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Conservation Translocations

In this issue

New International and National Guidelines for Conservation Translocations

Meeting the Favourable Conservation Status Test for European Protected Species

Wood Ant Nest Translocations

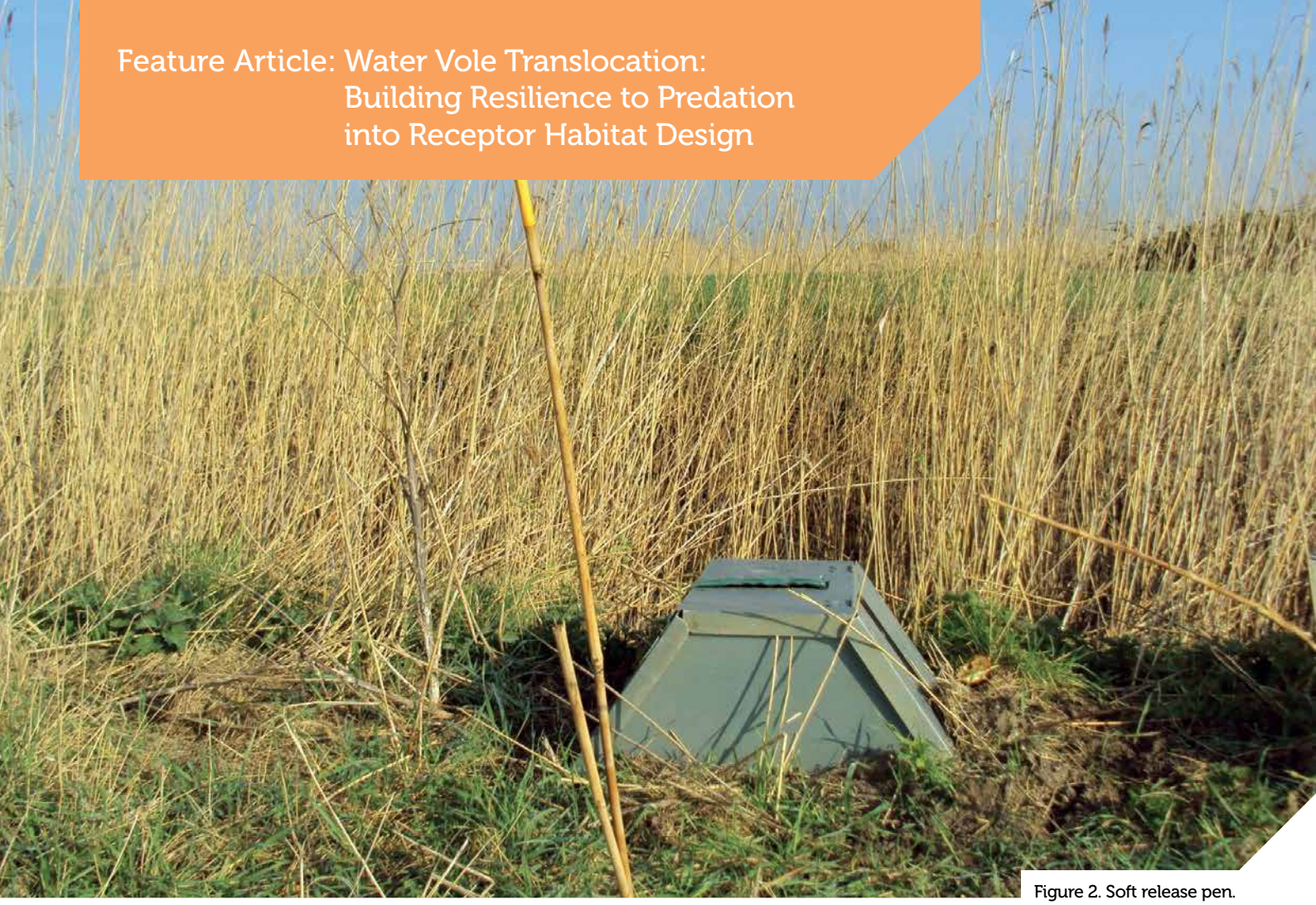

Figure 2. Soft release pen.

Water Vole Translocation: Building Resilience to Predation into Receptor Habitat Design

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The complexity of habitat design is considered to be a key factor in the success of water vole translocation. This article describes a water vole *Arvicola amphibius* translocation project and discusses whether predator resilience can be built into complex habitats designed primarily for water vole mitigation.

Introduction

In order to create new wetland habitat on Wallasea Island nature reserve in Essex, it was necessary to translocate or displace water voles from a network of ditches bisecting former arable land. This was undertaken against a background of continuing widespread decline of water vole populations in the UK, attributed to the spread of the introduced American mink *Mustela neovison*. Some sites in England still support large populations of water voles and there is evidence to suggest that habitat quality and complexity play a key factor. For example, surveys in the Chichester/Pagham coastal plain in west Sussex found evidence of water vole activity and mink at sites with an interconnecting network of ditches, isolated ponds and reed beds. Conversely little or no evidence of water vole activity was found in continuous linear water bodies (rivers, streams and ditches) despite the availability of apparently suitable habitat (National Water Vole Survey 1989/90). It is thought that the extreme linearization of riparian habitats increases the vulnerability of water vole populations to predation by mink and native predators, while increasing fragmentation of riparian habitats and a

reduction in patch size as a result of urban development may limit opportunities for recolonisation following predation events (Rushton *et al*. 2000). Due to the high numbers and widespread distribution of water voles at Wallasea Island, the habitat creation scheme provided an opportunity to assess the importance of habitat complexity in maximising water vole survival following translocation.

The site

Wallasea Island is a 774 ha nature reserve owned and managed by the Royal Society for the Protection of Birds (RSPB). The RSPB, working in conjunction with Crossrail and BAM Nuttall is in the process of creating a new wetland habitat for birds and other wildlife by re-using soil excavated during tunnelling operations undertaken as part of the London Crossrail project.

BAM Nuttall working as principle contractor on behalf of Crossrail at Wallasea Island has imported 3 million tons of excavated material from Crossrail's tunnels and stations. The imported material has accounted for nearly 80% of the total excavated material transported by rail and water from Crossrail tunnels, which removed 150,000 lorry loads from the roads of London. Excavated material from Crossrail wharfs was delivered to Wallasea Island on 2000-tonne ships; up to four of these ships were discharged each day across two, large, purpose-made pontoons and an 800 m conveyor system; the materials were then moved into final position on the site by dumper trucks.

The project timescale and work schedules have taken account of legally protected species including water vole, otter *Lutra lutra*, badger *Meles meles*, European eel *Anguilla anguilla*, adder *Vipera berus* and common lizard *Zootoca vivipara*, as well as breeding birds. Habitats within the site comprise arable, extensively managed and semi-improved grassland, field margins, flood embankments and an extensive network of ditches and soke dykes. Approximately 167 ha of existing arable farmland habitat and 9080 m of soke dyke and ditches will be lost as a result of the wetland creation scheme.

Between March – April and September – October 2013, 206 water voles, 50 adders and 8,200 common lizards were translocated outside the Crossrail works area but retained at Wallasea Island site in enhanced or newly created habitats.

Figure 1. Water vole with radio-tracking device (courtesy of Thompson Ecology).

The project aimed to enhance biodiversity across the site. Partnership with RSPB was a key part of Crossrail's sustainability strategy and the project was awarded Gold for Habitats and Biodiversity at the Green Apple Awards in November 2014. The award was in recognition of implementation of environmental best practice in relation to ecological mitigation works.

Translocation and predation

An extensive water vole survey in 2012 gave an estimate of 124 breeding female water voles (186 individuals) using methodology defined by Strachan (2006). Following consultation with Natural England and the issue of a licence by the Wildlife and Licensing unit, a water vole mitigation strategy was agreed that included large-scale displacement and live cage trapping and translocation. The results of the displacement study are still being assessed and are not discussed further in this article.

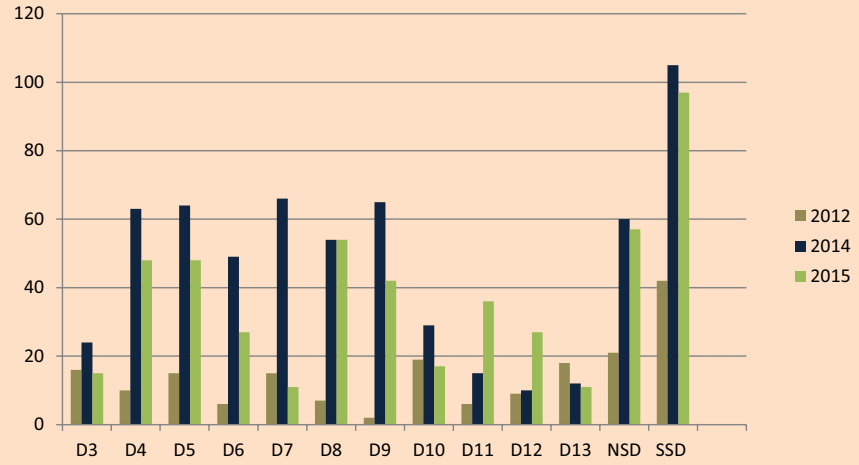
In total, 23 adult water voles, representing approximately 10% of the population, were trapped and fitted with radio tracking devices (Biotrack product code: Pip Ag393 cable-tie collars, weighing 3.2 g; Figure 1). Eleven of these voles were translocated into soft release pens (Figures 2 & 3) outside the proposed works areas in 2013. Each water vole was released immediately following its capture into an individual soft release pen. A total of 100 metal A-framed soft release pens (Figure 2) were partially dug into the ground and left *in situ* for seven consecutive days following the release of an individual water vole into each pen. The pens were spaced at 25 m intervals along the western edge of the site within a newly created water vole receptor site and along three existing linear ditches. Males and females were released into alternate pens, hay was supplied as cover and a supply of food comprising apple, carrot and cucumber was supplied daily until the water voles had vacated their pen.

Figure 3. Water vole in soft release pen.

The construction of each soft release pen enabled the water voles to burrow out of their own accord.

Each translocated vole was radio tracked and located once a week for 12 consecutive weeks. Radio tracking revealed that five of the 11 translocated water voles survived to set up new territories and remained within 50 m of their soft release pens over the monitoring period. Four voles were tracked to a fox *Vulpes vulpes* den (confirmed by auto-remote trail camera), located approximately 150 m north of the channel where the water voles had been released. The water voles were assumed dead and predated by foxes and no further movement of the tracking devices was recorded. Two more voles were never located on site despite extensive tracking effort using vehicles and an experienced tracking team. It is likely that the two missing water voles were taken by birds of prey, possibly marsh harrier *Circus aeruginosus*. Whilst foxes appeared to be the primary predator affecting the radio-tracked animals, their presence appears to have had no adverse impact upon the population to date (Figure 4).

Although there is currently no evidence of mink at Wallasea Island, future incursions cannot be ruled out. Mink are commonly associated with wooded or scrub cover close to aquatic habitats and generally avoid open and exposed sites (Dunstone 1993). The development of the site as a wetland, providing habitat for ground-nesting waders and wildfowl, will make it more attractive to many predators including mink. The design of new water vole habitat at Wallasea Island (Figure 5) has therefore incorporated a structurally complex ditch system in combination with pools (Figure 6) and scrapes providing both refuges and a focus for future recolonisation. As well as mitigating for the loss of existing field boundary ditches, this new habitat should be a key element in a cryptic landscape restricting access for predators of ground-nesting birds across the island and increasing the likelihood that potential prey will be overlooked, or the costs in effort will divert predators away from potentially productive but difficult to access areas.



Key: D3 – D13 = Ditch numbers. SSD = Southern Soke Dyke. NSD = Northern Soke Dyke
Y axis shows number of water voles

Figure 4. Water vole population comparison data (courtesy of Crossrail).

Figure 5. (Above) Wallasea Island wetland creation scheme design (courtesy of RSPB).

Figure 6. Water vole receptor site (courtesy of RPSB).

Predation of water voles is likely to be focused directly or opportunistically within the ditch system; indeed it is likely that ditches will act as a highway increasing the probability of opportunistic predators encountering water voles. It is suggested that by creating a new ditch network that is as complex as possible with good vegetative cover the likelihood of active burrows being overlooked or missed entirely by predators is greatly increased.

Post-Translocation Population Levels

Monitoring was undertaken at Wallasea Island in April 2014 and 2015. All enhanced ditches, the receptor site and existing ditches where water voles had been displaced and/or translocated into, were re-surveyed using the same methodology as during the initial 2012 water vole survey. A population estimate of 616 and 455 water voles (respectively) was recorded. These results indicate that although the number of individuals decreased from 2014 to 2015, the overall water vole population following large-scale translocation and displacement has increased by approximately 35% since 2012 (Figure 4).

The increase is considered likely to be attributed, in part at least, to the ecological enhancement works that were undertaken within the retained riparian habitats during 2013 prior to translocation. This included dredging of silt and removal of excessive emergent vegetation to increase water flow within the channels. Where connectivity between adjacent ditches had been lost, culvert repair works were undertaken to reinstate connectivity across the site.

Conclusions

Post-monitoring studies indicate that translocation and displacement of water voles at Wallasea Island was largely successful. There has been a 35% population increase since the baseline survey in 2012, prior to the commencement of Crossrail soil relocation and habitat creation works. Evidence that foxes predated water voles fitted with radio collars following release into the new ditch system demonstrates the potential impact of predators, although it is not known whether the radio collars increased the vulnerability of water voles by acting as an impediment to escape or as a visual or auditory attractant.

Future translocation and habitat creation projects should consider the potential impacts of mink, foxes and other predators, as well as habitat features such as scrubby areas or rabbit burrows likely to provide denning sites for foxes, when selecting suitable translocation sites. The impact of native predators on fragmented water vole populations is often overlooked (Forman 2004), particularly when there is no evidence for the presence of mink. However, this study suggests that foxes had no long-term impact on the water vole population at Wallasea, unlike mink, which are known to be a potential threat to the survival of fragmented water vole populations or meta-populations (Dunstone 1993). The recovery of the water vole population at the receptor site at Wallasea provides evidence for the importance of a complex ditch system increasing the available area of water edge habitat and the total area for foraging and refugia than might otherwise be expected to be present in a linear ditch system (Rushton *et al*. 2000).

The more complex the habitat, the greater the opportunity for a stable meta-population of water voles to establish and the greater the likelihood that rapid colonisation will follow major predation events. Serious consideration should be given to restoring and enhancing water vole habitat with resilience to predation as a key component. It is hypothesised that increased habitat complexity may even allow mink and water vole to co-exist (Barreto and Strachan 1998). It is therefore strongly recommended that future studies investigate the design of new or existing complex habitats where mink are also known to be present.

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