

# Moving lizards and snakes from the path of new roads and improvements: how to get it right

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## 1 INTRODUCTION

### 1.1 The Scheme

The M6 extension scheme involves the upgrade of the A74 Trunk Road in order to improve the vital strategic connection between the M6 in England, and the A47(M) in Scotland. The improvement focuses on a 8.6km (5.4 mile) section of the existing road, from the end of the M6 motorway at Junction 44, Greymoorhill, to the start of the A74(M) at Guards Mill, just to the south of the Scottish Border at Gretna. Prior to the works, the A74 trunk road consisted of a dual 2-lane carriageway; the last 'missing link' in the motorway network between London and Glasgow, and the project involves a widening of the route to a 3-lane motorway. In addition, a new All Purpose Road (APR) for local and non-motorway traffic has been constructed. The location of the Scheme is shown on Figure 1 and the route is illustrated in more detail on Figure 2. The construction activities are due to be completed by December 2008 and the reinstatement and new planting are also likely to be substantially completed by the end of the year.



Figure 1

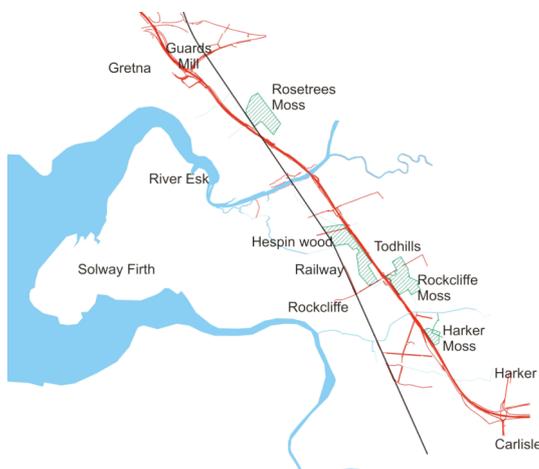


Figure 2

## 1.2 Ecological Impacts of the Scheme

Cresswell Associates have been responsible for the environmental co-ordination and all of the specialist ecological surveys required for this scheme: initial habitat and protected species surveys were followed by a suite of species-specific surveys covering a range of fauna and flora.

The majority of the route involves on-line widening and improvement and it has been possible to avoid most of the features of nature conservation value in the vicinity of the scheme. The majority of the land-take for the works involved existing road verge habitats. Whilst these were of limited intrinsic nature conservation value, they were found to support locally important populations of reptiles. This paper focuses on the design and implementation of the measures taken to conserve these populations.

## 1.3 Reptiles in Britain

There are six species of reptile native to Britain; three species of snake and three species of lizard. Only two of these species have been found in the vicinity of the scheme in question: the adder (*Vipera berus*) and the common lizard (*Lacerta (Zootoca) vivipara*).

In recent years, changes in land use, intensified agricultural management, and habitat fragmentation have led to a decline in reptile populations across the British Isles. Whilst common lizards are relatively widespread within suitable habitats in northern England and southern Scotland, (although thought to be declining in many areas), adders are more patchily distributed, less common generally and even rare in many parts of the region. Both are identified as priority species in the UK Biodiversity Action Plan (UKBAP). As regular inhabitants of road verges across the UK, reptiles are also included within a grouped species action plan in the Highways Agency Biodiversity Action Plan (HABAP) and are also mentioned in the Scottish Government's Trunk Road BAP. Given the importance of the adder populations in particular, it was appropriate to consider measures to conserve these populations as part of the scheme design. In addition, the common lizards and adders found beside the scheme, are protected against intentional or reckless killing and injury under the Wildlife and Countryside Act, 1981 (and subsequent amendments) and as such, reasonable measures were required to avoid their incidental mortality throughout the course of the project (licenses are not required for such activities).

## 2 BASELINE SURVEYS AND ASSESSMENT

### 2.1 Background Information

Few past records of reptiles were available for the general vicinity of the Scheme: two records of adders from Rockcliffe Moss (an area of boggy woodland adjacent to the A74) in the mid-1990's, and records of common lizard from Hespian Wood (another area of woodland adjoining the road) and

Rockcliffe Moss, although there were also abundant anecdotal records of adders along the verge of the A74. The initial walkover surveys undertaken in 2003 also encountered adders and common lizards within areas of the verge to be lost under the footprint of the proposed carriageway widening and associated works.

Initial multi-disciplinary habitat and protected species walk-over surveys identified three areas of particularly valuable habitat for reptiles which were subsequently targeted for extensive reptile surveys: Rockcliffe Moss and the land around the adjacent Motorway Service Area, the relict parts of Rockcliffe Moss on the opposite side of the A74, and Harker Moss (another area of boggy woodland adjacent to the route). Each of these locations are highlighted on Figure 2. In addition, due to the proposed loss of the majority of the verge habitat, transect-based reptile surveys of additional selected areas of the verge were also undertaken in an attempt to confirm the extent of reptile populations along the verges.

## **2.2 Baseline Survey Methods**

The methodology for surveying reptiles involved establishing a series of 'transects' (lines) of artificial refuges (comprising 0.5-1.0m<sup>2</sup> sections of heavy grade flame-activated bitumen roofing felt). These refuges were placed at approximately 10m intervals, and were positioned in order to maximise their likely use by basking reptiles. They were preferentially placed near to pre-existing basking spots and other potential refuges, adjacent to structurally diverse vegetation, and in south-facing aspects. These refuges were subsequently inspected in parallel with comprehensive searches for basking individuals in the surrounding vegetation. The intention of these surveys was to confirm which reptile species were using the sections of road verge and their distribution within them. An additional aim was to confirm the apparent viability and health of the reptile populations. Any potentially important features such as potential hibernation sites were also identified.

Each site was surveyed 10 times between March and October 2003, under weather conditions suitable for basking reptiles. Surveys were generally carried out when the air temperature was between 12°C and 19°C, with partial cloud cover.

## **2.3 Baseline Survey Results**

Adult adders were observed on a total of 37 occasions during the surveys; juveniles were observed on a further 12 occasions. No formal attempt was made to identify the animals individually, so it is not possible to conclude how many of these records relate to 'recaptures', but the impression gained was that most did not. The majority of records of adders came from south of the Esk crossing. Only two observations, both of adult snakes and both in adjacent habitat in the vicinity of Rosetrees Moss, were made to the north of the Esk. To the south of the Esk, the adder populations appeared to be centred around Rockcliffe Moss, and the land around the nearby Service Area; the relict parts of Rockcliffe Moss on the opposite side of the A74 and

Harker Moss. At these locations relatively large numbers of adders were recorded. However, adders were also regularly encountered on the road verges some distance in either direction along the Scheme from these foci, and opposite Harker Moss. Where adders were encountered more frequently, the population appeared to be healthy, with a range of sizes of snakes of both sexes having been recorded, along with a number of juvenile animals.

Adult common lizards were observed on a total of 27 occasions; juveniles were observed on a further 9 occasions. The impression from the numbers and distribution of lizards observed along the Scheme was that common lizard populations were scattered along the route corridor, present in some sections of the verge and absent from others. In each case, in contrast to adders, common lizards appeared to be present at relatively low densities, other than within the two mossland sites themselves and in the open, successional habitats adjacent to Hespian Wood, where a number of lizards were recorded. Once again, few lizards were recorded north of the Esk crossing.

### **3 MITIGATION STRATEGY**

The Mitigation Strategy was designed in accordance with the principles set out in DMRB Volume 10 Section 4, Part 7 Nature Conservation Advice in Relation to Reptile and Roads, Highways Agency, (2005); the most valuable features were retained and protected, and the timetabling of works took full account of the seasonal patterns of reptile behaviour.

The aims were to minimise the likelihood of incidental injury or mortality to reptiles during the site clearance and subsequent earthworks; to promote the survival of any relocated or translocated individuals; and to achieve biodiversity gains where appropriate. For the purpose of this paper, the term 'relocation' is used to indicate short-distance movements of individuals to within the same area of habitat, whereas 'translocation' refers to the capture and release of reptiles some distance from their original location. Both activities rely on the physical capture and movement of individual reptiles, whereas 'displacement' is intended to describe the process of encouraging (or forcing) reptiles to move from one place to another through habitat modification and/or direct disturbance.

Best practice in this regard dictates that, wherever possible, reptiles should be relocated to locations adjacent to or in the immediate vicinity of their existing home ranges or population centres. Only as a 'last resort' should they be moved.

In the case of this project, the overriding considerations were the suitability of adjoining habitat and the density at which the animals in question were living. Along the majority of the route the earthworks affected the full width of the verges. The vast majority of the verges were bordered by a narrow strip of taller vegetation or hedgerow associated with the highway fence, beyond which was closely-grazed grassland or arable fields. In a small number of locations the verges were bordered by more suitable habitat for reptiles,

including the relict 'mosslands' from which the snakes and lizards probably colonised the verges decades before.

Given that common lizards appeared to be present at low densities and that there were strips of marginal habitat that would remain available to them associated with field boundaries, side road verges and similar areas, along with the mosslands themselves, the intention was to move individual lizards largely by 'displacement' into these adjoining features. It was also anticipated that this would need to be supplemented by some capture and relocation to remove any remaining animals but, again, these were to be released into adjoining habitat features. Depending upon the numbers involved, the carrying capacity of these adjoining areas were to be reviewed, with habitat enhancement to be implemented as required.

It was recognised however, that the majority of these marginal habitats would not provide adequate 'receptor' areas for the resident adders: (a) there were too many; and (b) their habitat requirements were more extensive. Whilst it would be possible to relocate a proportion of the populations back into the adjoining mosslands (for animals caught nearby, it appeared likely that the mossland areas would simply form adjoining parts of the snakes' 'home ranges'), the majority of adders would need to be translocated to a suitable 'receptor site' some distance from the scheme.

The mitigation works comprised five key stages as follows:

- Identification and enhancement of 'receptor sites'
- Translocation/relocation of animals
- Habitat degradation and installation of reptile-resistant fencing
- Further translocation/relocation of animals
- 'Destructive searches'

These are explained in more detail in the following sections:

### **3.1 Creation/Enhancement of 'Receptor Sites'**

#### **3.1.1 Remote receptor site for adders**

An area of land within Forestry Commission ownership to the west of Penrith was selected as the receptor site for adders translocated from the verges to be lost.

The site comprised a large area (approximately 80 Ha) previously managed as softwood plantation that had been felled approximately three years previously. The site is now earmarked as a 'natural regeneration' area and thus will not be subject to future forestry activities that would threaten the safety of any translocated adders.

The site comprised a range of south- and east-facing slopes (illustrated on Figure 3), along with an extremely varied micro-topography of ridges and furrows, stumps and tilted root-plates. Much of the ground was covered by a

significant amount of brash, with clumps of grass, ruderal herbs and regenerating trees and scrub (at a very early stage of regeneration).

These features combined to provide a huge range of basking opportunities, refuges and potential hibernacula for reptiles. Having identified that the site comprised potentially high-quality habitat for adders, it was necessary to confirm that: (a) the site supported a sufficient density of prey to allow the translocated animals to survive and breed successfully; and (b) the site was not already used by adders.

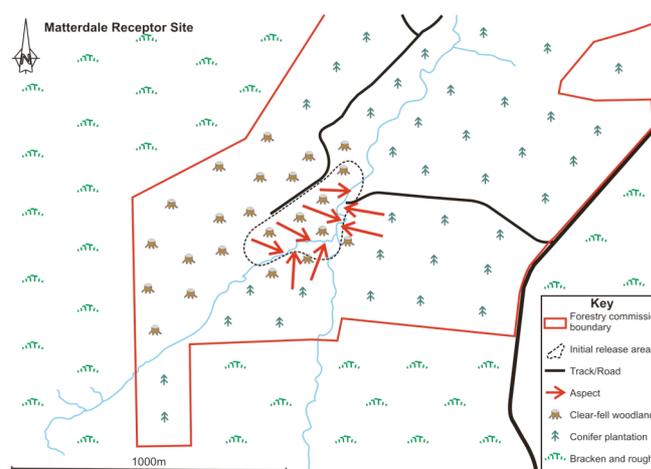


Figure 3

In May 2006 a grid of approximately 100 'Longworth' live capture traps were established in the centre of the 'receptor' area in order to investigate the presence of small mammals and to obtain estimates of population size for the adder's most frequent prey item, the field vole (*Microtus agrestis*). The traps were checked twice per day for three days. A total of 76 field voles were captured of which 25 were recaptured one or more times. Population size was estimated as approximately 250 individuals (using the Bailey 'Triple-catch' method (Bailey 1951) in the central 'initial release area' (shown on Figure 3). This represented a pre-breeding population, likely to rise in numbers substantially during the breeding season. In addition to field voles, smaller numbers of bank voles (*Clethrionomys glareolus*), wood mice (*Apodemus sylvaticus*) and common shrews (*Sorex araneus*) were also caught. These results indicated the presence of an abundant prey population.

The receptor site was visited on several occasions during April and May during which exhaustive surveys were carried out to confirm the absence of adders. During these surveys no adders (nor other reptiles) were found. This is likely to be as a result of the site's previous unsuitability when mature conifer woodland, and the fact that any nearby adder populations had not had time to colonise the site. As a result of these various investigations, the Matteredale site was confirmed as a good quality receptor site. No other candidate receptor sites were identified nearer the scheme that fulfilled the necessary criteria and for which consent could be obtained to release snakes.

No particular habitat enhancement measures were identified that would be appropriate to carry out across the Matteredale site; it was anticipated that the suitability of the site for reptiles would increase naturally over the coming years. Given that it was likely to be necessary to release adders into the site late in the season, three large artificial hibernacula were constructed to ensure that reliably frost-free refuges were available to the animals at the point of release. The design of these hibernacula is illustrated in cross-section on

Figure 4; the hibernacula varied in length, with the largest an 'L' shape approximately 10m long.

### 3.1.2 Adjacent receptor areas for common lizards

The majority of the adjoining habitat features were already in near-optimum condition for use by common lizards (albeit that some of them were rather small or narrow). Some limited tree felling and scrub clearance was undertaken within Rockcliffe Moss to help increase the basking opportunities (and hence carrying capacity) for lizards.

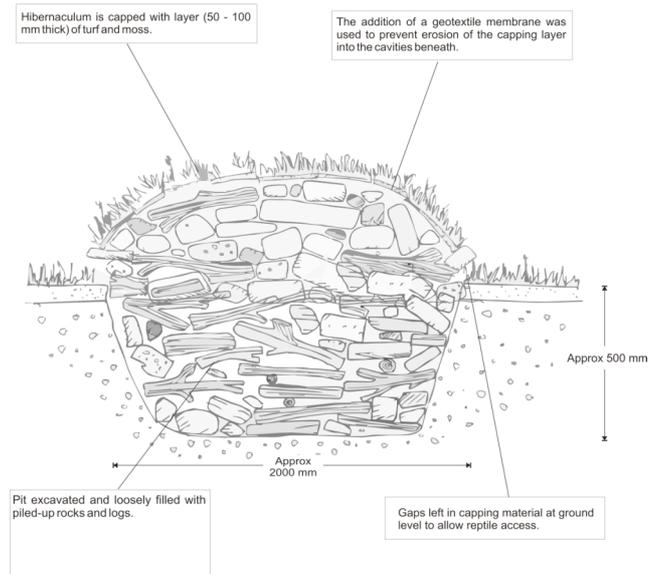


Figure 4

### 3.2 Translocation/Relocation of Animals

Artificial refuges were distributed throughout sections of road verge and other suitable CPO plots from which reptiles were to be relocated/translocated, during March 2006. Reptiles were captured from under and on top of these 'refuges', as well as from existing refuges and basking sites.

Individuals were captured by hand, and then held individually (in soft, breathable bags for snakes, and ventilated plastic boxes for lizards) and taken to the 'receptor' site(s) to be released. Mature adders were photographed (to allow individual recognition), weighed, measured (the thickness of the snakes' bodies was measured with care at 1/4, 1/2 and 3/4 of their body length) and sexed.

### 3.3 Habitat Degradation and Installation of Reptile-resistant Fencing

As the capture and relocation of reptiles progressed, following a search for basking animals, sections of road verge vegetation were trimmed to approximately 400mm and the arisings raked-off, under the supervision of an ecologist, to encourage reptiles to move into retained areas where appropriate. Some areas of verge supported a particularly structurally diverse grassland, with a dense moss layer which slowed the capture progress.

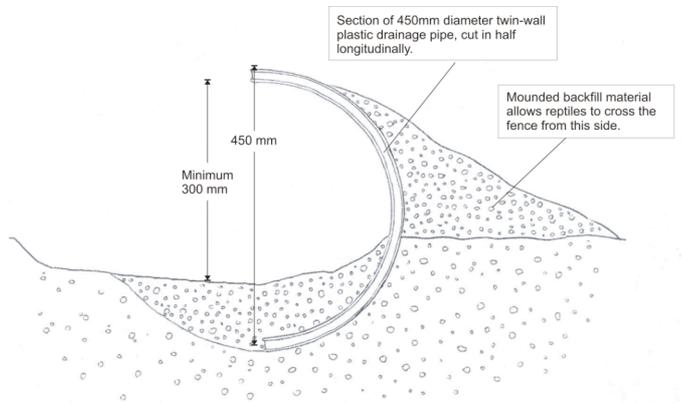


Figure 5

These areas were strimmed and raked several times. Immediately following this 'habitat degradation', a one-way reptile-proof fence was installed in each area, where the works boundary was adjacent to suitable habitats. The design of the fence is illustrated in Figure 5. The fencing served to prevent the previously translocated individuals and animals displaced from the verges by the strimming and raking-off operations from returning to the working areas. Its one-way design also allowed any remaining animals (those that retreated into soil fissures etc., to escape the strimming) to escape from the increasingly 'unfriendly' verges.

### 3.4 Further Translocation/Relocation of Animals

Following habitat degradation and fence installation, there was an intensive period of captures using the same techniques as described in 3.2, to remove any remaining reptiles. These were either transferred to the receptor site(s) or simply released outside the fenced area, as appropriate.

### 3.5 Destructive Search

The destructive search comprised the slow and methodical removal of vegetation and topsoil by machine, under the direct supervision of an ecologist, preceded by a final inspection for basking reptiles. Works were progressed in a manner that allowed any animals remaining in the affected section to be rescued without harm.

## 4 RESULTS OF THE TRANSLOCATION/RELOCATION OPERATION

### 4.1 Capture and Relocation of Common Lizards

Figure 6 indicates the numbers of lizards captured along the scheme. The distribution of captures reflects the results of the initial surveys, with the bulk of individuals captured from adjacent to the relict mossland sites and from the footprint of the APR close to Hespian Wood, but with common lizards present at relatively low densities along the majority of the scheme.

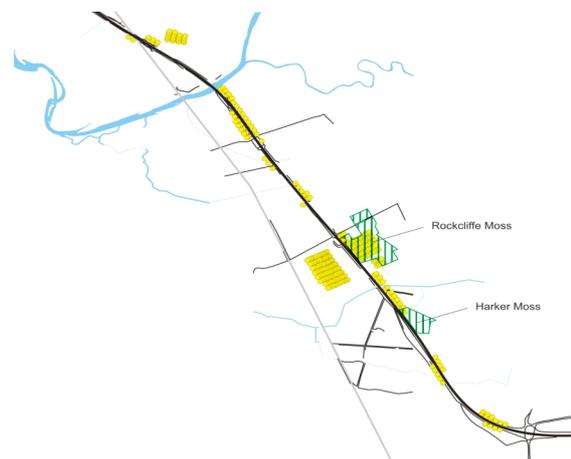


Figure 6

Figure 7 presents the reptile captures in each month of the operation. Both in 2006 and 2007, the bulk of the common lizards were captured during the summer/late-summer. This was as a result of some large daily totals when conditions were particularly good, coupled with an increase in the numbers of juvenile lizards available for capture at these times of the year.

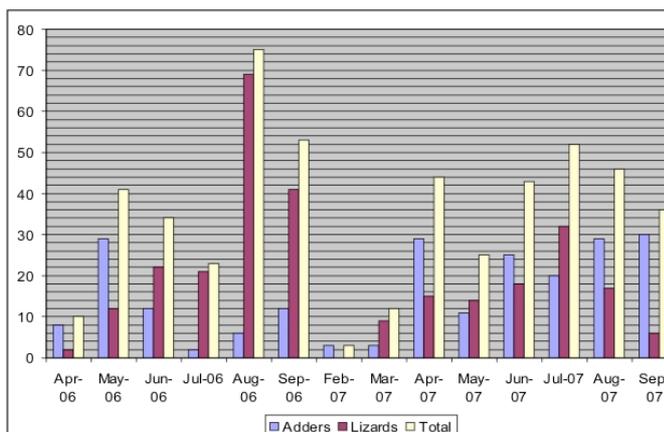


Figure 7

A total of 278 common lizards were captured and the majority of these were relocated to suitable release areas in the immediate vicinity. It is likely that a substantial number of common lizards were also displaced during the habitat degradation activities; these capture totals are not, therefore, likely to represent all of the common lizards that were present prior to the works.

#### 4.2 Capture and Translocation/Relocation of Adders

Figure 8 indicates the numbers of adders captured along the scheme. As for the lizards, the distribution of captures largely reflects the results of the initial surveys. The vast majority of the adders were captured on the verges adjacent to, between and opposite the relict mossland sites and in a small number of locations to the south. The adders originally identified in the vicinity of Rosetrees Moss, to the north of the Esk, appeared to be largely restricted to habitat features away from the road and none were captured from the adjacent verges during the project. The single young male adder captured in the vicinity of the Floriston junction, approximately 850m to the north of the remainder of the population in the vicinity of Rockcliffe Moss, may represent a dispersing individual. No other adders were seen or caught in this part of the scheme, neither during the walkover surveys, the targeted reptile surveys, nor the two years of intensive captures.



Figure 8

There was no clear seasonal variation in the capture totals for adders.

As a result of the spatial organisation of the capture operations: working back toward the adjacent mossland sites, the majority of the adders captured during the early stages needed to be translocated to the receptor site at Matterdale. These were animals from verges that bordered entirely unsuitable habitats. An increasing number during 2007 were relocated to the adjoining mosslands. Figure 9 indicates the numbers translocated and relocated each year.

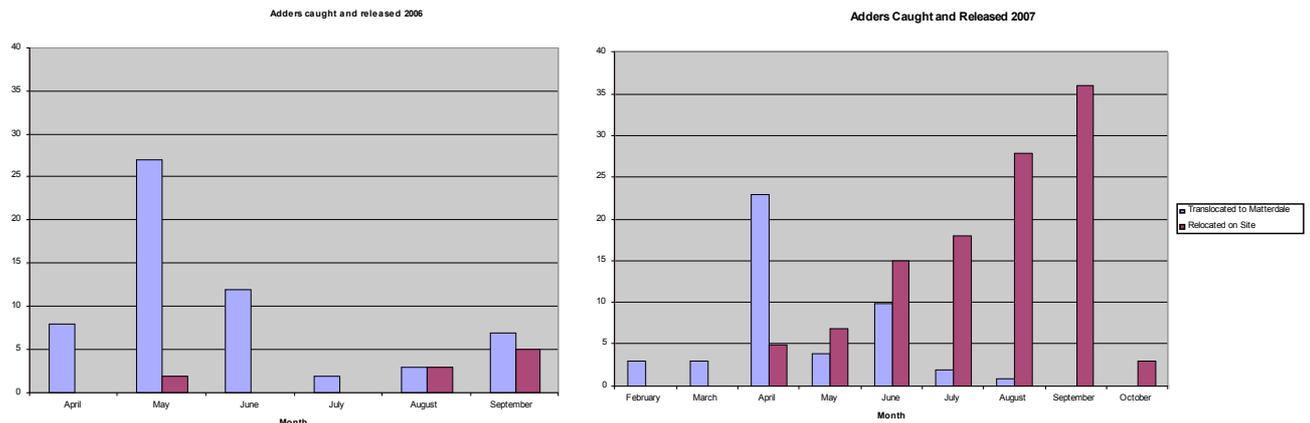


Figure 9

In contrast to the common lizards, it is likely that relatively few adders were displaced and that the capture totals given reasonably accurate indication of the numbers of adders present on the verges prior to the works. However, fewer than expected juveniles were captured. In all other respects, the populations appeared to be 'healthy', so it is unlikely that fewer than expected juveniles were being produced. What is more likely is that the youngest animals (particularly those in their first year) were harder to find (and thus to catch) and that they were displaced more readily from the works area than the adults.

A total of 228 adders were captured; of which 106 were released at the Matterdale receptor site.

The capture totals clearly indicate that adders were present along the verges to the south of the Rockcliffe (Todhills) junction at unusually high densities. Having excluded features that were entirely unsuitable for reptiles (areas of hard-standing etc), these relate to densities of approximately 75 individuals per Ha. Previous European studies have estimated densities of between 1-12 adders per Ha in suitable habitat. A recent study in Norfolk estimated a population density of 94 individuals per Ha, although the author thought that this may have represented a 'peak' in the population rather than a stable population size, following several years of exceptional prey availability and very sympathetic management (Beebee and Griffiths, 2000).

The translocated adders were released in five groups (sub-populations) within the Matterdale site. Each comprised a range of age and sex classes, as illustrated on Figure 10. This was to help promote the development of a self-sustaining 'meta-population' into the future.

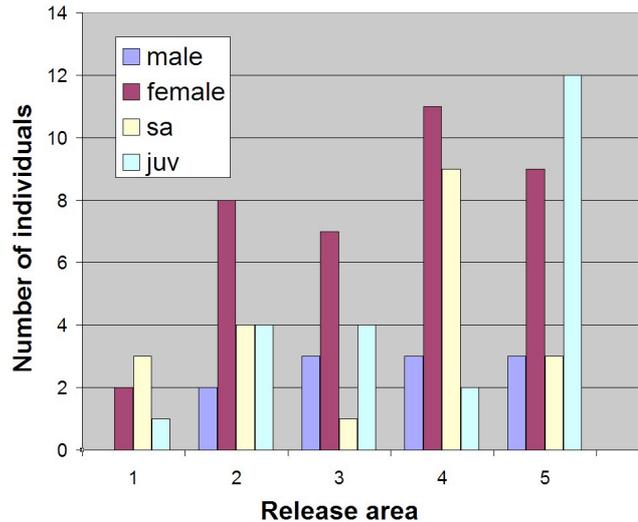


Figure 10

## 5 Monitoring of the Translocation Operation to Date

### 5.1 Monitoring Continued Prey Availability

The small mammal trapping exercise was repeated during autumn 2006 and spring 2007. Unfortunately, this revealed a dramatic reduction in numbers of field voles. This was not as a result of adder predation: a survey of an adjacent area separated from the release area by a river (and thus unlikely to yet be colonised by the released adders; none had been seen in the area; and, being north-facing, it is less suitable for them) also found a dramatic vole population decline. Substantial variations in field vole numbers are not uncommon. These population fluctuations tend to be cyclic in nature and whilst they tend to be particularly marked in successional habitats (such as regenerating clear-fell) they were probably also something the adder population on the original road verges were subjected to. The small mammal trapping also revealed a corresponding increase in the numbers of other rodents, particularly wood mice, upon which the adders could also feed. In addition, in 2007 common lizards began to be recorded on the Matterdale release site (presumably having colonised the site from adjacent habitats); these too will provide the translocated adders with additional/replacement prey items.

### 5.2 Monitoring the Health and Survival of Translocated Adders

The release area provides the translocated snakes with a complex, high-quality habitat, with super-abundant part-covered basking spots and refuges. It is also difficult to negotiate when surveying as a result of its ridge and furrow nature and the amount of lying brash and stumps, resulting in slow and noisy progress and a huge number of trip hazards.

This has combined to make re-surveys of the area difficult and inefficient. Only 12 individual snakes have been captured or observed during the

monitoring visits to date. This appears far more likely to be a result of survey difficulties than some failure of the translocation operation. Indeed all of the animals seen and captured have appeared to be in good condition, and have included two groups of (three and four) juveniles. At least the first group had been born at Matterdale, since these were seen prior to any juveniles being moved there.

## **6 Discussion**

### **6.1 The New Verges**

The verges and associated planting along the new scheme have been designed to create habitats suitable for re-colonisation by reptiles from the adjacent suitable habitats (particularly the 'population centres' at the relict mosslands). The reptile resistant fencing will be removed at the end of the works. Thus, in the longer term, similar (or larger) populations of common lizards and adders would be expected to become established beside the new scheme as were present alongside the original A74.

### **6.2 The Matterdale Site**

Monitoring of the translocated population is intended to continue until 2012. The gradual regeneration of vegetation within this area is likely to continue to improve its suitability for reptiles and whilst, in the much longer term, parts of it may then decline in suitability, the topography of the site and substrate conditions will ensure that substantial areas remain as good quality habitat into the future.

## **7 Conclusions**

The objectives set for the operation have been met:

- To minimise the likelihood of injury or mortality of individual reptiles.

Very few animals were encountered during the 'destructive searches', indicating that the vast majority had been successfully captured or displaced prior to the earthworks; those few that *were* found were all rescued unharmed. No animals have subsequently been found within the works area, suggesting that the fencing has been effective in protecting the remaining population.

- To promote the survival of relocated and translocated individuals

Although relatively few translocated animals have been recaptured, all appeared to be in good condition and breeding has been confirmed at the receptor site. The numbers of animals relocated to adjacent areas has been sufficiently low and 'diffuse' that the survival of the relocated (and resident) animals is unlikely to have been jeopardised.

- To achieve biodiversity gains

In the long-term an equivalent or greater number of reptiles are likely to become established along the verges of the new scheme *and* a new, self-sustaining adder population will have been established in a part of the UK where they are patchily distributed.

## **8 Bibliography**

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