to the animal or its habitat through Part I of the Wildlife and Countryside Act 1981 or through the Habitats Regulations 1994.

Designating particular parcels of land as protected areas or wildlife sites is particularly useful for influencing planning and for directing conservation activities. Most notably, the very best sites can be identified by designating them part of a national, or even an international, series of sites. Generally such designations are given only to sites of special quality. Protection of 'lower tier' sites can be by local designations but must often rely on protection offered by 'species protection' legislation.

While earlier legislation, such as the National Parks & Access to the Countryside Act 1949 and the Countryside Act 1968, still continues to be of some relevance, the most important provisions for designating land for conservation purposes in Great Britain are included in Part II of the Wildlife and Countryside Act 1981 (Section 28 onwards) and the Habitats Regulations 1994 (see Regulations 7 to 37, which parallel provisions under the Wildlife and Countryside Act 1981 in respect of sites of European importance).

Sites of Special Scientific Interest (SSSIs)

Site of Special Scientific Interest (SSSI) is the term used to denote an area of land notified under the Wildlife and Countryside Act 1981 (as amended) as being of special nature conservation interest. The SSSI designation applies throughout Great Britain. SSSIs are notified by the SNCO in the appropriate country.

Since 1949, the predecessors of the current SNCOs (i.e. the Nature Conservancy Council (previously the Nature Conservancy)) and more recently the SNCOs themselves identified areas of land or water with plant or animal communities, geological features or landforms of special interest. Before 1981 these areas, known as SSSIs, were notified to planning authorities to allow consideration to be given to their conservation in the planning process. However, because the special interest of these sites could be damaged or lost through activities not subject to planning control, further provisions to protect SSSIs were introduced by Parliament in the Wildlife and Countryside Act 1981 and the Wildlife and Countryside (Amendment) Act 1985.

Under the 1981 Act (as amended), an SSSI is now formally notified to the owners and occupiers of the land, the Secretary of State for the Environment and the planning authority. Sites notified under the National Parks and Access to the Countryside Act 1949 remain SSSIs, but the provisions of the 1981 Act relating to owners and occupiers do not apply until the land has been notified formally to them and to the Secretary of State. The process of notifying these existing SSSIs to owners and occupiers is often referred to as 'renotification'. This process has been largely completed.

Surveys since 1981 have revealed further areas that are also of special interest but that were not previously notified as SSSIs. These areas are being notified and these include extensions to some existing SSSIs.

If SSSIs or parts of SSSIs lose their special interest, the SSSI designation may be withdrawn by the SNCO. This process is referred to as 'denotification'.

Section 28(1) of the Wildlife and Countryside Act 1981 puts a duty on the Council of the appropriate SNCO to identify areas of land that are, in their opinion, of special interest. This interest must be notified to:

- every owner and occupier of the land;
- the planning authority;
- the Secretary of State for the Environment; and
- where appropriate to the water and sewerage companies (under the provisions of the Water Industry Act 1991), internal drainage boards (Land Drainage Act 1991) and the Environment Agency, formerly the National Rivers Authority (Water Resources Act 1991 as amended by the Environment Act 1995) or the Scottish Environment Protection Agency (Environment Act 1995).

The owners of minerals on SSSI land are also covered by the notification.

Designation of SSSIs follows two stages. The first is notification. This stage specifies the reasons for the interest and the boundary and provides a list of Operations Likely to Damage the interest of the site (OLDs, also and formerly known as Potentially Damaging Operations or PDOs).

Following notification, owners and occupiers are given at least three months in which to make representations or objections to the SNCO. The legal obligations on owners and occupiers of SSSIs are in force during this period. These concerns may be resolved by officers of the SNCO or will be referred to the SNCO Council during the second stage, which is confirmation. The SNCO Council must either confirm or withdraw a notification within nine months of its notification; modifications can be taken into account (but this cannot include an increase in size of the SSSI or adding to the list of OLDs).

Following the notification of an SSSI, the owner or occupier is not allowed to carry out any of the operations listed in the notification without consent from the SNCO, unless under a management agreement between them and the SNCO (under Section 16 of the National Parks & Access to the Countryside Act 1949) or after a four month period has expired since giving notice of intent to do the operation (section 28(5) and (6) of Wildlife and Countryside Act 1981 as amended by the Wildlife and Countryside (Amendment) Act 1985). Contravening these requirements without a reasonable excuse (such as having planning permission or needing to conduct an operation in an emergency) is a criminal offence (Section 28(7) and (8) of the 1981 Act).

The SNCO can request the Secretary of State to make a Nature Conservation Order under Section 29 of the Wildlife and Countryside Act 1981 (sometimes these are referred to as 'Section 29 Orders'). The objective of this is to extend the statutory negotiation period.

An Order will specify operations which may not be carried out on the site by any person. Owners and occupiers are required to give the SNCO three months' written notice of their intention to carry out an operation or permit it to be carried out. This period of notice is extended to 12 months if the SNCO offers to enter into a management agreement or an agreement to acquire the land (Section 29(6)). It is separate from the four months' notice described above. An operation may be carried out before the period of notice is completed either if the SNCO has given its consent to the proposal or if it is carried out under a management agreement with the SNCO. Emergency operations notified to the SNCO as soon as practicable and operations authorised by a planning permission are exempt from these requirements.

In contrast to the legal requirements under an SSSI notification, the obligations under a Nature Conservation Order apply to any person, and not just to owners and occupiers.

In practice, the designation of SSSIs follows published criteria (*Guidelines for the selection of Biological SSSIs:* Nature Conservancy Council 1989) and is intended only to identify the most outstanding sites of nature conservation interest. Many are designated on the basis of the habitats present; there are also criteria that allow sites to be selected because of the populations of amphibians and reptiles there (Chapter 15 of the SSSI

guidelines gives the criteria for amphibians and reptiles).

As at September 1996 there were 3,910 SSSIs in England covering 952,256 ha (about 6.8% of England's total area), 914 SSSIs in Wales covering 216,719 ha (about 10.3% of Wales' total area) and 1,411 SSSIs in Scotland covering 908,906 ha (11.6% of Scotland's area).

Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites

Special Protection Areas and Special Areas of Conservation are designated under Articles 4 and 3 respectively in the European Directives on the Conservation of Wild Birds (the Birds Directive, 79/409/EEC) and the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive, 92/43/EEC). Member States are required to designate key areas for the conservation of habitats and species listed in Annexes to these Directives. The onus is on the Member State thereafter to maintain or enhance the habitats within and outwith these areas to ensure that the listed species and habitats remain or return to a favourable conservation status at the EC level. These designated sites represent the most important areas for the conservation of listed habitats and species, and in all instances in the UK will first be notified as Sites of Special Scientific Interest prior to receiving their international classification. These protected sites will form part of a Europe-wide network known as the *Natura 2000* series of sites.

The UK is also a Contracting Party to the international Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention). Under the Convention, Contracting Parties are required to list, and thereafter conserve, at least one site in their territory as a Wetland of International Importance. Criteria for the selection of sites have been agreed under the Convention and allow for sites to be identified for intrinsic wetland values, importance for waterfowl, and importance for other non-avian wetland species of flora and fauna. In the UK, listed Ramsar sites are normally first notified as SSSIs.

Additional regulations (the 1994 Habitats Regulations) have been implemented for SSSIs to provide powers to enable the UK to meet its requirement to conserve SPAs and SACs. Planning policy guidance to implement these Regulations (PPG 9 in England, PPG (Wales) in Wales and Circular 6/1995 in Scotland) lays out local authority obligations with regard to *Natura 2000* sites.

The above designations are of considerable relevance to herpetofauna, both directly and indirectly. The great crested newt is the only British species of amphibian or non-marine reptile listed in Annex II to the Habitats Directive as a species requiring SAC designation. However, Ramsar sites may be designated for internationally important populations of any amphibian or reptile species associated with wetland habitats. Furthermore, other habitats important for both reptiles and amphibians are listed in Annex I to the Habitats Directive; notably wet heath and dry heath. Importantly, Article 4 of the Birds Directive requires conservation of certain bird species on SPAs through the conservation of their habitats. This affords direct protection of habitats for associated species, for example, smooth snake and sand lizard on sites with nightjar or Dartford warbler.

On these sites there is also a considerable opportunity in the future to conserve herpetofauna through ensuring that their needs are fully integrated into the site management plan preparation process. Such management plans are required for all *Natura 2000* sites and SSSIs by 2004.

National Nature Reserves (NNRs)

National Nature Reserves are designated by the SNCOs under the Wildlife and Countryside Act (Section 35). These areas are owned, leased and managed by the SNCOs, managed through a management agreement with the owners or owned and managed by an 'approved body'.

There are 180 NNRs in England covering 68,886 ha, 62 NNRs in Wales covering 18,592 ha and in Scotland 70 NNRs covering 113,238 ha (figures at September 1996).

Other designations (LNRs, SINCs)

Local Nature Reserves (LNRs) are sites owned or controlled by local authorities; some, though not all, are SSSIs. In England there were 534 Local Nature Reserves covering 19,646 ha, in Wales 37 LNRs covering 5,075 ha and in Scotland 23 LNRs covering 8,139 ha (September 1996). Local authorities consult the SNCOs about all new proposals for LNRs.

There are other designations used by Local Authorities to help identify areas of wildlife importance to the planning system. Very often these are identified and described by Wildlife Trusts. These have various local names depending on which Local Authority is involved; these include names such as County Wildlife Sites (CWS), Sites of Local Nature Importance (SLNI), Sites of Biological Interest (SBI), Site of Nature Conservation Interest (SNCI), Areas of Outstanding Ecological Quality (AOEQ) and may be graded locally to show different quality (e.g. SBI Grade 1). These are generically termed 'Sites of Importance for Nature Conservation' (SINCs). The criteria used to designate such sites are as variable as the names used to describe them. Very often these will be primarily, if not exclusively, either habitat oriented or botanically based. However there are moves to increase standardisation and to include faunistic characteristics (i.e. criteria based on the animals present); these offer great potential to local herpetofauna workers to allow sites that are of local importance to be identified and safeguarded through the planning process.

7.3 Animal welfare and miscellaneous legislation in Great Britain

7.3.1 Welfare legislation

The Protection of Animals Act 1911 (applying to England and Wales) and the Protection of Animals (Scotland) Act 1912 make it an offence to treat an animal cruelly or to cause it unnecessary suffering. Specifically this encompasses matters such as transporting animals in a way which causes suffering and the failure of the owner of an animal to exercise reasonable care in and supervision over it to protect it from cruelty. The Acts are restricted to 'domestic animals' and 'captive animals' and so cannot be applied to wildlife that is not in captivity.

They define a captive animal as "any animal (not being a domestic animal) of whatsoever kind or species, and whether a quadruped or not, including any bird, fish, or reptile, which is in captivity or confinement, or which is maimed, pinioned, or subjected to any appliance or contrivance for the purpose of hindering or preventing its escape from captivity or confinement". Moreover, the definition of 'domestic animal' extends to any animal that has been "sufficiently tamed to serve some purpose for the use of man". Though it does not specifically mention amphibians, clearly these fit within the definitions and so are covered by the legislation. However, though invertebrates are not specifically excluded, cases taken have indicated that the Acts are in fact restricted to vertebrate animals. This legislation is relevant to herpetofauna workers who catch and handle animals, perhaps for survey, and particularly so where animals are being taken into captivity or where translocations are being undertaken.

The Abandonment of Animals Act 1960 is a 'daughter Act' of the Protection of Animals Act 1911 and the Protection of Animals (Scotland) Act 1912 (collectively these Acts are known as the Protection of Animals Acts 1911–1960 and Protection of Animals (Scotland) Acts 1912–1960). This Act makes it an offence of cruelty to abandon any animal either owned or in someone's control, whether permanently or not, in circumstances likely cause the animal any unnecessary suffering. While its most obvious application would relate to the abandoning of domestic animals, its application may also affect other aspects of work done by herpetologists. The Act could extend to animals being released after short periods in captivity, e.g. for mitigation translocation, or from captivity to the wild as part of a reintroduction programme.

The Animals (Scientific Procedures) Act 1986 makes an important exception to the protection given by the Protection of Animals Act 1911 and the Protection of Animals (Scotland) Act 1912. With amendments, this Act also applies to Northern Ireland and amends the Welfare of Animals (Northern Ireland) Act 1972 (see section 7.5 below). This Act relates to the use of vertebrate animals for research throughout the UK. For this purpose the Animals (Scientific Procedures) Act 1986 says that a 'regulated procedure' will not normally be illegal if properly authorised. Accordingly the 1986 Act identifies the types of procedures that are regulated by the Home Office and gives scope for the necessary licences to be issued and defines the projects and establishments used for scientific procedures and for breeding and supply of specified animals. In essence a regulated procedure is a scientific or experimental procedure applied to a vertebrate that "may have the effect of causing that animal pain, suffering, distress or lasting harm". The use of any anaesthetic is considered a regulated procedure. Excluded from the definition are recognised tagging, marking or ringing techniques where their sole purpose is to allow subsequent recognition and where their application "causes only momentary pain or distress and no lasting harm". Where there is any doubt about interpretation, then a Home Office inspector should be consulted. The Protection of Animals (Anaesthetics) Acts of 1954 and 1964 make it an offence to conduct certain surgical operations on animals without the use of anaesthetics. These provisions may be of special importance to those wishing to study amphibians and reptiles by marking them (see Chapter 4).

The Animal Health Act 1981, as amended by the Animal Health & Welfare Act 1984, is primarily concerned with the spread of disease amongst farmed animals in the UK but may, in some circumstances, affect other species. For that reason it may be relevant to zoos, research stations and field studies of wild animals. Most significantly the Act allows restriction of movement and importation of animals and eradication programmes to control diseases. There is additional welfare legislation concerned with the transport of animals (e.g. Welfare of Animals During Transport Order 1994), which requires, for example, that animals must be fit to travel, vehicles and containers must be suitably adapted, and adequate food, water, temperature, ventilation and humidity must be provided.

The Dangerous Wild Animals Act 1976 regulates the keeping of dangerous animals such as lions, ostriches and venomous snakes such as cobras. These animals are listed in a schedule to the Act (as modified by the Dangerous Wild Animals Act 1976 (Modifications) Order 1984 (SI 1984 1111)). Since the Viperidae, which include adders, are listed, a licence will be required from the Local Authority for their possession. The accommodation provided for these animals must be such that they cannot escape, the premises must be inspected by a veterinary surgeon, and the licensee must hold insurance (approved by the Local Authority) to cover damage that the animal could cause. The application of these requirements to cases where adders are held in captivity for only a short while is unclear, though it is likely that the provisions of the Act would not apply in such cases. However, if adders were kept in captivity for a sufficient period of time to become domesticated, then their release to the wild would be prohibited.

The Pet Animals Act 1951 applies to any business selling vertebrate animals as pets, that is for domestic or ornamental purposes, and provides a system by which licences can be granted for such establishments. Zoos in Great Britain are subject to the Zoos Licensing Act 1981, which applies to any collection of animals, specifically including amphibians and reptiles, of a kind not usually domesticated and to which the public has access for more than seven days in any twelve month period. Licences must be acquired for an animal collection of this kind and the premises will be subject to periodic inspections to check that it complies with codes of practice for zoos. A person who exhibits a vertebrate animal must be registered with a Local Authority under the provisions of the Performing Animals (Regulation) Act 1925.

Finally, alongside these diverse statutory animal welfare provisions, it should be noted that various kinds of liability may arise in relation to the keeping or escape of animals. In particular, civil law provides for a range of situations in which compensation may be payable, e.g. where the animal escapes and causes damage or by keeping an animal it causes a nuisance to others or results in injury to a person that enters the place where the animal is kept.

7.3.2 Miscellaneous legislation

Unfortunately, there is not room to cover here all the various other pieces of legislation that may affect herpetofauna work. Some examples include: the Salmon & Freshwater Fisheries Act 1975, which controls the movement of fish and prevents, for example, unlicensed use of fish poisons to control them; the Town & Country Planning Act 1990, which requires planning permission for certain activities – this can extend to pond creation, and protects certain landscape features (e.g. trees); and the Forestry Act 1967 (as amended by the Trees Act 1970 and Forestry Acts 1979, 1986), which may require approval to be obtained to cut down trees above a certain size. These pieces of legislation are controlled by different authorities: in these cases they are the Environment Agency, Scottish Environment Protection Agency, Local Authority planning departments and the Forestry Authority.

7.4 Conservation legislation in Northern Ireland

7.4.1 Species protection legislation

Protection

The Wildlife (Northern Ireland) Order 1985 (SI 1985 No. 171 (N.I. 2)) is the principal legislation relating to the protection of wildlife in Northern Ireland. The Conservation (Natural Habitats &c.) Regulations (Northern Ireland) 1995 implement the requirements of the EC Habitats Directive.

One species of reptile and two species of amphibian receive protection through the Wildlife (Northern Ireland) Order 1985; this represents the full quota of Northern Ireland's herpetofauna. Protection is provided through Articles 10 to 13 of the Order and refers to Schedules 5, 6 and 7. The smooth (or common) newt *Triturus vulgaris* and the common (or viviparous) lizard *Lacerta vivipara* are included in all three Schedules; the common frog *Rana temporaria* is listed only on Schedule 7. There have to date been no variations to the Schedules that affect amphibians or reptiles. Marine turtles that occur in the waters off Northern Ireland or that are washed ashore are not protected through domestic legislation.

Article 10 provides protection to all species listed in Schedule 5. This prohibits intentional killing, injuring and taking (Art. 10(1)) and possession of live or dead specimens (Art. 10(2)). Damage or destruction of, or obstructing access to, any structure or place used for shelter or protection by a protected animal, or damaging or destroying something that conceals or protects such a structure (Art. 10(4) (a) and (b)), or disturbing an animal occupying such places or structures (Art. 10(4) (c)), are also prohibited. The legislation only applies to wild animals but there is a presumption that animals are 'wild animals' unless the contrary can be shown.

Article 12 prohibits certain methods of killing or taking of all wild animals using self-locking snares, "any missile which is not discharged from a firearm, including in particular any arrow or spear" or any explosives (other than ammunition for a firearm (Art. 12(1) (a) and (b)). In addition a wide range of other methods of capture or killing animals listed on Schedule 6 (which includes the common lizard and smooth newt) (Art. 12 (2) (a) to (d)) are prohibited. Traps designed to cause bodily injury (e.g. gin traps, snares, hook and line, electrical devices for killing and stunning, poisons or stupefying substances) are prohibited. Nets are not allowed to be used for catching these animals, nor are any of a long list of other methods including automatic or semi-automatic weapons, metal bars, axes or similar, devices for night shooting, any form of artificial light or mirror or other dazzling device, gas or smoke.

Sale, transporting or possessing for sale etc. of animals listed in Schedule 7 is prohibited by Article 13 (1); Article 13 (2) specifically prohibits the sale etc. of dead animals or any parts of animals listed on Schedule 7 unless registered with the Department of Environment (Northern Ireland). All three of Northern Ireland's native amphibians and reptiles are covered by this provision.

Exceptions (defences)

Article 11 provides exceptions to the protection afforded to Schedule 5 species through Article 10. There are provisions that allow requirements of the Agriculture Act (Northern Ireland) 1949 to be carried out, the possession of injured animals for treatment provided they are released once they are no longer disabled, and 'mercy killing' of severely injured animals. There is also the provision that allows an act that is "the incidental result of a lawful operation and could not reasonably have been avoided". Killing or injuring wild Schedule 5 animals is not an offence for emergency protection of livestock, crops or other property, provided that the Department of Environment (Northern Ireland) is notified immediately afterwards. There are provisions that allow licences to be issued to undertake activities which would otherwise be prohibited under the legislation.

7.4.2 Site protection

Areas of Special Scientific Interest (ASSIs)

Sites that are identified as being of particular importance for wildlife or for physiographic or geological features can be designated Areas of Special Scientific Interest (ASSIs) under the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (Art. 16).

7.5 Animal welfare legislation in Northern Ireland

In Northern Ireland animal welfare is addressed through the Welfare of Animals (Northern Ireland) Act 1972. Of particular significance is that this applies to both wild and captive animals and that the offence of cruelty and causing unnecessary suffering can therefore apply to free living wild animals (unlike the Protection of Animals Acts 1911–1960 and Protection of Animals (Scotland) Acts 1912–1960 in Great Britain).

7.6 European and international protection

While national legal measures apply directly to those engaged in work with herpetofauna, it should be recognised that many of the national laws enacted by the UK Government have the purpose of giving effect to international or European obligations. These may be a result of international conventions or European Directives and Regulations concerned with wildlife protection. Although these measures place direct obligations between nations at the level of Government, they usually require specific laws to be implemented within the different nations to ensure that practice within their national boundaries (or in some cases by their subjects elsewhere, e.g. at sea) complies with international commitments. A large part of UK conservation national law has been enacted for this reason.

7.6.1 International conventions

United Nations Conference on the Environment and Development (the 'Earth Summit')

It is significant that the UK is a party to the agreements reached at the UN Conference on the Environment and Development, which was held in Rio de Janeiro in 1992. These include the commitment under Agenda 21 of the Summit to 'sustainable development', whereby development is to meet the needs of the present without compromising the ability of future generations to meet their own needs. In addition, the UK is a signatory to the Convention on Biological Diversity, which recognises that a national responsibility exists to draw up plans and programmes to enhance biodiversity, including the establishment of protected areas, and to halt the loss of animal and plant species and genetic resources (see *Biodiversity: the UK Action Plan* (1994) CM. 2428 HMSO). Consequently, national measures will be necessary to ensure compliance with these obligations, and the protection of herpetofauna will be encompassed within them.

Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention)

At a regional level, the UK is a signatory to the Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats, also called the Bern Convention (1979). The European Union is also a signatory. This Convention covers all aspects of nature conservation by seeking to conserve wild fauna and flora in their natural habitats. It imposes a general duty on the parties to have regard to the conservation of wildlife and habitat protection in planning and development policies, particularly in respect of threatened species and especially when the conservation requires the co-operation of several states. The parties to the Convention meet annually to discuss implementation in party states. There is an amphibian and reptile expert group that advises the Standing Committee to the Convention about herpetofauna and related matters. Obligations arising under the convention are implemented in Great Britain under the Wildlife and Countryside Act 1981 and the Habitats Regulations 1994 (incidental to their role in implementing the EC Habitats Directive – see below) and in Northern Ireland through the Wildlife (Northern Ireland) Order 1985.

Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention)

The primary objective of the Convention on the Conservation of Migratory Species of Wild Animals, also known as the Bonn Convention (1980), is to protect migratory species. It does this by two methods. Firstly it provides strict protection for species listed in Appendix I, which comprises migratory species in danger of extinction throughout a significant part of their ranges. This is done by placing strict obligations on countries that are 'range states' of the species concerned. The second approach is to try to get agreements between range states for the conservation and management of Appendix II species.

The convention has little direct application to herpetofauna in the UK except that the marine turtles are listed on both Appendices I and II.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

This convention was signed in Washington in 1973 and is also known as the Washington Convention or abbreviated to CITES. It aims to control the international trade in threatened species. This is done through instituting a system of prior permits and certificates for any trade or importation and exportation of endangered species of fauna and flora, including readily recognisable parts and derivatives from them. Trade in many animal and plant species is prohibited through this convention. Species are listed on a series of Appendices; with Appendix I species being most strictly controlled (effectively a world ban on trade), with lower tiers of control through Appendices II and III (having diminishing requirements for import and export permits). These Appendices are agreed through meetings of the parties to the convention. The convention was implemented in the UK by the Endangered Species (Import & Export) Act 1976, but since many aspects of this legislation have been superseded by European legislation it has now been repealed. CITES is enforced throughout the European Union by the European Communities Regulation on the protection of species of Wild Fauna and Flora by regulating trade therein (No. 338/97). This requires a system of permits and certificates for imports and exports of the species concerned into the European Union. Permits are issued by 'competent authorities' in the member states (e.g. Department of the Environment, Transport and the Regions (DETR) for England, Scotland

and Wales, and DANI in Northern Ireland, with scientific advice from the UK Joint Nature Conservation Committee). The species are listed in Annexes to the Regulations that are similar to the CITES Appendices but in many cases are stricter. As well as restricting trade in threatened species, the 1997 Regulation also provides for the control of species that may cause harm if released to the wild in the country for which they are destined (and has listed bullfrog and red-eared terrapin for this reason). These Annexes are drawn up by a scientific working group working to the EU. The national legislation that provides offences for this in the UK is the Control of Trade in Endangered Species (Enforcement) Regulations 1985. This is known as COTES. New Regulations to replace COTES were expected in 1997. Although these measures are important for protecting non-native species being imported into the UK, with the exception of marine turtles, they have no application to the native British species.

7.6.2 European Union (European Community) legislation

Within the European Union various conservation measures have been enacted in accordance with a series of action programmes on the environment. Although conservation was not provided for under the original treaty establishing the European Community (Treaty of Rome 1957), subsequent amendments have made it explicit that measures of this kind may be enacted under European law. Hence the Community Treaty, as amended, now states that the objectives of the Union are to include a sustainable and non-inflationary growth respecting the environment (Art. 2) and policy relating to the environment is to pursue the objective of a prudent and rational utilisation of natural resources (Art. 130 R(1)). Consequently measures concerning the conservation of all species are within the legislative competence of the European Union.

Council Directive on the Conservation of Wild Birds, 'the Birds Directive'

An early measure (1979) concerned with wild bird protection, the Council Directive on the Conservation of Wild Birds (79/409/EEC), imposed an obligation upon member states of the Community to maintain populations of naturally occurring birds at a level corresponding to their ecological, scientific and cultural requirements by creating protected areas and managing habitats for this purpose. This was enacted in the UK through the Wildlife and Countryside Act 1981 and the Wildlife (Northern Ireland) Order 1985. Though the objective is to protect birds, the site protection systems that developed from this legislation in the UK have, incidentally, helped protect other wildlife including (see section 1.2.2 b. above).

Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC); 'the Habitats Directive'

The main objective of this Directive is the maintenance and restoration at a favourable conservation status, of natural habitat types and species of community importance, while taking account of cultural, economic, social and regional requirements. This was enacted in the UK through the Wildlife and Countryside Act 1981, the Wildlife (Northern Ireland) Order 1985 and the Habitats Regulations 1994 and Habitats Regulations (Northern Ireland) 1995.

Certain habitats and species have been listed on Annexes to the Directive (Annex I for habitats, Annex II for species. For these member states are required to identify sites that are protected as Special Areas of Conservation (SACs) (see section 7.2.2 b. above) and form part the Europe-wide network of sites called *Natura 2000*. Species protection provisions are set out in Article 12 of the Directive for species listed on Annex IV; the herpetofauna species native to Great Britain on this list are great crested newt, natterjack toad, sand lizard, smooth snake and the marine turtles.

7.7 Licensing

7.7.1 The purpose of licensing and applying for a licence

Licensing is a means by which activities that are otherwise forbidden can be carried out with formal consent. There must be a provision in the relevant legislation that allows a licence to be issued for the action requested and for the reason it is requested. Different statutory authorities are empowered to grant licences under different pieces of legislation. Even within any one piece of legislation it is possible that different authorities can issue a licence depending on what is wanted and why it is required.

In all cases the appropriate licensing authority should be consulted for up-to-date advice on the issue of licences, the standards that are expected and conditions that would be attached to any licences, for example, 'Method Statements' which detail the approach and techniques to be used. Licences are not issued retrospectively. Very often licences require a certain level of competence before they can be issued; reports are also often expected as a condition of the licence and these would be due shortly after the expiry of a licence.

General licences can be issued that allow certain activities for whole groups of people or for the entire population, without requiring individual licences to be issued. An example of this is the issue of a general licence by DETR to cover the sale of the four commoner amphibian species in Great Britain. This is valid for a three year period and allows the sale of adult animals with certain conditions attached relating to the time of year when animals are taken and the geographic location from which animals may be taken. This does not affect the actual legislation; it merely provides a simplified administrative process where individual licences would not otherwise be refused. A general licence was issued by the Nature Conservancy Council to allow survey of great crested newts by people in scientific and educational establishments to allow them to contribute to surveys.

7.7.2 The licensing authorities

Conservation legislation

Licences are issued under the Wildlife and Countryside Act 1981 and the Habitats Regulations 1994 for work on protected species by different authorities depending on the reason for wanting a licence. These functions are explained in Section 16 of the 1981 Act and Regulation 44 of the 1994 Regulations. The majority of work relating to herpetofauna is covered by the need to handle or disturb protected animals for conservation or scientific reasons. These licences are issued by the appropriate SNCO (Countryside Council for Wales, English Nature or Scottish Natural Heritage). The SNCOs are also the licensing authorities for educational reasons, photography or protecting zoological collections.

Apply to the Licensing Section of the appropriate SNCO at the following addresses: Licensing Section, English Nature, Northminster House, Peterborough, Cambridgeshire PE1 1UA, telephone 01733 455000; Licensing Section, Countryside Council for Wales, Plas Penrhos, Fford Penrhos, Bangor, Gwynedd LL57 2LQ, telephone 01248 370444; Licensing Section, Scottish Natural Heritage, 2/5 Anderson Place, Edinburgh EH6 5NP, telephone 0131 554 9797.

Licences in connection with public health or safety, prevention of the spread of disease or the prevention of serious damage to livestock, crops or other property may be issued, as appropriate, by the Ministry of Agriculture, Fisheries and Foods (MAFF), the Department of the Environment, Transport and the Regions (DETR), the Scottish Office Agriculture, Environment & Fisheries Department (SOAEFD) or the Welsh Office (WO). Sales of protected wildlife are regulated through licences issued by the appropriate Secretary of State (DETR, SOAEFD or WO). In addition, the Secretary of State can issue licences to permit otherwise prohibited acts, where this is considered to be for imperative reasons of over-riding public interest (in practice, this means for large nationally important developments such as major roads or rail links). Licences for releases of non-native species are dealt with by the respective Secretary of State.

In England, most aspects of the Wildlife and Countryside Act 1981 and Habitats Regulations 1994 are dealt with by DETR, Room 902, European Wildlife Division, Tollgate House, Houlton Street, Bristol, BS2 9DJ, telephone 0117 987 6154. For Section 14 licensing (non-native species releases) contact DETR, Chemicals & Biotechnology Division, Room 3/E4, Great Minster House, 76 Marsham Street, London, SW1P 4DR, telephone 0171 271 5000.

In Wales, all such licences are issued by the Welsh Office, Environment 4B, Welsh Office, New Crown Buildings, Cathays Park, Cardiff, CF1 3NQ, telephone 01222 825111.

In Scotland, Scottish Office licences are issued by Pentland House, 47 Robb's Loan, Edinburgh, EH14 1TY, telephone 0131 556 8400.

In Northern Ireland the licensing functions for all of the above are undertaken by Department of Environment (Northern Ireland) (see Art. 18 of the Wildlife (Northern Ireland) Order 1985). For further information contact the Environment and Heritage Service, Department of the Environment, Commonwealth House, 35 Castle Street, Belfast, BT1 1GU, telephone 01232 546558.

International trade licensing and enquiries about CITES permits etc. for England, Scotland and Wales should be directed to Global Wildlife Division, DETR, Room 822, Tollgate House, Houlton Street, Bristol, BS2 9DJ, telephone 0117 987 8691. For Northern Ireland, contact Department of Agriculture for Northern Ireland, Wildlife Licensing Section, Animal Health Division, Room 714, Dundonald House, Upper Newtonard Road, Belfast, BT4 3SB, telephone 01232 524825.

Animal welfare legislation

The Home Office oversees the majority of animal welfare legislation. Licence enquiries about regulated procedures under the Animals (Scientific Procedures) Act 1986 should

be directed to Home Office E Division, Room 976, 50 Queen Anne's Gate, London SW1H 9AT, telephone 0171 273 2898/2276. Licences for specific projects usually require the involvement of local inspectors.

The Dangerous Wild Animals Act 1976 is overseen by Environmental Health Departments of Local Authorities. These should be contacted for information and licensing under this legislation. The Transport of Animals Order 1973 is enforced by Local Authorities.

Miscellaneous legislation

Variously other organisations will need to be contacted for licences. The Environment Agency and the Scottish Environment Protection Agency oversee many aspects relating to the water environment, including discharging water and moving fish, and licences and consents to carry out such actions may need to be obtained from them. Planning legislation is controlled by Planning Authorities and permissions may need to be obtained through the planning system. The Forestry Authority is responsible for issuing felling licences where these are required.

In all cases the local offices of these organisations should be contacted; addresses can be found in the telephone directory.

7.8 The planning system and its role in conservation

Planning law is increasingly being used to secure conservation objectives. Primarily, the duties upon planning authorities are to prepare development plans and to determine particular applications for planning consent. These are provided for under the Town and Country Planning Act 1990 in England and Wales and the Town and Country Planning Scotland Act 1972 in Scotland, though these have to be read in conjunction with a large body of amending and delegated legislation and policy guidance. The Department of Environment, Transport and the Regions (DETR) issues numerous Circulars and Planning Policy Guidance Notes to assist with the interpretation of legislation and its implementation by planning authorities. Similar guidance is issued by the Welsh Office (WO), the Scottish Office (SO) and DoE (Northern Ireland).

Planning guidance specifically about nature conservation in England and Wales was, until recently, provided for under four Circulars. These are *Wildlife and Countryside Act 1981* (DoE 32/81 and WO 50/81); *Wildlife and Countryside Act 1981: Commencement of Part 1* (DoE 24/82 and WO 38/82); *Nature Conservation* (DoE 27/87 and WO 52/87); and *Planning Controls over SSSIs* (DoE 1/92 and WO 1/92). In addition there is reference to nature conservation considerations in other Planning Policy Guidance notes, for example PPG 7 on the *Countryside and Rural Economy.*

However, a new Planning Policy Guidance note on *Nature Conservation*, issued in October 1994 as PPG 9, cancels the earlier DoE Circulars as they apply to England. PPG 9 gives guidance on the Government's objectives for nature conservation, the roles of statutory bodies in nature conservation and the role of special sites and explicitly states that protected species count as a material planning consideration. Specifically, PPG 9 identifies a need for local authorities to consult English Nature when a protected species is found to be present at a site under consideration for planning purposes. This PPG does not apply to Wales, Scotland or Northern Ireland. Further planning guidance was issued in Wales in 1996: this is called *Planning Guidance (Wales): Planning Policy 1996* (Published by HMSO).

In Scotland, three principal Scottish Office Circulars relate to nature conservation. These are *Wildlife and Countryside Act 1981: Code of Guidance on SSSIs* (SO 1/83); *Wildlife and Countryside (Amendment) Act 1985* (SO 31/85); and *Nature Conservation and Part VIII of the Environmental Protection Act 1990* (SO 13/91). There is further guidance on Planning in Scotland in *National Planning Policy Guidance Note No. 1: The Planning System.* In Northern Ireland similar planning guidance to that produced for England is being developed.

Clearly, many kinds of development can have an adverse impact upon wildlife habitats. This needs to be carefully considered by planning authorities before granting planning permission for such developments. In particular, special planning procedures apply in relation to certain types of developments that are likely to have a significant effect upon the environment; these are usually large development schemes. An Environmental Assessment is often required by planning authorities for such projects before an application for planning permission will be determined. Environmental Assessments identify features of nature conservation importance that may be affected by development proposals and evaluate the impact the proposal will have on them. In some cases it may be necessary for particular conditions to be incorporated in a planning permission to secure conservation objectives. Mechanisms for achieving this may include the use of legally binding planning conditions or agreements under Section 106 of the Town and Country Planning Act 1990 (in England and Wales).

The planning process, generally, provides the scope for statutory and voluntary conservation organisations, environmental groups and interested individuals to make representations about development plans and specific planning applications. A development proposal may also be subject to Public Inquiry, offering an opportunity for conservation issues to be considered by a Government-appointed inspector.

If a statutory body charged with carrying out an administrative function, such as a planning function, exercises its duty in contravention of the law, the decisions or actions may be challenged in the courts by the judicial review procedure. An example of this could be where planning permission has been granted without proper consideration of protected species. This, however, can be expensive. In cases of maladministration by a local authority, decisions can be challenged by recourse to the Ombudsman.

More broadly, local authorities have a statutory duty to promote nature conservation and to take it into consideration in planning matters. Many local authorities employ ecologists and have countryside management or education teams. Conservation may also be advanced by county, regional or district councils by designation of Local Nature Reserves, recognition of Sites of Importance for Nature Conservation and positive conservation policies in development plans.

The planning system should therefore provide adequately for the protection of herpetofauna. However, it should be remembered that nature conservation is only one of the aspects that the planning authorities need to consider when developing plans or assessing planning applications.

7.9 Administration and law enforcement

The central role in the administration of nature conservation law is taken by the SNCOs. The Environmental Protection Act 1990 brought about major changes by abolishing the Nature Conservancy Council (with responsibility for nature conservation in the whole of Great Britain) and creating three distinct country agencies: the Countryside Council for Wales (CCW), the Nature Conservancy Council for England (English Nature, EN), and Nature Conservancy Council for Scotland which subsequently became Scottish Natural Heritage (SNH) (under the Natural Heritage (Scotland) Act 1991). The 1990 Act also created a new body, the Joint Nature Conservation Committee (JNCC), to provide advice and co-ordination at the UK and European level.

The SNCOs have specified nature conservation functions under the Environmental Protection Act 1990. The 'general' functions of three country agencies include establishing, maintaining and managing nature reserves, designating SSSIs, providing advice to the Secretary of State on nature conservation, disseminating knowledge about nature conservation; and commissioning relevant research. Certain 'special' functions which concern nature conservation in the whole of Britain are to be discharged by the Joint Nature Conservation Committee. In addition, the Countryside Council for Wales have specified countryside functions under the Environmental Protection Act 1990 and Scottish Natural Heritage have similar functions under the Natural Heritage (Scotland) Act 1991. These countryside functions are effectively the roles previously undertaken by the Countryside Commissions for Wales and for Scotland. Scottish Natural Heritage have further powers relating to such things as Natural Heritage Areas under the Natural Heritage (Scotland) Act 1991.

Although primary responsibility for nature conservation is allocated to the SNCOs there are many other bodies that possess nature conservation powers and duties. For example, under the Water Resources Act 1991, a specific duty to promote nature conservation in England and Wales was placed on the National Rivers Authority. The Environment Act 1995 abolished the National Rivers Authority and created the Environment Agency in England and Wales and the Scottish Environment Protection Agency in Scotland. These new regulatory authorities for water, waste and pollution are charged with an equivalent duty towards nature conservation. Agriculture and forestry legislation, such as the Agriculture Act 1986 and the Wildlife and Countryside (Amendment) Act 1985, also places duties on the Agriculture Departments and Forestry Commission in Britain to draw a balance between nature conservation and their other activities.

While the overall responsibilities for nature conservation lie with the SNCOs, other bodies and agencies perform an important role in the enforcement of nature conservation law. Offences that involve cruelty are often prosecuted by the Royal Society for the Prevention of Cruelty to Animals, the Scottish Society for the Prevention of Cruelty to Animals or the Ulster Society for the Prevention of Cruelty to Animals. Water pollution incidents are investigated and prosecuted by the Environment Agency in England and Wales (Environment Act 1995), by the Scottish Environment Protection Agency in Scotland (Environment Act 1995) and by Environment and Heritage Service in Northern Ireland (Water Act Northern Ireland 1972). Illegal poisoning of animals is usually investigated by the agriculture departments.

Enforcement of statutory species protection (Wildlife and Countryside Act 1981 Part I and 'Habitats Regulations' 1994 in Great Britain; The Wildlife (Northern Ireland) 1985 and 'Habitats Regulations' (Northern Ireland) 1995 in Northern Ireland) is usually pursued by the police or in Scotland by the Office of the Procurator Fiscal. Enforcement of statutory site protection (Wildlife and Countryside Act 1981 Part II in Great Britain; The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 in Northern Ireland) is usually pursued by the SNCO.

7.10 Full titles of conservation legislation

United Kingdom legislation

- The Conservation of Wild Creatures and Plants Act 1975; *1975 Chapter 48* (repealed 1981)
- The Wildlife and Countryside Act 1981; *1981 Chapter 69*
- The Environmental Protection Act 1990; *1990 Chapter 43*
- Natural Heritage (Scotland) Act 1991
- Statutory Instrument 1994 No 2716 Wildlife, Countryside. Conservation (Natural Habitats &c.) Regulations 1994: also known as the Habitats Regulations
- Environment Act 1995; *1995 Chapter 25*

Amendments

- Wildlife and Countryside Act (Amendment) Act 1985
- Wildlife and Countryside Act (Service of Notices) Act 1985
- Wildlife and Countryside Act (Amendment) Act 1991

Variations of schedules

- Statutory Instrument 1988 No. 288: Wildlife and Countryside Act 1981 (Variation of Schedules) Order 1988
- Statutory Instrument 1989 No. 906: Wildlife and Countryside Act 1981 (Variation of Schedules) Order 1989
- Statutory Instrument 1991 No. 367: Wildlife and Countryside Act 1981 (Variation of Schedules) Order 1991
- Statutory Instrument 1992 No. 320: Wildlife and Countryside Act 1981 (Variation of Schedules) Order 1992
- Statutory Instrument 1992 No. 2350: Wildlife and Countryside Act 1981 (Variation of Schedules) Order 1992
- Statutory Instrument 1992 No. 2674: Wildlife and Countryside Act 1981 (Variation of Schedules) Order 1992
- Statutory Instrument 1992 No. 3010: Wildlife and Countryside Act 1981 (Variation of Schedules) Order 1992

Northern Ireland Legislation

- The Wildlife (Northern Ireland) Order 1985 (Statutory Instrument 1985 No. 171 (N.I.2))
- The Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (Statutory Instrument No. 170 (N.I.1))
- Statutory Instrument 1995 No. 380 Wildlife &c. Countryside Conservation (Natural Habitats &c.) Regulations (Northern Ireland) 1995, also referred to as the 'Habitats Regulations (Northern Ireland)' 1995.
- Welfare of Animals (Northern Ireland) Act 1972.

Water Act Northern Ireland 1972.

European Union/Communities legislation

- Council Directive of 2 April 1979 on the Conservation of Wild Birds (79/409/EEC): also called 'the Birds Directive': published in the *Official Journal of the European Communities* No. L 103 pp. 1–6 (1979) and amended by Commission Directive of 6 March 1991 (91/244/EEC) published in the *Official Journal of the European Communities* No. L 115 pp. 41–54 (further Annexes in *Official Journal of the European Communities* No. L 164).
- Council Directive of 21 May 1992 on the Conservation of Natural and Semi-Natural Habitats and of Wild Fauna and Flora (92/43/EEC): also called 'the Habitats Directive': published in the *Official Journal of the European Communities* No. L 206 pp. 7–50 (1992).
- Council Regulation (EEC) No. 338/97 of 9 December 1995 on the protection of species of Wild Fauna and Flora by regulating trade therein: published in the *Official Journal of the European Communities* No. L 61 Vol. 40 (1997).

International conventions

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora; Also called CITES or 'the Washington Convention' (1973). Published as *Miscellaneous No. 25 (1973) Cmnd. 5459.* HMSO.
- The Convention on the Conservation of European Wildlife and Natural Habitats: also called 'the Bern Convention' A Council of Europe Convention (1979). Published as *European Treaty Series No. 104.* Council of Europe.
- The Convention on the Conservation of Migratory Species of Wild Animals: also known as 'the Bonn Convention' (1980): originally published as *Miscellaneous No. 11 (1980) Cmnd. 7888,* re-published in *Treaty Series No. 87 (1990) Cm. 1332.* HMSO.

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Chapter 8 Site assessment and protection

Trevor Beebee and Robin Grayson

8.1 Introduction

For amphibians and reptiles to be adequately conserved their sites need to be safeguarded. This requires not only an understanding of the nature of the threats that may affect any site but also the ability to put in place the necessary mechanisms to protect it. Threats can be many and varied; some are the consequences of human activities, others are natural processes that may need to be managed in order to reduce the risk to the amphibians or reptiles on the site.

Undoubtedly, no matter how well threats to sites can be identified or appropriate systems developed to address them, there will always be a need to prioritise conservation efforts. This prioritisation can be at a national or local level and can aim to deal with particularly threatened species or to tackle particularly significant effects. Consequently it is important that the right priorities are addressed when dealing with limited conservation resources and that mechanisms are developed so that problems are avoided in the first place.

Many amphibian and reptile sites are simply not recognised, at least not by the people who are making decisions about their management or deciding on planning issues that will affect them. The significance of populations is not understood, and good populations are lost simply because they are thought to be insignificant. Management may well be 'misguided'; the wrong technique may be applied or a form of management implemented to benefit one aspect of the site's nature conservation interest that may be detrimental to the reptile and amphibian interests. Often the population is not known about, or assessments are undertaken too late. Amphibians and, in particular, reptiles are often poorly represented in Environmental Assessments (EAs); many ecological surveys are done using 'botanically based' criteria such as Phase I Habitat Surveys. Although criteria have been developed for assessing amphibian and reptile sites (e.g. Nature Conservancy Council's *Guidelines for selection of biological SSSIs* (NCC 1989)), these have only limited application to many sites.

A number of approaches are possible for the safeguarding of herpetofauna sites. All types of protection should encompass all different habitats needed by the animals. At amphibian sites, for example, both the breeding pond(s) and a substantial surrounding area (ideally with a radius of at least 300 m from the pond) should be included. This chapter outlines ways of assessing amphibian and reptile sites and determining their importance for conservation. It also looks at ways of increasing the effectiveness of site protection.

8.2 Possible approaches to defending herpetofauna sites

8.2.1 Site designation

Assigning a designation to a site is particularly important because it 'flags up' the conservation importance to landowners and Planning Authorities and means that this interest can be taken into account when management is being considered or changes in land use proposed. Sometimes these designations can serve directly to protect a site, for example if there are conservation policies relating to certain designations, or they may mean that they attract incentives to allow sympathetic management.

Sites of Special Scientific Interest (SSSIs)

This designation is given by the SNCOs where they consider a site is of special interest (Chapter 7). According to published criteria (*Guidelines for the Selection of Biological SSSIs* (NCC 1989)), these allow the best great crested newt sites, most natterjack toad sites and the best 'assemblages' of the widespread amphibian species to be considered for SSSI designation (see Box 1).

Special Areas of Conservation (SACs)

This is a designation arising from the EC Habitats Directive with the purpose of developing a network of wildlife sites throughout Europe (called the *Natura 2000* series) (see also Chapter 7). This designation is based on lists of species and habitats published in the Directive (Chapter 7). The great crested newt is the only species of either amphibian or reptile in Britain listed for SAC site designation. However, certain habitat types important for reptiles and amphibians are listed. The Department of Environment, Transport and the Regions, guided by the Statutory Nature Conservation Organisations (SNCOs), is responsible for identifying and selecting sites in the UK to contribute to this series. All SACs are also SSSIs (see above and Chapter 7).

The guidelines indicate that all 'exceptional' great crested newt sites should be selected and that within any 'area of search' (NCC 1989) the best amphibian assemblage sites identified following detailed survey should be eligible for SSSI selection. Choices for designation of widespread amphibian SSSIs are based on the scoring system listed in the published guidelines (NCC 1989), unmodified by threat considerations. Similarly, most smooth snake and sand lizard populations should be selected (but only the important and established ones in Dorset), and the best localities in any 'area of search' with at least three reptile species can be selected. Though the occurrence on a site of single species of widespread reptile will count positively towards selection of sites that are SSSI quality for other criteria, this alone will not justify SSSI selection.

A similar system operates in Northern Ireland, where important locations can be designated as Areas of Special Scientific Interest (ASSIs).

Box 1 Criteria for Selection of Amphibian and Reptile SSSIs (Source NCC 1989)

1. International obligations

Under the terms of the 'Bern' Convention on the Conservation of European Wildlife and Natural Habitats, the United Kingdom, as a contracting party, is required to take the necessary legislative and administrative measures to ensure the conservation of important habitats of the sand lizard, smooth snake and natterjack toad.

2. Reptiles

2.1 Six native species of terrestrial reptiles occur in Britain. Of these, the smooth snake and sand lizard are regarded as endangered species and have been given full protection through Schedule 5 of the Wildlife & Countryside Act 1981. Site selection should take particular account of both species. The other four species are widespread and relatively numerous, and so the representation of outstanding assemblages should be the guiding principle. Reptiles are difficult to survey quantitatively; qualitative guidelines are therefore recommended. Reptile sites, at least for the endangered species, will be sand-dunes and lowland heaths. Where there is contiguous, open, semi-natural habitat, this should be included even though reptiles may not have been recorded in all parts of the site. Suitable man-made structures (e.g. tumuli, embankments and stone walls) should also be included.

2.2 There should be a presumption for selection of reptile sites on the following grounds.

2.2.1 All important and established populations of smooth snake *Coronella austriaca* and sand lizard *Lacerta agilis* in Dorset should be selected; for sand lizards, sites might be considered 'important' because of the overall strength of a dispersed population or because of the presence of an apparently discrete colony or colonies. All established populations in other counties should be selected.

2.2.2 In any Area of Search, the best locality containing at least three of the other species – adder *Vipera berus*, grass snake *Natrix natrix*, common lizard *Lacerta vivipara* and slow-worm *Anguis fragilis* – should be selected. Sites should not be chosen to represent populations of one or two species, but the occurrence of any species should count positively in the evaluation of sites chosen largely on other grounds, especially in areas where the species concerned is rare or at the geographical limits of its range.

Box 1 (continued)

3. Amphibians

3.1 Six native species of amphibians occur in Britain (see Table 1). Of these the natterjack toad and great crested (warty) newt are regarded as endangered and vulnerable respectively and have been given full protection through Schedule 5 of the Wildlife & Countryside Act 1981. Site selection should take particular account of both species. Any breeding site of these species adjacent to an existing SSSI should be considered for inclusion in the SSSI. The other four species are widespread and relatively numerous, and so the representation of outstanding assemblages should be the guiding principle. Any site with an assemblage score of five or more (see 3.2.3 and Table 1) and which is adjacent to an existing SSSI should be considered for inclusion in the SSSI. At a site where several breeding pools are utilised by amphibians, numbers of individuals should be summed to derive a total for the site. Amphibian SSSIs should exclude recently created garden ponds, swimming pools etc., and assessments should exclude any populations of species known to have been introduced. The site boundary should include suitable semi-natural terrestrial habitat where this occurs contiguous to or near the breeding site. Natterjacks require open terrestrial habitat, but the other species prefer structurally diverse mixtures of open, scrub and woodland habitats.

3.2 There should be a presumption for selection of amphibian sites on the following grounds.

3.2.1 For the natterjack toad *Bufo calamita*, all important and established colonies should be selected. 'Established' means that there should be evidence of a viable colony having been at the site over a period of five years or more but not necessarily breeding every year. It may not be necessary for five years' observations to be available, as a study of the age/size structure of the population may provide sufficient historical information. 'Important' should be taken to include colonies in the following types of site:

- sites with populations greater than the median size for a British population (i.e. more than 100 adults or 25 spawn strings per year should have been present during at lease two of the last five years);
- all heathland sites;
- the best or sole representatives in a Watsonian vice-county.

3.2.2 For the great crested newt *Triturus cristatus*, all exceptional sites (those where a night count in the breeding season exceeds 100 individuals) are eligible. In order to confirm population stability and/or to overcome problems associated with variability between counts (owing to changes in vegetation cover etc.), collection of data for three years is recommended for sites that are candidates for selection. If no site satisfies this criterion, the best site for the species in the Area of Search qualifies for selection, though not until a thorough survey of the area has been made.

3.2.3 Outstanding assemblages of widespread species (i.e. great crested newt, smooth newt *T. vulgaris*, palmate newt *T. helveticus*, common toad *Bufo bufo* and common frog *Rana temporaria*) should be selected. The natterjack should be included for sites that do not qualify separately under 3.2.1. A scoring system for assessment is given in Table 1, and a minimum score of 10 based on presence of at least four species is regarded as the qualifying score for site selection. When a survey of the area has been completed, the site with the highest score qualifies for selection if no site reaches a value of 10.

3.2.4 If survey of an Area of Search reveals a large number of sites that qualify on grounds of warty newt counts or assemblage scores, the SNCO specialist should be consulted for advice about which are to be selected. As a general rule, priority should be given to those sites that qualify both for great crested newts and for their amphibian assemblage.

Table 1 A scoring system for the selection of sites with assemblages of amphibians

		Low population	*Good population*	*Exceptional population*
		Score 1	*Score 2*	*Score 3*
Great crested newt	Seen or netted in day	<5	5–50	>50
	Counted at night	<10	10–100	>100
Smooth newt	Netted in day/counted at night	<10	10–100	>100
Palmate newt	Netted in day/counted at night	<10	10–100	>100
Common toad	Estimated	<500	500–5,000	>5,000
	Counted	<100	100–1,000	>1,000
Common frog	Spawn clumps counted	<50	50–500	>500

Notes: scores have to be for breeding sites observed during the breeding season. Daytime netting should be made during a 15-minute period for sites with less than 50 m of water's edge, for 30 minutes for sites with 50–100 m etc. To compute the total score for a site, add the scores for individual species and add one point for four of these species present and two points for five species. If natterjack toads are present, add two more points.

National and Local Nature Reserves (NNRs and LNRs)

These are site designations that define areas as nature reserves. NNRs are declared by the SNCOs and are often, but not always, managed by them (see also Chapter 7). LNRs are designated by Local Authorities following consultation with the SNCOs (Chapter 7).

Sites of Importance for Nature Conservation (SINCs)

The NCC *Guidelines for the selection of biological SSSIs* (NCC 1989) are often also used as the basis for many district-based SINCs (Chapter 7); these are also known under a variety of other names (Chapter 7). SINCs differ in emphasis from one Local Planning Authority to the next and are often 'botanically-based' and 'habitat-based' but are rarely 'amphibian or reptile based'. SINCs are key material considerations in drawing up local plans, wildlife strategies, green belt allocation, housing land allocations etc. An improvement in the system of site evaluation for SINCs is needed to allow identification of locally important sites for herpetofauna.

We suggest that all widespread amphibian species sites with scores of five or more using the NCC SSSI guidelines (NCC 1989) should be considered as SINCs. This process, which can involve the Wildlife Trust, entails informing the landowner(s) and Local Authorities of the site's significance in an attempt to ensure that populations are not destroyed in ignorance but instead are managed more sympathetically.

Local authorities and other bodies that might carry out or authorise damaging operations (such as local water companies or the Environment Agency or Scottish Environment Protection Agency) should also be informed.

8.2.2 Conservation options

As well as site designation there are other options that can be considered for furthering the conservation of amphibian and reptile populations: examples are given here. The choice of which is the most appropriate course of action will depend on a number of considerations, such as site status, importance of the populations and availability of resources (both cash and manpower).

Nature reserve acquisition

It is often desirable to secure a firm legal interest on a site by purchasing or leasing it, but very often this is not practicable owing to cost. Nonetheless, targets for acquisition or lease should focus on sites with good populations of threatened reptiles and on all natterjack sites as a priority. The best widespread species sites (i.e. those meriting SSSI designation) should be targeted in areas of the country without the three rarest species. A proactive programme of approaching landowners with a view to obtaining sites as nature reserves is also desirable; for NGOs and Local Authorities this should not be confined to SSSI-quality sites.

Agreements to allow/undertake management

Management agreements to (for example) clear out ponds or remove successional vegetation may be negotiated. The way that any management is done depends on the nature and importance of a site and whether it has a formal designation. Often, though, management tends to be carried out as and when needs and opportunities arise. A wide range of agreements can be made with landowners to manage sites. These can range from formal and legally binding 'management agreements' on SSSIs between landowners and the SNCOs, down to informal arrangements where permission is granted by a landowner to allow management on the site. Where possible, involvement of the landowner in positive site management should be encouraged.

Reducing traffic mortality

There are several ways to reduce traffic mortality of migrating amphibians, and these should certainly be considered at sites where road deaths are evidently high. Methods range from the least satisfactory (manual transfer of adults across the road by teams of volunteers, repeated indefinitely every year), through to expensive, but (if properly planned) effective, fence and tunnel systems (Langton 1989b). The best option would be to avoid splitting the population by careful design at the outset. Where a road divides the terrestrial and breeding habitats it is often more effective to create a new 'substitute' pond on the other side of the road and then fence the road to stop amphibians crossing from either direction. This effectively splits the population in two, but can work well where practicable (Schlupp & Podloucky 1994).

8.3 Assessing the conservation importance of and threats to amphibian sites

Conservation involves prioritisation. Which are the most important sites? Which are the ones most at risk? How can these two sometimes quite different assessments best be reconciled into conservation action? It is important to assess which amphibian populations warrant the most urgent and the greatest attention and resources.

8.3.1 Differentiating between species

The six native British amphibians are not equally protected by conservation law (Chapter 7). Natterjack toads and great crested newts receive the highest level of protection under the Wildlife & Countryside Act 1981 and the Conservation (Habitats &c) Regulations 1994, while the other four species (common frog, common toad, smooth newt and palmate newt) are protected only with regards to sale and trade; the natterjack toad is much rarer and more localised than the great crested newt. Similarly, in Northern Ireland, the smooth newt is afforded the highest level of protection under Schedule 5 of the Wildlife (Northern Ireland) Order 1985, whilst the common frog is protected only with regards to sale and trade. These facts must be taken into account when assessing sites for conservation importance and threat. In the following sections, which apply to Great Britain, we have grouped great crested newts with the four unscheduled species, and treat these five widespread amphibians as a distinct group separate from the natterjack toad. The great crested newt is then given elevated status within the widespread species group.

8.3.2 Conservation importance of widespread species sites

Various systems have been developed for objectively assessing site quality for amphibians. These include guidelines developed by the Nature Conservancy Council (NCC 1989) for assessing SSSIs (see Box 1) and a system developed along similar lines, but using more criteria, by Grayson, Parker & Mullaney (1991). Griffiths, Raper & Brady (1996) also developed a system for rating the relative importance of ponds based on density scores (see Chapter 1). Ponds are usually the focal points of widespread species' sites and so site quality is often assessed by looking at these features. Grayson, Parker & Mullaney (1991) recommended that actual initial assessment should be based on a number of features and a possible scoring system that allows comparison between sites (see Table 2). This system is similar to that used in the NCC's guidelines but is better suited to making local comparisons between sites in Great Britain. This system could be further developed to meet differing local needs.

This system (Table 2) allocates points based on four characteristics:

- How many species are present? The more complex the assemblage, the more important the site. Allocate one score point for each species except the great crested newt, for which two points should be given.
- How abundant are the various species? Assessment of numbers should be carried out as described in Chapter 1, taking account of the caveats for estimating numbers. Obviously big populations are

Table 2. An objective system for scoring amphibian populations to allow comparisons between sites. Ponds within 300 m of each other and connected by suitable habitat should be counted as one population.

Feature	*Observations*	*Score*
Species assemblage	Presence of smooth newt, palmate newt, common frog, common toad	1 point for each species present
	Presence of great crested newt	2 points if present
Species abundance	Smooth newt, palmate newt, common frog or common toad populations estimated to be over 500 adults but less than 1,000 adults	One point per species meeting this criterion
	or	
	Smooth newt, palmate newt, common frog or common toad populations estimated to be over 1,000 adults	Two points per species meeting this criterion
	and	
	Great crested newt populations estimated to be over 100 adults but less than 500 adults	Two points
	or	
	Great crested newt population estimated to be over 500 adults	Four points
Local significance	Palmate newts in Midland or East Anglia	Two points
	Great crested newts in south-west England, Wales or Scotland	Four points
Habitat quality	Assessment of pond and terrestrial habitat quality	No score – but features should be recorded

generally more important than small ones, but the relationship between nearby and connected breeding sites should also be taken into account. This is because there is likely to be some degree of movement between the ponds, which will affect the long-term survival of each. The term used to describe this related group of populations is a 'metapopulation'. Score one point for each of the following: smooth or palmate newt, common frog or common toad populations estimated to be above 500 adults; and two extra points for each of these species if their populations are estimated to be above 1,000 adults. For great crested newts these scores should be two points for populations of over 100 and four points for populations over 500.

- Is there any particular local significance? Common frogs, common toads and smooth newts are widespread in mainland Britain and so no specific local significance can be attached to populations in particular areas. However, palmate newts are rare in the Midlands and absent from much of East Anglia, and sites with this species in those areas should receive two points. Similarly, great crested newts are rare in south-west England, Wales (excluding south and north-east) and Scotland, and great crested newt sites in these places should receive four points.
- What is the overall habitat quality? Irrespective of amphibian population size, it is useful to make a further assessment based on both pond and surrounding terrestrial habitat quality. This assessment should not be scored (objective measurements would be too complex) but certainly recorded. Extra features of ponds worth noting include abundance and variety of macrophytes, presence of invertebrates such as dragonflies and water beetles, and occurrence of fish or waterfowl. The overall extent and makeup of surrounding good terrestrial habitat should also be assessed, e.g. along the lines of "about 10 ha, 50% woodland, 50% pasture".

Threats to widespread species sites

Although the presence and abundance of the various amphibian species constitute the most important features of site assessment, account must also be taken of particular risks that might elevate the conservation priority for a site above what it would otherwise be.

Obvious risks

In extreme cases, sites may be threatened by roads or urban developments already underway. In these situations, rescue and translocation of amphibians is usually the only option (Chapter 9). However, other problems that may be readily apparent include late seral stages of succession in neglected or overgrown ponds, pollution by oil spills, overstocking of wildfowl and livestock, use of agrochemicals (often manifest as dense growths of 'pea soup' green algae), high road mortality of migrating toads, and recent stocking with predatory fish.

Hidden risks

What might not be obvious includes plans for land-use change by the site owner (such as conversion from livestock to arable farming), or for water abstraction, landfill, road or housing development by local government or other authorities. Some of the subtler forms of pollution, including acidification, are also unlikely to show themselves without water sample analysis.

8.3.3 Conservation importance of natterjack toad sites

It is probable that most sites for this species in Britain are already known and assessed (Banks, Beebee & Cooke 1994). However, it remains possible that there are some populations left to find. Natterjack populations are normally quantified by spawn-string counts and night-time counts of adults at the breeding pools (Chapter 1) and categorised according to size: Class I sites contain many hundreds or low thousands of natterjacks; Class II have high tens or low hundreds; and Class III have low tens. In addition, heathland sites of whatever population size have special importance because they are so rare, and very isolated populations in any habitat also demand extra attention because they are probably at higher risk of extinction than those close to other populations.

Threats to natterjack sites

Natterjack habitats on sand dunes, upper saltmarshes and heathlands are especially vulnerable to a range of damaging changes. These include:

Ponds

Overdeepening (e.g. for angling purposes) or premature desiccation (e.g. by drought or increased local water abstraction) are equally undesirable. It usually requires careful investigation over several seasons to determine the significance of abstraction because in any one season the rates of pond desiccation will also be affected by weather.

Upper saltmarsh ponds require annual cycles of winter inundation by high tides followed by refreshing by rain or run-off in the spring. The construction of sea walls or barrages can prevent inundation, which may have important but subtle effects (such as removing invertebrate predators), while inland drainage changes, bank or road construction could prevent the essential recharging with fresh water. By the time these dangers are obvious it is usually too late. Only consultation with planning authorities can take them into account before the damage is done; retrospective mitigation projects may be too expensive to implement or their success difficult to predict.

Heathland ponds can be damaged by acidification, but this is a slow process that requires careful monitoring (by field pH measurements) over several years. Vegetational changes (e.g. the spread of *Sphagnum* mosses around the pond) may be indicative.

A threat to some dune slacks and saltmarsh ponds is coastal erosion. Trends are usually obvious years in advance of the pond being lost, which may give time to create new breeding sites in safer areas.

Terrestrial habitat

The major, and very widespread, threat to natterjack terrestrial habitats is successional change towards thick ground vegetation, scrub or woodland. This often follows cessation of grazing, which keeps vegetation short and more open and is especially important on dunes and heathlands.

Direct development, be it for houses and roads or for golf courses, is clearly as much of a threat to natterjacks as to the widespread species and again needs to be discussed with planning authorities in advance, if there is to be any chance of preventing damage.

8.3.4 Overall site assessment for widespread species

A full site assessment should include an investigation of the amphibian species present, the overall quality of the habitat and any threats which might damage or destroy it. Conservation value for amphibians can be quantified using one of the above scoring systems, together with supplementary evidence on other aspects of habitat quality, to produce a list of sites in order of relative importance. This allows an objective ranking of sites, which is useful for describing or selecting the most important sites, perhaps for local or even national designations. This list may then need rearranging in the light of known threats, since these may require more immediate conservation action, such as emergency management, 'rescues' or commenting on specific planning proposals. Obvious threats can be considered after simple observation, and hidden development risks after consultation with landowners and local authority ecologists or planning departments. Tests for subtle pollutants should be done only if there is some cause for suspicion about the state of the pond that cannot be explained by more obvious factors, or if finances allow random checking. Prioritisation can then be made along the following lines:

- Sites under imminent threat should go to the top of the assessment list if: (a) they contain great crested newts; or (b) they are among the top 10% of sites on the point scoring system. The need for rescues or translocation should only be considered where sites cannot be saved. The fact that these can be undertaken should not be used as a reason to allow the loss of a site.
- Longer-term threats should be judged on the basis of their severity and urgency; thus a minor pollution incident, likely to have a transient effect, may not affect conservation priorities at all, whereas a more protracted one (such as routine fertiliser applications) obviously should. The results of neglect and natural succession may require urgent attention or simply consideration at some future time; nearby roads may be killing few or many toads; and so on. Obviously no scoring system can hope to cope with all eventualities, and changes in position on the conservation priority assessment list on the basis of threats can only be done with some degree of subjectivity and on the basis of local knowledge. This should be carefully justified in each specific case.

8.4 Assessing the conservation importance of reptile sites and threats to them

There are several reasons why reptile sites require assessment:

- reptile populations can be decimated by well-meaning management unless expert advice is obtained first; sites known for decades are often assessed too late, leaving them difficult to defend;
- consultants who do ecological surveys for Environmental Assessments (EAs) may only give reptiles a cursory mention;
- many habitat surveys are based solely on botanical criteria and often neglect to evaluate reptile sites.

8.4.1 Conservation importance of a reptile site

Determining the conservation importance of a reptile site is usually difficult, and an uphill struggle if a newly discovered site is under immediate threat. Consequently it is important to document and evaluate reptile sites at the earliest opportunity. Once identified, it is easier to protect, and to justify protecting, a site because of its reptile interest.

Site assessment should not be based on 'population size' alone but rather should consider population status, breeding success, geographical significance etc. Determining 'population size' is difficult and it usually takes many visits by experienced herpetologists to gain even an indication of numbers (Chapter 1). For most sites, the existing information is enough only to establish which species are present. In determining the conservation value of a reptile site, emphasis should also be given to the availability of suitable habitat (area, features and quality) and the land management regime.

The conservation importance of a reptile site will be increased if the site makes a much wider contribution to conserving local or national biodiversity. The chance of protecting the site can therefore be correspondingly increased if a range of conservation interests is also assessed, for example:

- sand dunes, often of value for plants, invertebrates and amphibians;
- lowland heath, often of value for plants, invertebrates, amphibians and bird life;
- bare ground, often of value for invertebrates;
- rocky areas, often of value for lichens, bryophytes, molluscs, myriopods etc.;
- grassland, often of value for grasshoppers, crickets, bugs, ants etc.;
- amphibians, which require a habitat mosaic and are food for grass snakes;
- butterflies, many species requiring warm south-facing sunny slopes;
- dragonflies, many species requiring ponds with open sunny margins;
- status as Regionally Important Geological/ Geomorphological Site (RIGGS).

To document species richness and diversity and to ensure all issues are appropriately addressed, assessment of reptile sites by other specialists, e.g. botanists, lichenologists, conchologists, entomologists, ornithologists and mammologists, should be encouraged. Excellent manuals dealing with habitat management for invertebrates now exist (e.g. Fry & Lonsdale 1991; Kirby 1992), which also contain much of value for managing reptile sites.

8.4.2 Defining objective criteria for local reptile sites

To defend a reptile population, site assessment needs to relate to agreed national criteria. The NCC SSSI guidelines (NCC 1989) (see Box 1) may provide a useful starting point but need to be developed further for a wider application. Herpetofauna workers need to draw up regional criteria for reptile site assessment. Such moves should start with examination of the SSSI guidelines in their entirety, focused on three sections:

- site assessment for reptile species & assemblage (Box 1);
- site assessment to evaluate habitats with an emphasis on naturalness, extent, rarity and diversity (Box 1);
- site assessment to evaluate species-groups with an emphasis on diversity, population size and rarity (Box 1).

Although conferring less legal protection on a site than SSSI status, designation as a Site of Importance for Nature Conservation (SINC) can be both rapid and administratively simple. Any reptile site of more than very local merit under threat should be designated as an SINC very rapidly. Meanwhile it can be defended on the basis of it being a 'proposed SINC'. Any reptile site of SSSI quality should be designated as an SINC (and where these are ranked should be given highest status) without waiting for the necessarily lengthy SSSI selection and notification procedure to take place.

To be acceptable, evaluation criteria for reptile SINCs also need to be a modification of the existing criteria for SINCs in the area and must adopt the terminology already used in Local Plans, Unitary Development Plans etc. Of course, reptiles are already protected by national, and in some cases international, law but a reptile SINC provides extra protection to a discrete parcel of land with a mapped site boundary. By its SINC status it will demonstrate recognition of its local importance in the planning process.

In some regions SINCs are ranked: Grade A are of county/regional or national importance; Grade B are of more than district importance; and Grade C are of more than local importance. Ranking has merit for reptile SINCs. In some cases where a site is of good quality but the data do not support a higher designation it may be better to designate it without delay at a lower level while more information is being collected. Further site evaluation may lead to upgrading or downgrading and boundary revisions.

8.4.3 Suggested SINC criteria for different species

Smooth snake

All important and established populations of smooth snake in Dorset and all established populations in other counties are regarded by the SSSI guidelines (NCC 1989) as meriting selection as potential SSSIs. These therefore all merit immediate designation as Grade A SINCs. All smooth snake populations, even minor sites, merit at least Grade B SINC status.

Sand lizard

All important and established sites of sand lizard in Dorset are regarded by the SSSI guidelines (NCC 1989) as meriting selection as potential SSSIs. Sites might be considered 'important' because of the overall strength of a dispersed population or because of the presence of an apparently discrete colony or colonies. All such sites therefore qualify as Grade A SINCs and should be designated as such. Even small populations in Dorset merit protection as at least Grade B SINCs.

All established populations of sand lizard outside Dorset are regarded by the SSSI guidelines (NCC 1989) as meriting selection as potential SSSIs. Therefore all sites should be designated as Grade A SINCs to help arrest the decline of the species. This should include sites where reintroductions have been undertaken; however, the conservation value of recent introductions outside the presumed natural range needs to be considered carefully.

Adder, grass snake, common lizard and slow-worm

For the commoner species of native reptile (adder, grass snake, common lizard and slow-worm), the SSSI guidelines (NCC 1989) recommend that the concept of "outstanding assemblages" should be the guiding principle, and therefore the best localities containing "at least three" of these species should be selected as potential SSSIs. Furthermore: "Sites should not be chosen to represent populations of one or two species, but the occurrence of any species should count positively in the evaluation of sites chosen largely on other grounds, especially in areas where the species concerned is rare or at the geographical limits of its range", e.g. grass snakes in northern England. It follows that all sites conforming to these guidelines, i.e. the best sites in any vice-county containing three of the four species, should be designated as Grade A SINCs.

The SINC system should be used to extend protection to all sites of conservation value for reptiles that fall outside the SSSI guidelines, notably: any site with a large population of a single species; any site with moderate populations of two species; any site at the edge of the geographical range of a species; and any site with a long documented history. With a view to further developing this concept, a Key Reptile Sites Register is being developed through the Herpetofauna Groups of Britain and Ireland Network.

One advantage of reptile site evaluation feeding into a SINC system is that the threshold for declaring a SINC can be varied region-by-region and can be adjusted in the light of new survey information. However, to be effective, this demands considerable input by herpetofauna workers and active involvement of planning authorities, the regional offices of the national SNCO and the regionally based Wildlife Trusts, ideally co-ordinated by the county/district herpetofauna group.

8.4.4 Determining site boundaries

Determination of site boundaries poses a problem. It is rarely sufficient merely to encompass all sightings of individual reptiles. According to the SSSI guidelines (NCC 1989): "Where there is contiguous, open, semi-natural habitat, this should be included even though reptiles may not have been recorded in all parts of the site. Suitable man-made structures (e.g. tumuli, embankments and stone walls) should also be included". In drawing SINC boundaries, consideration should also be given to incorporating parcels of adjacent open land, if it provides an essential buffer against future land-use pressures such as housing (and cats). It is easier to defend such a buffer zone if it has already been designated as an integral part of the SINC.

Survival of a reptile population can depend as much on land use and management as habitat type. The site boundary should therefore be drawn around parcels of land use rather than be drawn too narrowly around a specific good habitat. Often, however, the persistence of a population can depend on land outside even the most generous drafting of a SINC boundary. For example, grass snakes and adders may travel long distances to favoured feeding, breeding and hibernation sites. Thus there is a need to conserve reptile sites as part of the broader landscape.

8.4.5 Assessment of reptile sites in the broader landscape

The long-term viability of each species in the broader landscape requires genetic interchange and natural colonisation between sites. SINCs and SSSIs alone, even in profusion, are therefore unlikely to arrest decline and may alone fail to achieve a 'favourable conservation status' for each reptile species.

For assessment of reptile sites in the wider landscape, it is useful to plot all known localities on a 1:50,000 base map of the area provided by the Local Planning Authority and colour in critical gaps requiring additional search effort. Superimpose boundaries of existing protected sites, since many reptile sites will already be protected 'incidentally' on botanical, ornithological, geological, geomorphological or amphibian grounds, but check the SINC/SSSI data sheets to ensure that recent reptile records have been highlighted. Then decide

which reptile records outside protected area boundaries are urgent priorities for site assessment.

Assessment of whole groups of reptile sites is an important step towards developing regional recovery programmes and to recognising 'reptile corridors'. Use 1:50,000 maps or 1 km O.S. grid squares to relate groups of reptile sites to variables such as: climate; altitude; geology; soils; proximity of dunes, heath, and railway lines; types of agriculture. Assessment of groups of sites may highlight the additional conservation significance of a particular reptile site because of its strategic position and may help to identify reptile sites of a type now rare.

Open land linking a group of reptile sites should be protected as a wildlife corridor by the Local Planning Authority. Improvements to linkages can be achieved through collaborative effort: Farming and Wildlife Advisory Group (FWAG) officers can alert farmers to grants; forestry owners can modify glades and rides; Local Authorities can manage public access land to maintain or increase reptile populations; highway authorities can manage roadside areas in a more reptile-friendly manner; Wildlife Trusts can be more proactive for reptiles on all existing reserves. Site evaluation is a vital part of this process.

Local Planning Authorities can have a major role in conserving reptiles in the broader countryside, so herpetofauna workers should encourage them to ensure that:

- reptile SINCs remain in open land, preferably in a designated Green Belt;
- wildlife corridors are sufficient in size and quality to connect reptile sites;
- buffer zones exist around each reptile SINC;
- statutory Local Plans and Unitary Development Plans (UDPs) defend reptile SINCs both on maps and by wording in the accompanying Written Statement;
- any revisions contemplated for future Local Plans and UDPs should be pursued only after funding and completion of reptile site evaluation in order to define constraints on land use;
- management plans for Local Authority controlled land (e.g. Country Parks, highway verges and picnic sites) make proper provision for reptile conservation;
- a presumption against development should exist in Local Plans and UDPs regarding sand-dunes and lowland heaths, and in such areas any planning application requiring an Environmental Assessment (EA) should include a reptile survey at the right time of the year conducted by an experienced herpetologist;
- EAs should include reptile surveys, even if there are no records for the site, provided the habitat appears suitable.

8.4.6 Responding to a development threat

Responding to threats to reptile sites can be difficult if, for example, the site has never been assessed by an experienced herpetologist, has not been designated as an SSSI or an SINC, or is threatened in a difficult season for surveying (e.g. winter), or if the planning application conforms with the policies and land use designation of the Structure or Local Plan or UDP.

The way forward is 'to get ahead of the threats': to evaluate and designate all known significant reptile sites as SINCs as soon as possible; to embark upon blanket surveys of land expected to be under threat during the life of the Local Plan or UDP; to create or improve the Local Planning Authority's Wildlife Strategy and Green Audit; to input reptile site assessments into the Officer Working Group responsible for forward planning of the next Local Plan (or UDP) and to encourage systematic activity of a Herpetofauna Group in each county/region, co-ordinated with the activity of the Wildlife Trust. Some Local Planning Authorities have Wildlife Advisory Groups, on which the Wildlife Trust and local Herpetofauna Group should both serve.

If a site is under threat and time is short, then it is important that the site is properly assessed for both reptile and other wildlife conservation value in order to give a full assessment of the wildlife value of the site.

Some development proposals require an Environmental Assessment (EA). This gives an opportunity to approach the Planning Authority. This should be done early, before the 'scoping' stage, to ensure that a reptile survey is conducted where this is appropriate. The SNCO, local Herpetofauna Group and Wildlife Trusts may themselves need to be provided with the necessary information to assist the process.

Obtaining adequate reptile survey information can be difficult, even if there is a requirement to consider reptiles during a site assessment. It is important that the value to reptiles of a site is properly assessed. This usually requires further field survey, although desk evaluation or collation of existing records may, in some cases, suffice, especially if the area has been well surveyed before. Consultants employed for such work may also need further guidance since it is important that the evaluation is carried out by someone who has a good understanding of reptile ecology and that the reptile survey isn't simply 'tacked on' to other surveys. Sufficient time in the appropriate weather and season is needed to see any animals and interpretation needs to be based on both the observations and a good understanding of how the animals behave. Consultants should conform to the *Guidelines for the baseline ecological input to environmental assessment in the UK* (The Institute of Environmental Assessment 1995). It can be valuable to keep a watching brief on the standards of consultants working on reptile survey, as consideration should be given to reporting to the statutory or planning authorities or to the professional institutions any consultants who undertake inadequate survey or make incorrect ecological assessments for these species.

Clearly, full ecological assessments are not going to be available for all sites. Where small developments are proposed there may not be a requirement to undertake such exercises, and at sites not designated as SSSIs or SINCs the need to take reptiles into account may not be immediately apparent to the planning authority or the developer.

Other activities that may threaten reptiles may also not need planning permission, for example changing the management of a site. Even in such cases there is still a need arising from their protected status to safeguard the reptiles against killing and injuring (all species) and disturbance, handling and habitat damage (smooth snake and sand lizard), under the Wildlife & Countryside Act 1981, or the common lizard in Northern Ireland under the Wildlife (Northern Ireland) order 1985. Furthermore, planning authorities are obliged to consider the presence of protected species when assessing planning applications. The interpretation of the protective legislation for the commoner reptiles is difficult. However there is a clear obligation to avoid killing or injuring reptiles unless it cannot reasonably be avoided (Chapter 7).

Increasingly the 'precautionary principle' is being promulgated within planning authorities. They may choose not to grant planning permission on sites where reptiles are or might be, or where the impact is not fully understood or adequate mitigation proposed. If site evaluation is incomplete or unsatisfactory, then the planning authority is able to reject the application on the grounds of 'insufficient documentation being provided by the applicant' and a Planning Inspector may reject any appeal on the same grounds.

If a reptile site is to be damaged, perhaps through development, then the conservation of the reptile population needs to be considered. Conservation 'on site' is usually best for the reptiles and often the easiest way to achieve satisfactory results. However, if the land remaining for reptiles becomes too small, or for other reasons 'on site' conservation is impractical, then a mitigation package should be put forward. The term mitigation has often been used to describe schemes that do not truly mitigate for the losses. When developing mitigation/compensation packages, or evaluating one prepared by someone else, close scrutiny is needed of a least the following parameters.

- Survey: is it adequate? Was it carried out at the right time of the year, under favourable weather conditions and by an experienced herpetologist, and did they seek prior input from local naturalists with special knowledge of the site?
- Area: what is the area of value to reptiles before, during and after the development? Has the area increased or decreased as a consequence?
- Carrying capacity: is the carrying capacity for reptiles reduced, maintained or enhanced, before, during or after the development?
- Buffer zones: is the site better buffered from disturbance (e.g. cats from houses, chemicals, fires etc.) before, during or after the development?
- 'On-site' measures: have all opportunities for maintaining reptiles 'on-site' been explored, for example positioning development sensitively to maintain important features? If on-site mitigation is proposed, is it adequate?
- 'Off-site' measures: have all opportunities for 'off-site' mitigation been explored, such as designation of off-site local nature reserve or changes to off-site land management, and can the site loss be offset by creation of new sites elsewhere?
- Management: what plans exist for monitoring and conserving the reptile value of the site long after the site has been developed? Has the developer set aside adequate funds for annual management in perpetuity? Is it sustainable; and what monitoring will there be?

8.4.7 Responding to other threats

Although many reptile habitats are lost to development, many others are lost by changes in habitat. Some changes occur as a result of natural succession, and a management decision is needed to determine which conservation priorities should prevail on a wildlife site.

On nature reserves, the conservation priorities need to be determined and then implemented through management objectives. In most cases it is desirable to manage habitat in a way that benefits reptiles, whether as a primary or secondary objective. With specialist advice, management for reptiles can also benefit certain plant species (e.g. some lichens, mosses and grassland plants), selected animal species (e.g. some butterflies, dragonflies, ants, woodlice, myriopods, bugs, small mammals and amphibians) and some key habitats (grassland mosaics, lowland heath mosaics, dune complexes, bare ground, open woodlands and rocky areas).

Outside reserves, the priority is to develop a system for informing owners, occupiers and managers of the presence of protected species, drawing attention to legal obligations and providing information on site management needs. One way to do this is to prepare a carefully written leaflet that also indicates sources of other expertise or advice. Where a landowner is co-operative, a surprising amount can be done, as shown in the following examples.

National Forests

The statutory bodies (Forest Enterprise, Forestry Authority) have a duty to maintain woodlands not only for timber crops but also for landscape, amenity and nature conservation value. There are training manuals for forestry staff to achieve these aims, and there is an opportunity for all UK forests to become of increasing importance for reptiles. No major reptile sites should now be planted up, former sites can be opened again, rides can be enlarged and cuttings of forestry roads can be kept open. Care needs to be exercised during certain management operations, such as cutting vegetation and gassing rabbits, so that these do not adversely affect reptile populations.

Rivers

The statutory bodies (e.g. the Environment Agency/ Scottish Environment Protection Agency) have a policy of encouraging wildlife of rivers and banks, including flood plains. Some reptile sites are on the edge of flood

plains or depend upon terrace banks, shingle beds, meanders, ox-bows, back-waters, water meadows and ditches. In many regions, the statutory bodies have completed river corridor wildlife surveys, but the maps and text need annotating with details of reptile (and amphibian) sites to ensure that river channel management takes them fully into account.

Highways

Local Authorities are often the highway authority or act as the agents for the Department of the Environment, Transport and the Regions. Apparent threats posed by highways work can be turned into opportunities. Wildlife surveys of motorway and trunk road verges have already been conducted in some regions to identify those of wildlife value. Funded by the highway authority, these are primarily plant surveys to identify grasslands requiring particularly mowing regimes. Reptile surveys are now a logical next step.

For major highway schemes, there is a willingness to commission detailed ecology surveys, including reptile site assessment, as required by the EC Directive on Environmental Impact Assessment (EC 85/337). Reptile surveys and site evaluation should be the norm in regions with important reptile populations. When considering mitigation, some south-facing cuttings and embankments should be left free of imported topsoil, with bare rock outcrop and basal scree. Positive management for reptiles of land elsewhere in the land envelope of the new highway should also be considered. Off-site mitigation can be achieved by the creation of new wildlife sites. Although the highway authority cannot readily use its compulsory purchase powers directly for nature conservation, there is some scope to use existing powers to allow the purchase of 'compensation' land.

Farming

Threats for many reptile sites come from changes in farming practice. This may be sudden and dramatic, such as through agricultural intensification, with hedgerow and stone wall removal and pond filling, or piecemeal and less obvious, such as loss of unimproved grasslands, sandy banks and bare shingle and the increased use of artificial fertilisers and pesticides. Pressure on marginal land owing to agricultural changes is also a major threat. Site evaluation is needed to document such overall deterioration as well as to provide an understanding of the mixed impacts of set-aside and new crops. However, opportunities exist to reduce these threats by improving areas peripheral to the main farming activities and through developing schemes, such as set-aside, to ensure reptile interests are built into them.

Chapter 9 Species translocations

Jan Clemons and Tom Langton

9.1 Introduction and definitions

Deliberate moving of amphibians and reptiles for conservation and other purposes is an increasing practice in the United Kingdom and around the world. This is largely in response to the destruction of habitats and as part of species recovery programmes. Species are moved into neglected habitats that have been restored and into newly constructed habitats.

The subject is controversial because of the general lack of understanding of animals and their needs, the difficulties in measuring the success of schemes and the concern that endorsing or encouraging translocation may perpetuate the moving of animals as a matter of course and result in the continued loss of valuable habitats.

Generally speaking, the approach to translocation requires very detailed considerations of each species and habitat concerned, and a commitment to monitoring the survival of released animals. At all times actions should address the conservation and welfare needs of each amphibian and reptile species and the conservation of each population. Many activities are regulated by licensing controls (Chapter 7).

Definitions and terms to describe translocation activities have varied. The terms used here are considered to be the most appropriate.

- Translocation – the movement of animals, usually deliberately, from one location to another.
- Introduction – the release of a species into a location where it has not previously been recorded. The recording of animal distributions is a relatively new activity and the absence of records from a particular location may not necessarily mean that it was or is absent. If the location is within the presumed natural range of a species and the habitat is suitable, such locations would be most suitable for introductions.
- Reintroduction – the release of a species in a location where it was once known but is now extinct. Many herpetofauna sites have been lost over the last fifty years to urbanisation, intensive agriculture, mineral extraction and afforestation. In time this can lead to disturbed land becoming available once again for species, in places such as abandoned mineral quarries and garden ponds (for amphibians) and forestry plantation rides and motorway embankments (for reptiles). These sites may not be colonised naturally, owing to habitat fragmentation and isolation. Reintroduction can therefore help a habitat increase its species-richness and diversity.
- Restocking – the release of a species into a location where it is already present. This could be to sustain and enhance a critically small population, for example when there is an imbalance of the sexes in the age structure. Alternatively, small populations could be genetically enriched by the addition of further individuals. (Note: sometimes the term 'Reinforcement' is used to describe these activities.)

9.2 Translocation as part of mitigation

9.2.1 Site safeguard

Protection is afforded to reptiles and amphibians by the Wildlife and Countryside Act 1981, The Conservation (Natural Habitats &c.) Regulations 1994 and the Wildlife (Northern Ireland) Order 1985 (Chapter 7). For some, both the species and their habitats are protected (e.g. great crested newt, sand lizard in Great Britain; smooth newt, common lizard in Northern Ireland); for others the protection is limited to the animals themselves (e.g. grass snake in Great Britain). Site threats, such as development, need to take account of this protection. Even where sites are protected, planning permission can allow their destruction, within the bounds of what is required to undertake legitimate activities. Therefore, where legitimate development is permitted, animals will often need to be moved off site or to safe areas within the site. There are certain constraints: the law requires reasonable effort to be made to safeguard the animals (i.e. reasonable capture effort); there is a requirement to find suitable and adequate places for their release; disturbance and the damage to protected species' habitat are allowed only in so far as they are necessary and cannot be avoided.

What action can be taken if a reptile/amphibian site is known to be threatened? This is discussed more fully in Chapter 8. Firstly, the exact nature of the threat needs to be identified. The site may be threatened by development, such as housing estates, out-of-town complexes or road building. The relevant planning officers or the landowners should be able to provide information about the scale and timing of any land-use changes. Secondly, the amphibian and reptile species recorded/present at the site need to be determined along with their distribution on the site (Chapter 1) and their level of protection under international and national legislation (Chapter 7). Thirdly, what is the status of the planning application? The planning authority can advise on this. Is the application for 'outline' or 'detailed' planning permission? Has planning permission already been granted? The application has to list all the relevant details and conditions, which include looking after protected wildlife, whereas an outline permission need only establish the principle of whether a development is acceptable and may be vague about the measures taken to protect wildlife. Fourthly, where it appears that insufficient attention is being taken to protect wildlife in an existing planning permission or in an outline or detailed planning proposal, there is scope to object, giving valid reasons. A survey of herpetofauna should be requested, if not already proposed, and this should be undertaken as early as possible (and done to an appropriate standard at the right time of year). For large developments this may even be required by law. The prime objective is to ensure that the species found on site are given full and proper attention when planning applications are considered and to see that their conservation is addressed when a planning decision is made. The protection of a site from development cannot always be achieved. In such cases suitable mitigation for the destruction of the animal's habitat should be provided by the party who is to cause the damage; depending on circumstances this may be a legal requirement or a condition imposed through the planning authority.

9.2.2 Mitigation standards

If detailed planning permission has not been granted, a request for mitigation measures can be made by representation to the appropriate planning officer. This is particularly applicable at present to any of the fully protected species (especially great crested newts) and the reptiles, with their greater legal protection, but can be more difficult to achieve in practice for the four common amphibian species. An agreement to carry out mitigation should be prepared by a developer and planning officers and be in a written form, detailing the actions to be taken.

The first recommended approach is to request some form of 'on-site' (*in situ*) conservation so that a suitable quantity and quality of habitat is either retained or provided within the development and that this be made a condition of the planning application. It is important to ensure that if *in-situ* measures are considered, sufficient habitat is set aside to allow the persistence of a viable population.

An important consideration is the inclusion of buffer zones around suitable habitats defined within the planning application. These should help to protect the animals from disturbance by humans, their pets, recreational usage and other damaging actions. It is very important that mitigation areas are not vulnerable to recreational or other pressures that prevent translocated animals from surviving. They should not be amenity areas renamed as nature reserves that will suffer from over-use by humans in the long term.

If there is insufficient space for *in situ* conservation to accommodate the whole population on the site, then the options need to be re-evaluated. There may be cases where it is better to move the whole population to a new site than to conserve only a part of the population *in situ*. This latter option will address the need to maintain the integrity of the translocated population.

If translocations are necessary to move animals to the new habitat, sufficient time must be made available for the proper capture of the animals. It is important that everybody involved with these projects appreciates that they are time-consuming and do not represent a 'soft option'. The effort and appropriate time period, however, will differ from case to case. For amphibians this may require two or more consecutive breeding seasons of capture effort, or very intensive effort at both the pond and the terrestrial habitat if a shorter period is considered. Reptiles are harder to catch. Often a rescue may need to extend over two full seasons to ensure that all the population has been removed and released within the recipient site. To be successful, mitigation translocations require the investment of a large amount of time and expertise. The likely success of such projects also needs to be considered: their success cannot be guaranteed. Therefore translocations to mitigate for loss

of amphibian or reptile habitats should only be considered as a last resort.

Suitable donor sites must be constructed/located/guaranteed in advance of any agreement that translocation is a viable option, and certainly before any capture period. Any receptor site must fulfil the criteria listed in section 9.3 and ideally be surrounded by a buffer zone.

Moving herpetofauna requires careful and meticulous planning involving properly trained personnel with proven trapping and handling skills. The translocator must consider the welfare of the animals, employ humane methods of capture (Chapter 3) and containment, obtain permission and licensing (if applicable) and ensure that such activities meet the requirements of the law (Chapter 7). Contracts are normally drawn up between the translocator and developer, outlining the translocation programme and agreements reached, before the operation is carried out. The Statutory Nature Conservation Organisations (SNCOs) may need to be satisfied that the plans are sufficient (especially if a licence is required), and voluntary bodies may wish to monitor activities to ensure that everything is being done properly.

Ideally, the population should be studied for at least one season prior to translocation. This will allow the translocator to assess the number and distribution of individuals that need to be caught and to plan the rescue accordingly. This will also identify which part of the site is used by the animals and whether suitable habitat can be selected for on-site protection.

As amphibians migrate to their spawning site they can be intercepted by a drift fence and pitfall trap system (Chapter 3), but remember that immatures may stay away from the pond for several years and may be missed by this method. With reptiles, refuges (Chapter 1) need to be laid over the site well in advance of emergence from hibernation. The more refuges used and the more visits made, the better the catch effort.

A study of a slow-worm site in southern Britain (Gent 1994c) has shown that 50 tins per 0.1 ha and a minimum of 15–20 visits should be made to capture a reasonable proportion of a population. However, as more work is done it is likely that these guidelines will be revised. It should be noted that different species use refuges to different degrees and this should be borne in mind when developing a trapping scheme for reptiles.

'Drift fences' (Chapter 3) can be used to enclose and exclose mitigation areas. Sometimes they can be constructed as 'one way' fences, by erecting them at a slight angle, so that animals can climb into an area but not climb out again. The areas can be brush-cut/strimmed to make it easier to locate and catch animals and to help prevent them from returning to the development area. As many visits as possible should be made, especially in the early stages (as the animals emerge from hibernation), to remove all the animals from the threatened area. Capturing reptiles is very weather dependent (Chapter 3), and trapping strategies will vary from site to site.

There are some cases where emergency 'rescues' need to be carried out; these occur with little or no prior warning. Cases such as these could be caused by a pollution incident, or the infilling of a pond, or heathland fires. There are cases on development sites where the presence of animals was not known about before work on site has started. Adequate mitigation may be hard to obtain, and often the only course of action available is to rescue as many animals as possible. Such emergency rescues are unlikely to be as successful as those planned in advance and carried out over a longer period of time, but sometimes this is all that can be achieved. If only small numbers of animals are involved, then finding sufficient receptor sites may not be too difficult. Liaison with the owner/developer is essential; where protected species are found, the legal obligation to avoid harming animals will remain in force. However, where there is a genuine reason for not being aware in advance of the animal's presence on site, what is considered to be 'reasonable' rescue effort may be different from a situation where the presence of animals has been known well before work on the site commenced.

Anyone intending to become involved in any translocation activities should be aware of their own limitations and circumstances. Often the services of a dedicated professional are required, and especially where this work forms part of a planning requirement. Although a volunteer group may have the necessary expertise, they may lack sufficient time and resources to do the job properly and to meet the stringent legal obligations required. Consideration should be given to:

- offering appropriate advice;
- time and resources required;
- liabilities that stem from giving advice or carrying out work;
- health and safety.

Volunteers are often best employed to provide advice with the intention of seeing that appropriate consideration is given to conserving amphibian and reptile populations during the planning process. For example this could involve suggesting sensible conditions to attach to planning permissions and seeing that they are carried out.

9.2.3 Selecting, preparing and monitoring the receptor sites

The selection of receptor sites can be the most difficult part of a translocation and will relate to anticipated number of animals to be caught. Because of this it is important to have a good understanding of the threatened population before translocation is considered. Guidance given in Chapter 1 will help in this matter, but, almost without exception, a larger number of visits using appropriate techniques will be necessary to gain an accurate picture of the status of a population subject to a planning proposal. If this is not possible, the mitigation proposal should assume that a good population exists, to ensure that the level of mitigation is adequate.

Suitable or potentially suitable receptor sites should be identified and surveyed to ensure the absence of the

species. If the habitat needs to be improved this should be put in hand at the earliest opportunity. In general, receptor areas should:

- be of a suitable size for the number of animals to be moved;
- provide good quality habitat according to known ecological requirements of the translocated species;
- be safe, at least in the foreseeable future, from land-use changes that would harm the population;
- preferably hold some form of protected status or be open land of low intensity use where survival is highly likely.

Where small numbers of animals are being moved it is often acceptable to add these to existing adjoining populations on which they will have little impact. If only small numbers of animals are released at sites without an extant population, it is possible that there may be too small a genetic base for long-term population viability or too few animals to breed at all. However, particular consideration needs to be given to the possibility of spreading pathogens to the existing population at the receptor site. As a guide, in the context of amphibians, 'small numbers' probably means up to ten adult individuals, fewer than 100 larvae or one or two 'clumps' or 'strings of spawn'. For reptiles a small number is less than ten animals.

Where larger numbers of amphibians and reptiles are involved, the receptor site should be free from the species to be translocated. An ideal site would be within or adjacent to a wildlife reserve that has a degree of protection and is wardened. Large-scale habitat construction or improvement would need to be carried out well in advance of the translocation if the animals are to stand a good chance of survival once they are released at the receptor site.

One important point is to ensure careful positioning of relevant key features such as amphibian breeding ponds and reptile hibernacula and basking banks. Such features should not be situated at the site's periphery. Details of habitat management to benefit amphibians and reptiles are outlined in Chapter 6.

One of the most overlooked aspects of a translocation programme is the subsequent monitoring of the receptor site to see if the translocation has been successful. 'Success' could be defined as the establishment of a self-sustaining population at the receptor site, perhaps with some quantitative measure to reflect a similarity of population size, or extent, to that which occurred at the donor site prior to the translocation. How long a population will need monitoring to show self-sustainability will be dependent on the species concerned and the criteria identified to measure success.

The generation time of the species involved will influence the monitoring period. Long-lived species such as snakes will require a much longer monitoring period than short-lived species such as the common frog.

Success criteria should form part of the mitigation package. These must be appropriate for the intention of the mitigation process. Generally it would be insufficient to say only that the animals have survived and bred. Monitoring should consider the numbers and condition of the translocated animals and the recruitment and survival of the next generation. If offspring return to breed for a number of generations, the population may be considered as potentially self-sustaining. The monitoring process will also show if alternative or additional management is required and a commitment to such actions should be recognised and agreed at the very start of the proposals to move animals.

9.3 Translocation as a proactive conservation tool

9.3.1 Introduction

Translocation can be used to promote the conservation of amphibians and reptiles by releasing animals in areas where they are historically known to have occurred. One of the requirements of the Bern Convention and the EC Habitats Directive is to use such reintroductions as a proactive conservation tool for European herpetofauna of conservation concern.

Reintroductions have been a component of the conservation programmes for rare and endangered herpetofauna in the UK in recent years and have been carried out as a supporting activity to complement site protection and habitat restoration and management. Considerable efforts have been put into translocating and releasing sand lizards to pre-prepared receptor sites since 1969. Many of these translocations have resulted in self-sustaining populations that thrive to this day. A similar programme has been carried out with natterjack toads and to a lesser extent with smooth snakes and great crested newts. More recently, translocation has been a major objective in the recovery goals of the English Nature natterjack toad and sand lizard Species Recovery Programme projects. One aim is to re-establish the two species in representative sites across their historical ranges, through translocation programmes. Such programmes aim to restore populations in order to help offset the contractions in their ranges and abundance in recent decades.

The construction of artificial ponds in gardens, particularly over the last 30 years, has helped to establish large populations of common frogs and smooth newts in urban and suburban areas. Translocation of animals to newly created garden ponds from nearby garden ponds that can spare a few individuals is perfectly acceptable and increases the species' distribution and abundance within its natural range. Most amphibians, however, will colonise of their own accord, and generally people should not be encouraged to move amphibians and their spawn unnecessarily. Furthermore the limitations of gardens as habitats should be recognised: garden ponds may be too small to support a self-sustaining population of great crested newts and are never suitable for natterjack toads.

Other projects have translocated commoner reptiles, but on relatively few occasions compared with amphibians. As new habitats become available, for example motorway embankments and mineral quarries, the possibility of translocating snakes and lizards from healthy populations could become more frequent.

Ideally, the habitat chosen for reintroduction, either previously existing or restored, should be similar to the one that supported the animals in the past, with respect to soil and vegetation type, vegetation structure and community composition. For such sites it is important that the factor(s) contributing to the extinction of herpetofauna populations are no longer operating. For example, many old natterjack toad breeding pools no longer support spawn development, and so breeding site quality may need to be improved.

Deterioration of prime reptile habitat has contributed to their decline, and sites need to be managed to provide areas for breeding and hibernation, so that expanding areas of invasive trees and shrubs do not overwhelm open heathlands and grasslands.

All factors contributing to the decline of a species at a site must be considered and addressed before a reintroduction takes place, otherwise these factors will eventually prevent a stable population from becoming established.

9.3.2 Guidelines for translocation of amphibians and reptiles

The first consideration is whether a translocation should be undertaken at all. This assessment needs to address the impact upon the 'donor' population (i.e. at the site from which the animals will be taken) and at the 'receptor' site (i.e. the site at which they are released). It also needs to determine whether the geographic area in which the animals are being released is appropriate. For example, is the habitat suitable? Is the area in which they are being released within the natural range of the species?

Translocation is a term which includes the following activities: *introductions,* where animals are released in an area in which they formerly did not occur; *reintroductions,* where a species is returned to an area in which it previously occurred but has become extinct; and *restocking* (or *reinforcement*) in which additional animals are added to an existing population. These different circumstances raise different questions about how, if at all, a translocation should be taken forward. The International Union for Conservation of Nature (IUCN) has produced a position statement on the translocation of living organisms (IUCN 1987), and various other papers, some specifically for amphibians and reptiles (e.g. in Nature Conservancy Council 1983), have been produced that look at the desirability and policies behind translocation (these have been collated and summarised in Bullock *et al.* 1997). Sometimes, whether an act is considered an introduction or a reintroduction can be dependent on how precisely a 'former site'/'former area' is defined. In general, introductions are discouraged, since this generally involves the release of animals to areas that are outside the natural geographic range or that are not suitable. However, there are cases where such introductions can be acceptable; perhaps some form of habitat change makes a new area suitable or the irreplaceable loss of habitat in the historic range makes this the only viable option. In other cases the absence of records need not imply actual absence of the species in the past (and thus the release area may form part of the 'presumed' natural range).

Reintroduction is perhaps the most frequently addressed topic, i.e. bringing animals back to former sites/former areas of its range. In general reintroductions are encouraged as a means to re-establish the range of species formerly found within an area. However even this may not be straightforward.

The IUCN (1995) have produced updated guidelines for reintroductions. While these are mainly aimed at programmes to re-establish lost species at a Regional or Country level, their spirit is equally applicable for reintroductions at any scale. These guidelines emphasise that such projects are lengthy and need rigorous review. They require work before a reintroduction is considered, during the exercise and after its completion. They can be summarised as :

- need to ensure no threat to the 'donor' population;
- need to ensure appropriate genetic stock is used (comparative studies may be needed in advance);
- reintroduction of a species must be within the natural range of the species;
- the habitats and other features within the site and the size of area to which they are being released need to be suitable to ensure a good chance of survival and the development of a self sustaining population (detailed studies of the animal's ecological needs may be required);
- the reason for loss of the species in the area in the first place must have been understood and addressed;
- the 'receptor' site should satisfy the habitat needs of the species for the foreseeable future;
- the impact of the release on the biological community at the receptor site needs to be evaluated in advance of the translocation;
- issues such as transfer of disease or of non-native species or other species that are not appropriate at the receptor site need to have been addressed;
- appropriate consultation must be carried out and the re-introduction must be supported by the local community; consideration needs to be given to a wide range of issues, such as human interest, landscape, economic considerations, agricultural factors etc., not just ecological aspects;
- the population should be monitored post-release to assess the success of the translocation (and to direct management) and to determine effects on other features of the environment.

These principles should be followed in all reintroductions.

Restocking is generally only appropriate where there is some evidence or reason to believe a population is so small that it is suffering from in-breeding or is simply not large enough to be viable. In such cases other measures alone, such as habitat management, would not prove sufficient to restore the viability of the population. Consideration would need to be given to the genetic origin of the release animals, disease transfer etc.

- There should be thorough consultation with the site owners and any tenants/occupiers of both donor and receptor sites. For protected or threatened species, or releases to sites with statutory protection, the appropriate SNCO should also be consulted. In many cases written permission and licences (as appropriate) may have to be obtained.
- In the majority of cases, the donor and receptor sites need to be as close to each other as possible, but the exact distance will depend on the species' longevity, behaviour and its ability to colonise new areas. A maximum distance of 1 km is currently recommended for the common amphibians.
- Animals should not be collected from populations where this would constitute a threat to the continued existence of the donor population (clearly this does not apply to 'rescue' sites). The animals should appear healthy and free of any diseases. It is important not to move any species other than that chosen. In the case of amphibian translocations care must be taken not to transfer unwanted species, such as the invasive alien waterweed *Crassula helmsii* (Chapter 11) or predatory fish such as stickleback or perch.
- The receptor site should be free from threats and ideally be within a local nature reserve or protected area. This is essential for the rare herpetofauna, which are best released on a managed Site of Special Scientific Interest (this will require consent from the SNCOs).
- Records of capture, release and subsequent dispersal and breeding will need to be made in order to monitor the success of the translocation. Records should be submitted to the appropriate Records Centre (see Chapter 10) so that the translocation is documented.
- If the translocation is unsuccessful, future attempts to introduce the species must not be undertaken until the reason(s) for the failure are identified and rectified.

Chapter 10 Herpetofauna groups and public involvement

Jim Foster and Julia Wycherley

10.1 Setting up a local amphibian and reptile group

10.1.1 Preliminary work

Any individual interested in herpetofauna and wishing to set up a local amphibian and reptile group (ARG) will find plenty of information available at both local and national level. Initial contact should be made with the Wildlife Trust for advice, support and contact with other people who may wish to become involved. Groups can often be set up as an official sub-group of the Wildlife Trust, giving the benefit of office space, resources and contacts. This may make the group more accessible than it would be if it were completely independent. Assistance can also be sought from the County/Regional Museums, County/Regional Record Centre or Natural History Society.

The next step should be to locate as many individuals as possible who can bring specific interest, knowledge and skill to the Group. Begin with the Common Species Co-ordinator at Froglife, who will provide a list of active workers in the county/district and will offer links to the Regional Representative of the Herpetofauna Groups of Britain and Ireland (HGBI). This Representative will also have links and contacts with ARGs in the neighbouring counties and regions. (HGBI regional representatives are also listed in the *Herpetofauna Worker's Guide*, which includes much valuable advice).

It is important to make contact with the local Environmental Records Centre and Natural History Societies at the outset so that recording work can be carried out co-operatively; these groups may also have contacts who will become involved in the ARG. Staff based at the local offices of Countryside Council for Wales, English Nature, Environment and Heritage Service Northern Ireland and Scottish Natural Heritage may be a valuable source of knowledge.

Other useful contacts may be made through the herpetological organisations such as the Association for the Study of Reptiles and Amphibians (ASRA), the British Herpetological Society (BHS), the Herpetological Conservation Trust (HCT), and the Societas Europaea Herpetologica (SEH). These groups will be able to advise of any staff or members in the area.

Recreation and land management organisations such as angling clubs, countryside rangers, Farming and Wildlife Advisory Groups (FWAGs) and the Forestry Commission can provide useful contacts. Police Wildlife Liaison Officers and RSPCA/SSPCA/USPCA Inspectors will also be valuable allies. Further publicity is essential and can be achieved through advertising in libraries and articles in the local press and church and village magazines. The local Wildlife Trust may be keen to have articles in its magazine or be willing to include ARG notices.

10.1.2 First meeting

At the first meeting it is important to establish the internal management and elect officials to enable the group to function efficiently. Typically needed are a Secretary, Treasurer, Recorder, and Chair.

Define the responsibilities of the officials so that the duties to be covered can be shared as effectively as possible. The Secretary can receive all mail and enquiries so that only one postal address and telephone number is publicised. Correspondence and specific enquiries can then be passed on to the most suitable member of the group for an appropriate response. Group funds and expenditure should be carefully recorded and be the responsibility of the Treasurer. As meetings are an important time for effective communication and planning, the election of one person to draw up the agenda and chair the meeting will maximise the usefulness of this time.

The task of gathering and collating records for the area is essential and one member should be nominated to undertake this work. This group Recorder can liaise with and take part in any national schemes as well as producing summaries and distribution maps of the records received. For larger counties there may be merit in having more than one Recorder. There may also be a need for a separate Amphibian Recorder and a Reptile Recorder if records are numerous. It is an obvious advantage, but not essential, for the Recorder to have basic keyboard skills and access to a home or office computer and printer.

The geographical area to be covered by the ARG needs to be defined. The overall aims of the group should be agreed and then the strategies devised (see 10.1.3.) It may be possible at this time to define specific targets for the group (e.g. intensive survey of ponds in a

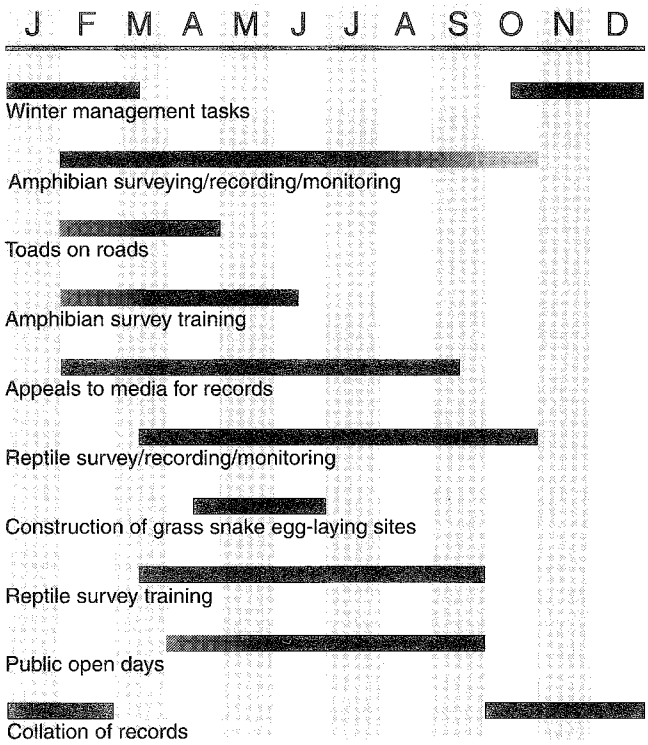

Figure 1 Calendar of activities for a local amphibian and reptile group.

given area, a special survey of a local key habitat), which can then be assigned to subsequent years. Suggestions for timings of activities are given in Figure 1.

One of the officials may like to create and maintain a record of the group's activities, including meetings, field work, site registers, press contact, publicity and involvement with corporate and statutory bodies and the general public.

10.1.3 Strategies

Training

Group members need to be aware of the need for accurate species identification (Chapter 2) when surveying, recording and monitoring. Training can be given by more experienced workers either in the field or at other meetings. General advice on training can be obtained from HGBI, which is developing standards for courses.

Equally important is members' knowledge of the various methods used in surveying (Chapter 1). If all members use the same good practice, then results and records will be comparable and of a higher quality. Familiarisation at an early stage with the various recording forms is of great value. As surveying proceeds, certain populations/habitats will be noted as being of particular importance or as being under particular threat. These should be surveyed regularly and consistently year by year.

Special training may be needed if dealing with legally protected or endangered species. The Countryside Council for Wales, English Nature or Scottish Natural Heritage can offer advice and information when licences are required (Chapter 7). Any members of the group likely to deal with adders may need specialist advice before attempting any action (Chapter 3) (contact Froglife for details).

From the outset, training in surveying should also include raising awareness of how records are used for ranking sites in terms of Sites of Special Scientific Interest (SSSIs) quality or as Sites of Interest for Nature Conservation (SINCs), County Wildlife Sites (CWSs) or key sites (Chapter 8). The Group should ensure that at least three members become familiar with SINCs/SBIs and can serve as a panel to appraise candidate sites.

As expertise develops, group members will become involved with the general public and the press dealing with enquiries. Training in how to approach these situations is useful so that standard advice is given, errors are avoided and the best made of each situation.

The need for training may be identified within the local group or be recognised by national organisations as a priority. There are various ways of finding training; some organisations can offer training courses, or develop them for you. These include BTCV, Wildlife Trusts, Froglife, Field Studies Council, SNCOs and Local Authorities. Commercial training companies do exist, but courses can often be expensive. In other cases local amphibian and reptile groups will develop their own training courses, either for their own members or for other groups and organisations. Where a training need is identified, it is worth contacting Froglife or other amphibian and reptile groups to see if an appropriate course exists or can be created or whether there is any value in developing such a course yourself.

Finance

Every group requires funds for expenditure on letters, telephone calls, equipment, display material and travel. High priority should be given to collecting information on fund-raising techniques and grants. Funds may be obtained from a wide range of sources, including trusts, local councils, environmental campaigns and companies. There is plenty of scope for imaginative fund-raising activities which not only raise the profile of the group to the general public but also provide a platform for possible social events.

Communication

A broadsheet/newsletter is a key factor in linking the members of the group, especially if membership is spread over a wide area. Together with regularly held meetings it gives a group identity and informs all members about current and future activities. Circulating information gives an overall picture of the work undertaken and an overview of records collected. Individual groups will develop their own style of presentation.

Media

Newspapers and magazines can be very helpful in disseminating information and raising public awareness. It can be useful to appoint one person who is responsible for contact with the press. The person concerned needs to have skills which ensure that points that need to be made are put across in a clear and concise manner, so that any resulting

publicity is not mis-reported. Many press contacts are made by telephone, but it is helpful to have all salient points written down so that information published is accurate. If the facts are not to hand then don't hesitate to offer to call back later, but be aware of others' deadlines.

Local radio is a very useful medium through which the group can gain publicity. Good preparation is essential to ensure accurate reporting. Predetermine the direction of any interview and try to keep firmly to this plan. Remember that it is not essential to follow the direction of simplistic or ill-informed questions as it is possible to respond with a series of 'statements' emphasising the points that need to be made. The radio interviewer will appreciate receiving a list of 'key' points prior to the interview.

Working with television is more complicated. Initial contact from the producer is usually in the form of a request for interviews, site visits, and the production of specimens for close up filming, *and* this is usually needed within the next 24 or 48 hours! This is where the previous work and site records of the group are very beneficial. The primary concern must be for the welfare of any animals required for filming. A specific licence may be required by the group as well as the film cameraman so advice should immediately be sought from the licensing section of the Countryside Council for Wales, English Nature or Scottish Natural Heritage.

The person undertaking selection of sites and the collection of animals to be filmed should be prepared to allocate at least a couple of days to this work, together with an extra day for the actual filming. Care must be taken during capture (Chapter 3), display and release to ensure that all animals are returned in prime condition to their source locations. Further advice on dealing with the media is given in Chapter 11.

Affiliation

The group should consider affiliation to other groups, e.g. Wildlife Trust, BHS, BTCV (see Becket & Foster 1997), with regard to corporate insurance, training, joint meetings, advice on practical activities, joint surveys and obtaining records. Attendance at regional and national meetings should be encouraged.

Education

As expertise develops within the group, members can be encouraged to raise the profile of amphibians and reptiles within local schools by offering advice, displays and talks. Schools welcome visiting experts, and slide talks about amphibians, reptiles, ponds and pond creatures are always very popular. This will often lead to schools adopting a pond. Many schools acknowledge the benefit of a wildlife area within the school grounds and have set aside space for this purpose. Typically this contains a pond which becomes overgrown and requires some management. Often there is no member of staff with the necessary expertise and time and the local ARG can be in a position to offer information and support. This usually creates a valid opportunity to give further advice on the creation of refuge areas and hibernacula.

Amphibian and Reptile Group open days are often very popular and usually well attended. A note to local clubs, schools and libraries giving the venue and date will maximise publicity. Children will often be accompanied by their parents on the day. It is sensible to link with the Wildlife Trust and BHS at events such as county shows on these occasions, as joint ventures extend the facilities available and create maximum publicity and support. A varied programme should be designed, especially if the event is held at a local nature reserve where displays, talks and guided walks offer interesting features for all ages and groups. It may be a good idea to have some native herpetofauna on temporary display. This can be useful for education and identification purposes. Remember, however, that the welfare of the animals is paramount and to check on any licensing requirements (Chapter 7). It is usually possible to link wildlife quizzes and competitions to the displays and talks.

Notice boards can be used to create static displays which inform the public about the ARG's interests and activities. Sites for these displays should be booked well in advance of the time required in places such as libraries, information centres and building society windows. Similarly, local adult groups are often in need of speakers on topics of local interest, and a member such as the ARG Chair could undertake this responsibility.

Equipment

ARGs should consider the purchase of some equipment. Survey equipment could include good quality tough hand nets, torches, snake handling gloves, O.S. 1:25,000 maps and waterproof field note books. Bottle traps can be made from old squash containers (Chapter 3). If members are involved in working near roads then the purchase of fluorescent vests should be considered. Froglife Advice Sheet 11 provides useful information on suppliers and prices of commonly used field equipment (Froglife 1996b). If habitat restoration or management tasks are planned then further expenditure on tools and safety equipment may be required.

Safety and insurance

It is vital to discuss group/individual safety in the field, and to establish guidelines for good practice. It may be useful to carry out a Health and Safety review in order to draw up a Health and Safety Policy. Contact HGBI for advice. Aspects that require consideration include water-edge safety, tetanus, Weil's disease, Lymes disease, working alone, working by the roadside, safe tool handling, and the use of protective clothing. If members enter private land they should contact the landowner first to obtain permission; surveys undertaken on local authority owned land, for example, may require the production of a public liability policy certificate. If the ARG operates as an official sub-group of the Wildlife Trust then activities may be covered by the Trust's insurance policy. If not, it may be advisable to take out a policy specifically for the group. HGBI can advise on this.

Field meetings

The group should establish a series of field meetings with the aims of collecting data and extending

individual and group expertise. If there is no-one with the requisite knowledge to provide advice, skilled members of other groups are often willing to offer help and training. The field meeting will vary according to the season. In early spring, amphibian recording can begin as soon as these animals emerge from hibernation. Preparations should be in hand for those groups which assist in 'Toads across Roads' schemes. As the year advances, reptile surveying should be undertaken while the recording of amphibian sites is continued (Chapter 1). Winter is the best time to begin site management projects but care should be taken not to disturb hibernation areas. This is also a good time to make the initial visit to any new site as the vegetation cover will be low, making access easier.

Database

The Recorder should receive and collate all records, so maintaining a local database either on computer or paper. This can be used to produce distribution maps at regular intervals, since such information is of great importance in designating SINCs and when planning queries are made. All data should be shared with the county/regional Biological Records Centre (if one exists) and the National Records Centres for inclusion in these national databases.

10.2 The functions of an amphibian and reptile group

10.2.1 Recording, surveying and monitoring

Recording should be a central theme to the group's activities. Ideally, the group should aim to gather data on species' distributions within the area through specific recording efforts, as well as through other activities such as collecting records from members of the public at open days.

Take the opportunity to explain the conservation benefits of recording, both to group members and to the public in general, since undoubtedly a great number of records are 'lost' through a lack of reporting. Outline the need to have accurate and up-to-date distribution maps so that site protection is facilitated. Describing local examples of where reptile sites have been lost owing to an absence of records, compared with cases of successful site defence, will often unlock latent recording potential. The key is to help people to realise that filling out record forms is a simple, painless and even enjoyable process, which nonetheless is an essential component of conservation.

The actual system of recording deserves some mention since groups need to work along common lines for it to be effective. The basic route for information flow in the Joint Nature Conservation Committee (JNCC)/Biological Records Centre (BRC) scheme (which now replaces all other national schemes) is as follows.

Individuals send their records to the regional recorder, who may be the ARG recorder, the recorder at the Environmental Records Centre or a private individual (details of the appointed recorder for each county or district are available from HGBI). Regional recorders act as a collation point and a filter to validate records. Records are then passed to the national level at BRC to be entered onto the national database. Any records arriving directly at BRC are sent back to the regional recorder for validation. Where records are sent to the BRC in paper form, print-outs and 'dot maps' of records are returned to the regional recorder. Where the records have been computerised at the regional level, records from other sources are sent by the BRC to the region, but it is assumed that the region is capable of producing its own summaries. It is essential that all ARGs use this single system, otherwise data will end up fragmented between different recording systems, distribution maps will be incomplete and sites could ultimately be lost as a result. The Statutory Nature Conservation Organisations (SNCOs) will also be looking to the BRC database as the single definitive repository for records. This does not, however, preclude the operation of local databases; in fact this is to be encouraged as long as the information is copied to BRC.

Recording is facilitated by effective survey design. ARGs may initiate specific survey projects (survey of all the farm ponds within a given 10 km square, for example). The objectives, conservation benefits and feasibility of such projects should be carefully considered, and plans for the best ways to conduct them should be drawn up. Discussing ideas with other ARGs who have experience of such projects may well prove profitable.

The actual survey techniques used are crucial, and standard methods (Chapter 1) should be followed so that results are comparable across regions. Aside from large-scale survey projects, work on individual sites is always useful in gaining information on species' presence/absence and abundance.

Monitoring should occur regularly at sites that are notable for high abundance or species assemblages ('key' sites) so that any threats may be detected early and averted and so that a check can be maintained on population size. Compiling a list of key sites can be of considerable use in, for example, the identification of SSSI/SINC quality assemblages and in encouraging the recognition of important herpetofauna sites on local authority plans.

10.2.2 Conservations targets and local 'Recovery Plans'

An exciting and valuable project for local ARGs is to develop conservation targets and local 'Recovery Plans' for the amphibians and reptiles in this area. These may form part of the implementation of national Biodiversity Action Plans. As such, it would be useful to contact the relevant SNCO for advice.

Although overall national guidance may exist, especially for the more threatened species, it is quite likely that no-one will be better equipped to come up with ideas about conserving the amphibians and reptiles in an area than the local ARG.

Recovery plans should form the basis of the work done by the group and should encompass conservation, site safeguard, survey, management, re-introductions, education and publicity. It is unlikely that the group will be able to do everything on its own and consequently working with others is an important part of the exercise. In fact it may be profitable to ensure that the proposals are developed with other organisations, such as the Wildlife Trust, or with the planning authority as part of a 'Local Agenda 21' (the plans by which a Local Authority fulfils its obligations to the United Kingdom Biodiversity Action Plan).

An example of a specific local Recovery Plan could be a plan for great crested newts. This should set broad aims (e.g. to restore populations to their former distribution in an area), specific objectives and a series of actions (e.g. extra survey, liaison with Local Authority planning departments) and targets (e.g. create one new pond per year). Otherwise ARGs may wish to get more closely involved with national species 'Recovery' Projects and should develop contacts within the SNCOs to find out how they can best become involved.

10.2.3 Site safeguard

ARGs should assist in the safeguard of local herpetofauna populations by monitoring applications moving through the planning system. This means that action can be taken if proposed developments appear to be in conflict with herpetofauna conservation interests. Ideally, ARGs are in a position to assess specific planning applications (this can happen if the group is closely affiliated to the local Wildlife Trust or Local Environmental Records Centre, for example). In this way advice can be given to the planning authority on potentially destructive developments. A thorough working knowledge of the appropriate legislation (Chapter 7) is beneficial if this task is taken on.

ARGs should regularly (at least annually) process survey information to ensure the most important sites for reptiles and amphibians are identified with a view to getting them listed as SINCs. This will ensure they gain protection – or at least recognition – in the planning process. The Group may need to set up a small panel to ensure survey information is converted into data sheets for potential SINCs. The Wildlife Trust will advise on the procedures for SINCs. To safeguard sites over the long term, ARGs should obtain copies of relevant Structure Plans, Local Plans, Unitary Development Plans, Mineral Plans, Wildlife Strategies etc. and scrutinise both maps and text. A dialogue with the planning authority, perhaps via an ARG member appointed to a wildlife advisory group, may lead to future land zoning recognising herpetofauna sites. ARGs should also consider advising SNCOs of sites with nationally important populations.

ARGs may be called upon to react to emergency calls from members of the public or other groups where there is an immediate problem, often where planning consent has been granted and site work has begun. Again, the legal aspects of any advice given or direct action taken should be carefully considered.

If a site is known to be subject to a change in land use, the ARGs may be contacted in advance to undertake translocation or other mitigation work. Translocation is not an operation to be taken lightly and requires considerable forward planning as well as physical effort and specific skills (Chapters 3, 7, 8 & 9). The degree to which ARGs become involved needs to be thought through in advance. Some ARGs may be well placed and have the necessary practical expertise to carry out such work, but even these should consider seeking further advice from appropriate organisations such as Froglife. While ARG members may often be happy to provide advice or to assist with genuine crises, their role, and in particular any commercial/financial relationships, in relation to the exercise needs to be considered carefully. Providing voluntary advice can be rewarding, but equally, group members may resent being used as free skilled labour by developers (or their environmental consultants). Entering into a commercial contract may be appropriate, especially if the mitigation is a binding planning condition, or if a legally protected species has to be translocated by the developer under licence. While this may be financially rewarding, the greater liabilities and commitments that result must be recognised and addressed fully.

Above all, no group should agree to undertake work in either a voluntary or commercial capacity that it is not in a position to service.

10.2.4 Education and publicity

ARGs should aim to raise awareness of native amphibians and reptiles, their habitat requirements and conservation status. In all dealings with the public and media, emphasis should be placed on conservation and legislative matters (the latter especially in the case of sale and the legality of killing and injury); see Chapter 11 for a fuller discussion of public relations. Displays, exhibits and presentations can occur at countryside shows, open days, museums, libraries, schools etc. Local press and media are usually keen to include stories about herpetofauna because they are perceived as being slightly out of the ordinary. Attempts should be made to quell any negative reporting (which may result from, for instance, stories about adders), and turn it into positive and helpful advice. Contact with the public represents an ideal opportunity to obtain records, but be aware of the problems of misidentification.

10.2.5 Information and advice

ARGs are in a good position to respond to calls for expert advice from statutory bodies, Wildlife Trusts, the general public etc. It may prove mutually beneficial to draw up a list of contacts willing to deal with enquiries in the different regions within the ARG working area and to distribute this widely. Creating a general enquiry form to go to all members, on which all calls are logged, with relevant details (name, address, telephone number of enquirer, date, grid reference, problem/query, advice given, outcome) can be of immense help. This will facilitate the extraction of records, and at the end of the year it will be easy to look back to work out the commonest form of enquiry and when they are most frequent; all this should help to evaluate efficiency and in planning future strategies. Members of ARGs may be called upon for emergency assistance with trapped or injured animals, snakes in gardens etc. Advice on these matters is given in Chapter 11. These occasions present an opportunity for positive environmental education as well as the collection of new records.

10.2.6 Practical conservation

ARGs can work independently or combine with BTCV and Wildlife Trust conservation volunteers, etc. to undertake habitat management. Of particular interest are pond creation/restoration, scrub clearance, creation of grass snake egg-laying sites, and hibernaculum construction (Chapter 6). ARGs may be called upon to give advice on these matters; equally, local reserve management plans may benefit from comments if groups are able to offer advice on sympathetic management.

10.2.7 Other activities

Specific projects undertaken by ARGs could include 'Toads on Roads' schemes (contact Froglife for details), or detailed studies of a particular site or population. The attendance at regional HGBI meetings is of immense importance in reporting the findings of the ARG to the

national level, and in keeping in touch with other groups for exchange of ideas and experience.

To maximise members' expertise, ARGs should consider establishing a small library of booklets and scientific papers, brought to each meeting by a delegated librarian for loans to members. The range of reports on surveying methods and papers on ecology dealing with herpetofauna is now considerable.

10.2.8 Useful contacts

Herpetofauna Groups of Britain and Ireland
c/o Froglife
Triton House
Bramfield
Halesworth
Suffolk
IP19 9AE
Tel: 01986 784518

Froglife acts as secretariat for HGBI and can offer advice on setting up and running ARGs as well as general information on herpetofauna conservation.

Association for the Study of Reptiles and Amphibians
Conservation Officer
c/o Cotswold Wildlife Park
Burford
Oxon
OX18 4JW
Tel: 01993 823006

Biological Records Centre
Institute of Terrestrial Ecology
Monks Wood
Abbots Ripton
Huntingdon
Cambs
PE17 2LS
Tel: 01487 773381

British Herpetological Society
c/o Zoological Society of London
Regent's Park
London
NW1 4RY

Countryside Council for Wales
Plas Penrhos
Fford Penrhos
Bangor
Gwynedd
LL57 2LQ
Tel: 01248 370444 or 385500

English Nature
Northminster House
Peterborough
PE1 1UA
Tel: 01733 455000

Field Studies Council
Central Services
Preston Montford
Montford Bridge
Shrewsbury
SY4 1HW
Tel: 01743 850674

Herpetological Conservation Trust
655A Christchurch Road
Boscombe
Bournemouth
Dorset
BH1 4AP
Tel: 01202 391319

Scottish Natural Heritage
2–5 Anderson Place
Edinburgh
EH6 5NP
Tel: 0131 554 9797

Societas Europaea Herpetologica Conservation Committee
c/o Pinetree Lodge
30 Endfield Road
Moordown
Bournemouth
Dorset
BH9 1TH

Chapter 11 Involving other people

Jan Clemons and Jim Foster

11.1 Introduction

Any opportunity to raise public awareness can greatly help herpetological conservation work by getting people more interested and involved with our native herpetofauna. This chapter outlines the most common queries about amphibians and reptiles and provides strategies for promoting public interest and support.

11.2 Amphibians

Over the last few years there has been a lot of interest in amphibians from a wide range of people and from the media, especially during the breeding season. Amphibians can greatly benefit from good public relations, owing to the many misconceptions about their lifestyles and habitat. The reports of amphibian declines, mass mortalities and the rapid disappearance of ponds from the countryside have highlighted the plight of amphibians to a wider audience and can be used to promote a better public image and understanding. Activities can range from giving talks, lectures and guided walks, organising management and monitoring programmes, to helping toads across a road.

When amphibian habitats are threatened, the herpetofauna worker may have to deal with developers, site owners, planning authorities and politicians. It is important that these people are aware of protective legislation (where applicable) (Chapter 7) and the need for both aquatic and terrestrial amphibian habitat, but generally it is the way the case for conservation is presented that is the decisive factor.

The herpetofauna worker must also deal with many enquiries from other people, many of whom have little or no knowledge about amphibians, and this section covers the main types of enquiry concerning amphibians. It also outlines how a request for advice can provide the opportunity to promote amphibian conservation and collect data on amphibian distribution. Dealing with amphibian enquiries where an element of persuasion is needed often requires as much knowledge of people as amphibians.

11.2.1 Amphibians in gardens

Many people are fascinated by amphibians and are keen to have them in their garden pond. Amphibians are excellent pest controllers in a garden and are known to readily devour slugs, snails and many insect pests.

Garden ponds can make a valuable contribution to the conservation of frogs, toads and newts and help to offset the continued losses in the wider countryside. Apart from being places where amphibians can breed, they represent valuable ecosystems where a large diversity of organisms can co-exist.

Site inspection

A few questions about the enquirer's garden will clarify its suitability for amphibians. The pond should be situated in a sunny, open location as warmth is needed for tadpole development. Apart from the shade they cast over the pond, leaf fall from trees overhanging small ponds can lead to management problems. The majority of leaves that fall into the pond will sink, smothering aquatic plants and using up oxygen in the water for decomposition. If the pond has to be near trees, it should be to the south of them. The pond profile is important: it should not have vertical sides, which would make it difficult for froglets and toadlets to get out onto land. The pond should be as large as possible but it is not unknown for frogs to breed in old sinks and bathtubs sunk into the ground, but this should not be recommended as there will be intense competition between developing amphibians for limited resources.

Householders with gardens should be encouraged to construct natural ponds for wildlife and not to stock them with fish, as these tend severely to reduce amphibian populations, being voracious predators of frog and newt tadpoles. Newts rarely flourish in fish ponds and should not be introduced if fish are present. Toads and fish easily coexist as the toad tadpoles are distasteful to fish and are largely left alone. The best solution is often to have two ponds, one for frogs and newts and a deeper one for fish and toads. If a second pond cannot be built it is still possible to establish small newt colonies if lots of submerged and floating aquatic plants are present to provide egg-laying sites and cover for the tadpoles.

Enhancement of the terrestrial habitat around the pond is important as amphibians spend more months of the year on land, either foraging or hibernating, than in water. There should be some dense vegetation adjacent to the pond to provide a humid habitat and cover for emerging metamorphs. Rockeries or log piles make excellent hibernacula and places of refuge. Lawns should either be regularly mown so that they offer little cover to amphibians or left alone after May (if practical) to minimise slaughter of emerging metamorphs; very short turf is a dangerous place for froglets and toadlets and encourages them to move away to seek concealment. However, if the grass is left to grow it can be strimmed in late Autumn. Other features in the garden can provide valuable shelter such as compost heaps, piles of rubble, 'wild' areas etc. Often amphibians will hibernate under patios and in greenhouses, garden sheds and cellars. Predation by cats and magpies can sometimes be a problem and this factor should be pointed out.

New ponds

An informal pond, irregularly shaped with an undulating series of shelves, is easily colonised by amphibians, but personal choice can prevail. Concrete, pre-moulded fibreglass shells and plastic liners are the most common materials for pond construction. Often cost is a limiting factor but the cheaper types of plastic liner do not last long. It is well worth investing in a butyl liner which is not damaged by frost or ultra-violet light and will last for many years.

Figures 1 and 2 summarise certain aspects of pond design, construction, suitable plants and maintenance.

Guidelines for larger scale projects in school grounds and conservation areas

In addition to the considerations relevant for site inspection in relation to garden ponds (above), constructing amphibian ponds in school grounds raises several further issues.

- Selection of a suitable site must take into consideration site security and public safety. Local

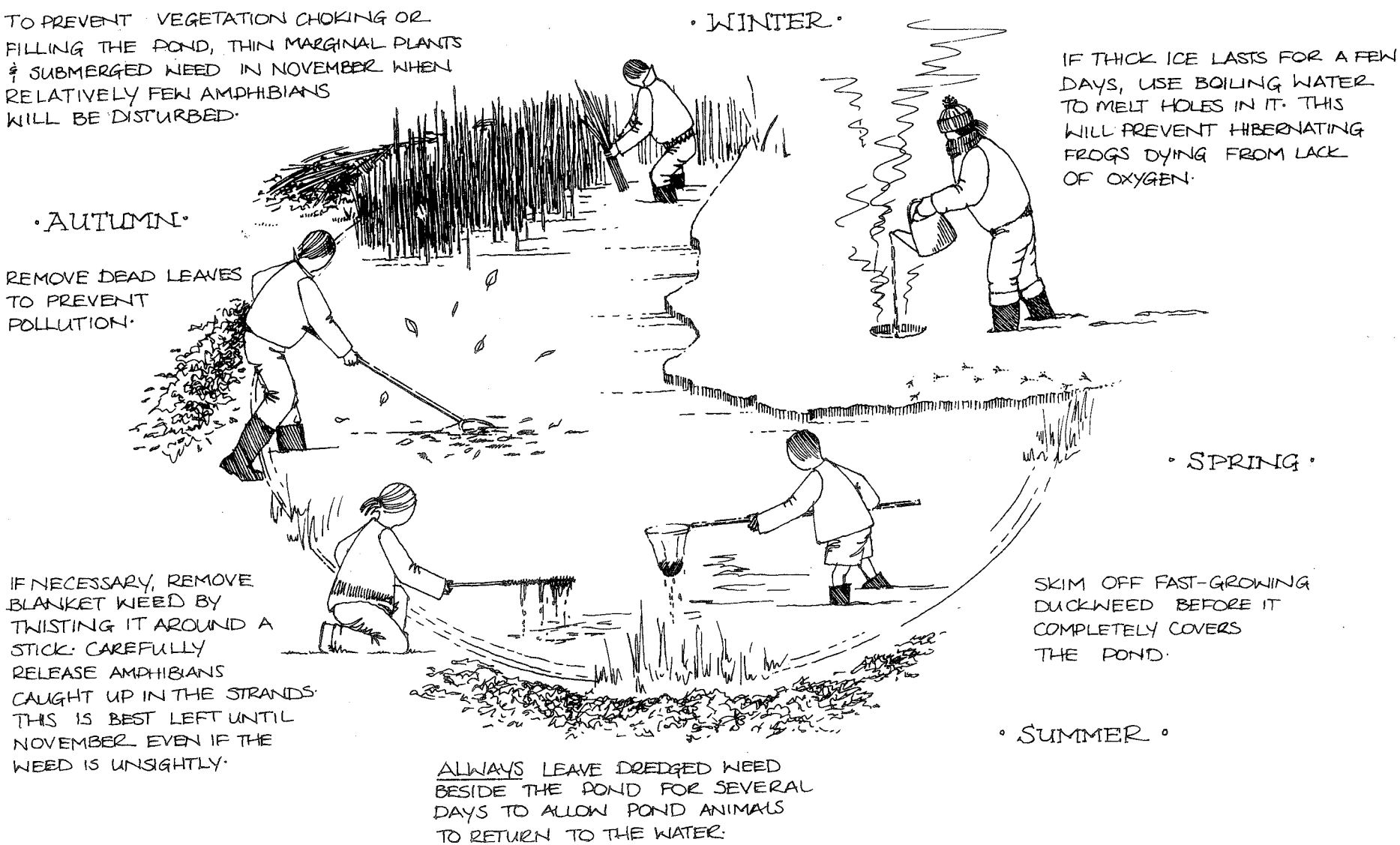

Figure 1 Pond maintenance calendar.

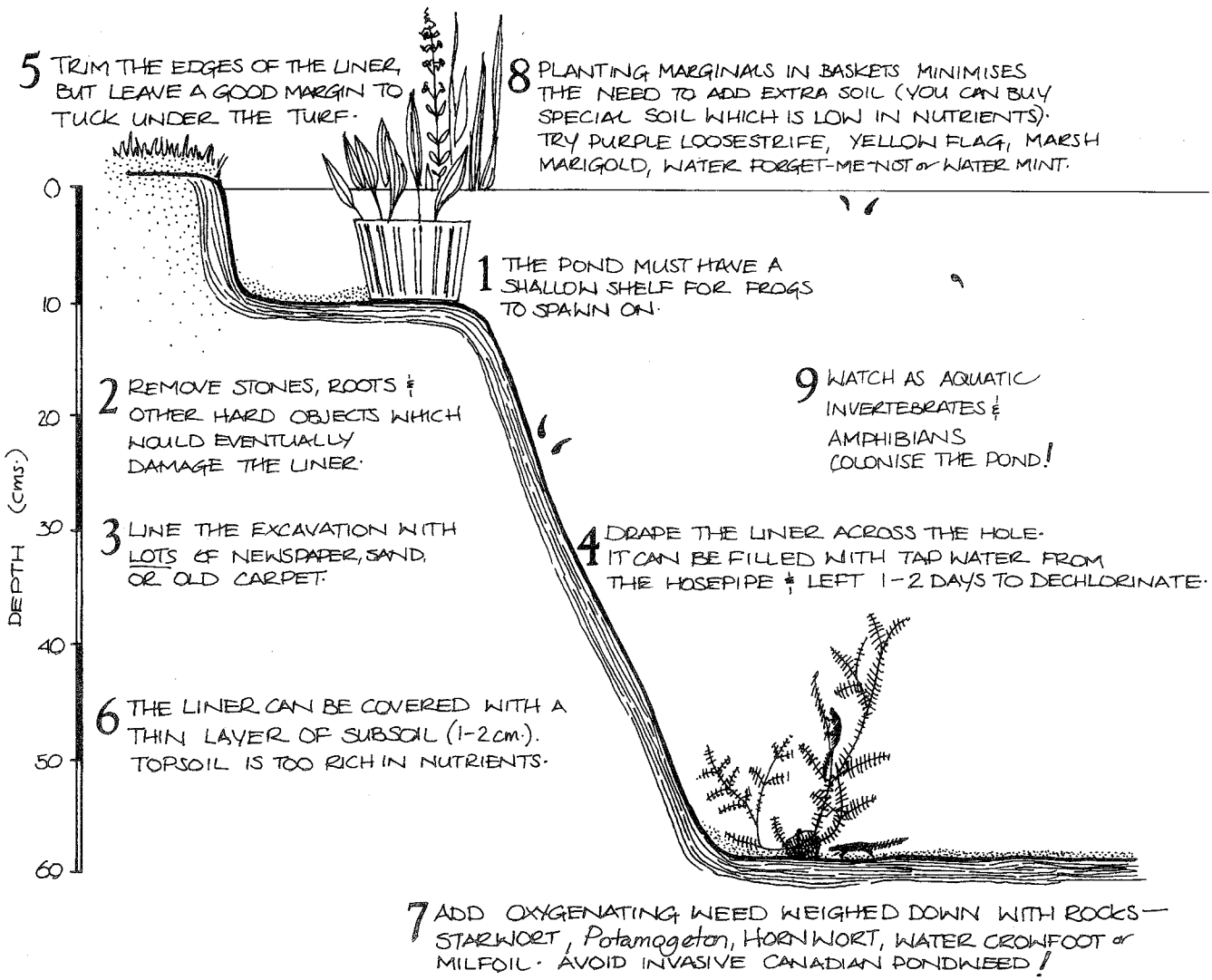

Figure 2 Cross-section of a new pond.

Education Authorities recommend that a school pond should be no deeper than 0.75 m. The site may require protection, especially from vandalism. Public access would have to be controlled, and a useful deterrent is the installation of security lights.

- If the site is in a built up area it is important to check with the appropriate authorities that the planned excavation and landscaping will not damage water mains, drains, gas or electricity supplies.
- Before any project is implemented, a programme for the subsequent management of the site must be agreed. A school conservation area could come under the remit of the school grounds maintenance policy, and management tasks on local nature reserves would need to involve the local community.

Introducing the amphibians

The best way of gaining amphibians in a garden pond is for them to colonise it naturally from other ponds in the area. If amphibians have not colonised a garden pond naturally and the pond is suitable, they can be deliberately introduced. Your stock should ideally come from as close by as possible, preferably from a neighbour's pond. In practice frog spawn is relatively easy to obtain, but great care must be taken to ensure that diseased stock and invasive alien water plants such as the New Zealand stonecrop *Crassula helmsii* (Figure 3) are not introduced by accident.

New Zealand stonecrop has been on sale in this country for years in aquarist shops as a fish tank plant and in garden centres as *Tillaea recurva*. It has now become a serious pest species in Britain, establishing itself in ponds, where it outcompetes native aquatic plants and becomes the dominant species. It is easily transferred to new ponds, and ponds containing *Crassula helmsii* should not be used as a source of plants, invertebrates or amphibians. The plant can be introduced to ponds on birds' feet and there is a known case of it being transferred between ponds on a herpetologist's wellington boots. Eradication is expensive and difficult: the whole pond must be covered with an opaque material such as black plastic to shut out the light for at least a year (NERC (undated)).

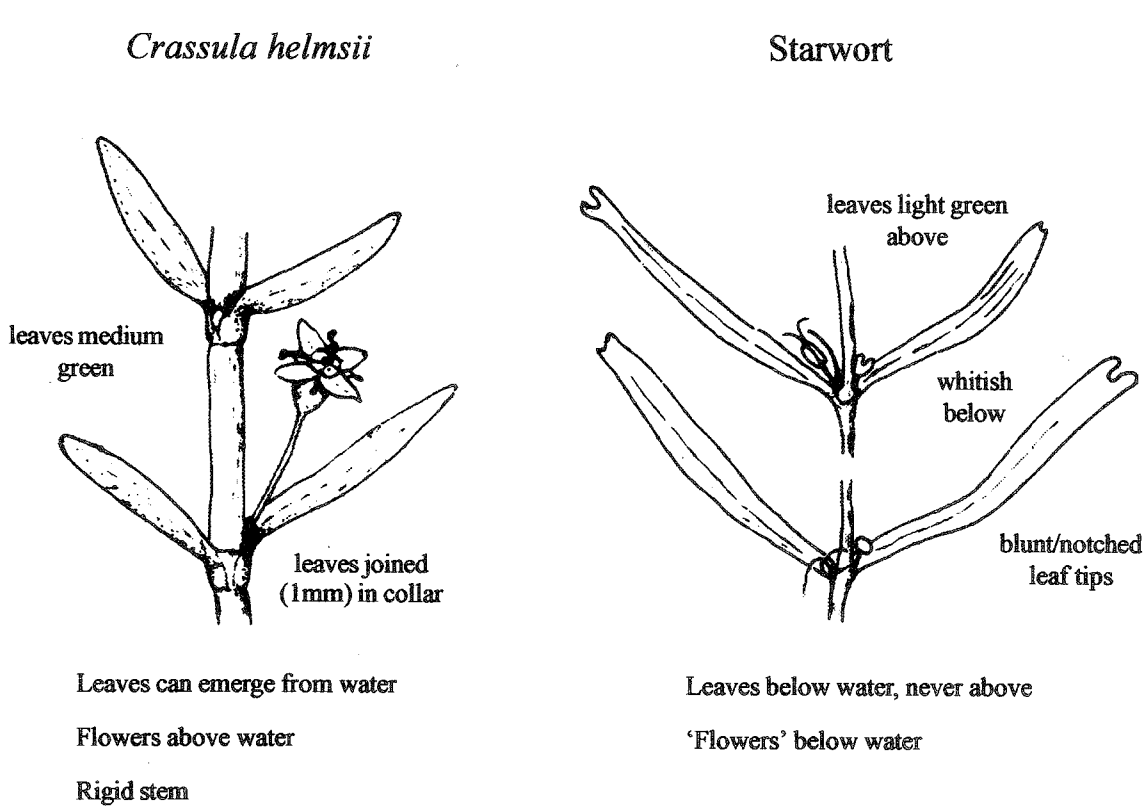

Figure 3 *Crassula helmsii* identification (reproduced from NERC (undated)).

Purchasing amphibian stocks from pet shops is not recommended and such exploitation of our native amphibians should not be supported as it is of no conservation value. Exotic amphibian species should never be released into garden ponds. Occasionally, native stock may be available from doomed sites and your Wildlife Trust or local herpetofauna group may know of sites in your locality. However, generally where sites are threatened it is preferable to encourage a proper mitigation package that recreates comparable amphibian communities, rather than take animals away piecemeal for releases to garden ponds.

Frogs are generally the most successful amphibian colonisers of new ponds. If there are other frog ponds in the area they will rapidly colonise a new pond. If introduced, the most successful method is to take one or two spawn clumps for two years from the same source. This should be sufficient to establish a self-sustaining colony. As frogs take two years to reach maturity, the third year should result in spawn being laid in the pond and negate the need for further spawn introductions.

A very common query during the spawning season is what to do with excess frog spawn in a pond. The answer is simple, the excess spawn should be left where it is unless a new pond owner in your neighbourhood is looking for stock. Each pond supports a certain maximum number of frogs, called the carrying capacity. Frogs are wild animals and the struggle for existence in a natural pond within a tadpole cohort will result in only the best adapted individuals reaching metamorphosis. Once frogs are established it is quite common to have garden pond colonies exceeding a hundred animals. Long-term studies of garden ponds have shown that there are large fluctuations in amounts of frog spawn laid from year to year and people need to be reassured that excess spawn is nothing to worry about (Beebee 1986).

Over the last few years the use of the term 'spawn swops' has been misleading. Swopping spawn (a type of restocking/augmentation) is not necessary between ponds that support established frog colonies and is potentially a means of spreading disease. In unusual circumstances it may have some value, for example where the respective colonies are declining perhaps owing to a lack of breeding females, or where small and isolated frog populations are showing serious signs of decline over a period of time; these may be genetically enriched by the addition of further individuals.

Establishing colonies of common toads is more difficult but is possible. Toads prefer larger ponds and the most successful method is to introduce spawn, rather than adults, from a local toad pond. One or two spawn strings can be wound round plants near the surface of the water where it is relatively deep (15–30 cm). Toads take three or four years to mature and, as for frogs, stocking could be done over a two-year period.

The rare and protected natterjack toad has specialised requirements and is not suitable for introduction to garden ponds.

Unlike frogs and toads, the best way to introduce common and palmate newts (if they have not colonised the pond naturally) is by releasing about a dozen adults, ensuring there is an approximate balance of sexes. March or April is the best time to carry out the introduction. Adults can be caught by netting a local, well established newt pond, ideally in a garden, that can

spare a dozen individuals. Careful examination of pond weed in August will reveal the presence of tiny newt larvae. A known case of a smooth newt introduction of 12 adults ten years ago into an urban garden pond has resulted in the presence of over 60 newts in the pond in the breeding season and colonisation of several new ponds in the surrounding area (J. Clemons pers. obs.). Alternatively, newt eggs can be introduced; often this can be accidental when stocking a pond with suitable plants (as the eggs are laid on aquatic plant leaves).

The great crested newt is less successful at colonising garden ponds than the other amphibian species. Only some of the larger fish-free ponds, surrounded by suitable terrestrial cover (rough grassland, scrub, woodland etc.) may be suitable for great crested newts. Furthermore, as this is a protected species, a licence from the Countryside Council for Wales, English Nature or Scottish Natural Heritage is required to transfer individuals to any pond. If you have a new pond that may be suitable for great crested newts, advice should be sought before applying for a licence as there are many factors that the SNCO would wish to take into account.

Views differ as to what is the best approach for introducing newts to a pond. If adults are to be released, then at least two males and three females should be placed in the pond in the spring for two consecutive years from the same donor site. Another approach that is often favoured, since it is less likely to have an impact on the donor population or to have welfare implications, is the release of newt eggs or larvae. These should be released in each of two consecutive years, placing about 50 larvae or 100 eggs into the receiving pond. Eggs can be collected on vegetation or on 'egg strips' that can be made by cutting 5 mm wide ribbons of black plastic bin-liners and placing them in a pond where newts will lay their eggs on them.

11.2.2 Threats to amphibians

Destruction of ponds

A lot of ponds in the wider countryside are neglected. Their conservation should be based on reaching an understanding with and obtaining the co-operation of landowners. New householders may wish to fill in a garden pond because they have young children and are afraid that they could fall in and drown. Older people may not be able to cope with the management of their pond and may wish to dispose of the amphibians. Garden ponds can be partitioned off from the rest of the garden with a variety of fencing, and help with pond management within the local community is usually available. Gardeners often advertise in the local paper, offering to carry out a variety of gardening chores for a reasonable fee. Many gardening services companies or Wildlife Trust consultancies will carry out maintenance work on ponds in private gardens. Putting pressure on people to leave garden ponds and amphibians undisturbed does not promote good public relations. Providing advice and, if possible, help of a practical nature is often more effective.

Pond restoration and management – important in terms of conservation

Many old and neglected ponds can become unsuitable for amphibians and a programme of restoration and management should be encouraged. Overhanging trees should be felled to open the pond up to the light and 90% of submergent and emergent vegetation removed. The accumulated sediment at the bottom of the pond may have to be dredged out and the water levels adjusted.

A simple management regime will ensure that ecological succession is kept at bay in ponds of all sizes. This should be carried out during the winter months when amphibian activity is minimal. It is important that emergent vegetation does not become invasive and that sufficient submergent vegetation, especially duckweed *Lemna sp.*, is removed to create large open areas within the pond. In smaller ponds it is important that fallen leaves are removed in autumn.

Unusual amphibian mortality

Over the last few years there has been a marked increase in reports of unusual incidences of mass frog fatalities. In 1992 there were 222 sites where adult frog mortalities were occurring, and in some cases all life stages were affected. Three-quarters of these reports were from garden ponds in towns and suburbs, mainly in south-east England. Symptoms include ulcerated and haemorrhaging states, including reddening of the skin, often referred to as 'Redleg'. However, some mass mortalities involve frogs with no obvious external abnormalities. As yet it is not known what causative factors contribute to these deaths, but various potential pathogens and environmental pollutants are under investigation (Cunningham *et al.* 1996). Toads and newts are also known to be affected. The Frog Mortality Project (telephone 01986 784518) is researching this phenomenon and all cases of sick or dying amphibians should be reported. There is no known danger to humans from handling sick frogs, but as yet no treatment has been found for the frogs. A leaflet is available to give advice to pond owners who discover dead or dying frogs (Froglife 1995e).

11.3 Reptiles

Snakes and lizards suffer from a jaundiced public image largely owing to misconceptions and superstition that are often reinforced by the media, advertising and entertainment industries. Dealings with the public should be undertaken with care so as to promote a favourable image and to emphasise factual information about the need for their conservation. Remember also that all our native reptiles are protected by law from killing and injury, a fact which is widely unknown or even in a few cases deliberately disregarded.

11.3.1 The public and snakes

Over the summer months, herpetofauna workers will often be called upon to advise in situations where there is a perceived conflict between people and snakes and slow-worms. Perhaps the commonest situation causing concern is sightings of a 'snake' in gardens. Anxiety in these instances can result from a fear of snakes *per se*, worry over risks to children or pets, and concern over the effects on other wildlife in the garden.

It can sometimes seem impossible to cure householders of their ophidiaphobia (fear of snakes). However, by presenting a positive image of snakes (their role in the ecosystem, cultural significance, harmless nature of grass snakes and slow-worms) and dispelling some of the widely held misconceptions, the determined herpetofauna worker can in many cases moderate the attitude of the householder from one of fear at least to tolerance or even to sympathy and interest.

Identifying snakes

If concern is expressed over the danger posed by snakes to children and pets, there are several important points for the herpetofauna worker to bear in mind. Firstly, if the enquirer refers specifically to having seen an adder, as is often the case, the worker should be aware of the potential for misidentification. It is surprising to what extent descriptions of an animal can be misleading and not entirely reliable; often this can be the consequence of a fleeting glimpse of a snake as it retreated into a rockery and many poor-quality drawings and descriptions of snakes can confuse rather than help. This can result in householders insisting on having seen adders, especially when combined with the commonly held erroneous beliefs about identification. The latter include a 'V' shape on the head always indicating an adder (often the black and yellow collar of a grass snake can be interpreted as a 'V'), the belief that all grass snakes are green (in fact grey or brownish individuals are common; in addition some lack the yellow and black collar), and confusion over size (remember that adders rarely exceed 65 cm whereas grass snakes commonly reach 80 cm). Ask for a precise description of the snake including the coloration, any markings, length and shape, but do not prompt the informant too much for specifics since this can lead to confused replies.

To narrow down further which species is being dealt with and to help in suggesting possible action, it is useful to ascertain the following: the type of garden (is it overgrown?); the soil type and habitat on land surrounding the garden; and the location of the nearest pond. Often a local herpetofauna worker will be able to tell from the location which species it is likely to be. Further clues can be gained from habitat type. Remember that many people cannot distinguish between slow-worms and snakes; bear this in mind when assessing the description, since slow-worms often occur in gardens and allotments. If a site visit is feasible it will increase the chance of identifying the animal and will further the potential for developing good public relations. Always try to follow up suspected adder 'problems' with a visit by someone who can identify species correctly. Giving out relevant advice sheets and leaflets will be beneficial. Froglife produces a colour poster specifically designed to help identify snakes (Froglife 1995f). Remember also to use these opportunities to gain reptile and amphibian records.

Advice to landowners

Once the species has been determined (or at least narrowed down), the herpetofauna worker can address the concerns of the enquirer. If there are worries that children and pets are in danger and the animal in question is *definitely* a grass snake or slow-worm, then obviously the advice can be reassurance that these species are totally harmless to humans, cats and dogs (although the converse is not true). Further comfort may be provided by informing the enquirer that snakes will usually be seen in the garden only rarely, that they may simply be straying from another preferred area and that they will usually retreat when approached. Point out in a non-confrontational manner that all native snakes and lizards are protected by law from killing and injury. It is worth stating that snakes are in decline nationally and that the householder is fortunate to own a garden which is visited by snakes. All too often, however, the response is insistence that they should somehow be 'removed'. Simply catching the snakes or slow-worms and moving them should not be the automatic solution. Firstly, this is not always practicable anyway and requires a lot of time and effort (Chapter 3). Secondly, it is not likely to solve the problem; even if a number of snakes and lizards are caught there could well be many more in the vicinity. Thirdly, in conservation terms, translocation is not a desirable solution since the process is fraught with potential difficulties (Chapter 9). It is always best to leave the animals where they are and to educate the householder to accept their presence. In limited cases, where a particularly distressed landowner cannot be reassured, or where the worker suspects that there is a danger to the reptiles or even a real risk to people (e.g. adders in playgrounds) if they are left on the site, it may be acceptable to move immediately threatened individuals (perhaps to an adjoining piece of land or garden, or, if that is not possible, elsewhere – see Chapter 9) and to advise on management that might discourage their recurrence (see below).

If the enquirer is concerned that snakes on his or her land are an avoidable threat to smaller animals, it is

important to point out that they are native wild animals and should be free to interact with other species as much as, say, owls or badgers are. Some people can be concerned that grass snakes take frogs and toads from their garden. Snakes may play an important role in removing the weaker or less alert individuals within a population of prey animals. Problems can arise if grass snakes hunt in garden ponds for goldfish. It is virtually impossible to stop snakes frequenting a pond without resorting to extreme measures such as fencing, which would damage the pond's aesthetic value; netting is not a satisfactory solution because of the risk of entanglement. It is best to stress that the snakes will only rarely take fish and are more likely to be after amphibians.

Ideally, of course, the aim should be to improve the enquirer's opinion of snakes so that he/she will take positive steps to manage their garden sympathetically. If the landowner is receptive, the following advice can be offered. The garden should be managed as a mosaic of habitats (i.e. by not mowing all grass at once, and planning to have some long and some short areas). Care should be taken when using strimmers and mowers to check the area is free of snakes beforehand. The garden can be improved by placing rock and log piles in sunny areas, creating basking spots and shelter. Of course, all of these suggestions will benefit the wildlife interest of the garden in general, not just snakes and lizards. For grass snakes, the creation of egg-laying sites by constructing compost heaps can be suggested. In gardens where there is already a compost heap being used by grass snakes, it should be stressed that this should not be disturbed between June and early October, so as not to interfere with incubating eggs, nor between late October and mid-April in case the heap is used as a hibernaculum.

Constructing a wildlife pond will also benefit grass snakes. If the householder uses netting over the pond or on the vegetable patch, it should be of a mesh size of 4 cm or larger, since snakes, toads and frogs can become entangled in smaller mesh. If this does occur and a local herpetofauna worker is not available, the RSPCA can respond to this type of difficulty where this is an immediate welfare problem. Entangled snakes need emergency attendance as they can overheat and die in less than an hour in direct sun.

Advice on adders

Action may be required if adders are found to be habitually present in gardens, playgrounds or other public places where children and pets play. Always stress, however, that in general the likelihood of being bitten by an adder is small unless they are handled and that the risks associated with adder bite are greatly exaggerated – but, equally, one should not be too complacent (see below). A site visit will be required to assess the actual extent of the problem. If there is found to be a large resident adder population and there is a real danger of a bite occurring, several steps can be suggested. It may be possible to fence off the area where the adders are concentrated (for example where they bask on embankments bordering a car park or playground). In some cases it may be useful to advise managing the land so that adders (or other snakes) will avoid the area. This would involve keeping vegetation cut back, mowing grass to a short sward and removing piles of debris and other refuges. As a last resort it may be possible to translocate the adders to another site though the difficulty of doing this should not be under-estimated (see Chapter 3 for guidance). Herpetofauna workers should be aware that there are legal requirements on the possession, transport and release of adders (Chapter 7). Any catching and moving of snakes should be undertaken by those with adequate experience and who are well aware of the legal consequences of their actions as well as the welfare implications (Chapter 3). Remember that keeping adders in captivity requires a licence from the local authority under the Dangerous Wild Animals Act 1976 (Chapter 7).

Adder bite

The adder is the UK's only venomous snake. Grass snakes and smooth snakes are very unlikely to bite but even if they do are non-venomous and the bite is rarely painful (but beware of possible infections that may occur as a result, especially tetanus). Herpetofauna workers should be aware, however, that every year a number of exotic pet snakes escape and a minority of these may pose a significant hazard.

The number of reported adder bites in Britain is surprisingly low and most are the result of ill-advised attempts to handle them. Although potentially dangerous, an adder bite is very rarely fatal and is easily treated. There have been only 12 recorded human deaths following adder bites since 1900, compared with around 300 as a result of insect bites and stings. Adders will not always inject venom when they bite. Nonetheless, any suspected case of adder bite should be treated seriously as local symptoms can be most unpleasant. Reassurance is vital, for if the casualty keeps still and calm, the spread of venom may be delayed.

Symptoms

Symptoms can be as follows (Anon 1992):

- pair of puncture marks;
- severe pain at the site of the bite;
- redness and marked swelling around the bite;
- nausea and vomiting;
- laboured breathing; in extreme cases breathing may stop altogether;
- disturbed vision;
- increased salivation and sweating.

Treatment

- Lie the casualty down. Tell them to keep calm and still.
- Wash the wound with soap and water if available.
- Secure and support the injured part, usually by fixing it to the body or other limb.
- Remove casualty immediately to a hospital.

If the casualty becomes unconscious whilst awaiting an ambulance, open the airway, check breathing and place the patient in the recovery position. If the casualty stops breathing, resuscitation is required, follow the guidelines issued by the major first-aid organisations (Anon 1992).

If pets or livestock are suspected of having been bitten, veterinary attention should be sought. Contrary to popular opinion, domestic animals and livestock are rarely seriously affected by adder bites, and veterinarians in areas where adder bites occur are able to implement effective treatment.

11.4 Presentations to the public

The fact that reptiles and amphibians often conjure up images of the unusual and the unknown in many people's minds is a drawback in that it can generate the problems outlined in Sections 11.1 and 11.2, but it also means that they attract media interest with relative ease. The local press and regional television and radio stations are often keen to seize on stories about herpetofauna and this opportunity can be used to good effect in spreading positive conservation advice and information.

If a group or individual has a story or project to promote, for example a survey of ponds within a district which would benefit from public involvement, the media can be contacted directly with a press release. This should be concise, 'punchy', not too technical and contain background information on any individuals or organisations involved. Present the story clearly so that it will be of immediate interest to journalists and eventually to the readers/viewers/listeners. If you are contacted by a journalist for an interview, bear the following points in mind:

- Always sound positive, knowledgeable and friendly so that the interviewer will be receptive to your comments and will take them seriously.
- If you are unsure about certain areas, offer to get back to the reporter or refer him/her to another expert.
- Do not be tempted to make things up.
- Avoid acronyms, jargon and hard science unless the article/programme specifically requests it; remember that what may seem basic to you is often new to the audience you want to reach.
- Consider replies carefully before speaking, and remember that hesitation and 'false starts' can be edited out of recordings so don't feel pressured to say the first thing that springs to mind; or be afraid to stop if you say the wrong thing.
- Try to be good humoured but do not present the story in a whimsical fashion or it will lose credibility.

Further caution should be exercised if contacted by the media to comment on a story which is already being worked on. Often reporters will have a fixed idea of what they need or want to hear and you may feel that the appropriate issues are not being addressed. Try to co-operate with the journalist as far as possible while at the same time stressing the points you feel are important. Negative reporting is a real bugbear in herpetology, especially as far as snakes are concerned; try to discourage ill-informed and unfavourable stories such as 'plagues of snakes'. Whenever possible, emphasise the conservation or legal aspects of the story, and if appropriate outline the importance of local involvement in ameliorating problems. Further information on working with the media in a local group is given in Chapter 10.

11.5 Working with other organisations

It is important for herpetofauna workers to develop good working relationships with other organisations in order to be most effective. This is important for making sure ideas are exchanged, for keeping up to date with new ideas and developments, for making sure that people know what others are doing and for ensuring that effort is not duplicated. In some cases the expertise of the herpetofauna worker is needed, perhaps for providing information about the ecology or conservation of amphibians and reptiles or to give a local perspective on certain issues. In other cases, the herpetofauna worker will need to use other people's experience or expertise.

Some examples of other organisations are given below, together with some suggestions on ideas for developing constructive working relationships. This is not intended to be a comprehensive review.

Police

The police are the primary enforcement agency involved with wildlife crime (Chapter 7). They have certain powers that allow them to enter land to investigate offences and are trained to deal with difficult situations. In particular, they have the necessary training and experience to collect evidence where offences may have been committed. In all cases where an offence is likely to have been committed and where this may lead to a prosecution, the police should be contacted.

All police forces in the UK have Wildlife Liaison Officers. These officers have a particular responsibility for issues relating to wildlife; however, the number of these in any force and the extent of other duties that they have to perform varies between forces. It is certainly valuable for the herpetofauna worker to identify who their police Wildlife Liaison Officer is and to develop links with them. This is especially so where the herpetofauna worker can, in turn, provide a service back to the police.

Often the police (even the Wildlife Liaison Officer) will have no specific knowledge about reptiles and amphibians and so will welcome a point of contact to help them deal with general enquiries, for example the 'snake in the garden'. Sometimes the police will also need 'expert witnesses' to help investigations into alleged offences or to provide evidence in court. This may take the form of identifying species, advising on the distribution of protected species etc. There may even be a need for some training for the police, or perhaps informal talks to them, about reptiles and amphibians, with an appropriate 'local flavour'. The police, in turn, may be able to provide training for herpetologists, perhaps in how to give evidence in court should they ever be called as a witness.

Statutory nature conservation organisations (SNCOs) and other statutory bodies

The three 'Country Agencies' in Great Britain – Countryside Council for Wales (CCW), English Nature (EN) and Scottish Natural Heritage (SNH) – have both local/area/regional offices and national offices. The local/area/regional offices deal most closely with locally based issues such as planning, local action plans, site safeguard and developing relationships with locally based groups. The national offices employ specialists and generally undertake functions such as licensing. It is usually most appropriate for herpetofauna workers to identify local/area/regional contacts, especially where the connection is as a consequence of developing a local group.

In Northern Ireland the SNCO is the Department of the Environment (Northern Ireland).

The SNCOs can give advice about designated sites. In turn they will benefit from a good working relationship with experienced, locally based herpetologists. Herpetofauna workers can become involved at a number of levels: they can provide data about distributions (either directly to local offices of the SNCO or indirectly via national recording schemes); they can become voluntary wardens on nature reserves or become involved with assisting with casework, such as site investigations or advising on the quality of mitigation proposals.

Where a good working relationship develops it is often possible for SNCO staff to attend local group meetings or regional events to advise how the statutory and non-statutory sectors can work most effectively together.

The Joint Nature Conservation Committee (JNCC) is a committee of the three country conservation agencies plus independent members. Its role is to provide advice to Government and others on national conservation issues, to set common national standards and carry out appropriate research. While JNCC oversees contracts relating to amphibian and reptile recording and monitoring, in general most contact for herpetofauna workers with the statutory agencies will be with the 'country agencies'.

There are other organisations with statutory remits for conserving wildlife who should be contacted. The Environment Agency (in England and Wales) and the Scottish equivalent, Scottish Environment Protection Agency (SEPA), provide advice (and a licensing function where necessary) in relation to the water environment, for example fisheries or issue relating to water tables etc. The Forestry Authority (FA) and Forest Enterprise (FE) are useful contacts with regard to woodland management and, in the case of the FA, issue licences for felling trees. These organisations will all benefit if there is a good dialogue to enable them better to understand the effects of their operations on amphibians and reptiles.

Wildlife Trusts, local natural history societies and other wildlife organisations

It is especially important to be able to develop good working relationships between specialist wildlife groups and county/area-based organisations. Each group has its own particular expertise, which can be shared to mutual advantage. Local herpetologists, whether part of an established Amphibian and Reptile Group or not, can

provide a great deal of information to Wildlife Trusts about the distribution and the needs of amphibians and reptiles. Often this expertise is not otherwise available to the Wildlife Trust/local natural history society.

The Wildlife Trust or other locally based organisation will have a very strong local focus and will often be involved in a wide range of local activities, such as consultations over planning, running and publicising events or managing nature areas. They may also employ staff or be serviced by volunteers who will be able to help promote herpetological conservation.

There are a number of specific projects that could be further developed as a consequence of developing contacts with the local wildlife organisation(s). For example, this would be a useful means for identifying locally important amphibian and reptile sites, perhaps as County Wildlife Sites (CWSs) or Sites of Importance for Nature Conservation (SINCs), or for running joint events that focus on amphibian and reptile conservation.

Other specialist organisations, either locally or nationally, may provide useful contacts. For example, the Royal Society for the Protection of Birds (RSPB) and National Trust (NT)/National Trust for Scotland (NTS) have strong national and local groups and own and/or manage substantial nature reserves. Contacts here may provide valuable records or benefit from advice on management. They may be able to advise herpetofauna workers on management methods; the herpetologist may be able to suggest management that would benefit reptiles and amphibians on their land. Other organisations, such as the Mammal Society, can also be valuable contacts. For example, they can help publicise herpetological surveys and, in return, herpetologists can promote work on mammals. In this way both organisations will benefit from co-operation by getting more records.

Royal Society for the Prevention of Cruelty to Animals (RSPCA), Scottish Society for the Prevention of Cruelty to Animals (SSPCA) and Ulster Society for the Prevention of Cruelty to Animals (USPCA)

The RSPCA (in England and Wales), SSPCA (in Scotland) and USPCA (in Northern Ireland) are charities with a specific remit for preventing cruelty to animals. This covers both wild and captive animals.

These organisations employ inspectors who can help animals that are injured or in distress and can investigate offences involving cruelty. These organisations are experienced in taking prosecutions in this area, including offences involving reptiles and amphibians. In addition, these organisations will have contacts with veterinary surgeons and so may be in a position to assist where injured animals require veterinary attention.

Contact with the local RSPCA/SSPCA/USPCA inspector is valuable. They may often be in a position to respond to enquiries from the public, such as snakes in gardens where the animal may be injured or threatened, or to provide advice on aspects relating to the law and keeping or rehabilitation of animals. Herpetologists may be able to assist their local RSPCA/SSPCA/USPCA inspector by helping with identification or providing other advice that specifically relates to amphibians and reptiles.

Local Authorities

Local Authorities, at the District, County or Unitary Authority level, are charged with a wide range of 'environmental functions'. One important function is determining planning applications, but in addition they may have an ecologist and countryside rangers. These can be valuable contacts for providing information about the local area, including records, and conversely they may well need access to herpetological expertise.

The planning process is undertaken by Local Authorities. It is important to be aware how best to influence this both at a strategic level, i.e. by influencing local and structure plans, and when providing advice on specific planning applications. A good working relationship with the planners and the ecologists is valuable here. One possible approach is to provide information about the distribution of amphibians and reptiles to the planning authorities, perhaps as 'sensitivity maps'. These should be in a format that is useful to the planners. It is often most useful to ensure a co-ordinated approach is taken with other local wildlife groups when providing ecological advice to the planning authority, to make sure that all wildlife needs are presented to a consistently high standard.

Many Local Authorities are now equipped with high-quality computing systems, including GIS (Geographical Information Systems) mapping packages. These can allow complex analysis of environmental data. Inclusion of herpetological information into these systems may provide a means for ensuring that it is considered in the planning process. Local biological records centres, which may be part of a local authority, are often responsible for providing the data for such analyses.

Local authorities have many other functions which may be usefully influenced by herpetologists. For example Parks and Leisure Departments own and manage areas of land that, with some guidance, could be made more attractive to amphibians and reptiles.

Schools

Children of all ages are fascinated by the natural world around them and the herpetofauna worker can play an important part in environmental education.

Environmental education is usually integrated across the whole curriculum and can be related to all aspects of school life. As part of this programme, schools are often very keen to invite outside speakers to give assemblies and classroom presentations to help the children develop positive attitudes and a sense of personal responsibility towards their environment. The school's pastoral teaching programme can provide a good opportunity for getting important messages across. For example, many heathland fires are caused by children who are unaware of the ecological damage they are causing or the threats to individual animals. A useful strategy could be a joint presentation with a police or fire officer to highlight the dangers and illegal aspects of

heathland arson. With younger children there are plenty of opportunities for them to learn about amphibians and reptiles. This can be a rewarding experience as younger children have not been too exposed to the traditional prejudices associated with these animals.

Most schools have a teacher responsible for the co-ordination of the environmental education programme and many Wildlife Trusts have an Education Officer. Contacts with these individuals may result in being invited to give a presentation in a school.

Direct contact with children can be rewarding but it is important to discuss with the teacher the aims of the presentation, so the subject can be presented in the right context for the age group concerned. Amphibians and reptiles can provide valuable and, more importantly, local examples to illustrate National Curriculum topics such as life processes and living things in their environment in science and ecosystems in geography. Fieldwork such as pond dipping and recording population sizes is extremely valuable and data collected can be incorporated into mathematics lessons.

The use of the school grounds to provide valuable wildlife areas has enormous educational benefits and an increasing number of schools have their own nature areas and ponds enabling a variety of activities to be carried out on site. For schools planning to create natural areas, advice could be given on habitat creation for amphibians and management needed.

School wildlife areas are a valuable resource for any class or subject teacher and, with the herpetofauna worker's input, can be imaginatively incorporated into many teaching programmes.

Presentations must be interesting and hold the children's attention. They should not be too long, and use of visual aids such as slides, videos and models gives variety to the presentation. Wild animals should not be brought into schools, but a good follow-up to the presentation would be to visit a suitable habitat where the animals can be seen in their natural environment. Involving children in special activities, such as sponsored toad lifts, is also a worthwhile activity if properly supervised.

During the presentation speak slowly and clearly, stopping frequently for question sessions. Younger children are inquisitive and eager to learn, so be prepared to answer all kinds of questions. Older children tend to ask more specific questions and A level students may well be researching and collecting data for a coursework project. It is equally important that you ask the children questions to ensure you are presenting the facts at the right level. Avoid being too technical with younger children and being too trivial or patronising with older children. In most cases, the enthusiasm the herpetofauna worker brings to the presentation will correlate with the success of the session in educational terms. Worksheets and other resources such as information leaflets can be given to the children for follow-up work with their teacher.

Consultants

Many herpetologists are unsure how to become involved with consultants, or even whether they should at all. This can be for a variety of reasons. Where the consultancy work involves development, conservationists may feel reluctant to work with people employed by the developer. In other cases the consultant may be employed to collate data, perhaps to produce a report with conservation benefit. In such cases there may be reluctance in providing data to commercial organisations that are seen to be profiting from other people's efforts. Sometimes, herpetofauna workers themselves choose to provide consultancy services, either as a full-time occupation or as occasional fund-raising exercises.

There are no hard and fast rules about involvement with consultancies or consultancy work. This largely depends on personal opinion. However, there are a few issues worthy of consideration. These include: what are the consequences of becoming involved, or of not becoming involved? If data are provided will the end product be better and perhaps result in a more favourable outcome for the reptiles or amphibians on the site? What are the consequences of becoming professionally involved – is the time available to do the job properly? Are the skills and expertise really available? What are the responsibilities – is insurance necessary in case the 'professional advice' given turns out to be wrong and results in large liabilities? Can the right, objective advice be provided or are participants likely to be too passionately involved (perhaps hoping to stop the development), or would they yield to pressure from the developers to provide a more favourable report? Be clear who is being represented by those getting involved: are they offering a service as an individual or as part of an organisation? If the latter, is this consistent with the policies of that organisation or supported by the other members of the group?

Involvement with consultancies can present problems. However, if a clear idea of the extent of work needed, why it is required and what it is to be used for is obtained at the outset, then it is possible to decide whether or not to participate and if so, how. If a fee is appropriate, this should be sorted out at the beginning and agreed in writing; if data are provided only for a certain purpose, or if they should be presented in a certain way or perhaps even be given only with interpretation, get this agreed in writing before the information is provided. It is important to make sure that the providers of the data are authorised to give it; remember that the copyright of the data belongs with the person who provided the record in the first place. It is important that dealings with consultants are honest and objective and any vested interests need to be declared. Once the ground rules have been agreed, and provided the approach when dealing with commercial organisations is reasonable and business-like (whether or not this requires payment), there is no reason why information or technical support should not be made available to such organisations.

Commerce, industry and landowners

In order to help amphibians and reptiles, contacts with commercial or industrial organisations or direct approach to landowners can be useful. They may be able to provide resources, perhaps sponsorship money,

materials, labour, loan of equipment such as JCBs or lorries, or even cheap rates of insurance etc. It is likely that in return for provision of resources the company will want something in return, usually publicity.

Direct approaches to individuals or companies that own land may also be beneficial. It is quite likely that many landowners will not be fully aware of the amphibians and reptiles on their land, or if they are, will not be aware of how to monitor or manage them. There may also be considerable potential to increase the herpetological interest in an area if the landowner is sympathetic, for example by creating new habitats or even introducing animals to the site. It is important to gauge the level of interest carefully.

Unfortunately, there is no simple formula for dealing with companies for help with resources or for approaching landowners. Their reactions will all differ and may range from very sympathetic and generous to outright hostility. It is useful to undertake as much research as possible before making approaches, perhaps also speaking to other wildlife organisations to see if they have had any previous or current dealings with the people concerned. This might not only make sure you are well prepared but will also help you avoid treading on other wildlife organisations' toes – they may already be negotiating with the company or landowner in question. After that, much depends on an individual's charm and negotiating skills.

Chapter 12 Health and safety

Tony Gent

12.1 Introduction

Health and safety are important issues to the herpetofauna worker. This is so whether the work, surveys or studies are carried out professionally, in a voluntary capacity or simply for personal interest and whether they are done individually, under contract to others or as part of a group or an organisation. It is difficult to provide an overview of health and safety issues for people having a range of different circumstances; it is important to be aware that these differing circumstances may result in differing needs and differing legal obligations.

There is a large and complex body of legislation to ensure safe practices at work. This has developed from the Health and Safety at Work Act 1974 and subsequent Regulations, some of which implement European Council Directives. This legislation is now increasingly prescriptive and, as a consequence, less difficult to interpret. It places duties on both employees and employers; failure to comply can result in heavy fines or custodial sentences. The legislation also extends to circumstances where people are working for others, even if this is not paid work, and includes activities involving volunteers. Even outside the work environment, there is a duty on everyone to ensure as far as practicable the welfare, health and safety of themselves, those working with them and others who may be affected by their activities.

As well as the need to consider safe working practice, herpetofauna workers are advised to investigate appropriate insurances. This should extend to covering not only oneself, employees and volunteers, but should also consider third party or public liability insurance. Often conservation work on public land, or where work is done, say, for a local authority, will only be permitted if adequate insurances are provided. Advice on insurance can be obtained from a number of sources; in particular the British Trust for Conservation Volunteers can advise on and provide insurance cover for conservation management tasks (help with all aspects of health and safety is provided by BTCV as a benefit of affiliation to that organisation).

12.2 Requirements of the legislation

The following provisions of the Health and Safety at Work Act 1974 are particularly important and outline the main duties incumbent on employers and employees:

- Section 2(1) *It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees.*
- Section 3 (1) *It shall be the duty of every employer to conduct his undertakings in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not thereby exposed to risks to their health and safety.*
- Section 7 *It shall be the duty of every employee while at work: a) to take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions at work; and b) as regards any duty or requirement imposed upon his employer or any other person by or under any of the relevant statutory provisions, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.*
- Section 8 *No person shall intentionally or recklessly interfere with or misuse anything provided in the interests of health, safety or welfare.*

The legislation makes no distinction between employment which involves payment and that which is unpaid. Rather it looks to identifying work that is done at the behest of someone else. For example if work is done for a statutory organisation, whereby that organisation requested someone to visit a site or undertake survey work, then there exists – as far as the health and safety legislation is concerned – an employer/ employee relationship. This is so wherever work is controlled or directed. Consequently, it is important to be sure about being able to accept liability for ensuring that safe working practices are followed before directing or requesting paid or voluntary work.

Where an organisation employs five or more people there is a requirement for written documentation in the form of health and safety policies and logs of risk assessments. Smaller organisations may also find themselves having to produce equivalent documentation to provide to other organisations wishing them to undertake contract work, so that the employing organisation can demonstrate that they have appropriately managed the health and safety of their contractors. Similarly, organisations may need to have Employer and Public Liability Insurances before they are allowed to undertake tasks on public land. Insurance companies may themselves require written health and safety documentation before they are prepared to entertain insurance cover.

In essence, the law is less onerous on individuals pursuing their own hobby, and many herpetological groups will find that their activities will not incur such liabilities. However, written health and safety documentation is valuable for any group and becomes increasingly valuable, and then a requirement, as the groups move away from 'recreational' or 'hobby based' activities through greater involvement with directed survey to undertaking contract work. The exact point where the transition occurs is hard to define and an evaluation of the extent and degree of 'direction' involved etc. will be needed. However, certainly where consultancy work is undertaken, the health and safety legislation needs to be followed.

English Nature is currently reviewing the role of voluntary workers in the pursuit of its conservation objectives. This work will look at, among other things, the health and safety implications for volunteers and for English Nature. As a consequence, the exact nature of the relationship between the two parties will need to be defined and this will allow a clear indication of the levels of training, the liabilities and responsibilities of each in order to satisfy health and safety requirements.

12.3 Risk assessment

All activities undertaken by herpetofauna workers should be assessed, in advance, for possible hazards and the risks arising from those hazards. In doing so, the necessary measures to ensure that these risks are, as far as possible, reduced and that the activity can be carried out safely and with minimal risk to the health or welfare of those undertaking the work, or others that may be affected. While sometimes such assessments may be made on an informal basis, more risky activities (such as surveying ponds at night, conservation tasks involving power-tools, Toad Crossing patrols) are likely to be subject to more formal procedures and written risk assessments should be produced.

Risks associated with any activity may vary depending on a number of factors, for example the location of a site or the time of day or season in which an activity is undertaken. Consequently separate risk assessments may be needed each time an activity is carried out. Written risk assessments are especially important when doing work commercially or where undertaking work on behalf of somebody else. The risks involved and necessary measures to allow work to be carried out safely can then be identified at the outset. This ensures that both the 'employer' and 'employee' are aware of the potential problems and can fully assess what is needed to do the task properly. Sometimes this may involve special equipment, training or additional people to do the work. Employers should not expect, and employees should not agree to undertake, work to be carried out in a manner that is unsafe. As a simple rule: *if in doubt about the safety of an activity – don't do it.*

As risk assessments should be produced for specific tasks, they may not all follow the same format. The aim is to be thorough, considering all risks that are reasonably likely (while accepting of course that it is impossible to take account of every eventuality). The following information may need to be included:

- identifying the task;
- the people who may be put at risk;
- health hazards (e.g. disease, stress);
- physical hazards (e.g. injury);
- organisational precautions (i.e. how the activity should be carried out);
- physical precautions (e.g. need for equipment or protective clothing, or avoidance of specific risks, such as exposure or drowning).

You may also choose to refer to other model risk assessments, specific legal requirements (e.g. legislation controlling the use of pesticides) and sources of further guidance. Risk assessments should be signed and dated to show that they have been read and understood. Some assessments need to be written for each time an activity is undertaken; other, such as 'working at the office' may need to be signed on a once a year only basis.

Examples of risk assessment and possible safety requirements are shown in Table 12.1; however, it is important to note that these are 'indicative', do not provide a comprehensive list of risks for each activity and may not be appropriate in all circumstances.

Table 12.1 Examples of risk assessment and possible safety requirements

Activity	*Hazard*	*Risk*	*Measures required*
Office work			
General	Inadequate lighting levels	Poor visibility may lead to eye strain, tripping over unseen hazards.	Ensure good lighting is provided and used. Position desks to make good use of natural light.
	Furniture:		
	Filing cabinets	Loading from top may cause it to be top heavy; open drawers may block exits, make cabinet unsafe and cause injury.	Load cabinets from the bottom; shut drawers when not in use.
	Shelving	Heavy items may fall from shelves; stretching may cause injury; standing on inappropriate items (e.g. chairs) may result in fall.	Stack heavy items below head height; frequently used items to be stacked below head height; use 'kick stool' to reach items on high shelves.
	Doors	People standing near doors may be injured if door opened on to them.	Avoid placing frequently used items (e.g. coat hooks) near doors. Open doors with care.
	Moving heavy objects	May cause muscle/back strain; may be dropped.	Avoid activity if possible; use purpose-designed equipment to move items.
	Trailing cables on floor	Trip hazard and may damage cables.	Use wall sockets; cover cables with safety tape.
	Electrical appliances	Risk of fire or electrocution.	Ensure electrical goods are safety tested; check cables. Do not overload sockets.

Table 12.1 *(Continued)*

	In the event of fire	Smoke and fire may cause injury or death.	Ensure fire precautions and evacuation procedure in place. Make sure exit routes not blocked. Have fire extinguishers tested.
Computing	Poor positioning of computer	May cause discomfort and strain.	Top of screen should be level with eye-line; use wrist rest.
	Screen	Flickering or bright characters on screen may cause eye strain.	Adjust brightness; use anti-glare screen.
	Desk/workstation	Small desks may result in accidents from items falling off it; need space on desk to support wrists.	Allow plenty of space for PC.
	Poor positioning of work station	Poor lighting, back lighting or glare; position may result in obstruction.	Position work station in area with good light and where it does not cause an obstruction.
	Inadequate chair	Poor design may cause posture problems and back and neck strain; may topple over.	Ensure a comfortable and adjustable chair conforming to minimum design standard is used.
Field work			
General	Environment:		
	Geographical	Getting lost/disorientated.	Carry maps and compass; aim to familiarise yourself with site or go with someone who knows the site.
	Terrain	Tripping & falling; twisted ankles etc.	Take care; be properly equipped; do not work alone or have good 'lone working system' in place (see below).
	Weather	Heat exhaustion/sun burn; lightning, cold, hypothermia.	Wear appropriate clothes; hat, suncream; sunglasses in hot/sunny weather. Avoid work in extremes of temperatures. Ensure good warm and waterproof clothing in cold and wet weather.
	Injury	Risk of injury from tripping, falling rocks, cutting self on fences, bushes and trees. Beware of animals (e.g. bulls, dogs). Severe injury may lead to loss of consciousness or concussion.	Take care on uneven or difficult terrain; avoid contact with animals. Liaise with landowner if appropriate. Avoid lone working or have good lone working system (see below). Ensure appropriate 'survival' equipment when at remote locations.
	Bites & infections	Bites from large animals; insect/tick bites and stings – may cause reactions and may result in zoonotic infections (e.g. Lymes disease); adder bite.	Avoid large animals; be aware of potential risks from insects and use repellents or wear clothing that covers areas where insects/ticks may bite. Be aware of symptoms of zoonotic infections and consult doctor if illness follows tick bites. Take care in areas with adders.
	Human factors:		
	Medical condition	Recurrence of illness; forgotten medication.	Voluntary declaration; good 'lone working system'.
	Fatigue	Loss of awareness; illness.	Ensure rest; keep track of time.
	Hunger/thirst	Loss of awareness, weakness, illness.	Ensure refreshments carried.
	Confrontation (landowner/poachers etc.)	Assault, threat, stress/fear.	Ensure clearance with owners for visit on private land; good judgement of situation; carry mobile phone.
	Lone working	Undetected injury; unable to summon help. Some situations may require more than one worker to make them safe.	Avoid lone working if possible; and do not lone work in risky situations. If lone working is unavoidable ensure a good reporting system so that someone knows where you are and when expected to return (and can summon help if needed) with set 'trigger times' and defined procedures to call for assistance/alert emergency services. Carry a mobile phone.

Table 12.1 *(Continued)*

Urban sites	As for 'General' (above) plus: Human factors	People with dogs, risk of attack, joy riders, discarded syringes and other discarded, hazardous material and objects.	Take special care; in many areas avoid lone working if there are risks or try to work during daylight hours. Ensure good reporting system; carry mobile phone.
Construction/ building sites	As for 'General' (above) plus: Construction activities on site	Machinery and vehicles. Uncompleted buildings, foundations, sewers etc.	Only enter site with permission and once construction staff are briefed; follow instructions, avoid work areas. Wear hard hat and high visibility jackets.
Military sites	As for 'General' (above) plus: Military use of site	Unexploded ordnance; military vehicles.	Liaise with MoD; do not touch metal objects; keep to marked routes
Reptile survey	As for 'General' (above) plus:		
	Adder bite	Injury/unconsciousness through adder bite.	Take care in areas with adders. Avoid handling adders, if necessary do so only if experienced/trained and when not working alone and using appropriate handling and safety equipment.
	Fire	Injury/smoke inhalation due to heath grassland fire.	Be aware of fire risk; take care not to start fires; be especially vigilant if high fire risk.
Pond/ waterway survey (day)	As for 'General' (above) plus: Water related risks	Risk of drowning; particular risk if working from a boat or steep sided banks and especially so when wearing waders.	Best not to work alone; ensure you can swim. Consider need for lifejacket when working on, near or over water and especially if working from a boat or wearing waders.
		Risk of cold following immersion in water; care with slippery or crumbling bank edges.	Consider need to bring towel and change of clothing if some distance away from home/base; take especial care at waters edge (beware of slipping and tripping).
	Zoonotic infections	Weils disease (Leptospirosis) a particular threat near water.	Ensure cuts are covered (perhaps wear rubber gloves) and any new injuries thoroughly treated. Seek medical advice if illness follows work near waterways especially if injured or having been immersed in water.
Pond/ waterway survey (night)	As 'General' and 'Pond survey' (day) (above) plus: Reduced visibility	Poor visibility leading to increased likelihood of slipping in to water/ tripping over.	Ensure good torch is used (with back up torch if needed); use stick to feel ground ahead.
	Human factors	Risk of attack (consider possibility that other people may have been drinking/ using drugs).	Assess intentions/behaviour of other people out at night. Keep a safe distance. Try to avoid lone working; carry mobile phone.
Site management			
General	Raising general awareness of risks to all on site	Risk of injury from work, from tools and other risks associated with working outdoors.	Provide on site health and safety briefing; have identified task leader and first aiders. Carry first aid kit; mobile phone (or similar). Ensure adequate rest periods and that refreshments are carried.
Clearing ponds	As for 'Pond survey' (above), plus: Special risks of working with tools and machinery in water.	Drowning; slipping and cold. Injury through cold affecting sense of touch and through working with tools in water.	Do not work alone. Take special care and consider need for precautions such as life jackets. Make sure ropes are available to help with rescue or to assist moving material from ponds.

Table 12.1 *(Continued)*

Cutting trees and scrub	Injury	Falling tree trunks/branches. Physical injury through contact with tree. Thorns/gorse spines.	Take care. Ensure proper techniques used for cutting timber. Only cut wood of less than 8 cm with hand saws. Only trained people to use power saw. Wear gloves and thornproof clothing. For power saw wear full protective clothing, including helmet, visor and ear defenders.
		Muscle strain from removing cut timber.	Avoid carrying or pulling too heavy loads. Ensure tree trunks are cut to manageable lengths.
		Injury from tools.	Use only those tools you are qualified to use or capable of using safely.
Risk to other people	Injury	Falling trees and timber.	Ensure area marked off and appropriate warning signs and information. Make sure unauthorised people are kept clear of work area. Stop work if unauthorised people in area.
		Debris	Tidy up after task, ensure fires are damped down.
Travelling			
Car (on road)	Hazards related to use of cars and associated risk of road use	Accident and injury; 'road rage'; loss of keys; theft or vandalism of car; running out of fuel/mechanical failure; car parking areas may be unsafe.	Drive defensively; keep spare set of keys; carry mobile phone to contact emergency numbers; do vehicle checks and ensure vehicle has adequate fuel; select safe, well lit area for parking.
Car (off road)	As above but with extra care because of uneven ground and difficult terrain	Danger of becoming stuck, sliding; rolling vehicle; greater chance of vehicle damage.	Avoid off road use where possible. Avoid rough terrain unless equipped with a suitable vehicle and having been properly trained. Carry mobile phone.
Train	Hazards relating to travelling by train and using stations/areas around stations	Late/cancelled train; loss of ticket/ money; accidents on train and when getting on and off train; assault.	Phone ahead to advise of changed timetable; alternative means of buying tickets; take care when alighting from train and care with hot liquids etc. on train; select safe place to sit, e.g. not alone or in empty carriage; avoid unlit areas and travelling late at night if possible.

12.4 Knowing your own/your employees' limitations

Part of safe working is to know your limitations or the limitations of your employees or those undertaking work on your behalf. Work should be planned to take these into account. This is particularly important for people who are unfit, have poor health or some medical condition. However, even those in good health need to be careful. Over-exertion or temporarily reduced fitness through over-tiredness, dehydration or hunger can result in an individual being weakened or having lapses in concentration. This can result in illness or, if driving, operating chainsaws or undertaking other dangerous work, injury. It is therefore important to make sure that adequate rest breaks are taken and that refreshments are available.

Part of the role of task leaders must be to keep an eye on those undertaking the work and ensure that they do not over-exert themselves. Also when letting contracts, the limitations of the contractors need to be considered. Extra time or resources may need to be set aside to ensure that work is done safely and without threat to the health or welfare of the contractors.

12.5 Health and safety briefings and competency certification

Some useful tools for ensuring that health and safety requirements are met include giving health and safety briefings before some activities are carried out and requiring that particular levels of competency are attained before certain activities can be done. Health and safety briefings are especially valuable on conservation tasks, where the task leader should advise workers of health and safety considerations. These may include ensuring that volunteers using hand tools (e.g. bow saws) only tackle tasks that they can undertake safely (e.g. only cutting trees whose trunks are below a certain diameter), that a safe distance is defined to keep people away from power saw operators, that specific risks on site are identified, that first-aiders are identified and that tasks are assigned to appropriate people. Such briefing can be conducted before any task, whether indoors or outside (e.g. outlining procedure in case of fire).

Some activities should (and in some instances *must*) only be undertaken by competent people. This may be a requirement of legislation; the policy of a voluntary group; those letting contractors; or the terms of insurance cover. For example, the use of all pesticides at or for work are restricted to certified personnel under the Food and Environmental Protection Act 1985 and Control of Pesticides Regulations 1986. Undertaking certain dangerous or specialised activities such as the use of chainsaws or firearms, or under-water diving, must likewise be restricted to suitably trained and qualified/licensed people. In other cases, training may be appropriate, even if at first sight the need is less obvious, for example in the use of ladders.

Specialist training should be given in first aid. Work places are required to have qualified first-aiders, who need to keep their certificates up to date by attending refresher courses. However, it is valuable for as many people as possible to attend courses in basic first aid (that at least deal with control of bleeding, cardio-pulmonary resuscitation and casualty management) so that they are aware of procedures to follow in the event of accidents or injury.

12.6 Health and safety statements/policy

All companies with more than five employees are required to have written health and safety policies. However, it is good practice for other organisations, both commercial and non-commercial, to do the same.

A health and safety statement should outline the policy of the organisation. It should be used not only to set standards for those working for the organisation, whether as paid employees, society members, volunteers, researchers, students etc., involved with the organisation, but also to identify health and safety standards that it expects of contractors working for it or the standards it expects to employ when contracted by others to do work. Such statements can be quite short (such as the one given in Box 12.1 below) or they can be quite lengthy documents that prescribe standards and procedures for the whole range of an organisation's activities. For example, a health and safety statement may include:

- defining responsibilities;
- describing accident reporting and other reporting procedures;
- outlining first aid requirements, including training and provision of (and content of) first aid boxes;
- describing standards for vehicles (including equipment to be provided in each);
- identifying specific codes of practice, guidance notes, risk assessment forms;
- listing specific risk assessments for different situations;
- outlining procedures for different activities, including, for example, the need for health and safety briefings or minimum competencies for undertaking different activities;
- identifying training needs;
- describing legislative restrictions, such as Control of Substances Hazardous to Health (COSHH) Regulations;
- providing proforma risk assessment and accident reporting forms.

Box 12.1 gives an outline health and safety policy statement produced for guidance to local Amphibian and Reptile Groups by Froglife (dated January 1995).

Box 12.1 Amphibian and Reptile Group Health and Safety Statement

Introduction

The [NAME] Amphibian & Reptile Group (ARG) recognises and accepts its responsibility to ensure, so far as is reasonably practicable, the health, safety and welfare of all its volunteers. The ARG also accepts its responsibility for the health and safety of other people who may be affected by our activities.

Aims and objectives

The ARG will take all reasonable steps within its power to meet its responsibility to provide a safe and healthy work place and environment for all its volunteers, paying particular attention to the provision and maintenance of:

- tools, equipment and systems of work that are safe and healthy;
- safe arrangements for the use, handling, storage and transport of articles and equipment;
- adequate information, instruction, training and supervision to enable all volunteers to avoid hazards and contribute positively to their own and their colleagues safety and health at work;
- safe places of work and safe access to them.

The ARG will also require those individuals working for it, and any organisation with whom any joint activities are held, to have and implement adequate health and safety procedures.

Health and safety organisation

Overall responsibility for implementing the ARG's Health & Safety policy lies with the elected Management Committee of the Group.

The Chairman and Hon. Secretary are responsible for the day to day implementation of the policy and have the following responsibilities:

- to decide on matters relating to health and safety and make recommendations to the ARG's Management Committee on the implementation of the appropriate procedures and work practices;
- to be a channel of communication between the Group's members and its Management Committee, in particular the notification of suitable dress and equipment required to be provided by individuals participating in any activity;
- to provide advice and information on health and safety, and provide training as required;
- to carry out safety inspections, risk assessments, investigation of accidents and monitoring of equipment;
- to monitor this policy, and its efforts to achieve its objectives, and to recommend any amendments to the Management Committee.

Management of health and safety at work

The ARG will take all reasonable steps within its powers to:

- assess risks to the health and safety of its volunteers (and contractors) and of anyone else who may be affected by its work activities and identify all necessary preventative and protective measures;
- make arrangements for putting into practice the health and safety measures that follow from the risk assessment covering planning, organisation, control, monitoring and review;
- set up emergency procedures;
- provide volunteers (and contractors) with easily understood information and training about health and safety;
- co-operate with other employers and users of any work site.

Duties and responsibilities of volunteers

While the ARG fully accepts its own responsibilities, volunteers (and contractors) are reminded that they also have duties and responsibilities, principally to take care of their own health and safety and that of other volunteers and to co-operate with the group on health and safety issues and practices.

This particularly applies to:

- co-operating with the ARG and its officers by adhering at all times to the Group's health and safety procedures and the instructions given by those responsible for health and safety;
- report all accidents (however minor), near-miss occurrences and hazardous situations immediately to either the Chairman or Hon. Secretary for assessment;
- attend activities with the appropriate clothing and equipment, as notified prior to the event by the Group's officers; wear any safety or protective clothing and equipment provided by the Group;
- work safely, efficiently and without endangering the health and safety of themselves and any others who may be affected by what they may or may not do.

Health and safety development

This policy and associated health and safety practices and procedures will be revised regularly to ensure, so far as is reasonably practicable, the health and safety and welfare of all the ARG's volunteers and contractors.

12.7 Further advice and information

Further advice can be obtained from:

English Nature
Northminster House
Peterborough
PE1 1UA
Tel: 01733 455000
Health & Safety Helpline (with 24-hour answer phone): 01733 455062

Health & Safety Executive Infoline: 0531 545500

British Trust for Conservation Volunteers
36 St Mary's Street
Wallingford
Oxfordshire
OX10 0EU
Main telephone: 01491 839766
Doncaster office (insurance advice): 01302 859522
Leeds office (health & safety advice): 0113 230703

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