



Sand lizard

Conservation Handbook

The Sand Lizard Conservation Handbook

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“I think every conservationist should bear in mind its well chosen name in Colin Simms’ book “The lives of the British lizards”: “The Aristocrat” (Simms, 1970). In all my studies I compared *L. agilis* with *L. vivipara*, typified by Simms with the likewise well chosen name “The Commoner”, and again and again I came to the conclusion, that he named them well.

In all the north-west European regions this “aristocrat” needs our special care, a quiet, large castle to live in and plenty of time to grow old. Only then we can preserve it for our children.

Dr. Henk Strijbosch,
Dept. of Animal Ecology,
Nijmegen University, 1988.



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1. Introduction

The sand lizard *Lacerta agilis agilis* in Britain is on the north-western edge of its biogeographical range. It is a communal species most frequently associated with localised, topographical features that receive a lot of sunshine in mature areas of dry sandy heaths or dense marram grass on coastal dunes. Because these features tend to be particularly important for reptiles they are known as *foci*.

Due to vast habitat loss, primarily during the twentieth century, natural populations were lost in Kent, Sussex, Hampshire, Wiltshire, Berkshire, Cheshire and north and west Wales and the species' presumed former range in Devon and Cornwall (no validated historic records exist for these two Counties). Further substantial colony losses of 97%, 95% and 90% were observed in parts of Merseyside, the Weald and north Surrey and Dorset respectively. Remaining colonies are mostly on areas of heath or

dune that are often fragmented and surrounded by coniferous forests or urban development. These are highly susceptible to damage eg. by fire. Over 90% of the total United Kingdom population (which was estimated at c6500 adults in 1997) are in south-east Dorset, the species' last remaining stronghold. The current (1997) and known and presumed previous distributions in Britain are shown in Figure 1.

Due to such losses, here and across much of its north-west European range, the species was considered sufficiently endangered to receive protection through both national and international legislation (see Section 2).

Figure 1: Current and known and presumed previous ranges of the sand lizard in Britain: known past range includes areas with validated records and presumed previous range includes other areas within the natural range likely to have had the species on the basis of not validated records and/or presence of good habitat.



Autecological research and habitat management since the 1970s, together with a national Species Recovery Programme (1995-97) (Corbett & Moulton 1998), has allowed some reversal of the sand lizard's plight. However the overall effect of these has been limited by continuing damage and threats to the species and its habitat through out the range. The approach to sand lizard conservation in Britain includes the following components:

- Site protection, with most if not all localities being notified as Sites of Special Scientific Interest (SSSIs) and the largest or otherwise significant ones becoming nature reserves.
- Management of sites to maintain and, where necessary, restore suitable conditions for sand lizards.
- Translocation of sand lizards to ideal sites within their known or presumed historic range. The emphasis is on re-creating dune populations in southern Britain, north and west Wales and Merseyside. However, heathland translocations are also being undertaken to help restore the range of the species in this habitat.

This handbook provides practical guidance for the conservation of sand lizards. It therefore covers management and translocation, survey and monitoring, site protection, mitigation and identifies sources of further advice and assistance. The methods described here have been tried and tested extensively and are known to work.

2. Legal protection, international obligations and licensing

The sand lizard is protected through both national and international legislation. It is listed on the Council of Europe's *Convention on the Conservation of European Wildlife and Natural Habitats* (the "Bern Convention") (Annexe II) and on the European Community's *Directive on the Conservation of Natural and Semi-natural Habitats and of Wild Fauna and Flora* (the "Habitats and Species Directive") (Annexe IVa). These collectively require strict protection for the species and its habitats under British law. In Great Britain protection is provided by the Wildlife and Countryside Act 1981 (listed on Schedule 5) and the Conservation (Natural Habitats, etc.) Regulations 1994 (listed on Schedule 2).

Taken altogether the Act and the Regulations make it illegal to:

- Intentionally or deliberately kill, injure or capture sand lizards.
- Deliberately disturb sand lizards.
- Damage or destroy sand lizard sites, breeding or resting places or places used for shelter or protection.
- Possess a sand lizard, or any part of a sand lizard, unless acquired legally.
- Sell, barter, exchange or transport for sale, etc., sand lizards or any part of them.

The legislation covers all life stages. Eggs, juvenile and adult sand lizards are covered equally by the legislation.

There are some cases where the law allows these actions to occur. For example, injured animals can be kept to tend to them provided they are released as soon as they have recovered and "mercy killing" of severely injured animals is permitted. The law also allows actions which would otherwise be illegal provided that these are the incidental result of a lawful operation and that they *could not reasonably be avoided*.

Licences can be issued to allow otherwise prohibited acts (eg. capturing or handling sand lizards). Licences for scientific study and conservation, education and photography are issued by the statutory nature conservation organisations (namely English Nature in England and the Countryside Council for Wales in Wales).

This is only a general guideline to the main provisions of the law. The Wildlife & Countryside Act 1981 (Part I, notably Sections 9 and 10) and the Conservation (Natural Habitats, etc.) Regulations 1994 (notably Regulations 38 to 40) should be consulted for further details.

People involved with sand lizard conservation, including those studying them, managing their habitat or owners of land where sand lizards are present, need to be aware of the law and the constraints and obligations that follow from it.

In recognition of the continuing threats to and the conservation needs of the species, the sand lizard has been listed as a priority species for conservation action in the United Kingdom (UK Steering Group on Biodiversity 1995b).

3. Habitat requirements of sand lizards

Wherever they occur in Britain and over much of their range in north-west Europe, there are two critical elements of habitat structure that are essential for sand lizards to survive. These are:

Insolated and predominantly south-facing mature heath or dune habitat with a varied vegetation structure. Adult, immature and juvenile sand lizards require the variable structure provided by this mature vegetation and this type of terrain for cover, for hunting and to allow them to regulate their body temperatures. The vegetation is naturally uneven aged and varies from open ground, through low vegetation to thick bushy plants. Often within bushes there is good ground cover of mosses, lichens and / or vegetation litter providing a further level of structural variation that is valuable for sand lizards.

Unshaded, predominantly south-facing areas of exposed sand. Sand is essential for egg incubation. Successful egg development can only occur in pure mineral sands or sandy gravels with low amounts of organic matter and without physical disturbance, for example by horses, bicycles, vehicles or grazing animals.

These basic habitat features must be continuous with each other as sand lizards are poorly equipped to cross areas of unsuitable habitat. Often these areas exist within a matrix of less suitable habitat resulting in localised concentrations of reptiles. *These optimal areas (foci) are of particular importance to sand lizard conservation.*

These conditions are generally met in only two habitat types in Britain, notably coastal dunes and lowland dry heaths. The specific structure of these habitats is outlined below.

Lowland dry heaths

Habitat. Unshaded areas of open sand surrounded by similarly unshaded deep, mature dry heather (predominantly ling *Calluna vulgaris*) on south-facing slopes, banks, etc. form ideal sand lizard habitat. These features form the sand lizard *foci* on heathland.

Well drained, predominantly south facing and unshaded sands or sandy gravels are necessary for the successful incubation of eggs. Areas of bare sand that are used include footpaths, quarry slopes, erosion gullies, exposed areas of boundary banks,

sandy fire-breaks, etc. This typically covers between 2 and 10% of ground area on heathland *foci*.

The sand lizard is closely associated with sunny slopes, tumuli, hillocks, gullies, boundary banks, etc., though they are also found on flat areas where they are particularly associated with path edges. All such areas are generally covered by mature and naturally uneven aged stands of heather which provide ideal cover, basking and foraging areas for the species. Sand lizards will be found elsewhere but generally at lower densities. Other habitats are less likely to provide the optimal conditions for the species but may provide important links between *foci*.

Fire, scrub, tree and bracken encroachment and habitat trampling will damage the mature plants and variable vegetation structure that are important to sand lizards, and especially at *foci*. These can cause long-term damage or even extinction of local populations.

Coastal dunes

Habitat. The areas of sand dunes used by sand lizards are neither very mobile nor very 'fixed'. Rather they are found on dunes where marram *Ammophila arenaria* and lyme grasses *Elymus arenarius* form thick, tangled tussocks amongst open patches of sand. Unshaded areas of this habitat on sunny dune ridges are ideal sand lizard habitat. This can be found on both frontal and, to a lesser extent, on fixed dunes.

As with heathland, sand is required for egg incubation. Typically between 5 and 20% of ground area are open sand on dune *foci*. South facing topographical features are favoured and continuous areas of mature marram are necessary for the species for cover and foraging areas.

Again fire, scrub encroachment and habitat trampling are detrimental to both the animals' habitat and population status.

Active dune building processes are important for maintaining sand lizard habitats. This requires the appropriate control of public pressure on foreshores and in frontal dunes.

Other habitats

The only other areas in which the species is found are secondary habitats derived from the two main types, ie. dune and lowland dry heath. In these

areas a diverse range of habitats are used, eg. private gardens, rubble piles, rough grassland, etc. However, these areas always have to have adequate ground vegetation for cover and foraging, and areas of exposed sand for egg incubation.

Historically the species was known to inhabit chalk heaths. More recently it has been associated with clay heaths where a more friable waste material abandoned after quarrying.

4. Management methods necessary for sand lizard sites

The habitat descriptions in Section 3 identify ideal conditions for sand lizards and also for many other endangered or declining fauna characteristic of pristine dune and lowland dry heath habitats. In this section, practical methods for creating and maintaining such conditions in these inherently fragile ecosystems are documented. These methods may need to be tailored to the needs of each site.

It is important to note that while sand lizard conservation requires sympathetic management of whole sites, particularly ensuring connection between important areas for sand lizards, specific management for the species is usually achieved

most effectively by concentrating resources on managing the foci. It is essential to note that the habitats on sand lizard foci are highly vulnerable to damage. Long-term damage to both foci habitats and the resident sand lizard populations can occur when inappropriate, insensitive or ill-timed management operations are undertaken. Every care therefore must be taken when management is undertaken to minimise disturbance and damage.

There are seasonal constraints on all management methods used for sand lizards. Management should be carried out during appropriate time periods to avoid the possibility of serious and long-term damage or disturbance to resident sand lizard populations or other features of interest on the site. The management techniques described below should only be undertaken during the time periods as specified in the Heathland Management Calendar (see Figure 2). When considering using herbicides it is important to ensure that operatives are appropriately qualified and that the statutory conditions of use detailed on the label are followed.

Figure 2: The Heathland Management Calendar showing seasonal constraints to different heathland operations. Taken from Gent & Gibson (1998), with permission, and based on the Heathland Management Calendar produced by Dorset County Council/ Dorset Heathland Forum.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Scrub Control												
Gorse coppicing												
Other cutting												
Stump treatment												
<i>Sap is rising, so treatment is likely to be ineffective.</i>												
Mowing/foraging												
Annual maintenance												
<i>Beware reptiles at the edge of heather patches</i>												
New sites												
<i>Harvest heather seed.</i>												
Rotovotation of firebreaks												
On mown site												
<i>Avoid sandy sections: reptiles may be hibernating or egg-laying</i>												
On unmown site												
<i>Beware reptiles and breeding birds!</i>												
Re-rotovotation												
<i>Beware breeding birds!</i>												
Burning												
<i>Not suitable for key reptiles sites</i>												
Bracken control												
Cutting:												
<i>Not suitable for key reptile sites</i>												
Spraying:												
<i>Best done after fronds unfurl and before the first frost.</i>												

-  Most effective and least damaging time to carry out the work.
-  Work may be less effective and / or requires more care to avoid disturbance.
-  Birds from mid-April to end of August. Both Woodlark and Dartford warbler nest early, and the latter may breed a second time, so avoid favoured areas. Nightjars may also be present in bracken or using areas of leaf/bracken litter near tree stumps.
-  Reptiles are above ground. They may be sluggish and slow to avoid danger in Spring and Autumn. Be especially careful at the edge of heather patches.
-  Hibernating reptiles below ground.
-  Reptiles eggs incubating, especially in sandy sites.

Please note that this calendar was adapted from the Heathland Management Calendar produced by the Dorset Heathland Forum - timing may vary in other counties.

The following management techniques are for both dune and heathland *foci* except where stated otherwise. Due to the nature of these habitat types, follow-up management is often necessary for the long-term stability of the resident sand lizard populations.

Sand

Provision and maintenance of open sand are possibly the most critical management practices for sand lizard conservation. Areas of unshaded sand are essential for successful egg incubation and therefore population stability. For successful incubation, sand lizard eggs require a fine, well drained sand containing at most only a very small amount of organic matter. Sand patches often need to be close to dense vegetation. This provides cover for the female while laying eggs. Eggs are not laid too close to vegetation typically 10 - 30cm away as plants draw moisture out of the sand making it too dry for the eggs to develop.

Figure 3: Sand lizards dig egg-burrows and "trial" egg-burrows in open areas of sand.



Egg burrows and trial digs are found in open sand, 10 - 30cm away from vegetation (further in flatter areas).

Sand management is necessary on both heath and fixed dune *foci*. Frontal dune *foci* however have naturally high amounts of bare sand and should not require any active sand management. Sand management should be done only on sunny days during mid-April to mid-May when the sand lizards are above ground. During this time period lizards are out of hibernation but eggs have not yet been laid.

On any *focus* you should aim for between 2 and 20% of bare sand. Sand management should be carried out on areas of *foci* that will give both the maximum benefit to the resident population whilst causing the least damage to their habitat. Such areas have to be unshaded and well insolated and therefore are predominantly south-east to south-west facing. When creating open sand, it is important to consider their value to sand lizards and also to bear in mind other possible positive and negative impacts. Sand with varying gradients can also provide valuable habitats for a variety of invertebrate species and linear features free of vegetation can prove valuable as fire-breaks. While long strips of sand are generally recommended both for the ease of creation and maintenance and their subsequent use by lizards, very large patches of sand would generally be inappropriate. The whole area of a very large sand patch would not be used by lizards and their size may encourage erosion. Creation of such extensive areas of bare sand could also damage other features of conservation interest.

There are a number of sand management methods, the most successful being blading and turfing. Blading involves the use of machinery and is used to provide relatively extensive areas of sand, often associated with providing more effective fire-breaks. Such features are often created around the periphery of *foci*, though additional sand (and fire-breaks) are often appropriate within large *foci*. A fire-break should initially be mown about 2m or more in width. Bare sand can be created using an excavator or a bulldozer

with a 2m wide and angled blade. The machine works along this fire-break, pushing the excavated material to form a bank on the most appropriate (ie. usually northerly) side of the fire-break. This is repeated until only pure sand remains. These banks soon become re-vegetated and used by sand lizard and other heath species. The bladed strips, however, remain open for a number of years and are generally relatively easy to maintain. Turfing

involves hand-digging turves with spades, removing organic material to a sufficient depth to uncover pure sand. The minimum viable and practical size of turfed areas should be 2m x 1m. This method is labour intensive and requires a high maintenance input. In some circumstances turving is the only viable option for providing open sand, for example on steep slopes or small sites without vehicular access.

In many ways bladed and turf cut areas reflect the traditional features on heathland such as boundary banks, cart tracks, turf cutting and small scale extraction of soils and minerals, etc. Such activities

will generally require specific consents from English Nature or Countryside Council for Wales on SSSIs. Areas of artificially exposed sand will, sooner or later, re-vegetate. This will leave this highly static species with few or no areas to lay eggs and consequently breeding will not occur. Population senescence and the localised loss of this species can occur quickly without open sand and maintenance may be needed every 3 years or so. The original areas should be re-managed, ie. re-turfed or rotovated (in the case of bladed strips), following the normal seasonal constraints.

Heathland

Figure 4: Heathland (a) in a poor condition with shading from extensive tree and shrub cover, lack of undisturbed bare sand, uncontrolled access and severe fire threats and (b) in an optimal state with generally unshaded aspect, undisturbed areas of bare sand for egg-laying, control of access by horse and vehicles and fire control measures.

a) Heathland: in poor condition for sand lizards

Dense stands of pine and gorse shade open ground and increase the fire risk. There are no fire-breaks.

Unrestricted, heavy recreational use causes disturbance, damage and erosion and destroys egg clutches.



b) Heathland: in good condition for sand lizards

Dense pine removed leaving scattered individuals on south and west aspects.



Avoid driving over sensitive areas where eggs may be damaged.

Dunes

Figure 5: Dunes (a) frontal dune system in poor condition with uncontrolled access causing damage to marram grass and extensive erosion, (b) over-‘fixed’ dune system in poor condition with absence of bare ground and loss of suitable ground vegetation through encroachment of dewberry and trees and (c) an optimal frontal dune habitat with good vegetation structure, natural areas of open sand with board-walks and fences to control public access.

a) Dune: in poor condition for sand lizards

Much of the site is overgrown by dense growths of dewberry, sea buckthorn and other shrubs. Trees are invading some areas. Heavy recreational use tramples and destroys vegetation on the site



b) Dune: in poor condition for sand lizards

Vegetation lacks structure: most marram grass has been lost - only isolated clumps remain. There are no masses of tangled vegetation.

Access is not controlled: a network of other paths through the dunes increases erosion and disturbance.



Fire is a significant hazard.

The main paths are severely eroded.

c) Dune: in good condition for sand lizards

Dense, tall, tangled marram.

Fences limit access to dunes.

If necessary, board-walks direct recreational access to less valuable areas or directly to the beach.



5 - 20% open sand between areas of mature marram clumps on foci.

Bracken

Bracken *Pteridium aquilinum* is highly invasive. Without effective management it will degrade and destroy *foci* habitats and will cause sand lizard populations to decline. There is a particular risk of encroachment of bracken after fire.

There are various management techniques for controlling bracken. However to avoid habitat damage the only acceptable method of controlling bracken on nearly all *foci* is via back-pack spraying using a selective herbicide such as Asulam (“Asulox”) at an equivalent concentration of 1:20 and an adjuvant. Lower concentrations are unlikely to be effective and may even yield bracken plants that are resistant to the herbicide in following years. Such spraying is both cost and labour intensive, but is usually the only practical method of control. Secondary spraying of any re-emergent fronds in the following season is also necessary.

Bracken spraying should be undertaken between June and August to be effective. This is when the fronds are fully unfurled but not hardened off. Spraying also needs to be done on dry days. If the plant fronds are wet absorption is low. Therefore if anything more than light rain occurs during or within 24 hours of spraying the site may have to be resprayed. However spraying is also ineffective in heat and drought conditions. Spraying must not be undertaken in windy conditions because of the risk of the chemicals drifting.

Other methods of control, such as mechanical spraying, or crushing using a roller, cause serious damage to mature heath and should therefore not be used on sand lizard *foci*. Should other techniques be used elsewhere on site consideration should be given to the possible presence of reptiles and appropriate precautions taken in areas being treated.

Scrub and trees

Trees (notably pine *Pinus* spp. and birch *Betula* spp.) and shrubs will shade out ground vegetation and cause the deterioration and eventual loss of heath and dune habitats. The loss of suitable habitats will lead to the loss of sand lizard populations. Shading will also have a direct effect on sand lizards and their eggs by cooling their environment. This affects the ability of animals to regulate their body temperatures and will prevent the successful incubation of eggs. Shading can be caused by trees on sites adjacent to sand lizard *foci*. In such cases management may

need to look at ameliorating effects of tree growth that is not actually on the *focus* itself (eg. forestry or amenity planting alongside banks).

Where invasion by scrub and/or trees is a problem it is essential that these are removed to allow the recovery of suitable habitats and of sand lizard populations. This management should be done during mid-September to the end of March. The amount of clearance necessary will depend upon the site; generally it is best to leave a very light scattering of trees and bushes. This provides a degree of habitat variety (for sand lizards and other heathland species) and has a landscape value. Deciduous trees and shrubs, such as birch and gorse *Ulex* spp., will usually require chemical treatment to prevent re-growth. Chemical treatment is via painting cut stumps or spraying any re-growth using, for example, Triclopyr (eg. “Garlon 2” or “Timbrel”) or an approved Glyphosate product (eg. “Roundup”) in wet areas with recommended adjuvant as appropriate.

Cut material should be removed from sand lizard habitats otherwise it will continue to smother and to kill the ground vegetation. Usually it should be dragged by hand to an access point where it can be chipped or to a sterile area of the site and burnt (though only under favourable weather conditions and with suitable fire precautions on hand). Large trees can be felled, have their branches removed (and chipped or burnt) and their trunks cut and piled on site.

Where tree or scrub cover is a problem on a site that still has a good ground vegetation, it is important not to damage the vegetation or its structure when removing the trees. The use of vehicles or heavy plant is therefore inadvisable. Management of such areas should be undertaken with hand-saws and chain-saws, operated by only a small team of people to minimise damage to *foci* habitat.

Too frequent removal of seedling pine or birch trees, etc., as is practised by many land managers, can cause serious trampling to mature dry heath. It is preferable to allow seedlings to grow for several years when they become easier to manage. This must still be undertaken sensitively, taking every precaution to minimise trampling damage, for example by using specific entrance and exit routes for dragging cut vegetation.

Where there is a dense tree cover but a surviving ground vegetation, trees are usually removed in two phases over several seasons. This allows time for

the habitat to recover and reduces the amount of trampling to already stressed plants. A degree of shading also reduces stresses to the plants from summer heat and from drought. Because of this it is often valuable to leave some trees even after the final clearance, and more so on south-facing slopes where the stresses are more apparent. Preferentially the retained trees should be birch or Scots pine.

Gorse provides a valuable habitat but should not be allowed to become dominant in sand lizard habitats. Mature gorse can provide a fire risk, especially along paths, road verges and on sites with high public pressure and in these cases mature gorse is cut. Cut material should be chipped or burnt.

Rhododendron *Rhododendron ponticum* should be removed or controlled on sand lizard *foci* and shallon *Gaultheria shallon* always eradicated anywhere it is found on heathland. Both species should be cut in late Autumn and disposed of (though shallon has to be burnt to prevent its spread - it should never be chipped). Any re-growth should be chemically treated, for example by spraying with Triclopyr (eg. "Garlon 2" or "Timbrel") and recommended adjuvant as appropriate, ideally the following Spring but in any event within 18 months.

Fencing

Fences are used to reduce or exclude certain pressures on sensitive heath and dune habitats. These pressures usually result in trampling damage, such as mountain bikes, vehicles, cattle, horses, military exercises or simply large numbers of walkers. Preventing such damage is particularly important on sand lizard *foci*. Fences around the periphery of *foci* will stop trampling damage to habitat and allow the regeneration of vegetation. They also prevent disturbance to and risk of trampling of lizards and their eggs.

It is essential that animals used in grazing regimes are kept away from sand lizard *foci*. Although cattle and sheep will not often eat the unpalatable mature dry heath or marram, they can cause significant damage through trampling and through dunging (leading to eutrophication of the soil) even in a short time-scale. This will lead to the destruction of the structure, important for the survival of lizards, and trampling of eggs. These can seriously affect the local sand lizard population in the long-term.

A variety of designs of fences can be placed around sensitive *foci*; though the most cost-effective are of

the post and wire design and/or knee rails. Fences should, preferably, be installed during mid-April to mid-May to minimise disturbance to sand lizards or their eggs. Installation of the fences should be preceded by a full assessment of the sand lizard interest on the *focus* and should be undertaken carefully to minimise damage to the habitat.

Linkage

Providing links between sites or between *foci* is highly desirable. It allows natural dispersal, genetic mixing and re-colonisation of areas following local losses, eg. after fires. The isolation of small populations of sand lizards by impassable barriers (termed "fragmentation") is a very real threat to the survival and viability of these populations. The creation or re-creation of these links may involve any combination of scrub/tree management, bracken control, providing sand or provision of fences depending on the characteristics of the site. For example, if two populations of sand lizards are separated on a site because of dense pine woodland, the removal of pines will, in time, allow suitable habitat to develop between the populations and consequently movement of lizards between them. In other cases habitats may need to be re-created allowing linkage between two formerly separated sites. Industrial (eg. land-fill sites), forestry or farm land, for example, may be available for restoration to heathland.

The principle aim of linkage is to provide suitable habitats to allow the movement of animals between populations. Ideally the linking habitat will in itself be good enough to support breeding sand lizards. However, in other areas simply the provision of a corridor of suitable habitat to allow movement will be valuable. These habitat corridors must be wide enough to cater for the needs of lizards. They must have suitable structurally varied vegetation and be unshaded.

Fire control

Of utmost importance, and particularly on heathlands, are the effective prevention and control of fires. Fires can devastate *foci*, not only killing and injuring animals but destroying habitats. While generally the vegetation regrows, it will often take 20 or more years for the necessary structure to be restored; often after fire, the vegetation that grows back might not be suitable for sand lizards (eg. bracken, gorse or birch on heaths or rosebay willow-herb *Chamaenerion angustifolium* on dunes).

Effective fire control on sites may require a number of different approaches. Many fires are started deliberately. Effective liaison with the police and fire services, removal of path-edge and “leggy” gorse bushes (often the areas targeted by arsonists) and good wardening can reduce the likelihood of deliberate fires. Controlling public access and appropriate fire warnings, with instructions on who to call if a fire is seen, can help reduce the risk or severity of accidental fire.

Once a fire starts on a site it is important that it is controlled and that it is put out. Fire-breaks provide one means of controlling the spread of fire. Large areas of heathland or dunes should be broken by fire-breaks. Mown or bare ground fire-breaks are useful especially for breaking the spread of fire by stopping lateral or back burning. Also on site it is important that there are good access routes for the fire services and that these are marked on maps and provided to the fire services. Emergency water supplies (eg. hydrants and/or fire-ponds) and strategically placed racks of fire-beaters should also be provided.

Extra effort may be needed to protect *foci*. Additional fire-breaks may be needed at sensitive *foci*, both around the periphery of them and within them to reduce the effects of fire should a fire spread to the *focus*. These can usefully be provided in association with sand exposure for egg laying. Special care needs to be exercised when creating fire-breaks on *foci*. Appropriate methods need to be used (eg. cutting, blading) and inappropriate ones (eg. burning) avoided. These also need to be created at the right time of year (see above and Figure 2).

Captive bred young sand lizards

Photo: Tony Gent

Management activities that are detrimental to sand lizard populations and to *foci* habitats

Some management practices will cause disturbance, can kill lizards or result in damage to the structure of vegetation and these will be deleterious to sand lizard conservation. These should be very carefully controlled, or even avoided, on sites with sand lizards and particular attention paid to safeguarding *foci* from harm. Burning and the effects of grazing animals can be highly damaging, at least in the short term, to the habitats used by sand lizards and can cause local population extinction (eg. New Forest heaths). Mowing of habitats can also cause damage as it can take a considerable time for the necessary structure to return to the vegetation to support a sand lizard population. The implications of using heavy machinery need to be thought through and its use on *foci* should normally only be considered where absolutely necessary and where guided by herpetologists. Where such activities are required on sites that have sand lizards the extent and the impact of the activity should be minimised. Generally only small areas should be burnt or cut and grazing should be extensive rather than intensive. The timing of the operations need to take account of the activities of sand lizards and the likelihood of sand lizards being present. *In most cases such practices should be avoided altogether on foci.*

Gassing rabbit warrens, and especially in Winter, and blocking mammal burrows for hunting will threaten reptiles using these as refuges. These activities must not be done on *foci*.

Pheasant rearing or feeding should also be discouraged near to sand lizard sites as these birds are known to kill reptiles while they are foraging.



Female sand lizard
Photo: Tony Gent



Male sand lizard
Photo: Nick Moulton



Ideal sand lizard habitat



Above: Prime sand lizard heathland habitat. Mature heather phase with an abundance of bare sand.
Photo: Mike Preston

Below: Prime sand lizard dune habitat. Tangled marram with patches of open sand.
Photo: Keith Corbett



Site management



Above: Re-cutting a sandy trace used by sand lizards for egg laying.
Photo: Mike Preston

Below: Mown fire-break with rotovated strips of bare ground.
Photo: Tony Gent



*Sand lizard eggs. Partly excavated
Photo: Mike Preston*



Above: Creating a strip of open sand using an excavator. Spoil is put in a mound on one side. Such features can also be created with a bulldozer.

Photo by: Mike Preston

Below: Power saws are used to remove large trees.

Photo: Tony Gent



Above: Equipment required for bracken treatment

Photo: Mike Preston

Below: Sand lizards need loose bare sand in which to lay their eggs. Small sandy traces are created using hand operated rotovator.

Photo: Mike Preston



Site management (continued)

Before



After



Above: (left) Pine and scrub encroachment on an area inhabited by sand lizards before clearance and above (right) the same area after clearance of pine and scrub. Photos: Mike Preston

Before



After



Above: (left) Bracken encroachment on prime sand lizard habitat and above (right) the same area one year after chemical treatment using the back pack method. Photos: Mike Preston

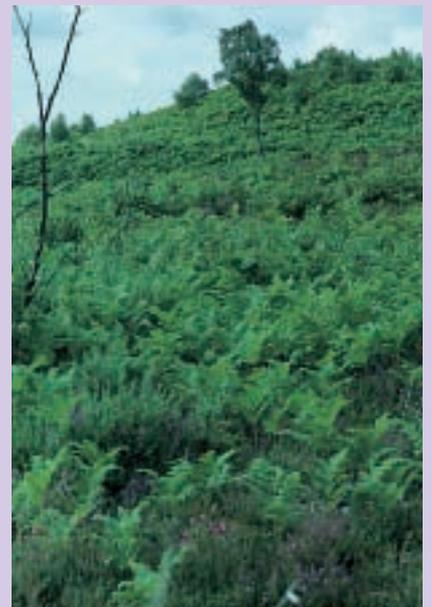
Problems



Above: Effects of fire on heathland.
Photo: Nick Moulton



Above: Shallon is a vigorous competitor of native heathland plants.
Photo: Neil Armou-Chelu



Above: Bracken can form dense stands and make areas unsuitable for sand lizards.
Photo: Keith Corbett

5. Translocation of sand lizards

Translocation forms an important component of sand lizard conservation practice. The artificial movement of animals to unpopulated sites is important to try to restore the former range of the species. These are released at sites in optimal conditions with a view to establishing new, viable populations. As colonies become isolated and links to other suitable sites become broken, natural colonisation or re-colonisation of areas becomes impossible. It also becomes increasingly likely that these small, isolated populations will become extinct (eg. through fire). Translocations are undertaken to redress this problem. It may be appropriate to release some animals on a site where there is a very small population to bolster numbers and reduce the possibility of in-breeding. This practice, termed re-stocking, is rarely done for sand lizards.

In all cases translocations should be undertaken only where they fulfil the purpose of placing animals in representative habitats within their known or presumed historic range. This serves to restore the former range of the species both on sites where it occurred previously and to other areas within the natural range on appropriate habitats to compensate for irreversible habitat losses elsewhere. The priorities for translocation in Britain are dune sites in southern England and in Wales, since the species has become very rare in these habitats, while assessing other possibilities in parts of the species' former range from where it is now lost, eg. Berkshire and Kent.

Any proposal for a release project must address a number of issues. Is the site that will receive the animals appropriate? Is the proposal ecologically viable? Are the right animals being selected for release and will their use cause any problems to existing populations? Has there been the right amount of consultation and have necessary permissions been obtained? The following issues must be addressed before proceeding:

Choosing the site

- There should, where possible, be good historic evidence of the previous occurrence of the species at or near the site. However, sand lizards are notoriously difficult to see and under-recorded and so such documentary evidence may not exist. Other indications of likely historic occurrence, such as the presence of the species habitat type within their regional

and climatic range, may be used to justify translocations at some sites where there are no species records.

- Sand lizard presence/absence. Potential sites should be properly surveyed (see Section 7) to ensure that the species is not present before a translocation to them is considered, unless the translocation is to restore a population on the verge of extinction (re-stocking). In the latter case, every effort should be made (by habitat management) to restore adequate conditions and thus revive the native population before a translocation is entertained.
- Re-introductions should only be carried out once the cause for original loss of the population has been identified and rectified and where natural re-colonisation is unlikely. This includes sites from which sand lizards have been lost due to lack of appropriate habitat or management that are now physically or geographically isolated from existing populations.
- Site security. Potential translocation sites should be secure and not threatened for the foreseeable future. Ideally they should have SSSI or nature reserve status, a sympathetic landowner and a management plan that takes sand lizard conservation needs into account.
- Permissions and agreements. It is important to consult to gain support of interested parties, eg. landowners and managers of recipient sites, herpetological experts and appropriate statutory bodies. A licence or other formal consents may be needed from the appropriate statutory nature conservation organisation (English Nature or Countryside Council for Wales).
- There must be a sufficiently extensive area of suitable habitat that can support a viable population.

Preparing the site

Management to prepare the site should follow the guidelines set out in earlier sections. Particular attention needs to be given to ensuring that all life stages are catered for and that the habitat can support breeding, feeding and over-wintering. As well as management prior to translocation, it is important that necessary resources can be provided for continuing management (if needed) so that the population can persist into the future.

Choice of animals for release

- The animals used should be of the right genetic type for the area. The three different regions ie. Merseyside, Weald and north Surrey and Dorset support populations that appear to be different and these may represent distinct “races”. Therefore any re-introductions must avoid mixing (or the *possibility* of mixing) of these “races” and where possible should use the stock most appropriate for the site.
- Obtaining animals for release should not jeopardise existing wild populations.

The majority of sand lizards for reintroduction purposes are now captive bred by specialists, in outdoor vivaria which conform as closely as possible to their natural habitat types ie. either dune or dry heath. The eggs are incubated artificially so they hatch in July. The juvenile animals are released on the receptor site as soon as possible (following a period of intensive rearing) to allow them to acclimatise to their new environment and so increase their chance of surviving their first hibernation. To establish a viable population with a good age structure, three annual releases each of around 50 juveniles are recommended. First breeding can occur on the site three years after the initial release.

Wild caught adult and immature animals are usually only taken from sites to be lost to development and only after planning permission has been granted. Exceptionally small numbers may be collected from sites with large and robust populations (and animals may need to be collected from a number of different sites). Where adults are used, 20 or more pairs generally need to be released at the receptor site to create a viable population. If released early in the season, breeding will generally occur the same year. Catching, housing, feeding, etc. a large number of wild animals can be problematic and most animals are translocated and released very soon after capture. This reduces the chance of stress, tameness, dietary deficiencies, etc. Wild caught animals should not be released to receptor sites after early September as they will have little chance to acclimatise and therefore hibernate successfully. Any animals caught late in the year should be over-wintered in established vivaria and retained for captive breeding.

Carrying out the translocation

- Animals should only be released on the receptor site in the appropriate seasons in good weather conditions ie. sunny and warm days during mid-April to early September.
- After the release occasional visits should be made to get an idea of the survival of the released animals. This concentrates on or within the vicinity of the release point. A programme of monitoring should be set up to determine whether the translocation is successful and in particular to see whether any changes to the management of the site are required.

Measuring success

In the short term a release can be judged successful if on-site breeding is recorded and if animals are seen on the site in subsequent years. This indicates that the site provides suitable conditions for survival (and successful over-wintering) and breeding. However a translocation can only truly be considered successful if a new self-sustaining population is established in the long-term. Long-term monitoring therefore needs to look at breeding success for a number of years after the releases have been completed.

6. Site protection and planning mitigation

Sand lizard habitats are protected by a number of different means. Many sites receive protection through various levels of designation. These may be protected as nature reserves; these can be National Nature Reserves (NNRs) that are declared by the statutory nature conservation organisations (SNCO) ie. English Nature or Countryside Council for Wales, or Local Nature Reserves (LNRs) designated by local authorities. A further designation is the Site of Importance to Nature Conservation (SINC), though these may be known by a variety of other names (eg. Sites of Biological Interest, County Wildlife Sites, Areas of Outstanding Ecological Quality). This is a local designation used by the Planning Authorities and such sites are often identified by Wildlife Trusts.

The majority of sand lizard sites in Great Britain have been designated Sites of Special Scientific Interest (SSSI). This is a statutory designation made by the SNCO which means that certain actions on the site are regulated to stop these threatening the interest on the site. The landowner and local authority should be made aware of the presence of the sand lizards by this process and are advised of the actions that cannot be carried out unless specially consented by the SNCO. SSSI designation is also an important consideration in planning; the SNCO is consulted on planning applications or other operations which can threaten the site, such as removal of vegetation, excavation, etc. Such designations are very valuable in safeguarding sites.

As well as the possibility of a site designation the animals and their habitats are protected by “species conservation” provisions of the Wildlife & Countryside Act 1981 and the Conservation (Natural Habitats, etc.) Regulations 1994 (see Section 2). These provisions provide an essential further tier of protection. Even on sites that have no designation, damage or destruction of the habitat and any activities that are likely to result in death, injury or disturbance to sand lizards are prohibited unless this cannot reasonably be avoided. In many cases such damage can be avoided, for example by changing timing of operations, doing things in a different way or not doing something at all in an area that will affect sand lizards. Where such changes can be taken on board there is a legal obligation to do so.

Planning guidance produced by the Department of Environment in October 1994 for England (*Planning Policy Guidance on Nature Conservation: PPG 9*) also gives very explicit direction that the

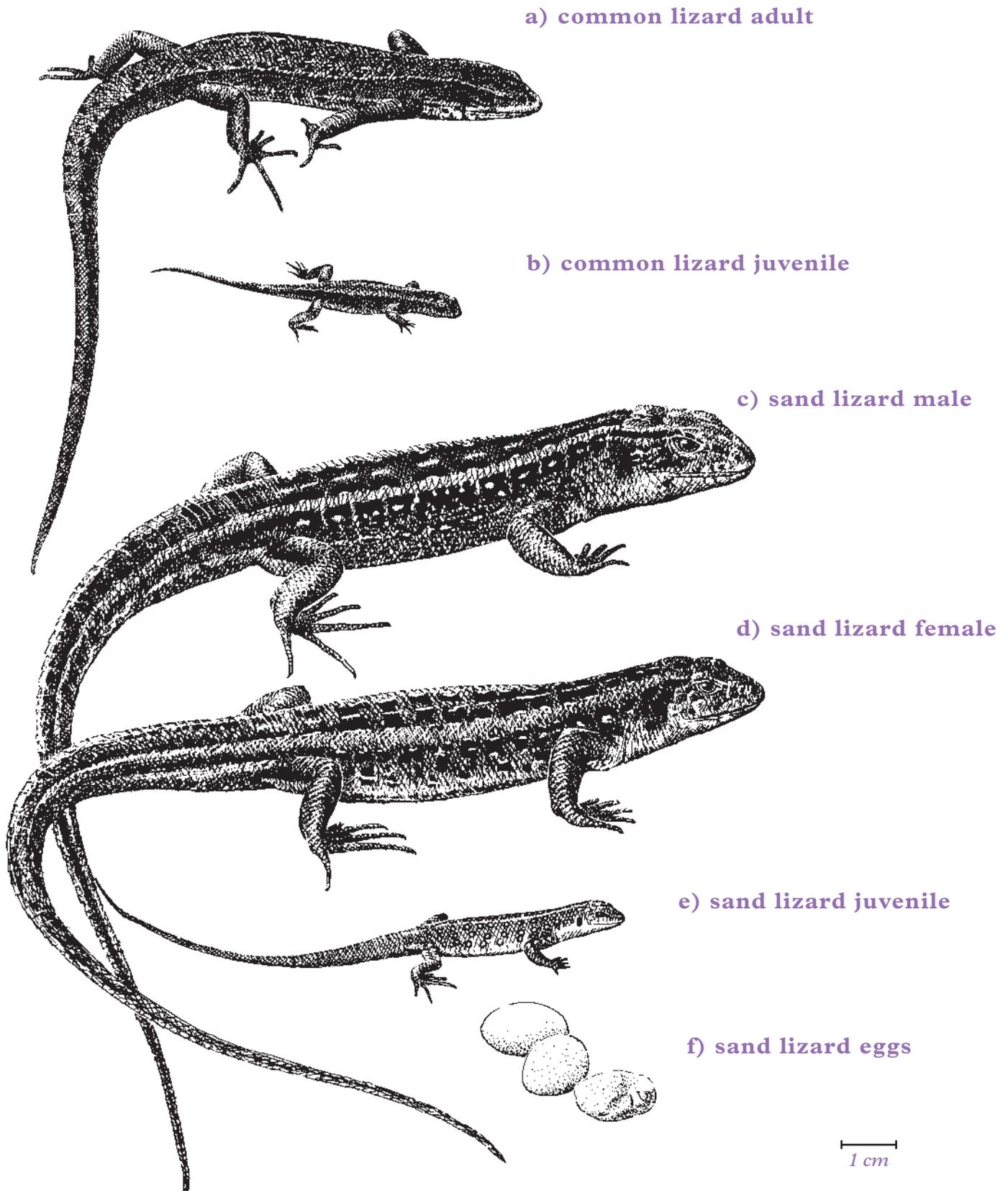
presence of protected species must be taken as a material consideration when determining land use changes or developing local plans. Equivalent guidance for Wales has been issued by the Welsh Office (*Planning Guidance (Wales): Planning Policy 1996 and Planning Guidance (Wales) Technical Advice Note (Wales) no. 5: Nature Conservation & Planning 1997*). Consequently sand lizards and their habitat must be taken into account by the planning authorities.

There may, however, be exceptional circumstances where sand lizard habitat has to be lost; sometimes even on designated sites. For example when planning permission is granted to allow development. In such circumstances the nature conservation case needs to be fully addressed when determining what course of action is appropriate at any site. Even where a site is to be lost the animals on that site remain legally protected and reasonable steps must be taken to safeguard them. A mitigation package should be expected and should be sorted out in advance within the conditions of planning consent. In any event, adequate effort needs to be spent to safeguard the animals (eg. capturing and moving animals) and providing them with a suitable alternative place (“receptor site”) to live. What constitutes a “reasonable” amount of effort is dependant upon the specific circumstances; the size and nature of the population, the extent of habitat loss or damage and the nature of the threat. For example it may be appropriate to improve habitat elsewhere or simply move animals to other parts of the same site provided that such habitat has been enhanced in order to support extra animals. After any mitigation exercise it is important to monitor the outcome. This may indicate that management needs to be changed to ensure the long term survival of the population.

7. Surveying and monitoring sand lizards

The sand lizard is difficult to observe in the field. It is well camouflaged, tends to hide away in vegetation and often only active during a few months of the year and under specific weather conditions. Even so, the presence and status of sand lizards can be assessed by a number of methods.

Figure 6: (a) common lizard adult and (b) common lizard juvenile, (c) sand lizard male, (d) sand lizard female, (e) sand lizard juvenile and (f) sand lizard eggs; (to scale).



Identification

An obvious pre-requisite to sand lizard survey and monitoring is the ability to identify the species reliably. Fortunately there is only one other native species of reptile in Britain with which the sand lizard could be confused, namely the common lizard *Lacerta vivipara* (see Figure 6 a. to f.). The wall lizard *Podarcis muralis* is the one (presumed) introduced reptile species that could be mistaken for the sand lizard. However this species does not readily use the same habitat as sand lizards, is extremely localised and, therefore, has not been included here.

The sand lizard is a short-legged, stocky species with a relatively large head. Adult sand lizards grow to about 9 cm from snout to vent, with a tail some one and a half times as long. Females are usually grey and/or brown, while males have green flanks which are vivid during the breeding season. Most animals have dark spots with light centre markings (*ocelli*) present on the sides and the back. Juveniles are a light to dark brown, have numerous and distinctive *ocelli* with white centres and a thin light coloured back band.

By comparison, common lizard adults are smaller than sand lizards. They are about 6.5 cm snout to vent (with a tail up to twice as long) and are much more slender. Their heads are notably narrower. Colouration is usually brown or olive. Females have dark flanks, a stripe along the centre of the back and more spots than the usually more uniform males.

Survey guidelines

Reptiles are ectothermic that is they derive the warmth of their bodies from external sources of heat energy. The sand lizard obtains most of this energy by “basking” in the sun. The only reliable way of surveying the species is to observe the animals while they are basking. Depending upon

both the season and prevailing weather, sand lizards may bask for the majority of the day or for as little as 20 minutes. Understanding the exact nature of sand lizard habitat, basking behaviour and survey techniques, ie. where, when, and how, is complex and requires experience and often many seasons of surveys to master.

Where: Even though the sand lizard is difficult to survey, it is very restricted in its use of habitat types. By understanding the habitats associated with this species it can be relatively simple to identify localities likely to have sand lizards.

Optimal sand lizard habitat consists of unshaded south-east to west facing banks, ridges, hills, etc. dominated with either mature dry heath or marram and with a high proportion of open sand eg. paths, erosion gullies, etc. Within such habitats the animal is most readily seen while basking on features such as path edges and open areas on banks, within gaps in the vegetation or commonly within the vegetation itself.

When: Surveys are best undertaken in the seasons when basking sand lizards are most likely to be encountered. These are:

Spring: late March to mid-May when the animals have emerged from hibernation and spend most or their time either basking or courting.

Autumn: late September to early October when the juveniles have emerged and are still found near unshaded areas of sand from which they hatched.

Even during these times, prevailing weather conditions will dictate the basking behaviour of the sand lizards. If the weather is too cold, windy, cloudy, raining or conversely too hot, without cloud, or dry and calm, the animal is rarely seen. In windy weather sand lizards are particularly skittish and if seen will usually be in sheltered areas at the base of vegetation. Ideal survey conditions are described in Table 1.

Table 1. Ideal survey conditions during different seasons

Season	Best Conditions	Time
Early Spring & late Autumn	Sunny, little cloud, light wind, c10+ °C.	1000-1230 & 1500-1700
Mid-Spring & mid-Autumn	Sun with cloud, light wind	0830-1130 & 1600-1700
Summer	Cloudy with Sun, light wind or sun after rain	0800-1000 & 1730-1830

As a general rule morning surveys should be carried out at the start of the first decent sunny spell of the day. If previous days have been cloudy or raining the corresponding first decent sunny spell will bring out to bask a higher percentage of a population.

“Test” egg-burrows can be found early in June in unshaded, predominantly south-facing areas of bare sand. Often more than one will be found in any one spot. The burrows have a flat floor, concave roof, and are about 2-3cm wide (these are illustrated in Figure 3). These are best found when the weather is clear, since heavy rain can make their identification more difficult and before any disturbance, such as trampling by people or animals. The advantages of surveying for test-burrows are that they are comparatively easy to locate and are present at a time when the adults are becoming more difficult to see as the weather gets warmer. However every care must be taken not to disturb such areas as this may lead to damage to newly laid eggs.

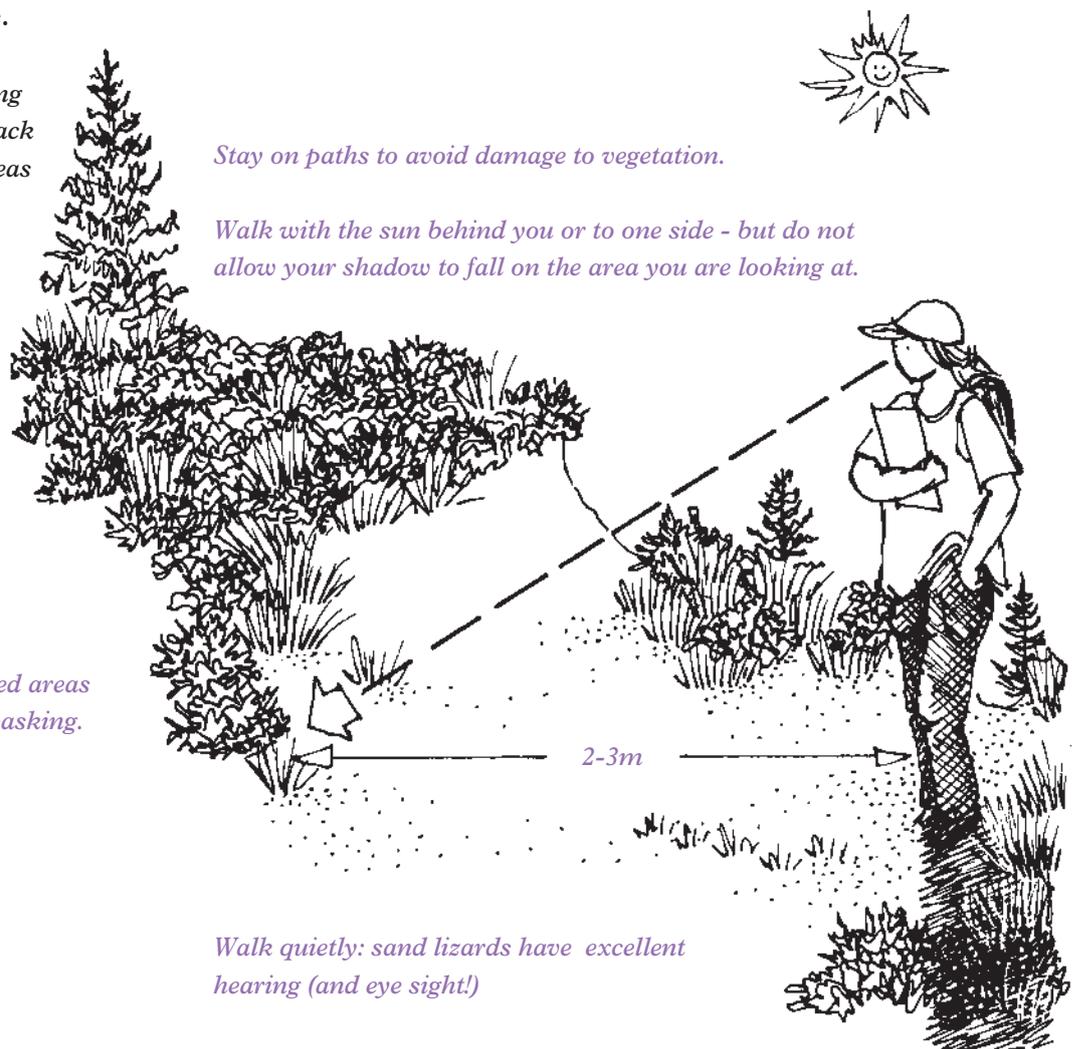
How: While surveying, every effort must be taken not to disturb basking sand lizards. If the animal becomes alarmed it will disappear either in the vegetation or within its burrow and become impossible to observe.

The way to look for sand lizards without alarming them is to walk very slowly without disturbing the vegetation. The basking animal will be facing the direction of the sun so it is advisable to try to have the sun at your back while surveying. This gives the surveyor a good angle of observation and the best light for seeing basking animals. It is generally best to survey along the sunny side of a sandy path edge. This minimises disturbance to both the species and its habitat while giving a much higher chance of observing basking animals. The observer should walk along slowly, focusing on favourable areas 2-3m ahead. This is generally the closest you can get to sand lizards before they disappear.

Even when taking care to be quiet, a number of animals will still become alarmed and disappear. This can often be heard as a distinct and typical “rustle” and the sound of moving lizards can be useful in revealing the presence of animals. If this is heard, the surveyor should carefully move away from the area and return 5 to 10 minutes later. Often the animal will return to the same place and revisiting these areas will give a reasonable chance of seeing the lizard.

Figure 7: when surveying keep the sun on your back and look in suitable areas some 2-3m ahead

Look in: sunny, sheltered areas where lizards may be basking.



Qualitative assessment

Simple “presence or absence” data (ie. qualitative data) allows an assessment of the distribution of the species. Successful surveys can confirm that sand lizards still occur at certain localities and identify previously unrecorded sand lizard sites and areas. Observations of newly hatched lizards (“hatchlings”) will show that breeding has occurred on site.

Searching different areas of a site can provide information about distribution within the site and can indicate how successful management (eg. scrub, sand, etc.) has been. However, it is very difficult to assess population size or to see population trends from simple “presence or absence” recording.

Local extinctions are hard to identify from occasional visits to sites. Rigorous survey is needed to demonstrate “absence”.

Quantitative assessment

The most valuable monitoring data are those that provide a measure of population size on a regular basis. These allow trends to be assessed and the evaluation of the relative importance of different sites and populations. However, due to the inherent difficulties in surveying sand lizards, the relatively short survey times and seasons, and the lack of experienced surveyors, accurate estimation of populations is often difficult and often prevents sufficient sampling effort or regular monitoring.

Although different approaches for collecting repeatable, quantitative data for sand lizard have been tried, the most valuable appear to be pre-determined transect walks (“Pollard walks”). These are designed deliberately to include habitat areas most likely to reveal adult and juvenile lizards while causing the minimum amount of damage and disturbance. For this reason the majority of survey transects make full use of any sandy paths. This bias in the survey technique is important to maximise the chance of seeing lizards and so provide sufficient data for comparison. This necessarily means that strict comparisons between sites can be difficult.

Surveying along these transects should be undertaken about four times during favourable survey conditions in Spring to assess the adult population, and again in Autumn to assess breeding success. Such surveys can be attempted annually to reflect the population trends, preferably by the same surveyor(s) for comparability. Accurate field observations both of the time spent surveying and the prevailing weather conditions should be recorded to help subsequent interpretation.

Habitat quality assessment

It is possible to make assumptions about the likely health of a population on the basis of the habitat condition. The continued presence of good habitat (see Section 3), looking at structure, presence of egg laying areas, etc., would be seen as positive, while the loss of such features would be an indication that the population was likely to have been reduced in size. Certainly changes in habitat quality should guide decisions about necessary changes in management. However it is unwise to rely on habitat assessment alone; some direct observation of sand lizards (or their activity) is needed to confirm continued presence and breeding success.

8. Advice and assistance

Advice and both financial and practical assistance can be found from a number of different sources. A first point of enquiry is the headquarters of the appropriate statutory nature conservation organisation (SNCO); English Nature can be contacted at their headquarters in Peterborough (01733 455000) and the Countryside Council for Wales in Bangor (01248 370444). Where handling or capture is contemplated, or other activities such as photography that may cause disturbance, a licence is required. Enquiries should be directed towards the appropriate SNCOs headquarters. Alternatively the local or regional offices of these can be contacted, especially if the enquiry relates to site specific or planning issues. Depending on the nature of the enquiry, some site specific or planning issues are best addressed to the Planning Authority. The addresses and telephone numbers of local SNCO office and planning departments can be found in the telephone directory or in the case of the SNCOs by contacting the organisations headquarters.

Financial support may also be available from the SNCO through grant aid (where a maximum of 50% of the costs can be covered) or via a Management Agreement for work on designated sites. English Nature’s Species Recovery Programme provided funding in partnership with the Herpetological Conservation Trust, Worldwide Fund for Nature and Countryside Council for Wales over a three year period for the conservation of this species (1994 -1997). Further funds are available to help support the national Species Action Plan that has developed from the Species Recovery Programme project.

The Herpetological Conservation Trust (HCT) undertakes a considerable amount of practical conservation work for the sand lizard and provides specialist advice on its conservation. It also owns and manages many reserves primarily for reptiles. It was both contractor and a major financial supporter of the Species Recovery Programme and now joint Lead Partner (with English Nature) for the sand lizard Species Action Plan. HCT is based in Bournemouth (01202 391319).

Local authorities are responsible for many aspects of biodiversity conservation and especially for protected species. This includes education, strategic planning and development control and enforcement.

9. The future : an action plan for the sand lizard

A Species Action Plan has been published for the sand lizard by the UK Steering Group on Biodiversity (1995b). An outline of this and the main conservation objectives for the species over the next ten years is given below.

UK Action Plan objectives and targets

- To maintain all existing breeding populations at least at current levels and where possible enhancing them
- To reverse the fragmentation of sites by habitat re-creation and management
- To re-establish 10 populations in suitable habitat to restore the range and distribution of the species by 2000

Areas for action 1: Policy and legislation

Developing schemes and policies to encourage conservation action: It is important to encourage the development of appropriate schemes, or the inclusion of measures within existing schemes, specifically to support sand lizard conservation on heath and dunes. Such schemes and policies should encourage management and re-creation of heathland and dune habitats and facilitate the creation of links between existing habitats.

Areas for action 2: Site safeguard and management

Site protection: Although the majority of sites are legally protected ie. SSSIs, etc, not all receive such protection. There are still a number of sand lizard populations at risk even on protected sites. These threatened populations should be secured where possible or, if planning permission has been sought or even granted, adequate mitigation packages must be pursued.

Habitat re-creation: The re-creation of heathland from forestry plantations, cultivated fields, etc. is currently being pursued. Although the heathland re-creation schemes afford little short-term gain for the sand lizard within the first c20 years, they still remain potentially the single most important factor in sand lizard population recovery. It is essential therefore that when management plans for these re-creation schemes are developed the sand lizard is included and its management needs suitably catered for. Habitat re-creation is also possible for dune systems; these schemes also need to include measures for sand lizard conservation in areas where sand lizards occur or those that could be considered for translocation.

Areas for action 3: Species management and protection

Foci habitat management: Appropriate habitat management methods have been summarised in Section 4. The national Species Recovery Programme (funded by English Nature, Herpetological Conservation Trust, Worldwide Fund for Nature and Countryside Council for Wales) undertook management on 120 *foci*. This management needs to be continued to maintain the condition of these sites and further management undertaken to improve sites that are currently in an unfavourable condition.

Where possible *foci* habitats need to be linked to each other by appropriate management.

Foci protection: Of utmost importance are effective fire control measures and this is especially so on heathland sites. As well as ensuring good on site protection measures, further progress is needed in preventing deliberate fires. Such measures would include education and enforcement and will need involvement of the police and fire services as well as conservation bodies.

On many protected sites sand lizard areas (ie. foci) are often not given due regard by landowners/managers undertaking land management activities often for conservation purposes. This may result in the specific management requirements for the species being over-looked, or other activities being done that result in damage. Such foci need to be seen as separate and sensitive areas and managed or protected accordingly. Appropriate means to achieve this need to be included in relevant management plans. Protection of foci needs to address the effects of grazing, burning and mowing regimes, rabbit gassing and sett-blocking. It also need to consider the impact of disturbance or damage on sandy paths/tracks where sand lizard eggs are developing; such damage is predominantly caused by vehicles, bicycles and horses.

Translocations: Further translocations are needed to off-set the loss of populations and should have the objectives of restoring the historic range and occurrence of the species on representative habitats. *Not all of the potential sites identified as suitable for sand lizard translocations have been acted upon and there is still considerable scope for further translocations. There is a continuing priority towards dune sites.*

Areas for action 4: Advisory

Ensuring awareness: It is important to ensure that landowners, managers and local authorities in areas with sand lizards are aware of the presence of the species, the legal status and conservation needs. It is important that good objective advice is available when needed. There is an on-going need to liaise with site owners/managers to promote good management practice, secure translocation proposals, prevent foci damage and aid development of long-term management methods.

Areas for action 5: Research and monitoring

Monitoring: Long term, systematic monitoring of key sites in Merseyside, Weald and north Surrey and Dorset should be instigated to assess future population trends.

Database: Survey data needs to be logged on to the Rare Reptile Database and appropriate levels of access and dissemination of information need to be developed.

Research: Most research essential for sand lizard

conservation has now been completed, however there are still areas in which further applied research would be useful:

- a. Analysis of the genetic variation of the three sand lizard “races” in Great Britain.
- b. Analysis of secondary egg-laying substrates ie. clay spoil and chalk in the context of global warming.
- c. Significance of predation by crows, cats and pheasants.
- d. Dispersal of immatures in particular with respect to the potential for colonisation.

Areas for action 6: Communications and publicity

Raising awareness: It is important to publicise the conservation needs of sand lizards and to explain about the rarity of the species. This could involve the use of zoos, other captive collections and the media.

10. Useful addresses

English Nature,
Northminster House,
Peterborough,
PE1 1UA.
01733 455000

Countryside Council for Wales,
Plas Penrhos,
Ffordd Penrhos,
Bangor,
Gwynedd,
LL57 2LQ.
01248 370444

Herpetological Conservation Trust,
655a Christchurch Road,
Boscombe,
Bournemouth,
BH1 4AP.
01202 391319

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