Natural England Technical Information Note TIN102

Reptile mitigation guidelines

England's six native species of reptile all have legal protection. They sometimes occur on land subject to development threats. If development proceeds there may be adverse consequences for the reptiles, as well as breaches of the legislation. Mitigation can reduce and compensate for development impacts, and can minimise the risks of committing an offence. Recent evidence shows that in many cases, carefully planned and implemented mitigation can offset the negative impacts of development. This note draws together existing guidance, recent research findings and field observations to produce a single set of standards for good practice in reptile mitigation. It has been prepared for ecological consultants and will be useful to developers, Natural England staff, local planning authorities and volunteers.

Background

All of our reptile species have suffered declines, to varying extents across the country. For the widespread species, most populations of which occur outside protected sites, development without adequate mitigation continues to be a significant reason for this decline.

Natural England urges developers and their ecological advisers to use mitigation not only to meet legal requirements, but also to assist in conserving these frequently neglected animals.

All reptile species are now on the national Biodiversity Action Plan (BAP) priority list, and local authorities and other public bodies have a legal duty to take their conservation into account.

Scope

This guidance covers the six native species of terrestrial reptiles in England:

- slow-worm *Anguis fragilis*;
- common lizard *Lacerta (Zootoca) vivipara*;
- sand lizard *L. agilis*;
- grass snake *Natrix natrix*;
- adder *Vipera berus*; and
- smooth snake *Coronella austriaca*.

Common lizard

In terms of status, these species may be divided into two groups:

The "rare species"

- sand lizard; and
- smooth snake.

The "widespread species"

- slow-worm;
- common lizard;
- grass snake; and
- adder.

Despite the term "widespread" some species are highly depleted locally and "widespread" does not mean ubiquitous or common.

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The emphasis in this guidance is on what are known as the widespread species. Generally the rare species are restricted to protected sites and therefore developments rarely affect them. However, where appropriate some advice on the rare species is given.

For ease of reading, “development” in this document has a broad meaning, referring to any land use change that might negatively impact on reptiles, whether subject to planning permission or not. Typical examples are road widening, construction of residential properties and improvement of drainage structures along railways.

This document is not intended to provide advice on impacts caused by conservation management, forestry, farming or other ongoing activities.

Reptile mitigation has been practised for around 20 years in England, with greatly increasing frequency over the last 5 years. Statutory and non-statutory guides have helped establish standard methods, though these documents typically focus on particular elements of mitigation. This note draws together existing guidance, recent research findings and field observations, to produce a single set of standards for good practice. Much of the advice is derived from recommendations from experienced ecological consultants.

Natural England has published this guidance following discussions with a range of people involved in reptile mitigation. It is intentionally concise, focusing on mitigation principles and technical standards. For general background on reptiles and legislation, please refer to standard texts and internet resources. Notable references are mentioned in *Further reading* below.

This note aims to provide the high level guidance that has been identified as critical. Consultation has also identified a need for highly prescriptive guidance on methods and effort, but this demand cannot be met for all topics, partly due to limited resources and partly because the evidence base for some areas is sparse, and setting guidance in such a situation would be unwise. Where there is reasonable evidence, we have developed specific guidance, for example on the survey effort scoring system.

We welcome feedback and may update this note with more detailed information as resources and evidence allows. Other organisations may also provide guidance to expand on this document and if this happens references will be updated.

The recommendations should be suitable for the majority of mitigation situations, but this is not a set of rigid rules, nor an exhaustive guide. Where other methods and approaches are known to work well, please provide details to help us improve future editions. See *Further information* below for contact details.

Where there are particular local circumstances which require the use of alternative levels of effort, timing, methods or strategies, a rationale based on the site circumstances will help to demonstrate that the mitigation plan chosen is sound. In some cases it may be necessary to show this to meet legal requirements.

Natural England and others may view unfavourably any attempts to use reduced standards solely for reasons of cost, development time constraints or to accommodate a larger development footprint.

Advice for planners and local authorities

It is important that planners and others working with the planning system appreciate that the legal protection for reptiles is only one element to consider in development control and forward planning.

Legislation prohibits certain actions, and planning decisions must take account of this. In addition Local Planning Authorities are also obliged to take a wider view of reptile conservation when undertaking their functions. This obligation stems from Section 40 of the Natural Environment and Rural Communities Act 2006, and the fact that all native reptiles are now BAP priority species.

Government policy is clear that planning decisions must take account of protected species (Planning Policy Statement 9: *Biodiversity and Geological Conservation*; hereafter referred to as PPS9).

Local Planning Authorities are expected to look beyond a narrow view of the specific offences that might occur through development. Paragraph 16 of PPS9 states that:

Local authorities should take measures to protect the habitats of these species from further decline through policies in local development documents.

This clearly has further reach than solely assessing whether a breach of the legislation might occur. Planners would be justified in rejecting a mitigation proposal if it would have a negative effect on local reptile conservation status, even if the project involved no breach of the wildlife legislation. This applies to both the widespread and the rare species.

Slow-worms can reach high densities on brownfield sites such as disused allotments

Government planning policy now explicitly requires local authorities to seek wildlife gains through the planning process (see in particular PPS9, paragraph 14), and not just to offset losses. Some developments have real potential to benefit reptiles. This is not covered further here. For detailed advice on opportunities for reptiles in the designed landscape see Bray & Gent (1997).

Whilst this document does not give advice on development control per se, planners should find it useful in assessing surveys, impact assessments and mitigation proposals submitted with applications. Further advice on considering reptiles in planning is available on Natural England's website, notably in relation to Standing Advice.

Advice for developers

Developers should use this guidance to help avoid or reduce impacts on reptile populations, and to ensure that there is at least no net loss to local conservation status. The best way to achieve this is to seek professional advice from an ecological consultant with proven experience in reptile mitigation.

Consultants vary in their experience of reptiles, and when employing a consultant you should request evidence of favourable outcomes for reptiles in several recent projects. Other indicators of a capable consultant include membership of a professional body, and demonstrable contribution to reptile conservation and monitoring projects.

A growing number of consultants have sound skills in this area, and can offer an excellent service. Unfortunately, a minority lack the understanding needed to complete mitigation to an acceptable standard. Worse, some offer to undercut good practice to save costs. Choosing such a consultant may result not only in poor outcomes for reptiles, but also time delays and alterations to construction proposals. The end result may be extremely costly, and could result in breaches of the law. For advice on choosing a consultant, see note 13 in the FAQs for Standing Advice. The direct link is in the *Further information* section below.

Legislation and licensing

This section provides a simplified summary of the key legislation relevant to reptile mitigation. It is not exhaustive and is intended for general guidance only. Please refer to the original legislation for definitive reference.

Offences may result from developments that harm reptiles themselves or, for the rare species, key elements of the habitats they use. The legislation contains exceptions to these offences in some circumstances, as follows:

Exceptions for widespread species only

If the act was the incidental result of a lawful operation and could not reasonably have been avoided (Section 10(3)(c) Wildlife and Countryside Act 1981 (as amended)).

Exceptions for rare species only

If the act is permitted under a licence issued under Regulation 53(2)(e), ie for the purpose of preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment.

Key points arising from the legal protection are:

- **For all species:** if a development has potential to impact reptiles in a way that could cause an offence, efforts must be made to reduce, and if possible, avoid those impacts.
- **For the widespread species:** actions which could predictably kill or injure reptiles may result in an offence, even if that outcome is not the prime purpose of the act. We therefore advise developers to use this guidance, along with advice from a consultant, to ensure they take reasonable measures to avoid harm. No licence is required for standard mitigation methods.
- **For the rare species:** the legislation is stricter than for the widespread species; both the reptiles themselves and elements of their habitats are protected, and there is no statutory defence. Unless direct impacts can be avoided, a Regulation 53(2)(e) licence from Natural England will normally be required. See *Further information* below on *European Protected Species: mitigation licensing*.

Penalties for breaches of legislation are up to £5000, and/or up to 6 months imprisonment (each per offence). In addition, anything used in committing the offence may be forfeited. The main legal protection applying to reptiles is outlined in **Table 1** on page 22.

Mitigation objectives

Overall objectives for all reptile mitigation projects should be:

- To protect reptiles from any harm that might arise during the development work.
- To ensure that there is no net loss of local reptile conservation status, by providing sufficient quality, quantity and connectivity of habitat to accommodate the reptile population in the long term, either on site or at an alternative site nearby.

These objectives should be used by consultants to frame the mitigation and set specific aims for every project, taking into account the particular circumstances of the site and the development proposals. Concisely setting out aims will help to produce an effective mitigation plan. It will also ensure that the developer and other interested parties can rapidly understand the rationale for the mitigation.

Mitigation must be proportionate and pragmatic. This must be considered when setting objectives and implementing mitigation plans.

Fencing can prevent reptiles entering areas subject to earthworks or heavy plant movements

Example mitigation aims

The following works were identified to protect slow-worms and common lizards at Sauria Common during archaeological investigations and the construction of a new car park:

- Erect fencing to exclude reptiles from the working areas and relocate any reptiles in the working areas to safe areas.
- The footprint of the new car park to be limited to areas of low to medium value for reptiles.
- Create new basking, feeding and hibernation habitats for reptiles along the northern edge of

the site where the land is currently of low value for reptiles.
- This new habitat to link to the habitat north of planned car park (maintain existing link).
- Create a link from the new habitat to the Country Park to the east.
- All existing and retained reptile habitat to continue to be under favourable management.

Surveys

A survey is required to properly identify the potential impacts of a development on reptiles and to plan the mitigation works. The level of survey required will depend on a range of factors, primarily the scale and type of the development, and therefore the likely impact on reptile populations, as well as on the specific reptile species that might occur on the site.

The more likely a development is to cause major losses to reptile status, the more intensive the survey needs to be. Note that, at the survey stage, the impact should be considered as the harm caused by the development without any mitigation.

Records from pre-development surveys, reptile removals and post-development monitoring must be sent to the Local Records Centre and, where one exists, to the national recording scheme. As is common practice in development related work, these records need not be submitted immediately, but they must be submitted within one year of data collection.

Survey methods

Desk searches for the results of past surveys at or near the site can be very useful. Sources include:

- The National Biodiversity Network (NBN) Gateway (**http://data.nbn.org.uk**).
- Local Records Centres (**www.alerc.org.uk**, **www.nfbr.org.uk**).
- Amphibian and Reptile Groups (**www.arguk.org**).

Widespread reptiles are under-recorded in most parts of England and the lack of a record is not a reliably indication of absence.

For records of the rare species, the NBN Gateway has good general coverage, and Amphibian and Reptile Conservation can provide more detailed information.

The main field methods used for reptile surveys in a mitigation context are summarised in **Table 2** on page 23. Note, these methods all require an experienced surveyor.

Survey results are affected by a wide range of factors, such as weather conditions, physiological state of reptiles, time of day, seasonality and habitat condition.

Reptiles are difficult to find, so a sound survey requires multiple visits in suitable conditions to reduce the chance of false negatives (ie incorrectly declaring absence, when reptiles are in fact present). For more information on survey methods consult *Further reading* below.

Roofing felt in suitable micro-habitats can help to survey for reptiles

Table 3 on page 24 shows some examples of survey methods that may be used as a supplementary field survey, alongside one or both of the methods in table 2. The methods in table 3 are generally of lower effectiveness and prone to false negatives, but may be worth attempting in many cases.

Pitfall trapping is not recommended because it would require leaving traps open during the day, creating an unacceptable risk to reptiles and non-target species.

The effectiveness of the survey methods varies considerably by species. **Table 4** on page 25 assesses and summarises the two most effective survey methods.

Finding sloughed skin can supplement other survey methods

Survey standards

Surveyor experience

Surveys to inform mitigation must be done by a field worker experienced in reptile surveys. Experience plays a major role in determining the results of a reptile survey, since there is a high degree of field craft involved. The field worker should have previously undertaken surveys in a range of habitats and for all the species potentially present, using all appropriate methods. A Natural England survey licence will normally be required where smooth snakes or sand lizards occur. This will depend on whether an offence would be committed if no licence were obtained.

Time, seasonality and weather considerations

Reptile detection is influenced by a complex interaction between physiological, behavioural and environmental factors. Factors affecting detection vary between species, and may vary for different life stages.

On current evidence it is not possible to draw simple, firm and precise recommendations about the optimal time of day, date and weather conditions in which to survey. The following standards are therefore given as broad guidance within which surveyors should select the appropriate timing for their particular survey.

Time of day: 0700 to 1800, on the condition that date and weather conditions (see below) must also be suitable throughout the duration of the survey visit.

Season: **Table 5** on page 26 shows how reptile detectability varies through the year.

Weather: In general, surveys should be targeted to the following weather conditions:

- Air temperature: 10-20ºC
- Wind: none to moderate
- Precipitation: none.

The influence of weather on reptile detection is complex. For example, high cloud cover appears to be favourable under some conditions, especially in summer, but may reduce detectability early in the season. The weather conditions in the days preceding a survey may be important, and where possible surveys should be conducted in warm, dry, sunny periods following cold, wet, overcast days.

Reptiles can sometimes be found in light summer rain. Wind may make refugia more attractive so long as ambient temperatures are high enough. Weather conditions must be recorded for each visit (temperature, wind, cloud, precipitation and summary of the previous week's conditions).

Male sand lizard: this species is difficult to detect outside early spring

Early season surveys are useful for sand lizard, common lizard and adder, and may be

successful in slightly cooler conditions than those indicated above.

Choosing a survey protocol

Deciding what type of survey to undertake will depend on a range of considerations. **Table 6** on page 26 should help you decide survey protocol.

The first step is to assess what broad impact the development might have on a population, if one were present. Assigning a development impact category is covered in the *Impact assessment section* below. The different types of survey, including "HSA" (habitat suitability assessment), are also covered below. Note that where different types of survey are indicated (for example, presence/absence + population size class), the survey effort can be combined, ie you do not need to conduct two separate sets of surveys.

In addition to the survey types below, there will often be a need for a targeted survey to establish key areas of a site (such as egg-laying or foraging habitat). This helps to assess a site's value for reptiles, and to design mitigation that will properly address this.

Presence/absence survey standards

The true absence of a reptile species is extremely difficult to establish with high confidence. However, for ease of terminology, a survey to determine presence or likely absence will be termed "presence/absence survey" here.

For each species possibly present, the survey may cease once the species has been detected. Note that the standards for effort given here are minimum values. Research shows that detecting reptiles, especially where they occur in small populations, can require substantial effort. The surveyor should increase the level of effort beyond these minima if, despite zero captures, there are indications of likely presence.

How to calculate minimum effort in terms of the number of days of survey, and visits through the season is explained on page 25 and the following pages. This takes into account the fact that the chance of detecting reptiles varies substantially between species and across the survey season. For example, one visit to detect slow-worms in March is much less likely to be successful than an identical visit in May. Therefore surveys early in the year need more effort (ie more visits) to be reliable.

Each species has a recommended minimum number of "standard effort units," ranging from 25 to 50, as displayed in **Table 7** on page 27. This table also gives the recommended survey methods. **Table 8** on page 27 gives "monthly effort weightings." Notes on how to use the tables and a worked example are available below table 8.

Population size class assessment

Determining the size of a reptile population is difficult without substantial effort. However, in many cases a precise estimate of population size is not required for an impact assessment and mitigation planning. It can be useful, though, to obtain an assessment of the population size in very broad terms, ie small, medium or large. Here, this is termed the "population size class".

Note that this classification and the methods to assess it are based on limited data and will be refined in future. **Table 9** on page 31 gives a method for categorising population size classes. There are two methods for determining population size class:

Method a: peak count: For each species, the first figure is the peak count of adults obtained by a thorough survey (by whatever method) under good conditions in one day, and at the optimal time of year for the target species. These figures can be derived from your presence/absence survey or from another recent survey done to a sound standard.

Method b: habitat suitability assessment: Establish the presence of the species and then assign a population size class estimate on the basis of a "habitat suitability assessment".

For a given site and species, if there is a discrepancy between the count-based method and the habitat suitability-based method, the highest population size class should be chosen. For instance, if a peak of only 11 slow-worms is found, yet the habitat suitability assessment is "exceptional", then you should categorise the site as having a "large" slow-worm population.

This precautionary approach is advised because of the complex relationship between numbers of animals detected during surveys and the actual population size. Whilst not a perfect method of assessing population size class, it will give an indication of the potential for the species on the site, which is the main objective of establishing the population size when assessing impacts and planning mitigation.

Estimating population size

Population size can be estimated by CMR (Capture-Mark-Recapture) techniques.

Registering slow-worm head pattern

It is generally difficult to obtain a robust estimate of reptile population size with modest confidence limits unless the population is small and isolated.

The best results are typically obtained for the adder. This species often occurs at rather low population density, can be located seasonally with confidence, and individual identification is feasible using head patterns.

Deriving a population size estimate by CMR is encouraged wherever feasible on high impact schemes, as it can be very useful for planning mitigation projects.

Exhaustive surveys (say over 20 visits per season, with a high density of sampling points) may also help to derive a population estimate. This method is highly time-consuming and often a CMR approach would yield a better result.

Population estimates based on habitat extent and theoretical population density are often unreliable. There are considerable problems with this approach and it is strongly discouraged, unless the surveyor has a detailed understanding of the ecology of the specific population and can demonstrate that the resulting estimate is sound.

Habitat suitability assessment

Making an assessment of habitat suitability can be invaluable in interpreting survey data, risk assessment, impact assessment, planning capture schedules, and planning habitat enhancement works.

For some species, for example the great crested newt *Triturus cristatus*, a thoroughly tested, objective method has been published, using methods developed by the US Fish & Wildlife service. As yet, no such method exists for UK reptiles. The following bulleted list, gives characters that influence reptile habitat suitability, and this can be used to develop an assessment method for a specific situation. It may help to read guidance on reptile habitat assessment produced for the National Reptile Survey, part of the National Amphibian and Reptile Recording Scheme (see *Further information* below for details).

Natural England would value information on any assessment methods used, to help us publish a more detailed, thoroughly tested method in future.

A walk-over survey will allow a competent field worker to gauge these 12 characters and give a whole-site assessment as “poor”, “good” or “exceptional” for uniform sites. For sites that vary substantially in nature, and especially for large sites, it will be more appropriate to produce a map subdividing the site into distinct areas on the basis of their suitability. Each area can then be assigned to one of these three categories.

A simple habitat suitability assessment should take as long as it requires to do a slow walk-over survey, plus a few hours to analyse your observations.

Reptile habitat characters

- location in relation to species range;
- vegetation structure;
- insolation (sun exposure);

- aspect;
- topography;
- surface geology;
- connectivity to nearby good quality habitat;
- prey abundance;
- refuge opportunity;
- hibernation habitat potential;
- disturbance; and
- egg-laying site potential (grass snake and sand lizard only).

Grass snake egg laying site

Evaluating survey data in a wider context

Once the reptile survey data has been assessed at the site level, it is important to evaluate it in a wider context. Factors to consider include: species status in the local area or region; population size in relation to others known in the area of search; habitat type. Information from Local Records Centres and Amphibian and Reptile Groups will help with setting context.

For example, any population of grass snake in Northumberland is of very high local conservation importance, given the scarcity of that species in north-east England.

Impact assessment

Effective mitigation requires a sound understanding of the potential impacts of a development. Impacts that manifest themselves after any construction may be just as important as effects due to the construction work itself.

The likelihood of some threats can be greatly increased by development, and this can be important even when the footprint is outside areas used by reptiles; for example there is increased risk of predation by cats and arson when residential development occurs adjacent to a heathland site. The main impacts types are as follows (note that this is not exhaustive):

Direct impacts

- Habitat loss through land-take.
- Population isolation through habitat fragmentation.
- Reduction in quality of habitat.
- Direct mortality.

Indirect impacts

- Disturbance.
- Refuse accumulation.
- Fire risk.
- Persecution, collection and predation.
- Hydrological disruption.

Table 10 on page 32 advises on how to assign a broad impact level to the proposed development. Once the potential impact on reptiles has been identified the sequence of steps should be as follows.

Step 1

Change plans to avoid impacts as far as possible, ideally removing all impacts. For instance, this may involve selecting a new site or altering the development layout.

Step 2

Mitigate impacts that cannot be avoided, ie reduce the level of impacts by making changes to the development plans or implementing special measures. For instance, this may involve reducing the footprint to avoid a key habitat feature, or capturing reptiles to avoid killing.

Step 3

Compensate for any residual impacts by taking positive measures, such as creating new reptile habitat.

Step 4

Deliver enhancements to local reptile status, as set out in PPS9, the Biodiversity Duty (Section 40 of the NERC Act 2006), and Natural England's Standing Advice on protected species.

Mitigation strategies

Once the possible impacts have been examined, the mitigation strategies should be considered. The main strategy options are in **Table 11** on page 33. As each case is different some options may need to be mixed to reach a favourable outcome. In general, the options become increasingly undesirable towards the end of table 11. Note, the least desirable options, involving non-adjacent relocations, may not be agreeable to Natural England and the Local Planning Authority as they involve a greater risk that there will be a negative effect on reptile conservation status. There would need to be a sound justification for why all other options had been exhausted before these options could be pursued.

Reptiles should only be moved to a non-adjacent site (ie one outside the normal home range) already containing the same species when:

- there is no viable on-site solution;
- only small numbers are predicted to be moved (say <50 individuals);
- habitat enhancement, creation or restoration works at the release site are undertaken which are likely to substantially increase its carrying capacity; and
- there would be no net loss to local conservation status.

The species will affect the mitigation strategy. For example adders appear to be closely linked to traditional hibernation sites, and relocating them to non-adjacent areas is almost never appropriate.

Adders emerging from hibernation

Grass snakes are highly mobile and may require a different approach to slow-worms or sand lizards, which move over much shorter distances. Sand lizards and adders may be more prone to public disturbance effects than the other species.

Receptor site selection

A receptor site is the place where reptiles are released after capture. This may be adjacent to the point of capture (often just outside the development footprint) or some distance away. Choosing and preparing a suitable receptor site is critical to the success of reptile mitigation.

Finding a suitable receptor site is often a lengthy process and developers should allow substantial time for this. Unless a site has already been lined up, surveys of several sites may be required, and this will take time. Often the best approach will be to score each possible receptor site using the criteria described below, and select the highest-scoring site.

Selecting a receptor site well in advance will make subsequent mitigation efforts proceed more smoothly. Depending on the type of habitat enhancement or creation required, it will normally take at least months and possibly several years to bring a receptor site into a condition suitable for receiving reptiles. Only in limited cases are little or no habitat works required before reptiles can be received.

Leaving receptor site selection until late in the planning process may cause delays and potentially substantial additional costs. The receptor site should be agreed before submitting the planning application because it forms a key element of the mitigation plan.

Finding a suitable site will invariably need a desk study and consultations with local sources of expertise. For ex situ, and occasionally for in situ schemes, surveys to establish presence/absence of target species will be required. These should follow the survey guidance above and in **Annex 1**.

The following habitat types are often used as receptor sites, since their character or history means they may be unoccupied by reptiles or be capable of substantial habitat enhancement:

forestry land; conservation headlands, uncultivated margins and associated habitat on farms; former hay meadows; arable reversion land.

This receptor site is becoming overgrown and will need management before reptiles can be released

Receptor site checklist

You must consider the following factors when assessing potential receptor sites.

Location

To help achieve the objective of no net loss to local reptile conservation status, the receptor site must be as close as possible to the development site. In most cases, the best interests of the reptiles will be served by an in situ approach. This means either (a) keeping them on part of the site that will retain good habitat, or (b) relocating them to an area immediately adjacent to the development site.

In all cases, reptiles should not be translocated to sites a long distance away, say over 20 km. There is a presumption against translocating reptiles outside the Local Planning Authority area. If it is unavoidable that reptiles are moved to a new LPA area, any mitigation and post-development works must be secured through a Section 106 Agreement or other mechanism that can be enforced outside the original LPA area.

The primary reason for this is that it results in a net loss to local conservation status. Other concerns relate to the potential for detrimental impacts at the receptor site – either on the translocated animals or any already present - due to genetic differences, pathogen transfer and local adaptation.

Where the proposal is to translocate reptiles over 5 km from the development site, you must show that all options for closer receptor sites have been examined and dismissed for sound reasons.

Ownership and protection status

The landowner must be content with plans to release reptiles, and for the needs of the reptiles to be accommodated in the future (notably site management and protection from threats to conservation status).

A written agreement must be secured to demonstrate the landowner is content.

SSSIs and other strictly protected sites are almost never to be used as receptor sites. This is because they will normally have particular conservation objectives which might be interfered with if reptiles are released, and because in any case, if broadly suitable, they will typically already support reptiles. Whilst SSSIs can seem attractive options, in some local areas there has been a contraction in reptile range as developers progressively shift reptiles onto protected sites. It is important that reptiles are retained in the wider countryside. In rare cases it may be acceptable to release reptiles on a SSSI:

- there must be no other practical options;
- the release would be consistent with the site's conservation objectives, and
- there has been agreement with Natural England and the landowner/occupier.

Size

The amount of habitat suitable for the species to be relocated should be no less, and preferable greater than, that to be lost through development. The amount should be assessed either (a) as it currently stands before the mitigation (if the site is already suitable), or (b) after any habitat enhancement and creation works (if such works are necessary, as will often be the case).

For the widespread species, some reduction in area may occasionally be acceptable if you can

ensure the quality of the habitat will be substantially higher than that to be lost. The advice above on habitat suitability assessment, can help in this regard.

Habitat status and connectivity

The habitats should either be already suitable for the species to be released, or capable of being made suitable. This assessment should go beyond general suitability, and ensure that the site includes all necessary features to support a population of at least equivalent status to that at the donor site (see *Habitat suitability assessment*, above). Moreover, there should generally be attempts to improve the extent and quality of habitats prior to relocating reptiles.

No reptiles should be released until the site is in a reasonable state to receive reptiles. Some management works may be undertaken post-release to further improve habitat quality, so long as they do not pose a serious risk to reptiles or other sensitive species. The site should be in favourable management or be capable of being brought into such a state (see below).

Receptor sites should be well connected to semi-natural habitats, and particular attention must be paid to grass snake relocations given the long distance dispersal behaviour of this species. If it is impossible to retain good connectivity in situ, then an ex situ (non-adjacent) receptor site may be more suitable.

Prey availability

Generally speaking, for relocations of any of the lizard species, prey diversity and abundance is likely to be adequate as long as the receptor site habitat quality is high. For the snakes, more investigation may be needed in some cases. You must be confident that the receptor site accommodates the rather more specific diets of adders, grass snakes or smooth snakes.

Reptile status

This depends on which mitigation strategy you opt for (see above). In most cases, it is preferable for the receptor site not to support the species to be relocated. You should either know, or try to infer, the reasons for this absence, and be able to remedy them. If a receptor site survey demonstrates reptiles are present in low numbers, do not make the common mistake of asserting that adding more reptiles is acceptable because “the population is below carrying capacity”. This logic is flawed because it relies on a misunderstanding of the carrying capacity concept, and ignores the issue of local conservation status.

Carrying capacity depends on a range of factors, notably habitat extent and quality. Reptile populations will vary in size over time. Relocating more reptiles to an occupied site without attempting to increase carrying capacity will result in a net loss in reptile status, and is therefore unacceptable. The key point is to try to increase the carrying capacity by improving habitat conditions.

Number of receptor sites

Generally, a single receptor site should be used to accommodate each development site lost. The rationale here is that splitting the donor reptile population between multiple receptors will result in more population fragmentation, when compared to the original situation. Exceptions to this may be indicated if, for example, large numbers of animals are predicted to be removed from a large development site, and you have located two or three similarly large receptor sites that are also highly suitable in all other respects. In such cases, if feasible there should be attempts to link the receptor sites over time. Using more than three receptor sites would almost never be advisable.

In rare cases, reptiles from several development sites might be released at a single receptor site. This can be acceptable where the site is large and there is good connectivity.

Site safeguard and long-term management

Receptor sites should be free of foreseeable threats. The most obvious point to check here is threats due to future planning applications. You should check with the relevant strategic plans that the site is in an area that makes this unlikely. For example, consider possible residential, industrial, commercial, minerals, road and rail developments.

You should send a record of the receptor site to the Local Planning Authority and recommend that it is marked on planning alert maps.

Ideally receptor sites should have some form of formal protection from future development, possibly via site designation. A frequently used method is designation as a Local Wildlife Site (often called County Wildlife Site, Site of Biological Interest, etc).

Other options for site safeguard include Section 106 agreements and restrictive covenants. You should also consider any other threats outside the planning system and relevant to the area, such as forestry operations or increased recreational use.

It is critical that alongside ensuring site security, there is a mechanism to guarantee favourable habitat management. These include:

- Section 106 agreement;
- legal agreement with landowner;
- transfer of ownership or leasehold to a land management company; and
- contract with land management company or conservation organisation.

The level of effort to achieve this will depend on the impact of the development and the importance of the population. Whichever mechanism you choose, funding for the long-term management of the receptor site must be secured from the developer (unless only minimal impacts are predicted).

Habitat creation, restoration and enhancement

Ensuring reptiles have access to good quality habitat is critical to achieving a favourable mitigation outcome. The best way to do this will depend on the circumstances. The following principles may help.

Assess the current condition of the site depending on the ecology of the target species and the habitat suitability assessment. Determine the currently favourable and unfavourable characters of the site.

For in situ schemes: critically assess the features that would be lost or damaged. How will these be replaced on the habitat to be retained? For example, if the development will destroy a bank frequently used for basking in late afternoon, then ensure a similar one is created (with the right orientation, etc) on the receptor site.

For ex situ schemes: Here the task is more complex as the works will have to create or restore all the requirements for the target species.

Precise methods for creating or improving habitat will depend on the target species and the site conditions. Guides to habitat management may help particularly Edgar et al, 2010; see *Further reading* below.

General principles of habitat enhancement

Maximise the amount of insolation (sun exposure). Ensure reptile areas are not shaded by trees, buildings or fences. Include south-facing slopes, particularly where these can be juxtaposed with other habitats and features of value

Incorporate as much small-scale variation in topography and exposed substrates as is feasible. Introducing patches of low-nutrient sub-soil as a surface treatment in areas otherwise covered with topsoil can be a helpful method of creating structurally-diverse habitats

Ensure there is a high level of structural variation in vegetation. This may mean ensuring landscape planting schemes develop a ‘mosaic’ of different vegetation types

It may be worthwhile, especially on large sites, to create “release focal points” where reptiles are released. These should be sited away from public areas. They should contain plenty of refuge habitat such as brash piles or bramble patches, have excellent vegetation structure, and be in areas of high insolation for much of the day. In this way, stress levels will be reduced when the animals are released. These areas can also be useful for monitoring.

Ensure the development layout does not affect connectivity between habitat features.

Avoid planting schemes that will predictably result in high shading levels in key areas, except where there is a reliable long-term habitat management mechanism.

Create substantial features such as large hibernacula in purpose-built embankments, which link with other boundary features.

Restore degraded areas by reducing dense tree and scrub cover.

Clearing trees and dense scrub to improve habitat for reptiles

Consider the specific needs of the target species. Slow-worms forage largely on soft-bodied invertebrates and so the receptor habitat must support these. Grass snakes are prone to becoming trapped in mesh, and falling into open drains, so these should be avoided on the receptor site.

Capture, exclusion and relocation/translocation

Reptiles are generally caught by hand. For the legged lizards, nooses can also be used so long as the fieldworker is highly experienced with reptiles and takes great care to avoid harm. Noosing may be useful for capturing lizards hiding among dense or thorny vegetation, such as bramble and gorse. Capturing reptiles by pitfall trapping is not advised because of welfare concerns.

Capturing adders requires particular care to ensure the welfare of both the fieldworker and the snakes. Experienced fieldworkers often use snake hooks or specialist puncture-resistant gloves that also cover the forearm. Snake tongs are not advised as there is a higher risk of harming the animal. All fieldworkers who would potentially capture adders should be trained in safe handling methods, first aid and emergency procedures. A risk assessment should be undertaken and hazard reduction measures put in place.

Locating reptiles for capture should follow the advice in survey methods, above. For those species more easily found using artificial refuges, you should use a very high refuge density (minimum 500/ha, ideally 1000/ha of potential habitat where conditions indicate this is merited) as this will increase capture rates over the densities typically used for surveys. Using a high density of refuges is especially useful for capturing animals unlikely to move far, such as juvenile lizards. It can also result in more rapid population depletion.

Corrugated iron, or "tins", are useful for surveying reptiles

Note, however, that there is no point in laying refuges on habitat unlikely to be traversed by reptiles. Refuges should be placed in locations with microhabitat features favourable to reptiles.

Importantly, when using refuges to help with capture, fieldworkers should not solely check refuges and ignore intervening habitat patches. Even though refuges greatly increase capture rates, direct observation should also be used to search.

All field gear must be regularly disinfected to minimise the risk of causing disease in wild reptile populations. Ideally, people who keep non-native species should not undertake reptile capture. If they do, they must take stringent precautions to avoid transmitting disease.

Using temporary fencing and vegetation management to help capture

It may be helpful to divide up sites with fencing to increase capture efficiency. In most capture projects you will need a perimeter fence to prevent re-colonisation. Installing fences (one-way or otherwise) between different phases of a phased development can often be useful as it permits a concentrated capture effort within the first phase areas, where access for construction purposes is required earlier than for the rest of the site. Fencing may not be needed if the site will be stripped bare immediately after the capture period, and re-colonisation is unlikely. On small, sensitive sites, the risk of harming reptiles through fence installation may preclude its use.

Careful vegetation removal can be used to encourage reptiles into certain areas of the site, and displace them from others. By discouraging reptiles from certain compartments, you can concentrate captures in specific areas, perhaps retaining islands or marginal strips. Refuges can be placed along "corridors" cut through dense vegetation, for example thick stands of bramble. This might make the capture operation more efficient.

Take precautions to avoid harming reptiles during vegetation management, since by definition the work will normally concentrate on good quality habitat patches. Cutting using a strimmer, brush-cutter or side-mounted flail can avoid having to drive over key habitat features. It is better to cut the vegetation in stages, rather than in a single, large-scale removal.

Hand searching and destructive searching

Hand searching involves carefully searching through dense vegetation, or dismantling small structures by hand. The aim is to find sheltering reptiles which are otherwise difficult to detect. Useful places to search include rubble piles, log piles and bramble-covered banks. Hand searching that does not carry a high risk of injury to reptiles can be done at any time in the capture period. Otherwise, it should follow a standard capture programme using methods described above.

Destructive searching is a potential harmful and often unproductive method that has been overused in mitigation practice. It involves using machinery to dismantle structures or excavate substrates to reveal sheltering reptiles. They can then be captured by hand. The degree to which this is possible will vary significantly from site to site and there may be overriding (human) health and safety considerations which constrain such activities. In some exceptional situations a destructive search can be helpful in removing the last few individual reptiles without compromising their welfare. Generally the best approach to adopt is to begin the search in a very careful and precautionary manner, and gradually increase the speed of the operation if no reptiles are found.

Smooth snake

It is very difficult to find reptiles sheltering underground or inside large above ground structures. Moreover, even with the most careful operation, injuries and mortalities may occur if a substantial number of reptiles remain. Hence destructive searching is normally only indicated after a thorough capture programme using standard methods described above. An exception would be where reptiles using a particular structure cannot be adequately searched for by any other means.

Destructive search is never to be used during hibernation. It should not be used across large

extents of uniform habitats such as grassland, heathland or scrub. Removing reptiles from such areas using standard capture methods is more effective and carries lower welfare risks.

Transporting reptiles, captivity and temporary holding areas

Immediately after capture, reptiles should be placed in a cloth bag secured with a plastic clip (snakes and slow-worms) or a small closable box (legged lizards). Adders should be then be placed in a box that is rigid, thoroughly escape-proof, lockable and clearly marked “Caution: venomous snakes.” Any vehicles used to transport adders should be similarly marked. The other species can be placed in lidded buckets or similar containers, lined with vegetation to provide a soft base.

Different species should be kept separately. Smooth snakes and sand lizards should be kept individually in separate bags. The time between capture and release at receptor site should be minimised, with 4 hours as a maximum. Take particular care over transport in especially high or low temperatures. Reptiles must not be released in cold weather, and so you may need to retain them overnight if temperatures fall suddenly.

Finding and preparing a suitable receptor site in good time means that captured animals can be released within hours of removal from the development site. Retaining reptiles in captivity for more than one day is not advisable in mitigation projects. Captive over-wintering of reptiles as part of planned mitigation is never acceptable.

Occasionally, reptiles are discovered inadvertently during works ie their discovery and capture is not part of planned mitigation. In such cases, it is normally possible to release them close by. As a last resort they can be brought into captivity, including over-wintering, if absolutely necessary. Note that for the rare species there are legal issues to consider here (capture, disturbance and possession, and potentially damage to habitat).

Do not retain reptiles in temporary holding areas when their final destination is uncertain. Such practice must be avoided by careful planning.

Occasionally temporary holding areas may be necessary if genuine emergency works require rapid removal of reptiles, for example when contaminated land is discovered.

In some cases, for releases from mid-August onwards, it can be helpful to release reptiles into a small fenced area within a large receptor site, to ensure that they stay close to the intended hibernation site. In all cases of such temporary fencing, the consultant must take responsibility for removing the fence as soon as its function has ceased.

Timing and effort in capture programmes

Table 12 on page 35 below gives a matrix for determining minimum capture effort. This method was developed to help consultants take into consideration the main factors that affect the depletion of reptiles in typical removal projects. These factors are:

- Species score: a weighting combining the typical catchability of the species with its conservation and legal status (note that this score has no applicability beyond the specific use in this table).
- Site size: the area of the land from which reptiles are to be removed; typically equates to the development footprint, but it may be more or less depending on mitigation strategy.
- Population size class/ Habitat Suitability Assessment: a weighting for the population density of reptiles in the capture area. Whichever of these two values gives the higher score should be used in this calculation. For large sites with highly variable habitat suitability, make an informed choice of which score best represents likely reptile population density.

Additional comments on capture programmes

Capture is not normally advised to mitigate for “negligible” impacts so long as no offences would be committed.

Calculations recommended here give the minimum effort, and in many cases the actual period will be longer due to local conditions.

Assessing whether a population has been substantially depleted solely by looking at capture rates over time can be problematic. There are often substantial variations in capture rates due to changes in capture effort, weather and seasonal behavioural changes. Declining capture rates do not necessarily indicate a depleted population. Further research is needed in this field before it can be used with reasonable confidence and therefore applied generally.

Reptiles should not be captured once they have entered hibernation, and in the immediate period leading up to this.

For in situ mitigation projects where reptiles are being released within their home range and can access their normal hibernation sites, captures may continue until just prior to hibernation, typically around mid-October although this varies substantially by species and location.

For ex situ projects (where reptiles are relocated outside their home range) and for in situ projects where reptiles are to be moved to areas with newly constructed hibernation sites, captures may continue until around 1 month before hibernation is expected to commence, typically mid-September. No captures should occur afterwards in that season, and captures should re-commence the following spring.

Post-development measures

Population and habitat monitoring

The effort for post-development population monitoring must be proportionate with the impact on conservation status, which is mainly determined by the population size and the development impact. Developments leading to a minor impact will lead to little or no additional costs to the developer in terms of post-development works.

Table 13 on page 37 shows recommended monitoring regimes. In each year of post-development survey, an assessment of the habitat condition must to be made, and this must be submitted to the person or organisation responsible for site management along with the reptile survey results.

Results of post-development monitoring must also be submitted to the Local Records Centre and to any relevant national recording scheme. This must be done within one year of data collection.

Habitat management and site maintenance

Experience shows that the long-term success of mitigation schemes often depends on there being active habitat management. Any receptor site must have a favourable management regime, and this must continue for the foreseeable future.

Some sites also require maintenance, such as routine care of fencing or interpretation panels. The results from habitat and population monitoring must be used by the site manager to inform management. Post-development measures may require a legally binding agreement, especially for projects affecting sand lizard and smooth snake. Funding for such works must be provided by the developer, and it is common for a management plan to be required as part of a planning consent. Tasks required in long-term management and maintenance include:

- Mowing, cutting or grazing of grassland and heathland to maintain a good vegetation structure and reduce scrub encroachment.
- Occasional scrub clearance and tree removal.
- Keeping sand lizard egg-laying substrate in good condition.
- Replenishing grass snake egg-laying structures.
- Removal of litter.

Further information

Natural England Technical Information Notes are available to download from the Natural England website: **www.naturalengland.org.uk**.

European Protected Species: *Mitigation Licensing – How to get a licence*; Natural England, 2010 **www.naturalengland.org.uk/Images/wml-g12_tcm6-4116.pdf**.

For advice on choosing a consultant, see note 13 in the FAQs for Standing Advice

www.naturalengland.org.uk/ourwork/planningtransportlocalgov/spatialplanning/standingadvice/faq.aspx#q13.

National Reptile Survey, part of the National Amphibian and Reptile Recording Scheme (NARRS) **www.narrs.org.uk/**.

For further information contact the Natural England Enquiry Service on 0300 060 0863 or e-mail **enquiries@naturalengland.org.uk**.

Natural England welcomes feedback on this document, to help improve future versions. Please send comments to **technicalinformationexchange@naturalengland.org.uk**.

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Annex 1 Detailed guidance for ecological consultants

Table 1 Main legal protection applying to reptiles

Species	Offence	Legislation reference
Widespread species: slow-worm, common lizard, grass snake, adder	Intentionally kill or injure	Section 9(1), Wildlife and Countryside Act 1981 (as amended)
Rare species: sand lizard, smooth snake	Deliberately capture, injure or kill	Regulation 41(1)(a), Conservation of Habitats & Species Regulations 2010
	Intentionally or recklessly disturb while occupying a structure or place used for shelter or protection	Section 9(4)(b), Wildlife and Countryside Act 1981 (as amended)
	Deliberately disturb, in particular affecting breeding, abundance or distribution	Regulation 41(1)(b), Conservation of Habitats & Species Regulations 2010
	Intentionally or recklessly obstruct access to a structure or place used for shelter or protection	Section 9(4)(c), Wildlife and Countryside Act 1981 (as amended)
	Deliberately take or destroy eggs (relevant to sand lizard only)	Regulation 41(1)(c), Conservation of Habitats & Species Regulations 2010
	Damage or destroy a breeding site or resting place	Regulation 41(1)(d), Conservation of Habitats & Species Regulations 2010
	Keep or transport	Regulation 41(3), Conservation of Habitats & Species Regulations 2010

Table 2 Main field methods used for reptile surveys

Method	Summary	Advantages	Disadvantages	Usage notes
Direct observation survey (DOS)	Search for reptiles whilst they are basking in the open or partial cover. Look in areas that provide insolation yet are close to cover.	Requires no specialist equipment or preparation (though selective clearance of very uniform habitats can aid detection).	Very low detection rates for some species, notably slow-worm and smooth snake (see **Table 4** for details). Highly weather dependent.	Visits must be carefully timed to favourable time of day,weather and seasonal conditions.
Artificial refuge survey (ARS)	Check underneath and on top of artificial refuges (for example, corrugated iron, roofing felt or similar materials), which are placed in suitable locations before the survey starts.	Substantially improves detection rate for some species. Slightly wider weather window. Allows easier capture (if that is required).	Low detection rates for some species, notably sand lizard (see Table 4 for details). Effort required in preparing and distributing refuges. Safety risk for people, pets and livestock (negligible with some refuge materials). Can put reptiles at higher risk of harm. Can be disturbed by people and land management operations.	Refuges must be placed in locations likely to be used by reptiles. Refuges must be laid at least 2 weeks in good conditions before survey starts. If refuges laid for long periods such that vegetation dies off underneath or it is colonised by ants, move refuge to new location nearby. For presence/ likely absence surveys, use at least 100 refuges/ha of suitable habitat, with minimum of 30 refuges in total on very small sites.

Table 3 Supplementary field survey methods

Method	Comments
Existing refuge survey	Search refuges already present on site. These include natural objects such as logs, as well as artificial debris such as discarded fence panels, tyres and bags. Of limited use where existing refuges are scarce or hard to lift.
Slough search	Finding sloughed skins is typically haphazard, as their location is rarely predictable. Often found snagged on low, woody vegetation or under refuges.
Egg search	Potential grass snake egg-laying sites can be gently dismantled to search for eggs once hatched. This should only be done when eggs will not be incubating, nor the structure used for hibernation (best period typically October, or April to May). Carefully re-assemble after search. Not advised for sand lizard.
Egg burrow search	Female sand lizards create egg burrows (and test burrows) with distinctively shaped entrances. Do not interfere with the burrow.
Track search	In very soft sand, such on dunes, reptiles may leave tracks. Care is needed in interpreting these, not least because they can be confused with marks left by other non-reptile species or objects blown by the wind, but finding them will be a good indicator to intensify other survey efforts.

Table 4 Effectiveness of survey methods by species

Species	Direct observation survey		Artificial refuge survey		Comments
	Juvenile	Sub-adult, adult	Juvenile	Sub-adult, adult	
Slow-worm	NR	NR	***	***	Refuges: Roofing felt and similar materials likely to be of similar value to corrugated iron.
Common lizard	***	***	***	***	Refuges: Roofing felt and similar materials likely to be of similar value to corrugated iron.
Sand lizard	***	***	*	*	Critical to select appropriate habitat features for survey. Refuges only recommended when (a) sand lizards suspected to be present at high density, and (b) refuges laid at very high density.
Grass snake	*	**	***	**	Direct obs. Especially valuable close to potential breeding sites and foraging areas such as ponds.
Adder	*	***	**	***	Direct obs.: best just after emergence from hibernation. Refuges: poor just after emergence. Corrugated iron refuges substantially more effective than other materials tested.
Smooth snake	*	*	**	***	Refuges: Corrugated iron appears to be more attractive, but roofing felt is effective if used at high density.

Key:
NR = method highly ineffective, not recommended for this species
* = method typically of low value, but effective in some circumstances
** = method of moderate relative effectiveness
*** = method has high relative effectiveness

Table 5 Variation in reptile detectability across the year

Month	Suitability	Notes
January	NR	
February	+	Some days suitable for emergence surveys for common lizard and adder in central and southern England.
March	++	Suitable for emergence surveys for common lizard and adder in central and southern England. Suitable for other species in especially warm conditions, but with high risk of false negative.
April	+++	Optimal for all species across England.
May	+++	Optimal for all species across England, except on hotter days.
June	+++	First half of June highly suitable for all species across England, though unseasonably hot, dry conditions will reduce detection probability. Second half of June generally less suitable, although overcast days may be highly suitable.
July	+	Generally poor except under prolonged conditions of overcast weather.
August	+	Generally poor except under prolonged conditions of overcast weather.
September	++	Suitable for all species across England.
October	+	Only suitable for widespread species under especially favourable weather conditions.
November	NR	
December	NR	

Key:
NR = Not recommended; detection probability extremely low
+ = Surveys appropriate only under certain conditions (see Notes, third column)
++ = Surveys appropriate but not optimal
+++ = Surveys optimal; target surveys to this period

Table 6 Considerations when deciding on survey type

Impact of development on population	Species		
	Slow-worm, common lizard	Grass snake, adder	Sand lizard, smooth snake
Negligible	Walkover survey only. No species survey required; adequate mitigation can be planned assuming likely presence if indicated by habitat, location, etc. Special care required for rare species, to ensure no licensable operations would result (in which case, some species survey is likely to be required).		
Low	Presence/absence only	Presence/absence only	Presence/absence + HSA
Medium	Presence/absence + HSA	Presence/absence + HSA	Presence/absence + population size class/HSA
High	Presence/absence + population size class/HSA	Presence/absence + population size class/HSA	Presence/absence + HSA/population size class + population size estimate

Table 7 Minimum standard effort and recommended methods for presence/absence surveys

Reasonable chance of presence	Method(s)	Minimum standard effort units
Slow-worm	ARS	25
Common lizard	ARS + DOS	30
Sand lizard	DOS#	50
Grass snake	ARS + DOS	30
Adder	ARS + DOS	30
Smooth snake	ARS	50

Key:
* DOS = direct observation survey
ARS = artificial refuge survey
# ARS may be used in addition to DOS if sand lizard expected at high density, and refuges laid at density of at least 200/ha

Table 8 Monthly survey effort weighting

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Slow-worm	NR	NR	2	5	5	5	3	2	4	2	NR	NR
Common lizard	NR	2	3	5	5	5	4	3	5	3	NR	NR
Sand lizard	NR	NR	3	5	4	3	2	2	3	NR	NR	NR
Grass snake	NR	NR	3	4	5	5	3	3	4	2	NR	NR
Adder	NR	2	4	5	4	3	2	2	4	1	NR	NR
Smooth snake	NR	NR	3	5	5	4	3	3	4	NR	NR	NR

NR = No survey recommended: whilst surveys done in these months might locate animals, the chance of this is very low and so any such survey visits do not count towards standard effort

How to use tables 7 and 8

To decide when best to survey and to calculate the minimum recommended number of survey visits, use the following steps:

- For a given site, you should decide which species have/has a reasonable chance of presence. This decision should be based on considerations such as habitat quality and site location in relation to known species range.
- For each species, look up the monthly weightings, and ideally undertake your survey in the months with high weightings (4 or preferably 5). Hence for grass snakes, an ideal survey would take place in May and June.
- If this ideal timing is not feasible, then you may undertake the survey during a less suitable period, but this will mean that more effort is required.
- Divide the “minimum standard effort units” figure (Table 7) by the “monthly survey effort weighting” (Table 8) in the months you plan to survey.
- This will give you a figure for the number of survey days recommended.
- You can then combine the standards for each species into a single site survey standard. In most cases, visits for different species can overlap.

Requirements for all species

Additional survey visits must be added if detectability is likely to be especially low, for example, site located at range edge, or the vegetation type makes normal surveys very problematic. Record any such factors in your report.

Each visit represents one day's survey in favourable weather conditions. A day's survey must be sufficient to employ reasonable effort to detect reptiles. As a guide, this should be at least 1 hour for small (<1ha) sites, to at least 4 hours for medium sized (>5ha) sites. Where weather conditions allow, two visits per day may be beneficial; these two visits would count as 1 day's effort. For very large or complex sites, several days may be required to count as a single survey session, or several fieldworkers can work in parallel.

There must be at least 2 days between each survey visit. If, after calculating the effort required or to accommodate weather or logistics, this means that the number of survey days will not "fit" into one month, they must be spread out over a longer period. If this extends into a month when the survey effort weighting is higher or lower, the number of visits should be decreased or increased, respectively. Note that a calendar month is used here as a unit of time only for ease of reference. In practice, surveys should not be "squeezed" into a particular month where the survey objectives would be better served by effort distributed over a longer period.

The period between the first and last survey visits must be at least 30 days (this does not mean a survey on each of 30 days, just that the site was sampled between day 1 and day 30).

Where the minimum standard effort unit divided by the monthly weighting does not result in an integer (a round number), you should round up, even if the decimal is <0.5. For example, 40 ÷ 3 = 13.3, indicating 14 visits; 30 ÷ 4 = 7.5, indicating 8 visits.

A presence/absence survey can cease once the target species is found, and this may occur before the minimum survey requirement is met. If, however, a population size class assessment is required, further survey may be needed, at least to the minimum stated in this guidance. This would then ensure that if a peak count were required, a suitable level of effort would be deployed.

Refuges should only be placed in areas likely to be used by reptiles. When planning surveys, it is useful to prepare a map of likely suitable habitat so that you can plan where to deploy refuges. The refuge density figures apply across such habitat.

Where refuges are used for surveys, they must be placed at a density of at least 100/ha of potential habitat, except where this becomes impractical (for example, on large sites) in which case density should be as high as is feasible given the site constraints. There should be a minimum of 30 refuges, whatever the site size.

Where refuges are used, they must be in place for at least 2 weeks of good weather conditions before the survey starts (this can be in the previous year).

Even where refuges are the prime survey method, surveyors should scan the surrounding habitat as reptiles may also be found in the open.

Survey timing should be altered to account for prolonged periods of unseasonably hot, cold, wet or dry weather, all of which may affect reptile detectability.

Where development impacts are high and any of the snake species are expected, it is preferable to survey in both spring and summer as snakes often use different habitats in these seasons.

For very small development sites (<0.2ha) and where there is predicted to be only a minor or temporary impact, survey effort (number of days) may be reduced to half of the recommended value (but the number of refuges must remain as per the recommendations).

Worked example

Species expected: slow-worm and grass snake. Ideally, survey should occur April to June. This is most likely to be successful at establishing presence or likely absence. It would also be most cost-effective for the client since fewer visits are needed.

However, irreconcilable project constraints in this case mean the survey must occur later in season, between July and September.

Slow-worm minimum standard survey effort units = 25. Monthly weightings:

- July: 3
- August: 2
- September: 4.

This gives the recommended survey effort per month, as:

- July: 25 ÷ 3 = 8.3 to 9 visits (rounding up)
- August: 25 ÷ 2 = 12.5 to 13 visits (rounding up)
- September: 25 ÷ 4 = 6.25 to 7 visits (rounding up).

Most suitable survey schedule for slow-worm is for 7 visits spread across September, with at least 2 days in between each visit (Option 1).

An alternative for slow-worm surveys would be to spread the visits out over August and September. Since August has a lower monthly survey effort weighting (2), proportionately more visits would be needed. Assume 4 visits are planned for September, that gives a score for September of 4 (visits) x 4 (monthly survey weighting) = 16 standard effort units. For this species we need a total of 25 standard survey effort units. This leaves 25 – 16 = 9 standard effort units to be deployed in August. This gives 9 ÷ 2 (August monthly effort weighting) = 4.5, rounded up to 5 (visits needed in August). Survey schedule is: 5 visits in August plus 4 visits in September (Option 2).

Grass snake minimum standard survey effort units = 30. Monthly weightings:

- July: 3
- August: 3
- September: 4.

This gives the recommended survey effort per month, as:

- July: 30 ÷ 3 = 10 visits
- August: 30 ÷ 3 = 30 visits
- September: 30 ÷ 4 = 7.5 to 8 visits (rounding up).

Most suitable survey schedule for grass snakes is for 8 visits spread across September. 7 of these visits can coincide with the 7 visits planned for slow-worm under Option 1 above.

An alternative for grass snake surveys would be to spread the visits out over August and September. Since August has a lower monthly survey effort weighting (3), proportionately more visits would be

needed. Assume 4 visits are planned for September, that gives a score for September of 4 (visits) x 4 (monthly survey weighting) = 16 standard effort units. For this species we need a total of 30 standard survey effort units. This leaves 30 – 16 = 14 standard effort units to be deployed in August. This gives 14 ÷ 3 (August monthly effort weighting) = 4.6, rounded up to 5 (visits needed in August). Survey schedule for grass snakes is: 5 visits in August plus 4 visits in September. This coincides with the slow-worm schedule.

In summary, the simplest survey schedule for this project would be to undertake 8 visits spread across September. An alternative would be for 5 visits in August plus 4 visits in September. Because the August-September surveys would happen during a month where the weighting is sub-optimal (less than 4), the survey should be spread across a period of around 60 days. Of course, the general comments mentioned above also apply (surveyor should search for emerging hatchling grass snakes as survey will cover typical hatching time; pay particular attention to direct observation near ponds; ensure surveys done during favourable weather conditions; etc).

Table 9 Deriving a population size class category using survey counts or habitat suitability assessment

Species	Population size class		
	Small	**Medium**	**Large**
Slow-worm	<10, or presence + "poor" habitat suitability	10-40, or presence + "good" habitat suitability	>40, or presence + "exceptional" habitat suitability
Common lizard	<5, or presence + "poor" habitat suitability	5-20, or presence + "good" habitat suitability	>20, or presence + "exceptional" habitat suitability
Sand lizard	<5, or presence + "poor" habitat suitability	5-10, or presence + "good" habitat suitability	>10, or presence + "exceptional" habitat suitability
Grass snake	<5, or presence + "poor" habitat suitability	5-10, or presence + "good" habitat suitability	>10, or presence + "exceptional" habitat suitability
Adder	<5, or presence + "poor" habitat suitability	5-10, or presence + "good" habitat suitability	>10, or presence + "exceptional" habitat suitability
Smooth snake	<5, or presence + "poor" habitat suitability	5-10, or presence + "good" habitat suitability	>10, or presence + "exceptional" habitat suitability

Table 10 Assessing the broad impact level of a development (Note that these effects are in the absence of mitigation)

Impact on population	Typical effects on reptiles and their habitat in the absence of mitigation (one or more effects)	Example
Negative: negligible	• Minor disturbance to individual reptiles • Minor loss or damage to broad habitat	Repositioning fence posts in horse pasture used occasionally by reptiles.
Negative: low	• Killing of small proportion of population • Fragmentation minimally affecting dispersal • Moderate damage of broad habitat • Introduction of minimal decline factors	Constructing a new toilet block on a heathland used by widespread reptiles.
Negative: medium	• Killing of moderate proportion of population • Fragmentation moderately affecting dispersal • Minor damage to key habitat feature • Moderate loss of broad habitat • Introduction of moderate decline factor	Construction of dual carriageway road close to edge of site site used by widespread species.
Negative: high	• Killing of high proportion of population • Fragmentation seriously affecting dispersal • Loss of key habitat feature • Major loss of broad habitat • Introduction of serious decline factor	Construction of residential development on sand dune system, with footprint destroying 80% of habitat used by adders and common lizards.

Notes:
"Key habitat feature" = feature critical for viability of population, for example, specific foraging area, egg-laying site, hibernation site

"Broad habitat" = habitat used for dispersal or general foraging, not critical to population viability

Table 11 Mitigation strategy options (Note the options are listed in order of preference)

Strategy	Outline of methods	Relevant development type; notes on applicability	Example of development; mitigation strategy
Preferred option Development plans modified to prevent harm	Timing, location or methods that could cause harm to species or habitats are modified to prevent harm. No specific habitat improvements necessary because no loss incurred.	Temporary or very small-scale developments. Applicable where no long-term habitat loss is predicted.	Construction of new cycle path in area used for basking & dispersal by slow-worms. Do works in winter.
Small-scale reptile protection: passive measures	Discourage use of works area by substantially reducing suitability. No removal or exclusion. No specific habitat improvements necessary because no loss incurred.	Temporary or very small-scale developments. Only applicable where scale of long-term habitat loss is negligible, and where vegetation and ground conditions allow. Not normally applicable for snakes.	Installation of new fenceline in rough grassland used by common lizards. Carefully reduce vegetation height to ground level for 3m either side of fenceline. Remove all refuges.
Small-scale reptile protection: active measures	Capture and removal of reptiles from works area, often with exclusion to prevent re-entry. No specific habitat improvements necessary because no loss incurred.	Temporary or very small-scale developments. Only applicable where scale of long-term habitat loss is negligible.	Improving drainage on bank used for hibernation and basking by adders. Install exclusion fence around works area, capture adders from works area, place outside fence, remove fence on works completion.
Habitat improvements, active reptile protection measures, relocation to adjacent area	Capture and exclude reptiles from works area, relocate them to adjacent receptor site, which may or may not already be used by target species. Restore, create or enhance habitats on receptor site, and/or on development (if reptiles could use it following completion of works).	Developments which result in moderate to high loss of habitat, and where it is possible to maintain conservation status by retaining the population in situ. Effectively the aim here is to keep a population of equivalent status at the same location.	Residential development resulting in loss of 30% of a site used by slow-worms. Improve habitats on receptor site, retain habitat in greenspace area in development. Capture slow-worms, relocate to receptor site.

Table continued...

Habitat improvements, active reptile protection measures, relocation to occupied non-adjacent area	Capture and exclude reptiles from works area, relocate them to non-adjacent receptor site which is already occupied by target species. Restore, create or enhance habitats on receptor site.	Developments which would destroy habitat occupied by only a small number of reptiles, and there is no feasible in situ receptor option (ie retain them on development or adjacent). Maintain local conservation status by ensuring the combined population at receptor site has potential to reach larger size and viability.	Large landfill project which would destroy a very small, relict population of sand lizard. Create new habitat at existing sand lizard site 1km away, by clearing dense plantation immediately next to occupied habitat; make other enhancements such as exposing sand. Capture lizards, translocate to occupied part of receptor site.
Habitat improvements, active reptile protection measures, relocation to non-adjacent area **Worst option**	Capture and exclude reptiles from works area, relocate them to receptor site not adjacent to development site and currently unoccupied by target species. Restore, create or enhance habitats on receptor site. May be necessary to capture and relocate from outside the works area as well, if only an unviable, small proportion of population would be left.	Developments which result in major loss of habitat, and where it is not feasible to maintain conservation status by retaining the population in situ.	Mineral extraction resulting in complete loss of a site used by common lizard. Improve habitats on receptor site 1km away. Capture lizards, relocate to receptor site.

Table 12 Recommended minimum number of capture days under ideal conditions

	Species score	Site size	Population size class/ Habitat Suitability Assessment
Slow-worm	15	<0.1ha = 0.1	Small/ Poor = 0.2
Common lizard	20	0.1-0.5ha = 0.3	Medium/ Good = 0.5
Sand lizard	30	0.5-2ha = 0.5	Large/ Exceptional = 0.8
Grass snake	25	2-10ha = 0.7	
Adder	25	>10ha = 0.8	
Smooth snake	30		

The process for using table 12

Select the species you plan to capture in the left hand column. For a site with several species, choose the one with the highest "Species score" in the table.

Working across the table from left to right, the minimum capture effort in days is calculated as:

Species score x (Site size + Population size class/ Habitat Suitability Assessment)

A worked example is given below.

Notes on using Table 12

The figures in the table are the recommended minimum number of capture days under ideal conditions as follows:

- good weather conditions throughout the capture programme.
- starting at the optimal time of year, typically April.
- deploying skilled fieldworkers expending high effort per day.
- where appropriate, a high density (1000/ha) of refuges in place for at least 2 weeks of good conditions prior to the main capture period. Note that capture may start during the initial 2 week period, but any effort expended will be in addition to the minimum effort calculated here.

Capture should continue until there has been substantial depletion of the population, ideally so that all animals have been removed (your attitude toward risk may affect this judgement).

The actual capture period may be substantially longer than the recommended minimum period recommended here, as capturing reptiles can require huge effort and local circumstances can make the task more difficult.

To complete a thorough capture period, such that one can have reasonable confidence in having substantially depleted the population, the minimum number of days derived here should be followed by 5 days with no reptile captures or observations, under good conditions. "Good conditions" here means that the species concerned would be expected to be active, given the weather conditions and season. This will vary according to local conditions.

Where there are factors that will predictably result in reduced catchability, additional capture effort should be added to the minimum derived from the calculation here. For example, capture programmes that start at a sub-optimal time (for example, July); highly complex vegetation; substantial underground refuge habitat.

One day = the effort expended by a competent fieldworker in a typical day's work. This will often require several "passes" of the same area, since reptiles will often retreat into cover and escape capture when approached. One day's effort will often require two visits to the site to coincide with the best survey conditions; one the in morning and one in the afternoon or evening (depends on species, season and weather). Capture programmes starting in autumn will often need to be suspended for winter and re-start in spring.

Table 12 worked example

Adders and common lizards are to be removed from an area of rough grassland and scrub. The area measures 0.4ha. While only two adders and six common lizards were found by survey, the habitat suitability has been assessed as "exceptional."

Using the table:

Adder has a higher "species score" (25) than the common lizard (20) and so we will use the 25 for the calculation for minimum recommended capture effort.

The calculation is:

Species score x (Site size + Population size class/ Habitat Suitability Assessment)

Which gives: 25 x (0.3 + 0.8) = 27.5

Rounding up gives minimum capture effort of 28 days. In this case, as the capture programme cannot start until late June, which is in a suboptimal capture period for adders, the consultant adds an extra 10 days.

Hence the final minimum capture effort is 38 days. The timing, effort and methods have been carefully assessed by the consultant and deemed appropriate for the two species at this site. The actual capture period, of course, may be longer depending on local factors, notably weather conditions.

Table 13 Recommended monitoring regimes

Population size class	Development impact	Widespread species	Rare species
Small	Low	None	None
	Medium	Yr 1: P/A + HSA	Yr 1, 3: PSCA + HSA
	High	Yr 1: P/A + HSA	Yr 1, 3: PSCA + HSA
Medium	Low	None	None
	Medium	Yr 1, 3: P/A + HSA	Yr 1, 3: PSCA + HSA
	High	Yr 1, 3: PSCA + HSA	Yr 1, 3, 5: PSCA + HSA
Large	Low	None	Yr 1: PSCA + HSA
	Medium	Yr 1, 3, 5: PSCA + HSA	Yr 1, 3, 5: PSCA + HSA
	High	Yr 1, 3, 5: PSCA + HSA	Yr 1, 3, 5, 10: PSCA + HSA

Notes:
P/A = Presence/Absence; HSA = Habitat suitability assessment; PSCA = Population size class assessment