Water vole mitigation guidance - Important updates for evidence-based good practice.

"It is still largely unknown how water voles react to 'displacement'…The wide acceptance of the use of 'displacement' as a mitigation technique is therefore based on the belief that it is a successful and cost-effective option, without many scientific trials to support this assumption."

(Water Vole Conservation Handbook, 2006)

Introduction

The publication in 2006 of the revised edition of the Water Vole Conservation Handbook (Strachan and Moorhouse 2006) provided a valuable update on aspects of the species' ecology and conservation. This publication was intended as a guide based on perceived best practice at the time. It was not intended to be an inflexible technical manual. Although the thrust of the Handbook's chapter on development mitigation was designed to encourage the retention of the species 'in situ' by avoiding impact to their habitat, in many instances this has proven impractical. Natural England conservation licences have been issued to remove water voles where there is no other option. Action under such licences should result in a meaningful nature conservation gain for the species.

Removal by Displacement

The revised 3rd edition of the Water Vole Conservation Handbook (December 2011) is quite clear that the removal of water vole populations from development footprints by employing a process of 'displacement' through habitat removal has a limited application as a field technique. Its utility is relevant for a short time in early spring where populations are either present at low densities or seasonally absent from a site. An assumption was drawn that the removal of a limited amount of habitat prior to the main breeding season would initiate movement by individuals to other parts of their wider territory. This process would be assisted by an ecological tendency for over-wintering individuals to disperse naturally at this time to seek new mates (Strachan R. personal communication). Displacement by habitat removal was limited in recommendation to lengths of less than 10 metres and no greater than 50 metres. Prior to this guidance the displacement of water voles by habitat removal was a commonly utilised technique to clear significant areas of their presence. It has been employed at various times of year and is still widely perceived to be a legal means of removing water voles from a site without recourse to a licence application.

The perception that this technique was actually effective was based on a questionnaire research project (English Nature - No 415) which was published in 2001. This report made clear that its conclusions were 'subjective and monitoring was not carried out'. Displacement was defined as a "method of removing the vegetation cover, thereby persuading water voles to voluntarily leave a site and move to another area". None of the case studies in this report identified individual water voles with either transponders (electronic micro-chips) or in any other way. None cited evidence from radio-collared individuals. There were project examples of water voles remaining in-situ following strimming, turf stripping and sheet metal piling. They were recorded as "swimming around workmen" while "trying to re-enter old burrows" (English Nature - No 415).

In July 2003, Cresswell Associates undertook a study using radio-collared individuals to assess their response to displacement after strimming. This study demonstrated that once the vegetation covering their abode was removed they continued to utilise their burrow systems via underwater entrances. They left no visible field signs of their presence and foraged away from their burrows to obtain food in the surrounding environment (Dean M. 2004). A similar study was undertaken by the London Wildlife Trust at the RSPB's Rainham Marshes Reserve. This project attempted to capture all the water voles in the 100 metre footprint affected by development prior to strimming for displacement. Twelve individuals were captured, radio collared and then released. After strimming they remained in their burrow systems but were observed sitting on piles of cut vegetation on the bank side. The verifiable recorded mortality for this project was 100% (Tansley D. personal communication). In 2006, a large-scale mitigation project on a system of Soke dykes in East Anglia captured more than 470 water voles from over 13km of habitat despite a regime of vegetation cutting designed to effect their displacement (Markwell, H. 2008).

The 2011 Water Vole Conservation Handbook itself cites four case studies where the displacement technique has been used (pages 91, 96, 97-98 and 102) and each time has been shown to fail. Natural England have confirmed that there is no robust evidence to suggest that displacement of water vole populations through a process of habitat removal is effective (Mitchell-Jones T. personal communication).

Displacement, if considered in its basic elements, is employed to remove a water vole from its place of shelter and rest. To do this, the technique must provide either a positive attraction away from its burrow system or a negative repulsion. This negative repulsion must have sufficient impact to ensure movement from the security of its territorial abode and must involve disturbance of the animal whilst using its burrow. The physical elements of displacement – removal of a food source and cover from predators – are intended specifically to ensure repulsion and sustained effect. Page 14 of the Water Vole Conservation Handbook (2011) states that "riparian vegetation…serves as both their food and shelter". The Wildlife and Countryside Act 1981 (as amended) specifically protects any structure or place a water vole uses for shelter or protection. Therefore displacement, although largely ineffective, seasonally-limited to a very short period in the early spring and only applicable to limited areas, should be covered by a licence. The lack of evidence to support its efficacy, despite its prevalence of use, makes a lack of regulatory control all the more worrying.

Displacement projects have commonly taken little account of the suitability of surrounding habitat. If there is vacant habitat adjacent to an established water vole colony then it is likely to be unsuitable for a reason such as: poor vegetation structure, unsuitable burrowing substrates, high numbers of brown rats, drought or flood. Where unoccupied habitat exists in the adjacent countryside, it will largely be due to wider factors such as predation by North American mink (*Neovison vison*).

Water vole killed and eaten in territorial fight

Water voles are highly territorial and demonstrate considerable fidelity to their natal territories. Although males can range more widely through a landscape, females and juveniles tend to remain within a colonial territory until changing weather patterns force movement. As temperatures drop, water levels rise and food availability decreases, water voles will disperse widely into the surrounding environment. High overnight rainfall can often prompt this behaviour (Gow personal observation). In captive populations maintained in outdoor enclosures, incidences of communal aggression become much more frequent at this time. Water voles can be savage fighters. Where colonies adjoin at high density habitat removal will at best push individuals directly into areas of already occupied territory leading to significant injuries and deaths.

Other methods of displacement which have been trialled are the forced flooding of burrow systems by the installation of artificial dams and the sectional drainage of water courses using the same methodology. Wild water voles will typically occupy complex burrow systems running from the water's edge up to the bank tops. At times of water fluctuation they will move up through these. In extreme flood conditions they will try to take refuge in rough vegetation on the bank tops or climb up into adjacent shrub cover. While it is very likely that many individuals perish as a result of such events they may also be forcibly dispersed into other areas of the surrounding landscape (Tansley D. personal communication). Studies have shown that where they can survive in the vicinity of their original burrows they will rapidly return when the water level subsides (Woodruff G. 2001).

A recent study - with a degree of verifiable survival - demonstrates that the drawdown of water can prompt water vole populations to move (Markwell H. 2008). Where the surrounding habitats are limited in extent or more equivocal in quality the impact of this technique on fragmented water vole populations is unverified. It is also known that water vole populations at high density will seasonally occupy dry channels and even embankments that are not directly linked to water bodies. The absence of adjacent water does not therefore preclude their presence in burrows. It may be that this technique if applied to populations in the spring when densities are naturally low could be an effective mechanism for clearing limited footprints.

Relocation by trapping.

Relocation of water vole populations by live trapping was originally considered to be an extreme mitigation option and was "not recommended in most situations" (English Nature – No 415). Although little was known regarding its effectiveness in 2001, this was prior to the initial attempts at large-scale reintroduction which commenced at Barn Elms in 2002. The Barn Elms project involved the release of 106 captive-bred individuals – descended from 3 pairs captured from a single fish farm on the river Itchen – supported by a further population of 36 individuals captured from the Kennet and Avon canal. In 2003, another smaller group of captive-bred individuals were released to reinforce the project and with subsequent minor reinforcements this population is still extant and flourishing. Barn Elms was initially chosen as a result of its highly suitable mosaic of well established wetland habitats; its difficulty of access for mink and for its excellent public awareness potential. Many other similar projects have now demonstrably established large, successful wild-living populations. Where habitat quality has been near ideal the survival rate of released individuals by the end of the breeding season has been as high as 85% (Gelling M. personal communication).

Although the long term survival of re-established populations will be complicated by issues of sustainability such as spatial isolation, mink control, habitat management and community support, the concept of reintroduction is demonstrably successful. The base criteria which govern success are as follows:

- The release of sub-adult water voles in populations of equal sex ratio.
- Their release at the right time of year. In June for over-wintered juveniles from the preceding year and in high summer (late July/August) for juveniles weighing in excess of 120grams in their year of birth. For adult wild populations captured in the autumn, release will be best targeted in the spring of the following year at a time of water stability and vegetation re-growth.
- Individuals captured in the autumn which weigh less than 160grams are unlikely to survive the winter even in well established receptor sites and will have to be held over for release in the spring.
- The release of substantial numbers from populations which are themselves genetically diverse and their reinforcement in subsequent years.
- The sustainable absence of North American mink from the wider landscape.
- The suitability of the sites for re-establishment. Sites where the main water systems incorporate or are linked to off-line wetlands, complex ditch or stream systems and have rising land round their perimeter - i.e. they drain into a landscape bowl and exit via a single point - are likely to be more secure than sites which are strongly linked to other water courses (Strachan & Moorhouse 2011).
- Security of site tenure with a ‘lead partner’ organisation based on the ground. This organisation should have the long-term will and ability to coordinate mink control and preferential landscape management for water voles.

Historically many water vole translocations undoubtedly failed due to the small numbers involved, unsuitability of receptor habitat, skewed sex ratios, age of individuals moved, timing of release and the isolation of receptor sites. Where water voles have been captured and then released in the reasonable vicinity of their original habitat there is evidence that they will go to significant lengths to return to their former abode. In one study involving a group of transpondered individuals, a single female returned to her point of capture across a ‘football field’ sized area daily for a period of three days (Strachan C. personal communication).

Trapping methods

Although the Water Vole Conservation Handbook (2011) recommends the use of collapsible Sherman traps due to their ease of transport, their complete construction from aluminium means that they are cold and prone to condensation. They do not afford significant space for dry bedding and, although practicable for experienced trappers, their employment can result in unnecessary mortality. Several purpose-built water vole traps are now commercially available. The best designs are light, complete units constructed from ½ inch weld mesh with a fixed rear section covered with wood or aluminium to create a water-proofed bedding area. They should not have a spring loaded locking mechanism to allow a light activation weight for the treadle and must have a simple locking bar fitted to their doors to ensure secure closure. This design allows for air flow and ensures bedding comfort.

Trapping of water voles is best timed for a period in early spring (March) when the species is generally active and before the onset of their main breeding season. This opportunity will however vary according to specific geographic location as breeding occurs progressively later further north. This is the most cost-effective option which will result in relatively low numbers of individuals being taken into temporary captivity. If trapping cannot be accomplished at this time then it is best targeted for the end of the breeding season between late September/early November. Although water voles can breed at any time of year - up to five litters per female per season - their largest litters are generally born in May.

Suckled female showing 8 teats

Female water voles exhibit a very strong bond to their blind and naked offspring. In the wild they have been observed rescuing offspring from flood events by moving them in their mouths. The Water Vole Conservation Handbook (2011) recommends that trapping programmes which capture suckling females should release them at point of capture and then seek to re-trap them after a period of weeks in the potential company of their offspring. Water voles have eight teats - four between their hind legs and four between the front. The top and lower two of these are not always readily visible. The middle four are generally obvious. On occasion teats can remain visible after one litter is weaned and before the birth of the next.

Teats on suckling female A

Female A with juvenile September 2011

Water voles additionally exhibit post-partum oestrus. Once they have given birth they shortly thereafter become pregnant again. If a captured female is suckling large offspring and is released by the time she is recaptured it is quite probable that she will have produced another litter. The best approach to this is to pre-plan mitigation works to ensure no trapping during the main breeding season. Where this is not possible and for relatively short distances of habitat - circa 50 metres - then trapping should only occur during the day to avoid overnight captures of suckling females. This process should ensure the checking of traps every two hours. If suckling females are captured, they can be released and their location recorded. It is likely that recapture will confirm their position and once the adjacent males have been captured and removed then perimeter isolation fencing can be erected to contain the females. Any dependent young can then be trapped three to four weeks later by which time they should be well-established. The adult females should still be released at this point for recapture after another three weeks by which time any further litter should be mobile and viable.

Exclusion fencing

As outlined above, water voles demonstrate a very high burrow fidelity. This can render effective exclusion difficult and consideration should be given to its practicality. For example if the impacted water course is to be completely removed it may be more pragmatic to capture the voles in-situ and destroy the habitat by either scraping or infilling. Trapping without exclusion fencing will however capture greater numbers of individual water voles from outside the development footprint. The installation of subterranean exclusion fencing into an occupied area of water vole habitat is likely to be a licencable activity in many cases (Mitchell-Jones T. Personal communication)

Where exclusion fencing is appropriate it should be set well back from the edge of the watercourse (> 5 metres) to avoid occupied burrow systems. In a recent project on the south coast of England, one metre high plastic water vole fencing was installed on site prior to trapping to retard the prospects of re-colonisation. As per the Water Vole Conservation Handbook, the fencing was buried to a minimum depth of 700 mm, and in most cases deeper. Individuals which were released outside the enclosure were subsequently recaptured again on a number of occasions within the fenced area. Initially re-entry of animals was through the one-inch square weld-mesh barrier across the watercourse (a specification recommended in the Water Vole Conservation Handbook to maintain water flow). On two occasions a dead sub-adult was found stuck in the weld-mesh at water level, attempting to re-enter the exclusion area. In both cases the animals had managed to squeeze their heads and front legs through but not their hind quarters.

Photo of water vole stuck in fencing

A smaller mesh size was retro-fitted and although successful in itself, re-entry of water voles was suspected from subsequent trapping results. It was presumed that this was through unidentified burrow systems running under the fence. Wire mesh with a hole diameter of a half inch or less (19 gauge) has been used successfully to contain captive water vole populations for many years. If this type of material is employed as an in-channel fence then the gauge size will need to allow for greater strength. Wire mesh grills in channels with even a limited flow collect detritus and need to be cleaned on a regular basis.

Wherever possible, and particularly where relocation is to adjacent habitats, a sunken weld-mesh out-turn fixed along the base of the fencing is highly recommended to deter undermining of fencing. Water voles are poor jumpers but good climbers. The Derek Gow Consultancy has worked with this species for many years using handling tubs of a depth of 45 cm and photography tanks of a depth of 36.25 cm. At no time has a wild-captured or captive water vole ever jumped out of either of these structures. However, given that ecologists often have less control of the construction site environment a greater fence height may be advisable to provide certainty of long-term exclusion. The material utilised for fence construction must be sheer and smooth.

The supporting posts should have flat surfaces to ensure a level join and must always be positioned on the inside.

Fencing across ditch systems to exclude water voles is commonly difficult to adequately install. Unless the ditch can be drained for installation there can be no guarantee of security. While materials such as interlocking sheet steel piling can be driven into the sides and bottom of a channel to a depth that will deter water vole recolonisation, they will inhibit the flow of the water course. A solution to this can be to allow the main channel to continue to flow while fencing off the banks on either side. The fencing design along either bank where it meets the water must be secure enough to withstand water wash and flood events while the fencing ascending the banks must be deep enough to deter re-access through established burrow systems.

Where this is not possible an alternative option may be to erect fences which traverse existing wet ditches on bunds constructed from stone. These should be 2 metres wide at their top to allow secure erection of fencing with a pipe culvert fitted below the normal level of the water table. These pipes should not be grilled to allow an uninterrupted flow of water. Although experience suggests that water vole access through these completely submerged culvert structures is uncommon, any remaining areas of suitable habitat within the enclosure should be checked for the species presence before destruction.

Receptor sites

Water voles are able to rapidly colonise suitable habitat where the source population is strong and where the receptor habitat is suitable. Newly created habitats often require at least two growing seasons in order to allow the establishment of strong root systems with good leaf cover. Many wetland planting schemes fail because the plants are left exposed by unexpectedly low water levels and lack of rainfall during the growing season. Steep banks also present a challenge for topsoil and moisture retention. The failure of initial planting schemes can often necessitate an unforeseen requirement to delay works or hold water voles over a longer period in captivity. This latter process will involve further breeding costs due to their relatively short reproductive life span. Allowing a realistic lead-in schedule for construction works is therefore clearly advisable. Much greater success in rapid vegetation establishment is commonly achieved through transplanting locally abundant emergent plants together with their rhizomes and attached silt/soils. This method can be enhanced by plug planting to further augment the available species range of plants

Future focus.

Commonly in development-led mitigation projects the prime preoccupation of consultants has simply been to remove populations of water voles from individual sites without any wider vision of the species’ longer-term prospects of survival. This is often a recognised compromise based on project timescales and budgets. Importantly the legislative drivers for wider conservation considerations are not as strong as those protecting animals and burrows in the face of development. This is where the issuing of Conservation Licences for the displacement and relocation of water voles can help. Overall the ‘success’ of development-led mitigations should not be viewed in the context of removal of the presence of water voles from a development site but rather in their successful establishment and long-term survival elsewhere.

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