Common Standards Monitoring Guidance

for

Reptiles and Amphibians

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Common Standards Monitoring guidance for reptiles and amphibians

1. Introduction

1.1. There are 12 species of non-marine reptiles and amphibians (collectively termed herpetofauna) generally accepted to be native to Britain (see Box 1). The British herpetofauna occurs across a wide range of habitats, and exhibits a variety of reproductive modes, behaviours and survival strategies. Despite often being grouped together for the purpose of academic study and conservation, amphibians and reptiles have very distinct differences in biology. For instance, British reptiles are almost exclusively diurnal whilst amphibians are largely nocturnal; amphibians lay jelly-coated eggs in water and have a larval stage, while reptiles may give birth to live young or lay eggs on land and have no larval stage; reptiles have impermeable, scaly skin while amphibians have moist, glandular, permeable skins; amphibians typically have larger numbers of young, with higher early stage mortality and more unpredictable survival than reptiles. The key features common to both amphibians and reptiles are: ectothermy (the dependence on external sources of heat to allow activity, because of an inability to raise body temperatures via internal means), small size, lack of truly social behaviour, and relatively modest dispersal abilities.

1.2. There is a significant variation in conservation status, from widespread and locally abundant (common frog, present in almost every 10 km square) to severely restricted (eg natterjack toad, found at only c.50 breeding sites). Even the commoner species have undergone declines in some areas. The over-riding cause of declines has been (and in many cases continues to be) the loss, modification and fragmentation of habitat through agricultural intensification and development. Other factors include natural succession leading to unsuitable habitat structure (especially shading), introduction of invasive flora and fauna, fires, inappropriate habitat management, effects of public access, and persecution. The type and significance of the decline factor varies across the species, and in many cases several factors act together synergistically.

1.3. The guidance that follows is summarised in Tables 1-4, which cover the following features:

- Great crested newt *Triturus cristatus*
- Natterjack toad *Bufo calamita*
- Amphibian assemblages
- Reptiles: individual species and assemblages

The tables should be used in conjunction with the relevant text.

Box 1: Native British herpetofauna (excluding marine turtles[1])

Amphibians[2]
Common frog *Rana temporaria*
Common toad *Bufo bufo*
Natterjack toad *Bufo calamita*
Smooth newt *Triturus vulgaris*
Palmate newt *Triturus helveticus*
Great crested newt *Triturus cristatus*

Reptiles
Slow-worm *Anguis fragilis*
Common lizard *Lacerta vivipara*
Sand lizard *Lacerta agilis*
Grass snake *Natrix natrix*
Adder *Vipera berus*
Smooth snake *Coronella austriaca*

Notes:
[1] There are no SSSI selection criteria for marine turtles, hence they are omitted from this note.
[2] The status of the pool frog *Rana lessonae* (a species historically accepted to have been introduced), has been re-evaluated in recent years. Evidence indicates strongly that it is in fact native to England (Beebee et al, in prep; Snell 1994). However, all native populations are now considered extinct and a reintroduction programme is in development (likely first release in 2004, using Scandinavian pool frogs). It was not considered valuable to develop generic CSM guidance for pool frogs, given that (a) there are no native pool frogs currently on SSSIs, (b) there are no SSSI selection criteria for the species, and (c) any future reintroduction to SSSIs would be on a small scale initially. In future, once the status of the species is accepted and fully incorporated into British conservation legislation and policy, there will be a need to revisit this.

2. Herpetofauna on SSSIs

2.1. The *Guidelines for the selection of biological SSSIs* (NCC, 1989) allow for the selection of sites for herpetofauna on the following grounds:

2.1.1. Amphibians: a scoring system operates whereby the occurrence of each species at a pond contributes a nominal score of 1 to 3, depending on population size (as assessed through survey counts). Scores for each species occurring on the site are summed, and individual pond scores can be aggregated where the ponds are in close proximity to each other, thus deriving a site score. Sites can be selected on the basis of exceptional single species populations (notably for great crested newt), or species assemblages (for the commoner species), if the scores exceed a stated level. All important and established natterjack toad sites are eligible for selection. Site boundaries should include suitable terrestrial habitat around the breeding pond.

2.1.2. Reptiles: in any area of search, the best locality containing at least three of the four widespread species (common lizard, slow-worm, grass snake and adder) is eligible. Sites supporting only one or two species should not be selected purely on grounds of reptiles, but their occurrence should count positively when considering sites selected largely on other grounds, especially in areas where the species is rare or at its range edge. In Dorset, all important and established sand lizard and smooth snake populations are eligible, and in other areas all established populations are eligible.

2.2. Note that this is a summary; refer to the text for full details.

2.3. Most SSSIs with herpetofauna interest features are in England, where the majority of populations of the rare species are found. The majority of English sites selected for herpetofauna are on the basis of exceptional great crested newt populations, natterjack toad populations, smooth snake and/or sand lizard populations, and amphibian assemblage sites. Wales hosts SSSIs notified for the great crested newt and amphibian assemblages. For Scotland notified features on designated sites include great crested newt, natterjack toad, and assemblages of both amphibians and reptiles.

2.4. For the wider conservation of this species group, however, it is important to bear in mind that many populations occur on SSSIs selected primarily for other species or habitat interest features, and in some cases these herpetofauna populations are of considerable importance. Therefore whilst this chapter specifically addresses sites where herpetofauna are interest features, the guidance on desired habitat condition should be used to inform management on, and the setting of conservation objectives for, a large number of other sites (for which citations do not mention herpetofauna but on which they nevertheless occur). This is especially important because the normal conservation objectives for some species and habitat features may not adequately accommodate the needs of herpetofauna.

3. Interest features and reporting categories

3.1. The interest feature should be recorded in the citation for the site, and will typically be either a species or a species assemblage. In some cases, it may not be immediately obvious exactly what the interest feature is, as the citation descriptions vary greatly and do not always match precisely with SSSI selection guidelines. Where there is uncertainty, guidance should be sought from country agency species specialists and designated sites advisers. The reporting category is either “reptiles” or “amphibians” as appropriate.

4. Herpetofauna habitats and habitat requirements

4.1. Being a diverse group, herpetofauna species are found on a wide range of natural, semi-natural and entirely artificial habitats. There are, however, some consistent ecological features for each species or species assemblage which allow identification of key habitat requirements. These in turn may form the basis of assessing the condition of SSSIs selected for herpetofauna.

4.2. Amphibian habitats require the following key components:

4.2.1. Breeding pond – favoured characteristics (notably size, profile and vegetation cover) vary for each species. The pond must provide food, cover and suitable microclimatic conditions for developing larvae. Adult courtship and egg-laying requirements also influence the type of pond favoured.

4.2.2. Damp, sheltered areas close to breeding pond for refuge, especially during the day.

4.2.3. Terrestrial habitats within a few hundred metres of the breeding pond that allow for safe dispersal, refuge and feeding.

4.2.4. Connections via suitable terrestrial habitat to other breeding ponds.

4.2.5. Food supply comprising a range of small invertebrates on land and in ponds (for adults), and detritus and algae in ponds (for larval frogs and toads).

4.2.6. Hibernation sites – normally on land, below ground, in structures that protect against frost, flooding and predators.

4.3. Reptile habitats require the following key components:

4.3.1. Open areas (i.e. allowing for partial or full insolation) for basking in close proximity to sheltered, vegetated areas for daytime refuge. This combination leads to a need for structural heterogeneity (patchiness) of habitat at and just above ground level.

4.3.2. Daytime temperatures on an adequate number of days in spring, summer and autumn of at least 15°C.

4.3.3. Night-time refuges.

4.3.4. Vertebrate and invertebrate prey items.

4.3.5. Ground vegetation cover over an area sufficient to allow feeding, refuge and dispersal.

4.3.6. For egg-laying species, specific breeding habitats.

4.3.7. Connections to other reptile sites, except where isolated.

4.3.8. Hibernation sites – normally south-facing and below ground or in raised structures; must protect against frost, flooding and predators.

4.4. These requirements together mean that reptiles and amphibians occupy a wide range of habitat types, but that within such habitats they may preferentially spend most of their lives in certain areas; there is often also seasonal movement between areas offering different features.

5. Rationale for the selection of attributes

5.1. A series of both direct (species observations) and indirect (habitat character) attributes have been defined. This combined approach is necessary because neither direct nor indirect attributes alone would allow a sound assessment of feature condition.

5.2. To illustrate the risks of using only one type of attribute, take for example a sand lizard site where only direct attributes were used. It would be relatively straightforward to undertake standard surveys for sand lizards and find apparently good numbers over a period of 6 years (given that the species is long-lived), but the habitat may be deteriorating in quality. This reduction in habitat quality, and therefore feature condition, may not always be translated into detectable changes in lizard numbers for several years. The underlying poor habitat condition may therefore be "masked" by the survey results, and the limitations on interpretation of surveys may compound this (see below).

5.3. Using the converse approach, take for example a great crested newt site where habitat attributes only were used. Feature condition might be assessed by considering the quality of the breeding pond and surrounding habitats, on the assumption that such considerations are a surrogate measure for sampling the population. However, here it is feasible that although habitat characters could be assessed as suitable, the population is actually declining and therefore feature condition is unfavourable. This situation could arise as a result of two types of error:

(a) our understanding of the precise habitat requirements is incomplete, and therefore the attributes proposed are also incomplete or even erroneous, or

(b) there could be a considerable time lag between changes in habitat condition and the response at the population level, thus rendering habitat assessments invalid if short-term evaluation is required. This is particularly relevant for a species such as the great crested newt, which can skip several breeding seasons (when there is a drought, for instance) without affecting the long-term viability of the population. Using a habitat attribute only approach could increase the likelihood of "false alarms", when habitats in a given season can appear to be unsuitable and yet the population trend is stable or increasing.

5.4. Two further sources of confusion frustrate the determination of appropriate attributes and targets for herpetofauna.

(a) For both amphibians and reptiles, our understanding of the relationship between monitoring results (counts etc) and actual population size, demography or viability is poor for most species.

(b) Populations naturally fluctuate in size and demographic profile over time, and notably for amphibians the magnitude of change in population size can be very large (reptile population sizes seem to vary much less over time).

5.5. Given these elements of uncertainty, it can be difficult to separate true population declines (and therefore feature condition) from monitoring artefacts or natural population changes; in most cases both these elements will contribute to complicate our interpretation of survey results. Only further applied scientific study will help to clarify this area of uncertainty.

5.6. In order to avoid confusion associated with interpreting survey counts, one possible solution is simply to record the presence or absence of the species. However, this approach results in a loss of resolution of monitoring information, and where practical and meaningful in the attributes a count is preferred over presence/absence assessment.

5.7. In considering the selection of attributes, a review has been made of the literature concerning the relationships between population size, population structure, habitat characters and population viability. For no single herpetofauna species is this considered to be near complete, but for some species there is good information in one or two areas (notably for the natterjack toad there is substantial background to support assessment of monitoring data, thanks to a recent review of time series data in site monitoring reports [Beebee & Buckley, 2001]). The selection of attributes is based on a combination of species and habitat attributes in order to provide a broad base for an assessment of feature condition. However, there has been a deliberate attempt to

reduce the number of attributes proposed, and measurements required, to the lowest possible number whilst still allowing a robust assessment. Thus, the CSM tables have been designed to focus on the critical features required to maintain the interest feature in a favourable condition (i.e. to maintain a population viable and above certain threshold levels). They should not be viewed as a set of detailed population monitoring methods. The distinction between these two purposes is subtle but important.

6. General points on attributes, targets and baseline values

6.1. The CSM tables are generic and are meant to provide a framework for the development of site-specific conservation objectives. The attributes are mostly mandatory in order to ensure a consistency of approach and consideration of all critical features, but there is considerable flexibility for most targets. This is necessary because there is a considerable variation among herpetofauna populations:

6.1.1. Phenological variation, according to geographic location: for instance amphibians in the far south-west breed much earlier than those in the north-east.

6.1.2. Habitat variation: the same species may occur on different habitat types, even in the same general locality.

6.1.3. Variation in population size and ecology: population sizes vary considerably across sites, and the particular characteristics of the site can influence processes such as dispersal or survival.

6.1.4. Site variation: even within the same broad habitat types, sites can vary considerably according to size, density of suitable herpetofauna features, degree of disturbance, etc.

6.1.5. Variation in suitable monitoring methods: some sites lend themselves to particular methods more than others.

6.2. Given that each site and therefore each population is different, site-specific conservation objectives should reflect the particular value of the site. CSM is not intended to be a recipe for uniformity among sites, and the methods described here should promote the maintenance of local differences whilst avoiding the setting of inappropriate or minimal targets.

6.3. The presence of particular habitat features that make the site distinctive or special is considered to be a discretionary attribute; this should be added only if the component cannot be adequately described with the other attributes. It will not be appropriate to use these ‘quality indicators’ on every site, but where they are used they should form an integral part of the condition assessment, becoming mandatory for that site.

6.4. At many sites the attributes for herpetofauna will need to be added to those for other species or habitats. In some cases this will allow for merging of attributes, where there are similar desired conditions; for example, there is likely to be considerable overlap in habitat attributes between reptiles and invertebrates on heathland sites. Such merging is to be encouraged as it simplifies the field assessment process and makes for a more “rounded” set of habitat objectives. However in most cases the herpetofauna attributes will need to remain as separate elements for assessment so

that the feature condition can be clearly determined. Where there are potential conflicts in objectives between those stated for herpetofauna and those for other interest features, please consult the relevant section of this manual for guidance on resolution.

6.5. The CSM tables will need to be altered to specify the particular interest feature for the site; this is particularly so for tables on amphibian assemblage and reptiles (the latter may be used for an assemblage or single species site) where the species or species group at the site must be listed. They have been written as generic tables as there is a great deal in common within each category.

6.6. Baseline values refer to habitat and population data collected at the time of designation, and are used to set targets for CSM attributes. For many herpetofauna sites, these data will have been collected over a period of several years leading up to the designation date, and will be included in the notification and designation papers or held on file. For the purposes of CSM, the period of 3 years immediately prior to designation is normally the most important in terms of population data, since these are normally included when considering the selection of sites (the SSSI selection guidelines explain this point further). In order to facilitate CSM, it will be necessary to collate this information and produce maps of the area(s) for assessment. In some cases (especially for older sites), the data collected at designation may be inadequate and it will be necessary to use more recent data or even undertake new surveys. Where the data used for designation are incomplete or absent, care must be taken if using more recent survey data as baseline values, especially where there have been significant changes to the habitats on the site since designation; consultation with Country Agency designated sites advisors is necessary.

7. Species and habitat assessment methods

7.1. The purpose of this guidance is to set standards for the attributes that should be assessed, and for the setting of appropriate and consistent targets. Also included here, notably in Tables 1-4, are suggestions of field methodology to be used, although a variety of approaches may be adopted. It should be noted, however, that the methods and effort recommended here have been arrived at after considerable discussion so that they are sufficient to establish correct feature condition. The likelihood of incorrectly classifying the condition of a site feature (e.g. concluding it is unfavourable when in fact it is favourable) will be greatly increased if lower levels of effort or less effective methods are adopted. The survey methods recommended here are conventional and there is considerable published guidance (see *Further reading*) and practical training available. This note does not repeat the methods themselves, but gives the recommended standards for survey effort and targeting required for CSM.

7.2. The habitat assessment methods are very simple to undertake, though an understanding of the habitat requirements of reptiles and amphibians is needed for correct implementation. For instance, the guidance on reptiles asks for a simple assessment of variation in habitat structure at ground level, but the surveyor will need to understand the types of structure favoured by reptiles.

8. Area for assessment

8.1. On smaller sites and those designated solely for the herpetofauna interest, the entire area likely to be used by the species should be assessed.

8.2. On large sites and those with multiple interests, however, it may be necessary to select a smaller area, or areas, for assessment in order to allow for a practical assessment. Where this is done, it is important to select subunits of the site which are representative of the whole area used by the species, ideally based on prior survey evidence. For instance, on a reptile assemblage site comprising dry heathland, wet heathland, acid grassland and discontinuous scrub, sample areas in each habitat type. Failure to do so could result in omitting parts of the site important for the functioning of the assemblage. Boundaries for the subunits should be chosen on the basis of their function for reptiles, and may or may not coincide with management compartments or habitat discontinuities. For reptiles, in many cases it will be important to sample interfaces between habitat types and mosaic areas.

8.3. For amphibian sites with many ponds (say more than 20) or with ponds very widely dispersed, it may be necessary for practical reasons to select a sample for assessment. The sample should aim to be as large as practical, with a minimum of 20 ponds or 10% of the total number of ponds, whichever is larger. On sites with very large numbers of ponds, it is possible to devise simplified attributes for the majority of ponds (such as presence, holding water in summer), while the sample would be assessed in more detail as given in the tables here. When sampling, select ponds that represent the variety of aquatic habitats and immediate terrestrial surroundings present across the site, as well as the geographic spread for very large sites.

9. Recommended visiting period and frequency of visits

9.1. Since the timing of visits depends on the species, this information is given in the tables. As a general point, visiting sites once every three years should be an absolute minimum, so that significant changes can be detected; in many cases the guidance recommends shorter intervals. Some events, such as fish introduction to great crested newt ponds or fire damage to heathland sites, can have rapid and serious consequences for the condition of herpetofauna populations. With careful planning, it should be possible to combine condition monitoring visits for herpetofauna with those for other interest features.

10. General points on habitat structure assessment for reptiles

10.1. Largely because of their ectothermic nature and vulnerability to (mainly avian) predators, reptiles are highly dependent on the structure of the habitat at and just above ground level. Vegetation structure is probably most important in this respect, but topography and refuge availability also play a role. It appears that reptiles favour a degree of heterogeneity, south-facing aspects, and interfaces between certain habitats, whilst they avoid large areas of very short sward or open ground. The size and viability of populations seem to depend to a considerable extent on these habitat characteristics (alongside breeding site availability for grass snakes and sand lizards), and they are the linking features across habitat types that support good reptile populations. However, it has so far proved impossible to quantify the relationship between habitat structure and population status in any meaningful way, although at

the time of writing there are attempts to develop methods for field experiments. In addition, guidance on desired habitat structure for reptiles and invertebrates, and its relation to grazing on heathlands, has been published (Offer *et al.* 2003); such guidance may assist with setting targets on reptile sites. As a general point, there seem to be many common microhabitat requirements shared by reptiles and invertebrates, and again this may be useful to bear in mind when setting and assessing targets.

10.2. It has also proved difficult to develop a straightforward, repeatable field method for categorising habitat structure. The guidance sets a framework for what structure is desirable and a method for assessing it, but it is accepted that improvements will need to arise through experience of using the methods, as well as targeted scientific studies should such work be undertaken. In order to assist with assessments in the meantime, some photographic examples of good and poor habitat structure are given in Figures 1 to 8.

Figure 1: Good grassland structure, showing variation from short sward up to gorse scrub.

Figure 2: South-facing bank (important basking/hibernation opportunities), with good quality structure provided by grass-heath mosaic.

Figure 3: South-facing woodland edge provides an important linear feature for many reptiles.

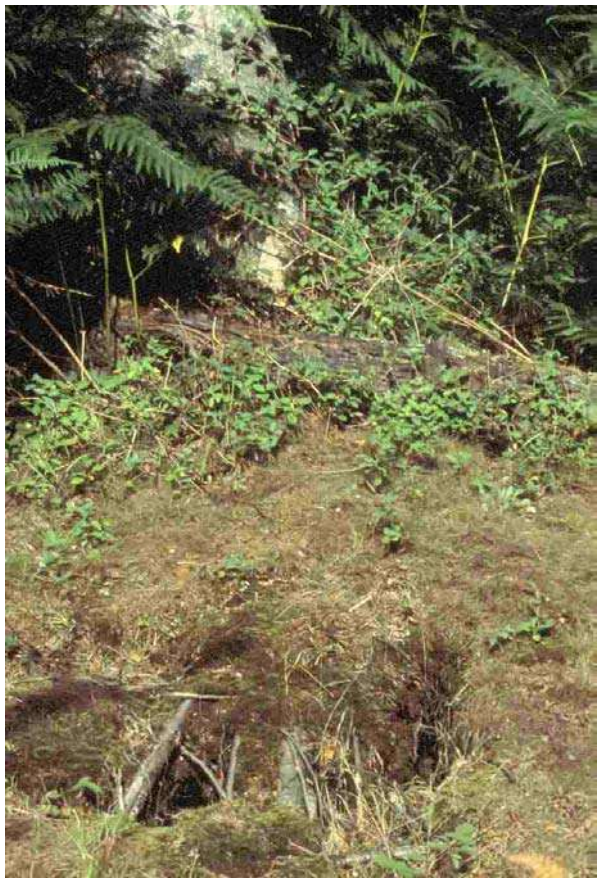

Figure 4: Crevices leading to exposed root system, in sun-exposed location at scrub edge, provides good hibernation opportunities.

Figure 5: Grass-heath-scrub mosaic providing an ideal combination of microhabitats for thermoregulation.

Figure 6: Uniform, very short sward grassland provides poor reptile habitat (here due to high grazing intensity). Large areas of entirely open habitat mean that thermoregulation is difficult and predation risk is greatly increased.

Figure 7: Extensive heather stands which are highly uniform in structure and low in average height provide poor habitat for reptiles (though such conditions are normal in early stages of heathland establishment).

Figure 8: Grassland in foreground has poor structure for reptiles (here as a result of grazing pressure) because there is little above-ground cover; habitat structure target fails if such conditions extend across large proportion of identified key area.

11. Assessing feature condition

11.1. An assessment of the condition of the feature must result in one of the following conclusions: favourable maintained, favourable recovered, unfavourable recovering, unfavourable no change, unfavourable declining, partially destroyed, or destroyed. The general issues regarding these terms and the timing of assessments are explained elsewhere in this manual. For herpetofauna CSM, the following system is advised:

11.1.1. Favourable maintained: all attributes meet targets in current assessment, and previous assessment favourable.

11.1.2. Favourable recovered: all attributes meet targets in current assessment, and previous assessment unfavourable.

11.1.3. Unfavourable recovering: at least one attribute does not meet target in current assessment, but an evaluation of attribute scores indicates that either

(a) The attribute is demonstrably recovering in status compared with previous assessment and it is predicted (on best judgement) that the target will be met, or

(b) The attribute is predicted (on best judgement) to meet the target given the management measures in place and the prevailing site conditions.

For instance, a great crested newt site with very high levels of shading around most of the ponds would lead to the failure of the shading attribute. If however there is ongoing management to reduce shading scrub and trees, or a management agreement to do so has been signed and there is no reason to doubt it will be properly implemented, then it is predictable that the attribute will improve to meet the target and “unfavourable recovering” is the appropriate category. A difficult issue arises where it appears that the population has declined to such a point that even the rapid implementation of the management might not recover the population; it is a matter of judgement in such cases as to when the predictability of recovery is certain and therefore whether unfavourable recovering is appropriate. Note that the period of time to elapse before the target is reached may be several years.

11.1.4. Unfavourable no change: at least one attribute does not meet target in current assessment, and an evaluation of attribute scores indicates habitat and/or species is neither improving nor declining in status compared with previous assessment.

11.1.5. Unfavourable declining: at least one attribute does not meet target in current assessment, and an evaluation of attribute scores indicates habitat and/or species is declining in status compared with previous assessment.

11.1.6. Partially destroyed: attribute scores demonstrate that a distinct component of a population or one species within an assemblage has been destroyed and there is no prospect of recovery due to a major change in the long-term processes that affect it. This might relate, for instance, to the loss of populations within certain ponds even though other ponds within the site continued to support the species.

11.1.7. Destroyed: attribute scores demonstrate that the population or assemblage has been destroyed and there is no prospect of recovery due to a major change in the long-term processes that affect it. Examples would include the functional

extinction of a population through a disease, climate change or destruction of habitat.

11.2. Note the following general points:

11.2.1. The interest feature can only be assessed as favourable when the targets for all attributes are met. The interest feature must be declared unfavourable when one or more targets fail(s).

11.2.2. The determination as to whether an interest feature is recovering, no change or declining is left to the assessor. It will be based on the results of attributes, along with an assessment of the programmed management and prevailing site conditions. It may involve complex balances between positive and negative influences.

11.2.3. As a general rule, there should be no determination of recovering, no change or declining categories based solely on survey counts of individuals, unless the magnitude of change is extremely marked and has persisted over at least 3 years. This is because of the risk of a masking effect by underlying natural fluctuations in population size.

12. Skills requirements for monitoring

12.1. The following are requirements:

- Experience of survey methods for reptiles or amphibians as appropriate. The survey methods suggested are not very advanced and with training a general naturalist can learn them quickly (one possible exception being direct observation of reptiles, which seems to be highly influenced by observer experience).
- Understanding of herpetofauna habitat requirements.
- Understanding of the habitat management techniques used on the site.

12.2. Prior knowledge of the site, preferably including surveys of the species concerned, is highly desirable, though this can be gained by familiarisation visits.

13. Materials required for monitoring

13.1. For all species:

- Standard outdoor gear (strong footwear, warm clothes, waterproofs if appropriate, etc)
- CSM table(s) and field recording form(s)
- SSSI citation
- Baseline data on previous herpetofauna sightings
- Base map for navigation and annotating; photographs if available

- Management plan, if deemed necessary
- GPS unit, if deemed necessary (can be helpful on large heathland and dune sites)
- Compass, for assessing value of features for reptiles and shading orientation for amphibians
- As an option, a camera to record habitat conditions; this is particularly useful for between-visit comparisons.

13.2. For amphibians:

- For night visits, a powerful torch (50,000 candle power minimum, recommend 500,000 – 1M cp). Smaller torch for navigating between ponds is useful
- Depending on survey method chosen, a dip net and bottle-traps may be required
- Thermometer
- Wellington boots or waders.

13.3. For reptiles:

- Corrugated iron sheets ("tins"), carpet tiles or similar, if refuges are chosen as a survey method (normally to be set on first visit and then left in place)
- Thermometer.

13.4. For health and safety reasons, it is essential that (a) at least one assistant accompanies the surveyor for night visits, and (b) a day visit is made a short time prior to the night visit, in order to become familiarised with the site. Even where sites are long-known to the surveyor, it is worth bearing in mind that site characters can change rapidly and it is best to discover this in daylight. A spare torch is required in case of failure of the main torch, and consideration should be given to using life-jackets and throw-lines if waterbodies appear to pose particular risks (eg very deep water, slippery banks). Obviously, the normal considerations regarding prior access agreement with landowners, etc, apply and such procedures will help night visits run more smoothly.

14. CSM field recording forms

Standard field recording forms for undertaking assessments are in development for each species and assemblage. It is recommended that the same forms are used for each interest feature in order to encourage uniformity of assessment. Contact Country Agency specialists for further details.

15. Use of monitoring data collected by others

15.1. For some species, notably the natterjack toad and sand lizard, there is a great deal of survey information being collected by existing monitoring efforts. The

Herpetological Conservation Trust undertakes and/or co-ordinates much of this for the rare species, and has recently established a database. For the widespread species, the monitoring effort is much more patchy and there is generally less coverage, although there is a growing network of volunteer surveyors in county Amphibian and Reptile Groups undertaking herpetofauna surveys. For the most part, these data will relate to species presence or counts, rather than the habitat attributes detailed in the guidance here. Nonetheless, there exists an opportunity to work together with others for mutual benefit to collect information on herpetofauna on protected sites. It is recommended that contact is made with these and other groups wishing to become involved to discuss joint projects.

16. Further reading

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17. Acknowledgements

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Table 1. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: Great crested newt *Triturus cristatus*

Reporting category: Amphibians

NB: All attributes listed are mandatory, unless indicated as discretionary.

Attributes	Targets	Method of assessment	Comments
Eggs	Present in all or sample[1] breeding ponds[2] at least once every 4 years. (i.e. acceptable for eggs to be absent from individual ponds 3 years out of 4; fail if any breeding pond lacks eggs for 4 years)	Record presence by one day or night visit Mid-March – Mid-May. Survey for 4 consecutive years within 6 year reporting cycle. 1 visit per assessment year required.	Eggs normally laid starting mid-February (southern England) but increasing numbers present (and therefore easier to find) through spring. Best to combine with visit for adult attribute.
Adults	At least 20% of peak[3] count for 4 consecutive years (i.e. fail if total falls below 20% of peak for 4 consecutive years).	Record sum total of number of adults detected in all or sample[1] ponds in spring. Record for 4 consecutive years within each 6 year reporting cycle. 3 visits per year required. Timing based on known peak season for the area, and in-year weather conditions; likely to be Mid-April to Mid-May in central areas. Derive peak by summing counts across site on "best" night for each season.	Considerable between-year variation is frequent; see Overview.
Presence of ponds (permanent and temporary)	Give minimum figure, to be selected on site basis. No net loss of ponds from date of designation.	Record number of ponds present. Record once every 3 years. Any time of year.	Ponds to include breeding ponds as well as non-breeding ponds, since the latter may be used for foraging or for sustaining prey populations. In exceptional cases, a net loss may be acceptable if enhancements are made to remaining ponds.
Aquatic macrophyte	"Good" cover of marginal vegetation,	Visual assessment between May and mid-	This attribute allows for considerable

Attributes	Targets	Method of assessment	Comments
cover	emergent, submerged and/or floating vegetation to be present in at least 50% of breeding ponds.	September. Record for 4 consecutive years within each 6 year reporting cycle. 1 visit per year required. "Good" defined as: • 25% - 100% of margin covered by marginal and emergent species, and • 25% - 75% of pond bottom/ midwater/ surface covered by submerged or floating species.	variation in aquatic vegetation, but should prohibit a majority of ponds becoming overgrown, or suffering severe macrophyte die-back. Short-term algal blooms and duckweed *Lemna* coverage not normally problematic. Attribute should also serve as a proxy for detecting eutrophication, toxic spills, catastrophic reduction in invertebrate community, or underlying water quality issues; however if other evidence confirms one of these is a serious problem in >50% of ponds and the vegetation cover measures are nonetheless acceptable, then the attribute should fail.
Pond persistence	Generic target for most sites: Minimum summer water depth 10cm for at least 50% of all or sample[1] breeding ponds on each year of assessment. Note: the target may be adjusted downwards at sites where early desiccation is a natural feature (eg sand dunes, with many small, shallow ponds in close proximity) and where previous records demonstrate this is consistent with population viability. Target may be adjusted upwards at sites supporting ponds that do not normally dry out in summer.	Record approximate depth of water in identified breeding ponds between mid-August and mid-September. Visual assessment is suitable. Record once every 3 years.	High inter-site variation. Note the requirement for setting site-specific objectives with deviation from the standard target at sites where ponds naturally desiccate more frequently and earlier in the season without negatively affecting population viability. Target setting may require examination of historical site records and weather conditions to assess normal desiccation pattern.
Pond shading by scrub/trees	Sites with <20 breeding ponds: <25% of breeding ponds to have >20% of southern margin solidly shaded.	Visual assessment of extent and orientation of pond margin solidly shaded by scrub/trees directly overhanging or	Shading of southern margin is detrimental. Some shading of northern margin is often beneficial.

Attributes	Targets	Method of assessment	Comments
	Sites with >20 breeding ponds: Use above target in most cases, but if the habitat type and previous newt monitoring suggest a higher extent of shading is acceptable, <50% of breeding ponds to have >20% of southern margin solidly shaded.	adjacent to margin (not floating or emergent macrophytes). Assess April to June. Record once every 3 years. Shade should only be counted if relatively solid (and therefore likely to cause lower light levels and lower water temperatures).	Note that site context is important to consider (eg woodland sites should have higher threshold for shading than sand dune sites).
Fish and wildfowl	Sites with fewer than 5 breeding ponds: Fish and wildfowl problems absent from all ponds. Sites with > 5 breeding ponds: Fish and wildfowl problems absent from >75% of ponds.	Visual assessment, March-September. Record for 4 consecutive years within each 6 year reporting cycle. 1 visit per year required. Look for fish and stocked wildfowl, or evidence of their presence: characteristic disturbance at water surface for fish, high turbidity, nests, droppings at pond margin, major loss of aquatic macrophytes, presence of algal blooms, heavily grazed grasses on bank. Numbers required to fail target: • Fish: any number of individuals (need only to determine presence). • Wildfowl: > 4 pairs/ha of open water.	Fish refers to all species known to be predators of great crested newt larvae, including stickleback, goldfish, orfe, rudd, pike, roach, perch. Target can be adjusted downwards if regular desiccation is likely, or (exceptionally) if larval survival is high despite fish presence. Target may be adjusted upwards if site is especially vulnerable (eg all ponds linked by ditches). "Wildfowl" refers to stocked ducks, swans or geese, and not natural populations of moorhens etc (which are not problematic).
Terrestrial habitat extent	No loss of area or fragmentation of site (through significant barriers to newt dispersal), compared with status at designation.	Determine area by walking site and comparing with map or aerial photo; most semi-natural habitats within 500m of breeding pond to be included. Assess presence of fragmentation. Any time of year. Record once every 3 years. Fragmentation refers to significant barriers to movement such as walls, buildings, and not, for instance, footpaths or tracks.	Can be modified if there have been major, beneficial habitat alterations since designation

Attributes	Targets	Method of assessment	Comments
Terrestrial refuge habitat - structure and quality	Presence of suitable terrestrial refuge habitat – define on site basis.	Visual assessment at any time of year. Record once every 3 years.	High inter-site variation; dependent on site context. Record key features at time of designation and define components providing refuge potential; mark on map. May include discrete features or patches of habitat. Base on habitat structure that (i) provides refuge from extremes of climate (hot, cold, or dry); (ii) provides daytime shelter; (iii) is conducive to invertebrate prey populations. Most important close (<50m) to main breeding ponds. Most often provided by shrub layer, tussocky grass/rushes/sedges, scrub, woodland, leaf litter, cracked clay, quarry spoil, rubble, heaped brash, deadwood, log piles. Eg broadleaved woodland sites may have much undisturbed leaf litter, deadwood and exposed old root systems.

Notes:

[1] "sample ponds" applies at sites with high numbers of ponds (say >20), meaning that regular monitoring at each pond is prohibitive; select at least 20 individual breeding ponds or 10% of the total number of breeding ponds (whichever is larger) as a sample, to represent geographic spread and variation in pond type plus immediate terrestrial habitat across the site. Sample ponds should ideally support a majority of the breeding population (i.e. select ponds with high counts).

[2] Breeding pond = a pond in which egg-laying and successful metamorphosis is likely to occur at least 1 in every 4 years.

[3] Peak count to be taken as the highest site total from monitoring data in the 3 years leading up to designation.

Table 2. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: Natterjack toad *Bufo calamita*

Reporting category: Amphibians

NB All attributes listed are mandatory, unless indicated as discretionary.

Attributes	Targets	Method of assessment	Comments
Toadlet production (metamorphs emerging from breeding ponds[1])	For at least 1 year in every 4 years, each breeding pond to have baseline toadlet production[2] +/- 1 order of magnitude. Fail if zero production at all breeding ponds for 3 consecutive years.	Visual assessment of number seen at emergence (mid-May – July, depending on site), using log scale (0, 1s, 10s, 100s etc). Assess every year. 3 - 6 daytime visits required per year to identify peak number, depending on conditions.	
Breeding pond presence	No net loss in extent or number of breeding ponds.	Visual assessment March-September. Record once every 3 years.	In exceptional cases, a net loss may be acceptable if enhancements are made to remaining ponds.
Breeding pond persistence	Generic target for most sites: Minimum summer water depth 5cm for at least 75% of breeding ponds on each year of assessment. Target may be adjusted according to pond type.	Record approximate depth of water in identified breeding ponds between mid-May and July (timing dependent on normal metamorphosis date for area). Visual assessment is suitable. Record once every 3 years.	Between-visit variation due to ephemeral nature of breeding ponds is likely. Target setting may require examination of historical site records and weather conditions to assess normal desiccation pattern.
Aquatic macrophyte cover and shading	>90% of breeding ponds to have: • aquatic macrophyte covering/shading less than 25% of surface, and • no scrub solidly shading southern margin of pond. Target may be adjusted to suit pond characteristics.	Visual assessment April-June. Record once every 3 years.	
Terrestrial habitat in	No loss of area, or fragmentation, compared	Visual assessment by walking site; most	Map suitable habitat at designation.

Attributes	Targets	Method of assessment	Comments
proximity of breeding ponds - extent	to designation status	semi-natural habitats within 500m of breeding pond to be included. Map conditions at designation. Assess at any time of year. Record once every 3 years.	Normally includes: bare ground, short-sward grassland, marram, ericaceous vegetation. Excludes woodland, scrub and dense, rank, grassland swards.
Terrestrial habitat in proximity of breeding ponds - condition	Set site-specific targets according to conditions. Use the following as a guide. Habitat structure to be open, with: • no significant encroachment of dense scrub vegetation, and • areas of low sward to remain low (height approx 1cm), and • bare/sparsely vegetated areas to remain as such, and • bare sand, slag or rock piles.	Visual assessment by walking site. Map conditions at designation. Assess at any time of year. Record once every 3 years.	Scrub encroachment: Pine, willow, birch and sea buckthorn scrub are of particular concern. Bare sand, slag or rock piles are used for burrowing and there should be some adjacent to breeding ponds.
Discretionary attribute: Breeding pond water quality (saltmarsh sites and saltmarsh ponds seaward of dunes only)	Breeding ponds exposed to seawater inundation.	Assess by autumn or early spring site visit, according to local conditions. Record once every 3 years.	Recharging by freshwater (inundation by run-off or rainfall) in late spring is essential but should be accommodated by other attributes.

Notes:
[1] Breeding pond = a pond in which spawn is laid and successful metamorphosis is likely to occur at least 1 in every 4 years.
[2] Baseline toadlet production = the number of emerging toadlets recorded at designation or in best year within 3 years of designation, if higher.

Table 3. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: Amphibian assemblage

Reporting category: Amphibians

NB All attributes listed are mandatory, unless indicated as discretionary.

Attributes	Targets	Method of assessment	Comments
Adults (or spawn for common frog)	Fail if: • Score for any individual species falls by 2 points from baseline[1] value for 3 consecutive assessments, or • Total score falls by 5 points from baseline[1] value for 3 consecutive assessments.	Assess by torch survey, netting, visual assessment as appropriate for species present. Assess 3 years in every 6 years. 3 - 5 visits for each assessment year, depending on species. Survey dates depend on site location and species, likely to be mid-Feb - March for frogs, mid-March - April for toads, mid-April – mid-May for newts. Day and night visits depending on species.	See Table 29 (page 268) in SSSI Guidelines for scoring system.
Juveniles, tadpoles and spawn/eggs	Fail if no spawn/eggs, tadpoles or juveniles (< 1 year old) found in/adjacent to identified breeding pond for each species for 3 consecutive assessments.	Visual or netting. February – September. 2-3 visits per year, depending on species present. Assess 3 years in every 6.	Observations most efficiently made during the visits for adult
Presence of ponds (permanent and temporary)	Give minimum figure, to be selected on site basis. No net loss of ponds from date of designation.	Record number of ponds present. Record once every 3 years. Any time of year.	Ponds to include breeding ponds as well as non-breeding ponds, since the latter may be used for foraging or for sustaining prey populations. In exceptional cases, a net loss may be acceptable if enhancements are made to remaining ponds.
Pond persistence	Generic target for most sites: Minimum summer water depth 10cm for at least 50% of all breeding ponds on each year of	Record approximate depth of water in identified breeding ponds between mid-May and mid-June (for sites supporting	High inter-site variation. Note the requirement for setting site-specific objectives with deviation from the

Attributes	Targets	Method of assessment	Comments
	assessment. Note: the target may be adjusted downwards at sites where early desiccation is a natural feature (eg sand dunes, with many small, shallow ponds in close proximity) and where previous records demonstrate this is consistent with population viability. Target may be adjusted upwards at sites supporting ponds that do not normally dry out in summer (especially common toad sites).	frogs or toads) or mid-July to mid-August (for sites supporting newts). Visual assessment is suitable. Record once every 3 years.	standard target at sites where ponds naturally desiccate more frequently and earlier in the season without negatively affecting population viability. Target setting may require examination of historical site records and weather conditions to assess normal desiccation pattern; target should be appropriate for range of species present.
Pond shading by scrub/trees	Generic target: <25% of breeding ponds to have >20% of southern margin solidly shaded. Target may be modified for sites that normally support higher levels of shade.	Visual assessment of extent and orientation of pond margin solidly shaded by scrub/trees directly overhanging or adjacent to margin (not floating or emergent macrophytes). Assess April to June. Record once every 3 years. Shade should only be counted if relatively solid (and therefore likely to cause lower light levels and lower water temperatures).	Shading of southern margin is detrimental. Some shading of northern margin is often beneficial. Note that site context is important to consider (eg woodland sites should have higher threshold for shading than sand dune sites).
Terrestrial habitat extent	No loss of area or fragmentation of site (through significant barriers to amphibian dispersal), compared with status at designation.	Determine area by walking site and comparing with map or aerial photo; most semi-natural habitats within 500m of breeding pond to be included. Assess presence of fragmentation. Any time of year. Record once every 3 years. Fragmentation refers to significant barriers to movement such as walls, buildings, and not, for instance, footpaths or tracks.	
Terrestrial refuge habitat - structure and quality	Presence of suitable terrestrial refuge habitat – define on site basis.	Visual assessment at any time of year. Record once every 3 years.	High inter-site variation; dependent on site context. Record key features

Attributes	Targets	Method of assessment	Comments
			at time of designation and define components providing refuge potential; mark on map. May include discrete features or patches of habitat. Base on habitat structure that (i) provides refuge from extremes of climate (hot, cold, or dry); (ii) provides daytime shelter; (iii) is conducive to invertebrate prey populations. Most important close (<50m) to main breeding ponds. Most often provided by shrub layer, tussocky grass/rushes/sedges, scrub, woodland, leaf litter, cracked clay, quarry spoil, rubble, heaped brash, deadwood, log piles. Eg broadleaved woodland sites may have much undisturbed leaf litter, deadwood and exposed old root systems.
Mandatory attribute applicable to sites with good or exceptional great crested newt populations: Fish and wildfowl	Sites with less than 5 great crested newt breeding ponds: Fish and wildfowl problems absent from all ponds. Sites with > 5 great crested newt breeding ponds: Fish and wildfowl problems absent from >75% of ponds.	Visual assessment, March-September. Record once every 3 years. 1 visit per year required. Look for fish and stocked wildfowl, or evidence of their presence: characteristic disturbance at water surface for fish, high turbidity, nests, droppings at pond margin, major loss of aquatic macrophytes, presence of algal blooms, heavily grazed grasses on bank. Numbers required to fail target: • Fish: any number of individuals (need only to determine presence). • Wildfowl: > 4 pairs/ha of open	Fish refers to all species known to be predators of great crested newt larvae, including stickleback, goldfish, orfe, rudd, pike, roach, perch. Target can be adjusted downwards if regular desiccation is likely, or if larval survival appears to be high despite fish presence (sometimes the case in, eg, highly vegetated ponds). Target may be adjusted upwards if site is especially vulnerable (eg all ponds linked by ditches). “Wildfowl” refers to stocked ducks, swans or geese, and not natural populations of moorhens

Attributes	Targets	Method of assessment	Comments
		water.	etc (which are not problematic).
Mandatory attribute applicable to sites with exceptional populations of one or more newt species: Aquatic macrophyte cover	"Good" cover of marginal vegetation, emergent, submerged and/or floating vegetation to be present in at least 50% of newt breeding ponds.	Visual assessment between May and mid-September. Record once every 3 years. 1 visit per year required. "Good" defined as: • 25% - 100% of margin covered by marginal and emergent species, and • 25% - 75% of pond bottom/ midwater/ surface covered by submerged or floating species.	This attribute allows for considerable variation in aquatic vegetation, but should prohibit a majority of ponds becoming overgrown, or suffering severe macrophyte die-back. Short-term algal blooms and duckweed *Lemna* coverage not normally problematic. Attribute should also serve as a proxy for detecting eutrophication, toxic spills, catastrophic reduction in invertebrate community, or underlying water quality issues; however if other evidence confirms one of these is a serious problem in >50% of ponds and the vegetation cover measures are nonetheless acceptable, then the attribute should fail.

Notes:
[1] Baseline refers to counts achieved at designation or within 3 years of designation, whichever is higher.

Table 4. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: Reptiles (single species or species assemblage)

Reporting category: Reptiles

NB All attributes listed are mandatory, unless indicated as discretionary.

Attributes	Targets	Method of assessment	Comments
Adults	Single species site: Presence of at least 1 adult recorded Assemblage site: Presence of at least 1adult of each species recorded	Direct observation using transect targeted at suitable habitat features, plus refuges if appropriate (latter advisable for slow-worm, adder, grass snake, smooth snake). 4 visits per year, March – June or September. Assess once every 3 years.	Visits must be in good weather conditions, as activity highly weather-dependent. Use standard transect across pre-selected path in key area(s)[1], based on previous survey data.
Juveniles/neonates/ eggs	For each species present: Presence of juveniles (<1 year old), eggs or evidence of egg-laying. Fail if none found for 2 consecutive assessments (i.e. twice in a 6 year reporting cycle).	May be located during adult survey. If necessary: • (for sand lizard sites) investigation of likely egg-laying habitats in June; • (for all species sites) search for neonates/hatchlings from mid-September to early October. 4 visits per year (possibly coincident with adult survey). Assess once every 3 years.	These visits may be combined with adult assessment, then further visits undertaken if no juveniles etc found.
Habitat structure	Presence of suitable open patches and variation in vegetation structure and topography close to ground level[3] in key areas[1]. Define site-specific target. Fail if key areas become subject to: • major reduction in height of vegetation, or • major increase in uniformity of	Visual assessment, March – October. Assess once every 3 years.	Requirement is for open, south-facing basking spots close to denser vegetation or refuge cover. Difficult to describe quantitatively. Can be provided by a mosaic of gaps in vegetation, vegetation types of varying heights or densities, presence of refuges (log/ rock piles, etc),

Attributes	Targets	Method of assessment	Comments
	habitat structure, or • major increase in shading on important features.		gullies etc. Interfaces between vegetation types (eg scrub – grassland) or ages are often important, especially when south-facing. Vegetation/habitat types most commonly applying: rough grassland, tussocky grassland, ruderals, mires, mature heather, and marram. Requirement for sand lizard on heathland: deep, mature, uneven-aged heather. A largely uniform structure is detrimental. Predominant shading is detrimental. Refer to Figures in Overview for guidance.
Hibernation sites	Presence of structure(s) which provide hibernation opportunities. Define site-specific target.	Visual assessment, any time of year. Assess once every 3 years.	Great variation between sites; to establish, advisable to survey in early spring to find emerging reptiles. Hibernation sites could be south-facing banks, tumuli, tree root systems, mammal burrows, debris piles, etc. Features need to be above flood line, with a roughly southerly aspect, and have crevices for access.
Mandatory attribute for grass snake sites only: Egg-laying sites	Presence and integrity of egg-laying site(s). Define site-specific target.	Visual assessment, April - September. Assess once every 3 years.	Variation between sites; survey in late August can help to find features. Typical features: mounds of rotting vegetation, muck heaps, cuttings heaps, deadwood, crevices in sunny ground.
Mandatory attribute for sand lizard sites only: Egg-laying sites	Presence and integrity of unshaded, bare sand with southerly aspect, close to vegetation cover suitable for shelter. Set	Visual assessment, April - September. Assess once every 3 years.	Heathlands: often provided by scrapes, paths, eroded gullies, quarry slopes, fire-breaks or patches

Attributes	Targets	Method of assessment	Comments
	site-specific target by defining location, number and size of main sand patches. Fail if subject to substantial mechanical damage.		between vegetation. Sand dunes: provided by bare sand in between marram and lyme grass stands on south-facing features.

Notes

[1] Key area = part of the site identified or strongly suspected to be of prime importance for reptiles, eg sand lizard focus, combined foraging/mating/hibernation areas for adder. There may be more than one per site. Map key area(s) to give extents for habitats to be assessed. Especially important to do this on large sites where significant portions are of low value to reptiles.