



Water Vole Releases and Conservation Translocations in Britain

Good Practice Guidance

October 2026

Version 1

This document should be referenced as:

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These guidelines provide an important update to the previous Water Vole Conservation Handbook (Strachan et al. 2011). They form an invaluable compilation of the current state of knowledge at the time of publication and provide a beneficial tool kit for shaping water vole conservation translocations. However, this is a complex field and the Statutory Nature Conservation Bodies (SNCBs) reserve the right to take alternative positions or interpretations which may arise from differing geographies, contexts and legislation in the respective UK countries. Users should refer to the respective SNCB websites for policy updates and issues concerning legislation and licensing.

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This guidance has been produced with input through workshops and meetings with the organisations below (and listed on p7). Participation in the creation of the guidance does not equate to endorsement of all elements of the guidance.



CIEEM is pleased to endorse this guidance as providing minimum standards and good practice for those carrying out water vole releases and conservation translocations in Britain.



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1. Introduction

Background and Scope

- 1.1 There have been numerous translocations of water voles within Britain since the late 1990s, including for the purposes of improving their local conservation status and to safeguard individual water voles during development projects due to their legal protection¹. Further translocations are expected to take place in the future for both reasons and, given the continued decline of the species (Glossop and Morse 2024), it is likely that they will occur more often.
- 1.2 Current guidance on how and when to translocate water voles is lacking. Information gathering during water vole translocations in the past, to determine success or failure and to guide future practice, has not been done in all cases and has lacked consistency where it has been done. There is no complete list of all water vole conservation translocations that have taken place in Britain.
- 1.3 This document has been prepared by Merryl Gelling of Spires Ecology Limited and Mike Dean of MD Ecology Limited on behalf of People's Trust for Endangered Species (PTES) and Natural England (NE). It is the product of a study to review relevant information gathered through a literature review and collation of data on known translocations. It aims to set out good practice guidance on water vole releases and conservation translocations in Britain to improve their effectiveness, and to aid future data gathering. It has been based on the best evidence available at the time of writing. Expert knowledge of the ecology of the species has been drawn upon where evidence is lacking. It should be updated as further information becomes available.
- 1.4 The majority of water vole releases to date have taken place in lowland habitats in rural settings. The extent to which this guidance is relevant to water vole conservation translocations in upland and urban scenarios is therefore limited. It does not cover fossorial populations².
- 1.5 The term **Conservation Translocation** is defined by the IUCN Guidelines for Reintroductions and other Conservation Translocations, as '*the intentional movement and release of a living organism where the primary objective is a conservation benefit: this will usually comprise improving the conservation status of the focal species locally or globally, and/or restoring natural ecosystem functions or processes*' (IUCN/SSC 2013). This definition excludes scenarios where water voles are, or have been, translocated solely for the purpose of facilitating development.
- 1.6 Guidance on water vole translocations for the purpose of facilitating development is therefore outside the specific scope of this document. Nevertheless, the research undertaken to inform the guidance sought to gather information from such water vole translocations where considered to be relevant.

¹ Water voles are protected in England and Wales under Section 9 of the Wildlife and Countryside Act 1981 (as amended), having been added to Schedule 5 of the Act initially with partial protection in 1998 and extended to full protection in 2008. In Scotland, water voles receive partial protection under the Wildlife and Countryside Act 1981 (as amended).

² Also referred to as grassland or terrestrial water voles, fossorial water voles are not associated with water. In Great Britain they are mainly found in Scotland.

Equally, some elements of the guidance will also be relevant to the successful translocation of water voles in development situations, particularly:

- Section 5 (Site Selection);
- Sub-sections within Section 6 (Source of Animals relating to Wild-caught water voles, Genetic considerations and Disease considerations);
- Section 7 (Recommended Release Protocol);
- Section 8 (Post-release Monitoring); and
- Section 9 (Mink Control and Eradication).

1.7 The IUCN Guidelines describe two broad types of conservation translocation: Population Restoration and Conservation Introduction. Conservation translocations of water voles in Britain (past and future) fall into the category of attempted Population Restoration, as they have or will take place within the indigenous range of the species (a Conservation Introduction is the translocation of a species to areas outside the indigenous range). The **indigenous range** is defined by the IUCN Guidelines as the '*known or inferred distribution generated from historical (written or verbal) records, or physical evidence of the species' occurrence*'. However, it also specifically allows for scenarios where there is no direct evidence of previous occupancy, but where '*the existence of suitable habitat within ecologically appropriate proximity to proven range may be taken as adequate evidence of previous occupation*'.

1.8 There are two categories of Population Restoration, both of which fall within the scope of this guidance document:

- **Reinforcement**, defined by the IUCN Guidelines as '*the intentional movement and release of an organism into an existing population of conspecifics. Reinforcement aims to enhance population viability, for instance by increasing population size, by increasing genetic diversity, or by increasing the representation of specific demographic groups or stages*'.
- **Reintroduction**, defined by the IUCN Guidelines as '*the intentional movement and release of an organism inside its indigenous range from which it has disappeared. Reintroduction aims to re-establish a viable population of the focal species within its indigenous range*'.

1.9 The term 'indigenous range' in these definitions is replaced by 'natural range' in both the English and Scottish guidelines (DEFRA 2021 and National Species Reintroduction Forum 2014) for conservation translocations. In Scotland once an animal or plant population has died out, and it no longer has the potential to re-colonise naturally, that locality is legally considered to be outwith its 'native range', which has implications for licensing (see p15 in the Scottish Guidelines).

1.10 In most cases the guidance in this document applies equally to reinforcements and reintroductions, and distinguishing between these two categories can be difficult, given the population dynamics of water voles. It therefore refers to conservation translocations in general. A distinction between reinforcement and reintroduction will only be made where it is specifically relevant to do so.

Project team

1.11 The preparation of this guidance document and the research on which it has been based were overseen by a project steering team, comprising representatives from the following organisations/groups, as well as the authors:

- Natural England (NE)
- Natural Resources Wales (NRW)
- NatureScot
- People's Trust for Endangered Species (PTES)
- The Wildlife Trusts National Water Vole Database and Mapping Project
- UK Water Vole Steering Group

Consultation with stakeholders

1.12 The following individuals and organisations were consulted on a draft version of the guidelines in writing and/or during an online stakeholder workshop held on 11 September 2025:

Nida Al-Fulaij (PTES)	Emily Macfarlan (Ecology Elements)
Helen Booth (MHE Consulting)	Katharine Maclean (Environment Agency (EA))
Tyrone Capel (Wildwood Trust)	Tom Moorhouse (Oxford Wildlife Research)
Rosie Carter (NE)	Ali Morse (The Wildlife Trusts)
Becky Clews-Roberts (NRW)	Silviu Petrovan (PTES)
Emily Cowell (Canal and River Trust (CRT))	Dawn Phythian (NE)
Helen Donald (NE)	Rob Raynor (NatureScot)
Charlie Dwight	Hazel Ryan (Wildwood Trust)
David Elliott (National Trust)	Jane Sears (RSPB ³)
Matthew Ellis (NRW)	Graham Scholey (EA)
Sam Facey (Zoological Society of London)	Dawn Scott (Nottingham Trent University)
Derek Gow (Derek Gow Consultancy)	Robyn Stewart (RSPB)
Ryan Greenwood (NatureScot)	Chris Strachan (EA)
Gemma Harding (NE)	Darren Tansley (Essex Wildlife Trust)
Graham Holyoak (NWT ⁴)	Samantha Taylor (CRT)
Claire Howe (NE)	Nia-Joelle Weinzwieg (Cardiff University)
Matt Larsen-Daw (The Mammal Society)	Sandra Wells (NRW)
Emily Luck (PTES)	Jenny Williams (NE)
Julia Massey (M&H Ecology)	

³ Royal Society for the Protection of Birds

⁴ Northumberland Wildlife Trust

About the authors

1.13 Merryl Gelling has more than 20 years of experience in water vole scientific research having undertaken her DPhil and post-doc research at the Wildlife Conservation Research Unit (WildCRU), University of Oxford, in addition to having over 15 years' experience as an ecological consultant focusing on protected British mammals. She is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and a Chartered Ecologist. Merryl led research into the effectiveness of the displacement technique (Gelling, *et al.* 2018) and is co-author of the Water Vole Conservation Handbook (3rd Ed)(Strachan, *et al.* 2011).

1.14 Mike Dean has more than 25 years' experience in ecological consultancy and in delivering mitigation in relation to water voles. He is a Fellow member of CIEEM, a Chartered Ecologist and a Chartered Environmentalist. Mike is the lead author of the Water Vole Mitigation Handbook (Dean, *et al.* 2016) and is the author of a field guide for water vole surveyors (Dean 2021). He has undertaken applied research into the effectiveness of the displacement technique (Gelling, *et al.* 2018).



2. Glossary of Terms

- 2.1 *Water Vole Conservation Translocation* – the intentional movement and release of water voles where the primary objective is a conservation benefit, normally the improvement of the local conservation status of water voles. This definition excludes the intentional movement and release of water voles for the purpose of facilitating development.
- 2.2 *Conservation Translocation Site (CTS)* – the area within which a project is attempting to establish water voles, and where it has control over the management of wetland habitats.
- 2.3 *Release Site* – a contiguous area of suitable habitat for water voles within which release pens are located, plus 150m beyond the outermost release pens.
- 2.4 *Cohort* – the group of individual animals being released within a given Conservation Translocation Site (CTS).
- 2.5 *Minimum Viable Population (MVP)* – the smallest extant population that would be expected to have a 90% chance of survival over a 100-year period.
- 2.6 *Viable colony* – a colony of water voles that is sufficiently large to achieve Minimum Viable Population (MVP) size either in its own right or, more likely, by being linked to other colonies that together achieve MVP. In the definition of Favourable Conservation Status for water voles in England it is defined as a colony of water voles at medium or high relative density over a 2km stretch or more (as measured by number of latrines) (Howe and McGuire, 2026).
- 2.7 *Metapopulation* – a group of spatially distinct colonies of the same species that are connected by, and rely upon, the dispersal of individuals between them.
- 2.8 *Donor population* – the population from which animals are trapped and removed in order to form a founder population in a new location, or to provide stock for captive breeding.
- 2.9 *Relative (population) density* – it is rarely possible to accurately estimate the number of water voles present within a wild population. Instead, latrine counts are used to give an indication of the relative population density on a scale of Low, Medium or High, as set out in paragraph 3.3.16 of the Water Vole Mitigation Handbook (Dean, *et al.* 2016).
- 2.10 *Carrying capacity* – the maximum number of individuals of a species that a habitat can support. Carrying capacity is reached within a given habitat when no further population growth occurs.
- 2.11 *Favourable Conservation Status (FCS)* – describes the situation in which a habitat or species is thriving throughout its natural range and is expected to continue to thrive in the future (Hanna 2021).
- 2.12 *Riparian vegetation* – vegetation associated with the margin of a watercourse or waterbody that is used by water voles as food and cover, including herbaceous vegetation on the bankside and emergent vegetation rooted below water level that together form a contiguous band of habitat.
- 2.13 *Culvert* – an enclosed structure, such as a tunnel or pipe, carrying a watercourse or ditch under a man-made structure, such as a road, railway or building.



3. When is a Water Vole Conservation Translocation Appropriate?

3.1 Water vole populations have suffered a significant decline over the course of the 20th Century (Glossop and Morse 2024). Conservation translocations are an important tool in aiding the re-establishment of the species within its former range. However, the release of water voles should only take place where it is necessary and where it is likely to be successful.

3.2 Conservation translocations should therefore only be considered where there is a demonstrable need, and where the release can contribute to an improvement in the conservation status of the species.

This means that locations for conservation translocations should meet the following criteria:

a) The Conservation Translocation Site (CTS) is within the natural or indigenous range of the species.

In general, any 10km grid square (or hectad) within which water voles have previously been recorded can be considered to form part of the indigenous or natural range (see Figure 1)⁵. Some locations with no historical records may also be reasonably argued to form part of the indigenous or natural range, such as:

- Locations where Figure 1 (page 14) shows no historical records but there are available published sources that confirm historical presence.
- Individual hectads for which no water vole records exist, but which support suitable habitat and are surrounded by historical or current records with no obvious barriers to the movement of water voles between the adjacent hectads. In less populated parts of Great Britain there may be clusters of hectads with no records that fall into this category.

In Scotland once an animal or plant population has died out, and it no longer has the potential to re-colonise naturally, that locality is legally considered to be outwith its native range. A licence from NatureScot would be required to release water voles in such a location.

Determining whether any given location in Scotland is within or outwith the native range should be done in consultation with NatureScot.

b) American mink are absent, or a catchment-level control/eradication programme is underway or is planned, meaning that American mink will be absent by the time of the release and for the foreseeable future.

Water vole releases should only be planned at sites where American mink (*Neogale vison*) are absent or are being actively controlled or eradicated, or there is a commitment to commence such a programme prior to the release. Information on the local status of American mink and any control/eradication programmes will therefore be required for any water vole

⁵ The possible exception to this is locations where the records relate to water voles that have been previously released in the absence of any records of water voles prior to that release. Given the way that data are collected on water vole distribution, such circumstances are likely to be difficult to identify in practice.

conservation translocation. Such programmes need to have long-term funding to ensure that they are likely to continue for the foreseeable future.

Further details are provided in Section 9.

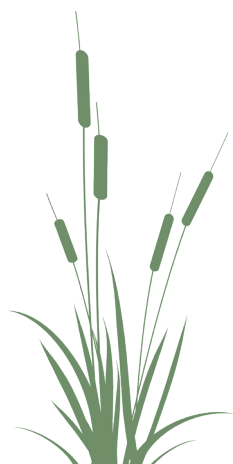
c) *Water voles are either:*

Absent (or likely absent) and are unlikely to colonise naturally; or

Present but the population is not viable and is unlikely to recover without reinforcement.

Further details are provided in Section 5, under the sub-heading 'Current status of water voles at the Conservation Translocation Site'.

- 3.3 If water voles are present and may recover their status with appropriate habitat management and mink control/eradication, then a conservation translocation will generally not be appropriate. For example, in parts of Eastern England, where American mink have been eradicated from large areas, natural re-colonisation by water voles from the surrounding population is likely to occur, and a release would therefore not normally be recommended. An exception would be where monitoring of mink-free areas over a period of approximately five years, for example, has shown no recolonisation by water voles.
- 3.4 Similarly, if water voles are absent from a given location, but a viable population is present in the surrounding area which is likely to colonise that location within the next five to ten years, then a conservation translocation is not appropriate.
- 3.5 There may be opportunities to link large-scale wetland habitat creation projects with water vole conservation translocations; such projects will need to assess the appropriateness of a water vole release and the suitability of the site according to the same factors as a release into existing habitat.
- 3.6 Translocation of water voles may also be undertaken to facilitate developments. Where water voles are to be captured from development sites it is for the relevant Statutory Nature Conservation Body to determine whether or not a translocation is appropriate. It is beyond the scope of these guidelines to comment on this further.



Box 1: Things to do when starting to plan a water vole conservation translocation

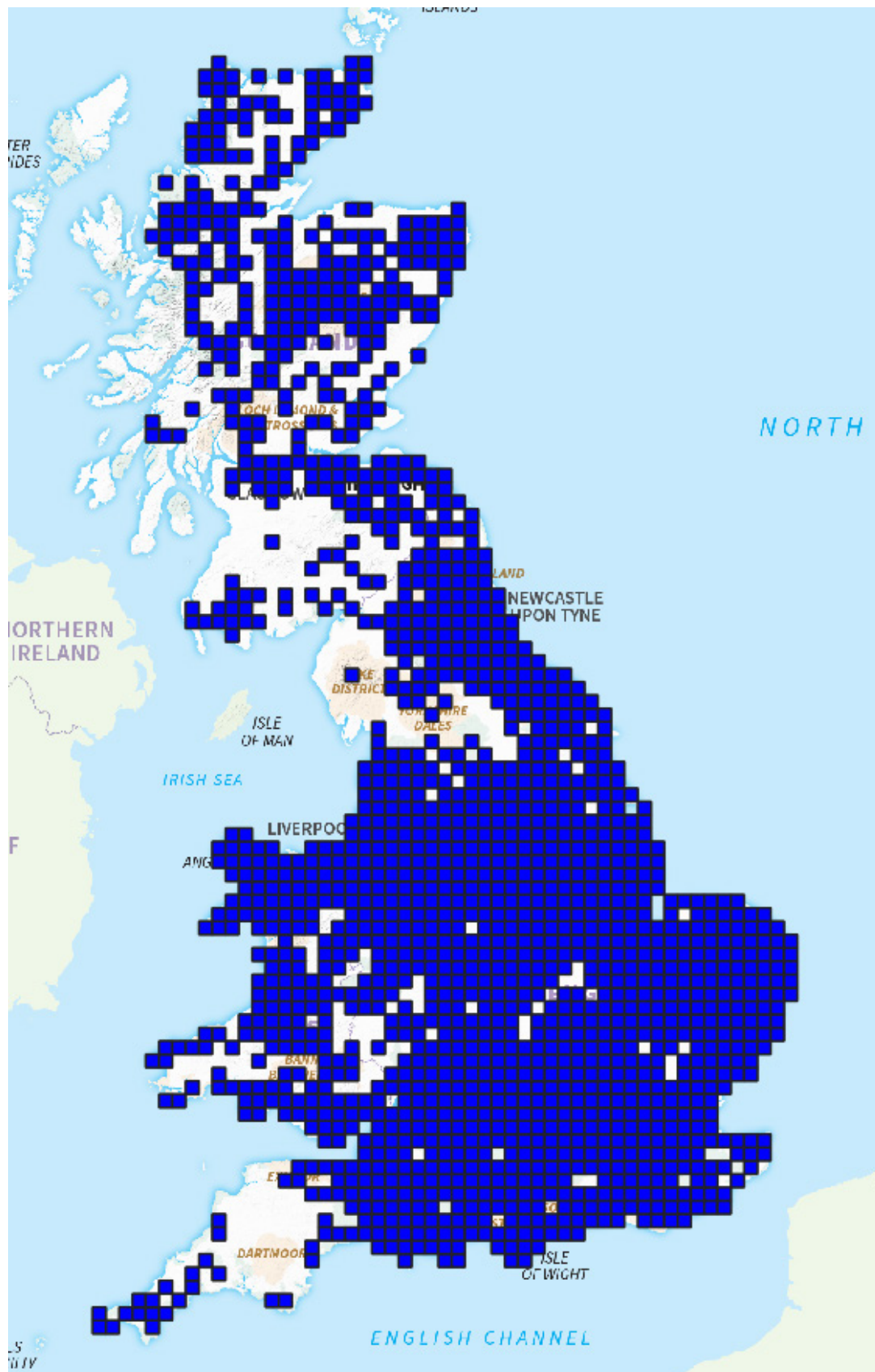
- a) Reflect on your reasons for the translocation – is it necessary and will it benefit the species?
- b) Review this against the three criteria listed in Section 3:
 1. *The CTS is within the natural or indigenous range of the species.*
 2. *American mink are absent, or a catchment-level control/eradication programme is underway or is planned, meaning that mink will be absent by the time of the release and for the foreseeable future.*
 3. *Water voles are either:*
 - i. *Absent (or likely absent) and are unlikely to colonise naturally; or*
 - ii. *Present but the population is not viable and is unlikely to recover without reinforcement.*
- c) Assess the local status of water voles with reference to the most recent regional maps published by the National Water Vole Database Project⁶ and the local status of American mink and any control/eradication programmes.
- d) Review the available information about historic, current or other planned releases in the local area (see PTES website⁷) to help ensure that the release is appropriate and complementary to other conservation efforts.
- e) Set out the project-specific objectives that you are hoping to achieve and understand the expected ‘general’ objectives of all water vole conservation translocations (see Section 4).
- f) Ensure that you understand the habitat requirements of the species from appropriate reference sources including the Water Vole Conservation and Mitigation Handbooks (Strachan, *et al.* 2011 and Dean, *et al.* 2016) and Water Vole Field Signs and Habitat Assessment (Dean 2021) and have sufficient available habitat, of an appropriate quality, for a release (see Section 5).
- g) Review these guidelines and ensure that you understand the requirements for:
 - Ownership and management control (see Section 5)
 - Current status of water voles and survey effort required to establish this (see Section 5)
 - Sourcing of animals and practical considerations of the release itself (see Sections 6 & 7)
 - Post-release monitoring to determine success (see Section 8)
 - Mink monitoring, control and eradication (see Section 9)
- h) Prepare a draft Project Plan, documenting your assessment of the appropriateness of the site, setting out clear objectives, identifying roles and responsibilities, detailing the approach to mink control/eradication, specifying the source of water voles for the release and proposals for monitoring, with a clear timeline. Natural England have a published scoping form⁸.
- i) Seek advice from the relevant Statutory Nature Conservation Body and other local experts.
- j) Inform PTES about the planned release via the PTES website⁷.

The next steps of the process are set out in Box 2.

⁶ <https://www.wildlifetrusts.org/national-water-vole-database-project>

⁷ <https://www.ptes.org>

⁸ <https://www.gov.uk/government/publications/reintroductions-and-conservation-translocations-in-england-code-guidance-and-forms>



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Figure 1: Historical distribution of water voles in Britain between 1861 and 2022, based on data supplied from Glossop and Morse (2024).

Note: this map should be taken as indicative as it is based on known records only.

4. Establishing Aims and Objectives

General objectives

4.1 Each conservation translocation must have clear aims and objectives. Success against these aims and objectives will be the focus of post-release monitoring and project evaluation (see Section 8). Several of these will be general aims and objectives that apply to all water vole conservation translocations and which define a successful release, as described below.

4.2 These general objectives have been based on the recommendations set out in the IUCN Guidelines and the English and Scottish reintroduction guidelines on monitoring and success. They have been adapted as appropriate to relate to the ecology and population dynamics of water voles and the available options for measuring success in relation to water vole populations.

4.3 The IUCN Guidelines identify ‘*commonly observed phases of development of successfully translocated populations*’:

- Establishment Phase – from first release to when post-release effects (e.g. high mortality and dispersal away from the Release Site) are no longer operating that may slow initial growth.
- Growth Phase – when there are expected to be high rates of increase and/or expansion of range, continuing until the population approaches carrying capacity.
- Regulation Phase – when there is a reduction in survival and/or recruitment due to the increased population density.

4.4 The rates and duration of the Establishment and Growth Phases are expected to vary widely and be species-specific. The general aims set out below are based on the Establishment and Growth Phases. Measuring success against the Regulation Phase is likely to need to be monitored on a national or regional basis, rather than at individual Conservation Translocation Sites (CTSs).

General Objective 1: Survival of sufficient individuals within the released cohort to allow establishment

4.5 A 100% survival rate of individuals during the release process should be aimed for. This includes the transportation of animals to the Release Site as well as the release itself, up until the time that each animal has left its release pen. Any deaths within this period need to be documented and the causes identified.

4.6 There have been very few recorded deaths of individual water voles during previous releases (three recorded deaths either during transport or within release pens, out of a total of 21,390 known released animals between 2000 and 2024). It is therefore impossible to determine what percentage survival rate is required for a successful release, but 100% survival is clearly possible and should therefore be aimed for.

4.7 Water voles should persist at the Release Site throughout the year of release (Year 0) and Year 1 following release, demonstrating over winter survival and establishment of a release cohort.

General Objective 2: Successful breeding within the Release Site

4.8 Water voles should have bred successfully within the Release Site leading to an increase in length of occupied habitat and/or relative density of animals, ideally by the end of Year 1 following release, but certainly by the end of Year 2.

4.9 There is a lack of detailed monitoring data available from previous releases on which to base this objective. However, given the population dynamics of the species it is considered important that a released cohort is breeding by Year 1. If breeding does not occur by Year 2 this is likely to result in the loss of the colony.

General Objective 3: Expansion of the released cohort

4.10 There should have been continued growth of the population observed in Years 3 and 5 following the release, with an increase in local distribution and/or relative density. The water vole population within the CTS should be approaching carrying capacity by Year 5.

4.11 As with the previous objectives, this is based on an understanding of the population dynamics of the species in the absence of sufficient detailed monitoring data from previous releases.

Project-specific objectives

4.12 Each conservation translocation will also have its own project-specific objective (or objectives) relating to improvement of local conservation status. These will differ between individual projects and will effectively define why a specific site has been selected (see Section 5). Examples of possible project-specific objectives include:

- A. Establishment of a viable water vole population in a region or county from which they have become extinct, e.g. Kielder, River Meon (case study 2), the Trossachs (case study 4, see also Chapter 11 in Gaywood, *et al.* 2016);
- B. Expansion of a local population into catchments or areas where they are not currently present through the establishment of new viable colonies, e.g. Upper Thames (case study 1).
- C. Establishment of colonies in strategic locations to act as a link between otherwise isolated colonies or populations, thereby increasing the viability of all linked colonies;
- D. Increasing the viability of a vulnerable colony, including one established by a previous release and which has low levels of breeding success and/or relative population densities, e.g. Barn Elms (case study 3).

4.13 Scenario A above is an example of a Reintroduction. Scenarios C and D are examples of a Reinforcement. Scenario B is difficult to categorise and could conceivably be defined as either of these.

4.14 The project-specific objectives should be related to targets or priorities set within each relevant country or region for improving the conservation status of water voles. In England these are set out in the definition of Favourable Conservation Status (FCS) for the species (Howe and McGuire 2026).

4.15 Where a project involves the capture of water voles from the wild, a further aim must be that there was no detrimental impact on the conservation status of the donor population in the long-term (at least five years post-trapping). See paragraphs 8.27-8.29.



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5. Selection of Sites

Background

5.1 There are a number of different site-specific factors that will need to be considered by any project to determine both:

- 1) Whether the release of water voles is appropriate for the project's aims; and
- 2) Which site or sites is/are suitable for the release of water voles, given the aims.

These factors are described in the following paragraphs.

General location

5.2 Water vole conservation translocations should only occur within the species' indigenous or natural range. See paragraph 3.2, part (a).

Size of Conservation Translocation Sites

5.3 Conservation Translocation Sites must be, at least, large enough to provide sufficient habitat to allow the establishment of a viable colony (see Section 2, Glossary of Terms) and capable of supporting a release of at least 60 animals over a length of at least 1.5km of watercourse (see 'Suitable release sites' below, and Section 7). In some cases they will need to be considerably larger, dependent on the project-specific objectives, the nature of the habitat and the proximity of the site to other known water vole colonies/populations.

5.4 Water voles do not necessarily need to be released throughout the entire CTS – it is feasible to release water voles in discrete locations within the site and expect that the colony/colonies will expand into other parts of it, provided that the habitats are well-connected and maintained in a suitable condition. Allowing or encouraging the establishment of water voles beyond the CTS will be appropriate in most cases, but habitat beyond the CTS should not be relied upon as a factor in determining whether the CTS is sufficiently large for the release, if the project has no input into its management.

Site ownership and maintenance

5.5 The project must have ownership of the CTS, or landowner agreement⁹. Importantly, the project must have control over management of wetland habitats.

5.6 There should be no mowing of bankside vegetation or weedcutting/removal of in-channel vegetation at the Release Site in the year of release. Mowing of bankside vegetation and weedcutting/removal of in-channel vegetation at the Release Site is acceptable (and often necessary) in subsequent years, but should be done on a rotational basis to ensure that at least 50% of the habitat within the Release Site

⁹A Memorandum of Understanding between the project and the landowner should be prepared to define the role and expectations of each party.

is not affected in any given year. Stocking densities will also need to be controlled in locations where grazing animals can access the Release Site, such as is likely to be the case in upland areas, to ensure that habitat suitability is maintained.

5.7 Watercourses that are managed by a third party organisation, such as the Environment Agency or an Internal Drainage Board, can still be used as a Release Site, provided that the management regime and timing is such that the site will provide sufficiently good habitat for water voles during the release and in the long-term, and that the project has been discussed and agreed with the organisation responsible for watercourse maintenance.

5.8 Where a release of water voles is planned for a Site of Special Scientific Interest (SSSI) or other designated site the relevant Statutory Nature Conservation Body should be consulted, as a specific consent may be required.

Suitable Release Sites

5.9 The Release Site needs to be sufficiently large to accommodate the release cohort with appropriate spacing between individual release pens. The size of the release cohort will be determined by the project's aims and habitat quality in the Release Site, as discussed later in this document. However, in general, release cohorts at lowland sites will comprise at least 60 animals (see Box 3 for details) of approximately equal numbers of males and females, released at 20m intervals or equivalent spacing per individual if more than one animal is released per pen (see Section 7). The Release Site will therefore comprise a minimum of 1.5km of watercourse including at least 150m either side of the outermost pens.

5.10 The habitat within the Release Site should be contiguous, and have connection to habitat in the wider landscape to facilitate dispersal.

5.11 In many cases more than 60 animals will need to be released, and the Release Site will be proportionately larger as a result.

5.12 There is a lack of evidence on which to base minimum numbers for releases at upland sites. Until further data become available it is recommended that releases in such locations also comprise at least 60 animals in total. However, given that water voles are likely to exist at lower densities at upland sites (see Capreolus Wildlife Consultancy 2005), and that sufficiently large areas of contiguous habitat to accommodate 60 animals are unlikely to be available, for upland releases:

- The overall length of habitat needed for a release is likely to be greater than 1.5km of watercourse¹⁰; and
- This can comprise multiple smaller Release Sites that are connected to provide the overall length of watercourse habitat required.

5.13 Release pens at upland sites should be spaced at proportionately greater intervals to account for the habitat being likely to support water voles at lower densities.

5.14 In urban locations, it may also be appropriate to consider the use of multiple smaller Release Sites that are connected to provide the overall length of watercourse habitat required. Release Sites should comprise a minimum of 1.5km of watercourse for a release cohort of 60 animals, as described for lowland scenarios.

5.15 Release Sites need to be in locations that are not liable to flood. Sites with the potential for significant changes in water level during the release itself should not be used. Sites that flood regularly in winter should also not be used for releases, as this is likely to negatively impact the establishment of the released cohort.

5.16 It is vital that the practicalities of releasing water voles are considered when selecting a Release Site. Release Sites must have suitable locations for siting release pens, as discussed in Section 7.

Current status of water voles at the Conservation Translocation Site

5.17 A reintroduction involves the release of water voles at a CTS where they are currently absent. It is not good practice to release water voles at locations where they would be likely to colonise naturally in the near future.

5.18 The release of water voles at a CTS where they are present (a reinforcement) is not likely to be appropriate in most cases. Water voles have a high reproductive output and their populations can recover where there is sufficient available habitat, as there would have to be for a potential CTS to be considered. However, a reinforcement may be appropriate where the population is not viable. For example:

- Where there are desk study records of water voles but field surveys failed to find conclusive evidence of presence. Water voles may be present but are at such low densities that they are not detectable.
- Where water voles are present at low relative density and are isolated from other water vole populations in the surrounding area, making it unlikely that water voles will disperse into the CTS. In this case a large, self-sustaining population would need to be established.

5.19 In such cases the release of animals can be justified on the basis that it is required to allow the recovery of the existing population. This principle accords with Natural England's Threatened Species Recovery Actions 2025 Baseline, which includes an action to identify sites for water vole conservation translocations 'where natural recolonisation or recovery is unlikely' (Wilkins, *et al.* 2025). The reasons for the lack of viability of the existing population should be understood and remedied before a reinforcement release is considered.

5.20 CTSs should ideally be located between 2km and 10km from the nearest known water vole colony, measured along suitable dispersal routes rather than along the shortest possible distance (i.e. accounting for meanders in rivers) to maximise the potential benefits of each release.

- 5.21 It is not recommended that conservation translocations take place in isolated locations where released animals are unlikely to link up with other known populations within five years (for example, more than 10km via a linked watercourse route from known populations), except where the CTS is sufficiently large to allow the establishment of a self-sustaining and robust population in its own right. This would be likely to require multiple releases involving several hundred animals (such as was the case for the River Meon).
- 5.22 There is currently no published evidence regarding the rate at which water vole colonies in Britain will extend beyond their own boundaries to link up with other known colonies or populations. However, dispersal distances are assumed to be on average 2km in core population areas (Telfer, *et al.* 2003).
- 5.23 The long-term persistence of colonies located within core population areas is positively influenced by the presence of nearby populations (Morgan, *et al.* 2019) due to the more frequent occurrence of recolonisation of adjacent habitat as part of the process of metapopulation dynamics.

Current status of water voles at the Release Site

- 5.24 Releasing water voles into habitat where they are already present should be avoided as this could have an adverse impact on the existing population through increased competition. Therefore, irrespective of whether the release is a reintroduction or a reinforcement, water voles should be absent from the Release Site itself.

Habitat suitability

- 5.25 In rural lowland situations, all habitat within the Release Site and more than 50% of the available habitat within the CTS should be classed as either ‘optimal’ or ‘good’ habitat for water voles (see Table 2.1 in Dean (2021)) and the average width of riparian vegetation (see Section 2, Glossary of Terms) should be at least 2m, but ideally greater than 3m (see Box 3). The width of the riparian vegetation (or equivalent in non-riparian habitat types) available within a CTS is important, as this directly impacts the initial and post-release survival rates of individual animals (Moorhouse, *et al.* 2009). It also increases forage availability for the release cohort which directly influences the rate at which young water voles reach sexual maturity and are therefore able to contribute to subsequent growth of the colony (Moorhouse, *et al.* 2008).
- 5.26 It is essential that the project has control of habitat management within the CTS, either directly or through working with landowners, and that this is designed to ensure that the habitat remains as suitable (and more than 50% as ‘optimal’ or ‘good’) in the long-term. Detailed prescriptions should be set out in a Habitat Management Plan covering a minimum of five years, and ideally 10 years post-release.
- 5.27 There is no published equivalent form of assessment of habitat suitability for water voles in upland or urban habitats. In general, habitat occupied by water voles at upland and urban sites may be less likely to meet the criteria for ‘optimal’ habitat, but habitat that would be classed as ‘good’ is present

in such scenarios. A 2-3m wide fringe of riparian vegetation is also not widely available in upland and urban situations; releases in such scenarios would need to develop their own means of assessment to demonstrate that the habitat within the Release Site and CTS is sufficient to support the numbers of animals being released and to achieve the project's long-term objectives in terms of conservation status.

Habitat connectivity

5.28 Water voles exist in meta-populations, reliant on dispersal of individuals between colonies. Isolated colonies are extremely vulnerable to stochastic events, such as flooding or an increase in predation risk. The release of water voles at isolated locations, without identifiable dispersal routes must therefore be avoided.

5.29 It should be possible to identify dispersal routes between a CTS and the location of known water vole populations, based on a review of Ordnance Survey maps and aerial photos. A field visit may be appropriate where the dispersal routes cannot be identified from available desk-based resources, and where access is possible. It should be noted that water voles will generally disperse along watercourses in lowland situations but are less likely to be restricted to movement along watercourses in upland landscapes.

5.30 A proposed CTS on a watercourse with obvious direct links to other watercourses that support water voles would generally be expected to have sufficient connectivity, provided that the linking watercourses provide suitable habitat for water voles and that there are no major barriers to water vole dispersal on a given route.

5.31 Further research is required to better understand the extent to which culverts, tunnels or bridges of different types, sizes and lengths present barriers to water vole movement and thereby result in the fragmentation of water vole populations. Anecdotal evidence suggests some use of straight culverts up to 56m in length with an internal diameter of 2.7 x 3m, where light is visible at the opposite end (Massey 2022). However, the frequency of use of such culverts is unknown, and the 'tipping point' at which a culvert or tunnel becomes too long to be navigated by a water vole is also unknown. This tipping point is also likely to vary for different types and sizes of culverts or tunnels in response to a range of factors.

5.32 For the purposes of this guidance, until further research on this topic is available that suggests otherwise, it is recommended that water vole releases are not undertaken in locations where the animals would need to pass through a culvert or tunnel of 60m or more in length to disperse to another colony.

5.33 Unenclosed structures, such as weirs or canalised sections of watercourses with reinforced banks may also negatively affect the ability of water voles to disperse along a watercourse. The extent to which they act as a barrier to movement will depend on factors such as adjacent land uses, length of watercourse affected and availability of riparian vegetation within or adjacent to the structure to

provide cover. The presence of such features will therefore also need to be considered, particularly in urban locations.

5.34 Where the aim of the project is to establish a large, self-sustaining population through multiple releases, the presence of slightly longer culverts or tunnels between the reintroduced population and nearest known extant populations may be acceptable. However, the 60m maximum length of culvert or tunnel would be applicable between each individual Release Site in such scenarios.

5.35 The release of water voles into lakes or ponds will require further consideration. Water voles use lakes and ponds of all sizes. They are capable of dispersing between such features, or between a pond and a nearby river for example, using small streams and ditches that feed into or drain lakes and ponds. Water voles can also cross terrestrial habitats when dispersing to/from lakes and ponds, and have often been found to do so over distances of tens of metres (or considerably more in upland landscapes). They are less likely to do so as this distance increases, although the upper limit of this is unknown.

5.36 For the purposes of this guidance, it is recommended that lakes and ponds are only used as a CTS where they are directly linked to, or are located within 50m of, surrounding watercourses, with clearly identifiable dispersal routes between them.

Absence of mink, ongoing monitoring and control

5.37 Invasive American mink are known to be a primary factor in water vole decline and therefore it is vital that the absence of mink from the CTS and a suitable buffer around it, is established before the release takes place.

5.38 The recommended buffer area to be established as mink-free prior to release is at least 10km around the CTS (see Section 9).

5.39 This should be done using mink rafts and live-capture traps, ideally incorporating 'smart' technology which can be left *in situ* long-term and negate the need for daily physical checks of traps (see Section 9 for further details).

5.40 Ongoing monitoring and lethal control of any detected mink must be implemented to ensure the long-term protection of the water vole colony. Mink control must be undertaken on a landscape or catchment scale and will need to be co-ordinated with other partner organisations (see Chapter 9 below).



Other threats to released water voles

5.41 Water voles can face a number of threats besides predation by American mink, inappropriate watercourse management and flooding, which should already have been addressed by consideration of the factors discussed earlier in this section. In some cases consideration should also be given to other, site-specific, factors that could include, for example:

- Cat predation – particularly for urban sites; Release Sites that would experience high levels of cat predation should be avoided unless the habitat is such that it limits the ability of cats to hunt water voles.
- Development impacts and/or mitigation – releases at sites within 2km of proposed or current developments that will have significant impacts on water voles and/or require mitigation, should be avoided.
- Water quality - water voles are known to persist in polluted watercourses, however there is limited understanding of potential impacts on individual health or fecundity. Releases into polluted watercourses should therefore be avoided.

Contribution towards Favourable Conservation Status

5.42 A water vole conservation translocation should contribute towards improving the local conservation status of the species.

5.43 Targets for determining Favourable Conservation Status (FCS – see Section 2, Glossary of Terms) of water voles have been set in England (Howe and McGuire 2026). A clear contribution towards these would be made if:

- The project established water voles in a 10km grid square within which they were considered likely absent in the most recent national survey (Glossop and Morse (2024) or subsequent updates of the National Water Vole Database Project); and/or
- The project established a new viable colony of water voles; and/or
- The project linked previously unviable colonies to form a viable colony/population.

5.44 A summary of the factors to be considered for site selection is provided in Table 1, along with a brief description of the information that should be sought to underpin the assessment of site suitability.

5.45 Preparing for a water vole conservation translocation can take several years and the status of the species and quality of the habitat can change within this timeframe. The site selection information should therefore be updated and reviewed as necessary. See Box 2 for a summary of the overall process.

Suitable habitat



Soft earth banks with grassy vegetation provide ideal burrowing substrate and abundant forage. The absence of hard engineering (toe-boarding, piling or revetment) allows water voles to excavate burrow systems directly into the bank.



A ditch that does not dry out and is managed on a rotational basis, with only one side cut each year. This approach retains tall bankside vegetation as year-round cover and forage, ensuring the water voles are never left without shelter and protecting them from predation following management works.



Upland habitat with a watercourse fringed by dense tussocky bankside vegetation providing year-round cover and shelter.



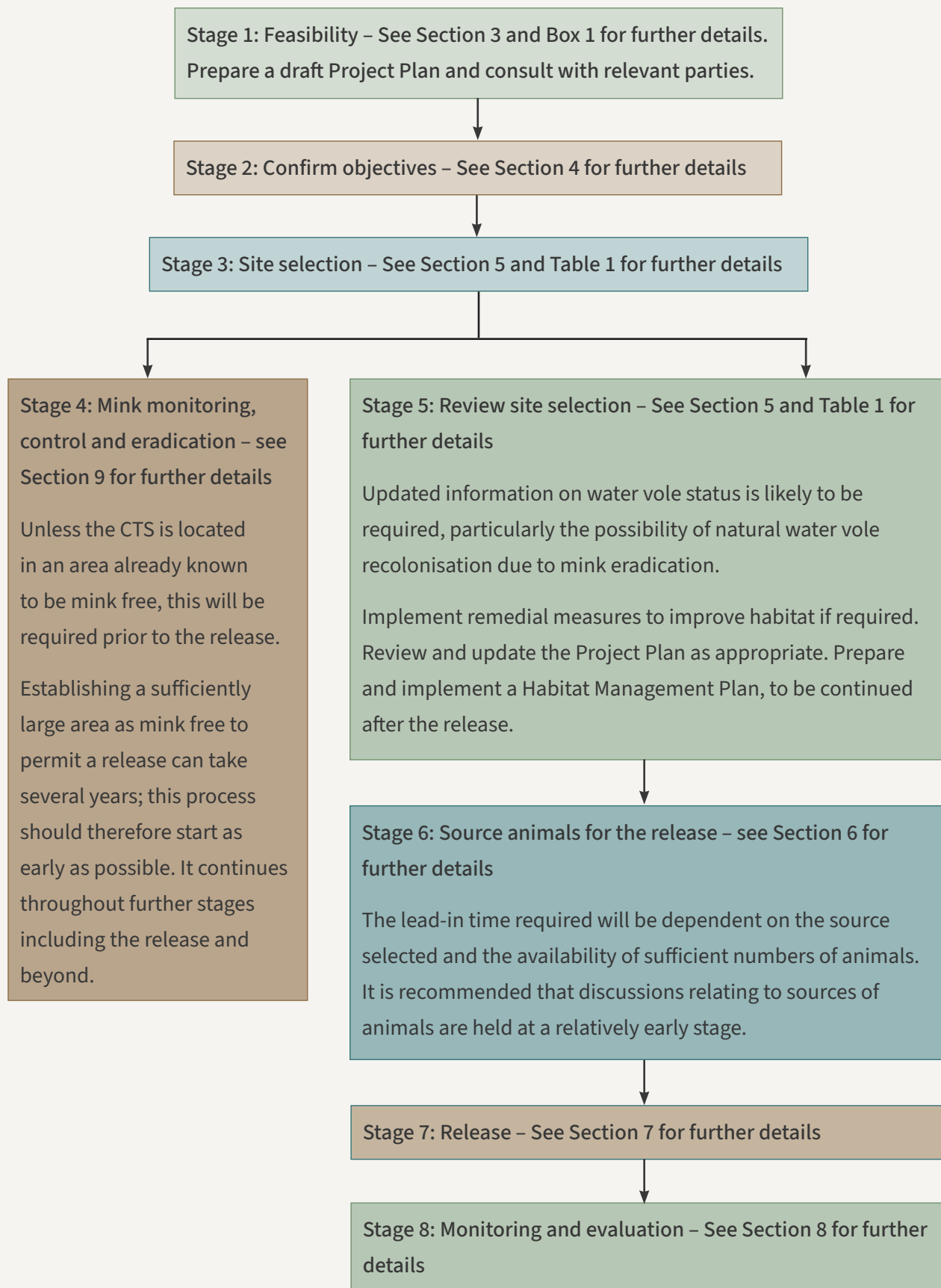
A watercourse with well-developed emergent vegetation at the channel margins, providing cover, forage, and suitable conditions for water vole nesting and burrowing in the banks.

Table 1: Site selection factors

Factor	Key points	Evidence required to demonstrate site suitability
General location	Within the species' indigenous or natural range.	Site located within the known or assumed historical range (see Figure 1).
Size of CTS	Large enough to allow establishment of a viable colony (at least 1.5km of watercourse bank or equivalent for non-linear habitats, greater at upland sites).	Maps showing extent of ownership and habitat suitability. Site is within the ownership of the organisation funding the release, or legal agreements have been signed giving permission for the release and subsequent habitat management.
Site ownership	Project has control over wetland habitat management throughout CTS and in the long-term.	
Suitable Release Site	The CTS contains one or more suitable Release Site(s), large enough to accommodate the release cohort with appropriate spacing between pens (at least 40m between animals of the same sex at lowland sites, greater at upland sites).	Identify and assess suitability of Release Sites, considering spacing and practical issues discussed in Section 7 under 'Siting of release pens'.
Water vole status at the CTS	In most cases, water voles are likely absent from the CTS. This would comprise a reintroduction.	Desk study search for records of water voles within 2km of the CTS.
	In some cases a CTS can still be used for a release where water voles are present (or are potentially present) in such low numbers that the colony is unlikely to be viable. This would comprise a reinforcement.	Field sign survey throughout CTS no more than two years prior to the release date, comprising two visits within the survey season and following the guidance in the Water Vole Mitigation Handbook.
	Located at least 2km from the nearest known water vole colony, ideally further (but generally less than 10km – see below). Avoid isolated locations where released animals are unlikely to link up with other known populations within five years (more than 10km from the CTS along a watercourse), unless establishing a viable population.	Desk study to identify nearest records. a) Data search with LERC b) Data search with NBN Atlas c) Check for other water vole releases – historic, current or planned.
Water vole status at the Release Site	Water voles are likely absent.	Field sign survey throughout the Release Site no more than two years prior to the release date following good practice guidance (see above).

Factor	Key points	Evidence required to demonstrate site suitability
Habitat	Needs to be of sufficient quality to support the release cohort and deliver the project's objectives in terms of conservation status. In rural lowland scenarios, all habitat within the Release Site and more than 50% of the available habitat within the CTS should be classed as either 'optimal' or 'good' habitat for water voles and with an average width of riparian vegetation of at least 2m and ideally more than 3m. Upland/urban habitats should meet these criteria but can utilise several well-connected Release Sites that cumulatively provide sufficient habitat.	Habitat assessment within the CTS to classify the habitat using relevant categories, e.g. Table 2.1 in Dean (2021) or appropriate alternative, and noting width of riparian vegetation.
	Identifiable dispersal routes exist between the CTS and known water vole populations; no major barriers and no requirement to cross more than 50m of terrestrial habitat.	Review of Ordnance Survey maps and aerial photos with field visits if needed – dispersal route(s) should be clearly identified.
Mink	Mink should be likely absent for at least 12 months prior to release from at least 10km around the CTS.	Mink monitoring and control/eradication using mink rafts ('smart' rafts where possible) across all connected watercourses including lakes and other static waterbodies at a catchment scale.
	Consolidated and expansive mink monitoring and lethal control ongoing within the buffer area and committed to for the foreseeable future.	
Other threats	Avoid sites with other threats, such as: • High levels of cat predation. • Within 2km of proposed or ongoing developments with significant effects on water voles or requiring mitigation	Assessment of other relevant threats.
FCS/local status	The site location should allow the project to make a positive contribution towards specific FCS targets or improving local conservation status generally.	To be determined individually for each project.

Box 2: Stages of a water vole conservation translocation



6. Source of Animals

Introduction

- 6.1 There are several stages to a water vole conservation translocation (see Box 2), some of which can take several years to complete including the sourcing of animals. It is important to determine the source of the animals at a relatively early stage of planning. There are a number of factors to consider, as described below.
- 6.2 Having sufficient numbers of animals available at the time when the site is ready for a release requires careful co-ordination and advance planning.

Captive-bred water voles

- 6.3 The benefits of using captive-bred water voles as a source of stock for the release cohort in a reintroduction include that no licence from a Statutory Nature Conservation Body is required for the release¹¹ (except in Scotland if releasing water voles outside of their native range¹²) and a minimum number and sex ratio of animals can be requested from the breeder which helps enable release planning and brings some certainty to the project.
- 6.4 Conversely there are also constraints associated with using captive-bred water voles, including that there are very few organisations that currently have the capability to breed water voles. This results in a finite number of individual animals available at any given time, and as such the number and sex ratio of animals available, and the timing of release may be dictated by the breeding establishment, particularly if they are facilitating releases at several different sites in any year.

Wild-caught water voles

- 6.5 The majority of previous releases have been undertaken using captive-bred water voles. Occasionally, wild-caught animals have been translocated elsewhere, generally taken from sites that are proposed for development or, more rarely, captured from large established populations for a specific project. Trapping water voles in either scenario requires a licence from the relevant Statutory Nature Conservation Body in England and Wales. The legislation is different in Scotland; trapping water voles is not currently illegal in Scotland but a licence may nevertheless be required in certain cases – it would be appropriate to seek advice from NatureScot to confirm whether a licence is needed.

¹¹ A licence is not required to release water voles, but a licence is required to trap water voles and take them from the wild in England and Wales (since 2008). It is important that the original source of any water voles obtained from captive-bred populations is known and it is confirmed that any animals that were taken from the wild were captured legally.

¹² In Scotland once an animal or plant population has died out, and it no longer has the potential to re-colonise naturally, that locality is legally considered to be outwith its native range. A licence from NatureScot would be required to release water voles in such a location.

6.6 Where wild-caught water voles are used for a release, the impact on the donor population will need to be considered to ensure that it is not adversely affected. Detailed advice on the scenarios in which the capture of water voles from the wild for a reintroduction or reinforcement should be considered acceptable is beyond the scope of these guidelines. Where this is being considered the relevant Statutory Nature Conservation Body should be contacted for advice.

Genetic considerations

6.7 Wild water voles display high genetic diversity throughout regions, with finer-scale diversity being identified between populations within watersheds (Baker, *et al.* 2020). Preservation of such genetic diversity aids both population persistence, and its long-term adaptive potential. The advantages of preserving regional characteristics must be balanced against the practical difficulties of sourcing local water voles for any given conservation translocation; the parts of Great Britain where a reintroduction is needed may well lack robust populations that could act as a source of animals for a release.

6.8 Captive-bred water voles may have lower genetic diversity due to a lack of new stock entering the captive population, which may also have further negative implications due to the decreased fecundity of animals bred in captivity over successive generations; low genetic diversity in release cohorts may be a factor in the failure of some previous reintroductions. It is therefore recommended that steps are taken to ensure appropriate source populations provide sufficient genetic diversity within the release cohort. Further research is required to better understand the genetics of captive-bred water voles and the implications for releases.

6.9 It is also important to note that many of the water vole conservation translocations to date have involved the release of water voles at locations in completely different regions of Great Britain than the region from which the animals were originally sourced. And there has been mixing of animals between different regions in captive breeding populations; the genetic lineage of animals currently held in captivity is not known in all cases.

6.10 In general, then, this guidance does not intend to place significant restrictions on the movement of water voles between regions, or the mixing of animals from different regions in captive breeding. However, there are certain restrictions that are considered appropriate at this stage, as set out below.

6.11 Wild water voles in Britain have two distinct phylogenetic clades which broadly separates Scottish water voles from those found in England and Wales, and whilst this divergence is insufficient to suggest different species, appropriate source populations which do not mix lineages should be used to conserve the evolutionary heritage (Piertney, *et al.* 2005). There is some natural genetic mixing between clades along the border and into Northern England. However, the mixing of clades in captive breeding is not recommended.

- 6.12 These guidelines do not cover the release of fossorial water voles. However, releasing of animals which originated from fossorial populations into wetland sites, and *vice versa*, should be avoided in the absence of research to better understand the difference in behavioural adaptations between the two population types, although in areas where both types exist there is known to be movement between the different habitats.
- 6.13 It would also be appropriate for captive breeding facilities to ensure the breeding of a genetically diverse stock and the maintenance of a studbook, although it is beyond the scope of this guidance to recommend specific measures to achieve this.

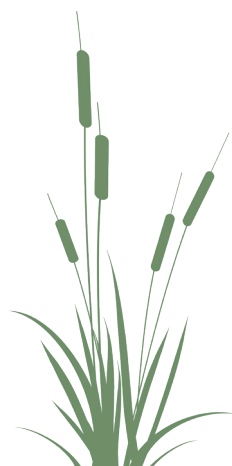
Disease considerations

- 6.14 The IUCN Guidelines on Conservation Translocations identify the possible need for health and mortality monitoring, which ‘*assesses the extent that an establishing population is experiencing disease, or adverse welfare conditions or mortality, as a basis for identifying underlying causes*’. This is rarely undertaken for water voles, regardless of whether they are captive-bred and released, or translocated as part of development work. The Institute of Zoology has undertaken a Disease Risk Analysis for Water Voles in England (Donald and Sainsbury 2021), with detailed evaluation for 15 identified hazards, five of which were considered a medium risk of triggering disease in water voles.
- 6.15 There is a risk from disease to the success of a conservation translocation, or to other wildlife species present in the landscape, if water voles for release are exposed to novel pathogens and/or parasites while in captivity. This risk is reduced if water voles are housed in biosecure facilities at locations that keep no animals that have been bred outside Great Britain. In addition, all animals coming into a captive breeding facility, regardless if they are wild or from an alternative breeding establishment, should be housed in suitable quarantine facilities until appropriate health screening is conducted.
- 6.16 To date, non-native parasites have not been found in free-living water vole populations, including those populations originating from captive-bred populations. However, post-release surveillance should be ongoing including detailed post-mortem of individuals found dead either in the wild or in captivity.
- 6.17 A large proportion of the disease risks analysed by the Zoological Society of London can be appropriately managed by ensuring good hygiene and biosecurity measures (Natural England and Zoological Society of London, in press). Should additional surveillance be required, the use of non-invasive techniques including the collection of faeces, and its analysis by a relevant expert, should be considered.
- 6.18 Elevated stress, leading to distress (whereby normal homeostatic responses can no longer be maintained) can reduce the immunocompetence of individuals which may render water voles at increased susceptibility of otherwise benign infections (Gelling, *et al.* 2012). Such biological costs could result in a failed reintroduction due either to direct impacts, or reduced fecundity leading to lower reproductive success. Such factors may be difficult to observe.

6.19 All actions associated with a translocation, including capture, interim housing and transport which may occur on more than one occasion, the release process and post-release support and monitoring should be regarded as a potential source of stress (Gelling, *et al.* 2010; Gelling, *et al.* 2012) and reduced or refined where possible. Where volunteer groups or media coverage is involved with a release, consideration will need to be given to how this can be balanced with the requirements to minimise stress levels in the animals.

Trapping methods and care of animals in captivity

6.20 The appropriate methods for trapping water voles are outside the scope of this guidance. Similarly, the protocol for caring for water voles in captivity is also outside the scope of this guidance. Both topics are covered in the Water Vole Mitigation Handbook (Dean, *et al.* 2016), in Appendices 2 and 3 respectively. Should any water vole be found dead in England, it may be sent to the Disease Risk and Health Surveillance Team at ZSL for post-mortem inspection funded by Natural England. The team should be contacted at drahs@zsl.org for further instructions.





7. Recommended Release Protocol

Minimum number of animals, sex ratio and age range

- 7.1 The minimum recommended number of individuals for a reinforcement release in rural lowland landscapes is 60. This figure is derived from the Minimum Viable Population (MVP) size of water voles, calculated using data from published field studies (see Box 3). Successful releases in the Upper Thames catchment using similar numbers of animals (in that case, 44 animals per release site) were most successful where releases occurred at three separate locations over a three-year period, with release sites within 2km of each other. Releases using fewer animals at isolated sites have generally been unsuccessful.
- 7.2 The minimum recommended number of individuals for a reintroduction in rural lowland landscapes is 180. This has been based on the successful releases within the Upper Thames catchment, which established a new water vole population; the successful releases were those where there were three separate releases in close proximity. A reintroduction could therefore comprise one single release of 180 animals or multiple smaller releases, for example, three separate releases of 60 animals, at different Release Sites within 2km of each other.
- 7.3 Multiple releases at the same Release Site in separate years are not recommended. If a conservation translocation at a given Release Site has failed the reasons for this will need to be determined prior to any subsequent release at the same site. Each release should therefore seek to release the entire cohort in a single season.
- 7.4 The exception to this is where a conservation translocation aims to establish a meta-population using multiple separate Release Sites, such as a reintroduction comprising three separate releases of 60 animals, within 2km of each other; in this case consideration should be given to phasing the release over three years (one year per Release Site) to minimise the risk of all of the animals being lost to a single unforeseen catastrophic event.
- 7.5 Importantly, water voles must not be released in greater numbers than the habitat within the Release Site can support. As discussed in Section 5, a Release Site for 60 animals will comprise a minimum of 1.5km of watercourse. Releases of larger cohorts will require proportionately larger Release Sites.
- 7.6 For releases at upland sites, a minimum of 60 animals is also recommended at this stage in the absence of robust data to allow calculation of a specific MVP size for upland populations. However, water voles in upland habitats generally exist at lower densities than water voles in good or optimal habitat in the lowlands; it is therefore recommended that Release Sites would need to be proportionately larger (see Section 5).
- 7.7 As discussed in Section 5, the use of multiple smaller sites (with fewer than 60 animals at each, but adding up to an overall total of at least 60) may be appropriate in upland or urban sites where a sufficiently large amount of contiguous suitable habitat cannot be identified. This approach

was taken for the Kielder reintroduction and (in part) for the Trossachs reintroduction and proved successful overall, but there is insufficient data on which to base a specific protocol. There have been reintroductions in Greater London that will yield useful information on urban reintroductions in the future, but these have occurred too recently to inform this guidance.

7.8 All releases to date have used an approximately 1:1 sex ratio, although there is some variation from this in practice as the sex ratio of the release cohort is dependent on that available from captive-bred stock.

7.9 Animals should be sexually mature at the time of their release (females 112g and males 115g minimum weight (Moorhouse, *et al.* 2008)) and no more than 12 months old to ensure that they can contribute to successful establishment of the population. Older animals can be released but should be counted as additional to the minimum numbers recommended above and therefore only if there is sufficient space at the Release Site; they should be released at the periphery of the Release Site rather than in the central core area to reduce competition with individuals of breeding age.



Box 3: Minimum Viable Population size estimates for extant water vole populations

These estimates were calculated using population viability analysis software (VORTEX 10.9) with information on population densities of water voles from published field studies in a range of lowland British sites (Moorhouse and Gelling in prep), including within the Upper Thames area and Norfolk. The Minimum Viable Population (MVP) size is the smallest extant population size that would be expected to have a 90% chance of survival over a 100-year period under given conditions. The MVP estimates rely upon different levels of emergent and riparian macrophyte vegetation abundance on both banks perpendicular to the watercourse and can be related to ‘optimal’ (high vegetation abundance of >3-5m on both banks), ‘good’ (2-3m vegetation on both banks) and ‘poor but suitable’ (<2m of vegetation on both banks) habitat assessment classifications.

Habitat quality and vegetation abundance	Minimum Viable Extant Population	Required water-course length
Optimal habitat with high vegetation (>3-5m of emergent and bankside riparian macrophyte vegetation on both banks, perpendicular to the watercourse)	53-61	1km
Good habitat with medium vegetation abundance (2-3m of emergent and riparian macrophyte vegetation on both banks)	60-94	1.5 – 2.5km
Suitable but poor habitat with low vegetation (<2m width of emergent and riparian macrophyte vegetation on both banks) (NOTE: releases of water voles in habitat of this quality is not recommended)	125-200	4.0 – 6.5km

The guidance uses MVP size as a proxy for the minimum size of a release cohort in habitats of different qualities based on a proportion of them disappearing shortly after the release. These animals should be replaced relatively quickly by the first generations of water voles produced on site, thereby maintaining the MVP size in the short-term.

Vegetation abundance is the primary factor to influence both the initial and post-release survival of water voles (Moorhouse, *et al.* 2009), however other factors may impact the likelihood of success of a reintroduction, such as stress and animal welfare, and the potential increased predation rates due to individuals exploring and setting up territories in novel environments. Therefore, in a lowland habitat an average width of 2m of emergent and riparian macrophyte vegetation (on both banks) over a 1.5km watercourse length should be considered a practical minimum to sustain a viable colony, with vegetated margins of greater than 3m for at least 2km being preferable. Upland habitats or urban environments are likely to require the greater lengths of watercourse to support a MVP in general, due to lower habitat quality.

Timing of releases

7.10 The Water Vole Mitigation Handbook recommends spring for the release of wild-caught animals directly into a Release Site. Autumn releases are also possible although there are concerns about releases this late in the year as animals may not have time to establish themselves prior to winter. This is likely to be less problematic in lowland areas and more southerly latitudes. The timing of release of wild-caught animals is, in part, dictated by when it is appropriate to trap water voles; this is not a factor that needs to be considered for the release of captive-bred animals.

7.11 Most releases of captive-bred animals to date have been undertaken in either early-summer or late-summer. Both approaches are known to be effective. There have also been examples of spring releases that have been successful. There may be other options that deliver better results, but there are insufficient data available to allow an assessment of the likely effectiveness of differing from this approach.

7.12 There are therefore three recommended options for timing of releases:

- 1) Early-summer release (June). Release cohort of animals are young of the year from first litter with no older breeding adults, although potentially older post-breeding adults could be released as additional animals at the edges of the Release Site if there is sufficient habitat available. Released animals will only be competing with other young water voles rather than the range of ages typical in an extant colony. These young animals should breed in Year 0 on site, with them and their offspring overwintering to provide breeding animals for Year 1.
- 2) Late-summer release (August). Release cohort of animals from subsequent litters (i.e. those not able to be released in June or born afterwards) and any adults which have bred that year but are no longer required by the breeder. The young, released animals should successfully overwinter and prior to that may breed successfully on site in Year 0 although those offspring may or may not survive winter.

The early-summer / late-summer approach has the advantage of using the same breeding stock to obtain the animals to be released in both cases.

- 3) Spring release (late April or May). Release animals pre-breeding in pairs, with one male and one female introduced simultaneously to the release pen (see paragraphs 7.20 and 7.21 below for further details). This approach has the advantage of maximising the length of the breeding season available to the released animals on site. However, breeding may be unsuccessful and, if breeding does occur, young animals from the first litters will be competing with their parents in Year 0.

7.13 Releases of captive-bred water voles in autumn is not recommended. However, immediate translocation of wild-caught animals to a suitable receptor site in early autumn may be preferable to bringing animals into captivity in certain scenarios; this is outside the scope of this guidance.

- 7.14 Releases of water voles in later autumn, winter or early spring are not recommended, as the animals may struggle to survive colder conditions, vegetation die-back and possibly also flood events that are more likely at these times of year.
- 7.15 It will be appropriate to vary the timing set out above in northern England or Wales, in Scotland and at upland sites in all three countries. In these cases, early summer (June) releases are recommended. Whilst there have been successful releases at upland sites in late summer, the proportion of release sites that were still occupied by water voles in subsequent years at Kielder were higher for June releases than for August releases.

Release methods

- 7.16 The handling of water voles should be minimised during releases. Current guidance is for operatives handling water voles to wear clean, disposable or washable mask and gloves. Appropriate biosecurity measures should be employed at release sites, ensuring that clothing, footwear and equipment is clean and thoroughly dried, or has been disinfected.
- 7.17 It is appropriate to soft-release water voles into a pen from which the animals can gradually explore over subsequent days. Ideally pens should measure a minimum of 30cm x 60cm x 90cm (for individuals or siblings) and be made from wood and mesh. Pens should be at least twice this size for releasing non-related pairs. If there is no base to the pen and it is dug or pressed into the ground, water voles can dig out in due course, or if a 'complete' pen is used water voles can be released via a small door/baffle. Both scenarios permit the animal to come and go as it habituates to its new environment. Both pen types have been used successfully; it is not known whether one is more successful over the other. The choice of pen type will likely be determined by practical considerations, such as ease of installation and ease of re-use.
- 7.18 Approximately half of each pen should be provisioned with three or four segments of baled straw/hay for burrowing, nesting and to provide cover, and be supplied with carrots, apple and other vegetation and a shallow water tray which can be filled from the adjacent watercourse and should be topped up daily. Bedding material should be covered to protect it from getting wet during heavy rain, and there should be sufficient protection from the sun to avoid overheating.
- 7.19 Hard-release of animals straight into the wild with no protection or provision should be avoided: water voles are prey species, and naïve animals unfamiliar with their new environment may be at greater risk of predation in the period during which they are habituating to their new location.
- 7.20 It is recommended that each animal is released individually in its own release pen (i.e. one animal per pen) for several reasons:
- a) It helps to space the animals out at appropriate intervals, reducing the need to disperse to create a territory;

- b) It minimises the number of animals likely to be affected if there is a problem with one of the release pens, such as it becoming damaged or predated; and
- c) Water voles are predominantly solitary animals and will generally fight if one is introduced to another's enclosure, resulting in one of the animals being killed.

7.21 It is possible to release animals together in some situations, for example:

- a) A male and female can be released together if they are both introduced to a new release pen simultaneously, although a larger release pen than normal would be required. Should such a release be considered appropriate, the release pen should be a minimum of twice the size of those used for individual animals (at least 60cm x 120cm x 180cm). This should only be considered for spring releases; and
- b) A group of same-sex siblings can be released together assuming they have not been previously separated, but this is not recommended for the reasons of spacing and minimising risks.

7.22 Females should not be released into adjacent pens, instead males and females should be released alternately along the watercourse. This will help to mimic natural territorial spacing.

7.23 Once animals are in the release pens they will require ongoing provision of food and fresh water daily. Provisioning should occur for a minimum of three days after release (after the opening of release door/baffle for complete release pens if that is done later), or longer if there are still signs of water vole using the pen (up to a maximum of eight days). Water voles normally defecate into their water trays, so this may indicate whether an individual is still reliant on the pen post-release, and therefore when the pen might be removed.

7.24 Once animals are confirmed to no longer be reliant on them, the pens should be carefully removed from site. The hay/straw should be checked to ensure no water voles remain and then disposed of along with uneaten food. If the released animals have not burrowed out after eight days a route out of the pen should be created for them and the pen removed the following day.

Siting of release pens

7.25 Release pens should be situated along the watercourse towards the top of the bank and/or within or at the edge of dense riparian cover. There should be tall, dense vegetation providing food and cover along the front edge (nearest the watercourse) and both sides of the pen. Turves can be carefully excavated and positioned appropriately to ensure this, if suitable vegetation doesn't already exist at the time of installation.

7.26 Ideally, the opening part of the pen lid should be at the rear of the pen. This means that those checking on the animals and provisioning the pens are less likely to trample the vegetation in front, and along the sides, of the pen which could be used as cover for an emerging water vole. It is important that the water vole exit door/baffle location has good vegetation cover surrounding its' location, which should be towards the front of the release pen and the waters edge.

Appropriately sited release pens



A release pen sited towards the top of the bank within dense vegetation to provide cover and forage immediately adjacent to the pen.



A release pen positioned at the top of a vegetated bank, set back from the water's edge but within continuous bankside cover.



A release pen concealed by cut foliage and dense bankside vegetation extending to the water's edge. The cut branches provide shade and reduce overheating in warm weather, and the surrounding cover offers immediate refuge and foraging opportunities for water voles upon exit.



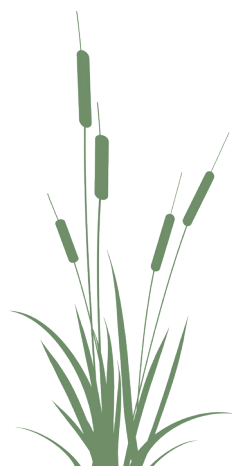
A release pen sited close to the water's edge amongst emergent vegetation. This location is on a canal, where water levels are unlikely to fluctuate significantly during the release process, allowing pens to be positioned closer to the water than would be advisable on more dynamic watercourses.

7.27 The precise location of the pen should be selected by an experienced practitioner taking account of the conditions at the time of the release and historical knowledge of the site. Pens should be positioned:

- a) Adjacent to permanent wetland habitat (i.e. avoid ditches or ponds that could dry out);
- b) On dry ground with a substrate suitable for burrowing (e.g. earth or peat; avoid stony, sandy or gravelly substrates or reinforced banks);
- c) Above flood levels;
- d) Within 30-50cm of the water's edge wherever possible, and no more than 1m away from the water;
- e) No more than 50cm above water level;
- f) No less than 10cm above water level for pens with no base, to allow animals to burrow out;
- g) Where there is suitable vegetation along the front edge and along both sides;
- h) Away from public access, or suitably fenced off, to ensure that pens are not tampered with during the release;
- i) In locations accessible for monitoring the animals and provisioning the pens.

7.28 Pens should be positioned so that animals of the same sex are at least 40m apart (i.e. minimum distance between pens is 20m provided that males and females are alternated) but could be spaced further apart (up to 100m) if there is sufficient available habitat. If more than one animal is released per pen the spacing should be increased proportionately. Pens should be within or immediately adjacent to optimal or good habitat, avoiding areas of poor habitat where possible.

7.29 At upland sites the minimum distance between pens containing animals of the same sex should be increased to at least 80m.





8. Monitoring

Rationale

- 8.1 The monitoring protocol described below is based on the recommendations set out in the IUCN Guidelines and the English and Scottish reintroduction guidelines on monitoring and success, adapted as appropriate to relate to the ecology and population dynamics of water voles. It has been informed by data gathered during Stages One and Two of the research project, as well as by the available options for monitoring water vole populations.
- 8.2 As described in Section 3, all water vole conservation translocations will have the same general objectives, as well as one or more project-specific objectives. The purpose of the monitoring will be to determine success or failure against these objectives.
- 8.3 Appropriate monitoring for determining success against the general objectives are described below. Additional monitoring may be required to determine success against the project-specific objectives.
- 8.4 Appropriate biosecurity measures should be employed during all monitoring visits, ensuring that clothing, footwear and equipment is clean and thoroughly dried, or has been disinfected.

Monitoring during the release

- 8.5 All release pens should be visited daily during a water vole release to:
- Check that the pens are intact
 - Check that the animals have appropriate provisions
 - Check for visible evidence that the animals are still alive, with minimal disturbance (e.g. partly eaten food, fresh droppings in the water bowl/tray)
 - Check for evidence of the animals having burrowed out of or exited the pen
- 8.6 If after five days there is no visible evidence of the animal, the pen should be searched to confirm that it is no longer present.
- 8.7 Any deaths during transportation or release should be recorded and the reasons ascertained wherever possible, through detailed post-mortem of individuals.

Post-release monitoring

- 8.8 A field sign survey of the entire Release Site should be undertaken in the same year as the release (Year 0). Surveying beyond the Release Site is not required in Year 0, unless no field signs of water voles are recorded within the Release Site. It should comprise a single survey visit and be undertaken 1-2 months after the release date; the timing of this survey visit will therefore be dependent on the timing of the release.

8.9 Field sign surveys should also be undertaken in the year following the release (Year 1), three years post-release (Year 3) and five years post-release (Year 5). The surveys should extend beyond the boundaries of the Release Site itself to include suitable habitat elsewhere within the CTS. Field sign surveys do not need to extend throughout the entire CTS in all years, where it is unlikely that water voles will have colonised it by that stage – surveys should commence in the Release Site and extend sufficiently far beyond it to confirm the extent of water vole distribution. However, it is generally expected that water voles should have colonised the entire CTS by Year 5; surveys should therefore extend throughout the CTS in Year 5.

8.10 Two survey visits should be undertaken in each of Years 1, 3 and 5 – one visit in the early season (late-April to late-June) and one visit in the late season (early-July to early-October). Ideally, the survey visits in Years 1, 3 and 5 should be undertaken in the same months of each season to ensure comparability of the data.

8.11 The recommended approach to monitoring is summarised in Table 2.

Table 2: Summary of recommended monitoring for water vole conservation translocations

Monitoring Year	Number of visits	Timing	Extent of survey
Year 0 (release year)	1	1-2 months after release date	Release Site only (unless no field signs recorded at the Release Site, in which case extend to search for evidence of released animals)
Year 1	2	Visit 1: late-April to late-June Visit 2: early-July to early-October	Extend beyond the Release Site to include other parts of the CTS where there is suitable habitat for water voles. The survey should extend as far as is likely that water voles will have dispersed; surveys should therefore cover a greater area in Years 3 and 5 than in Year 1, for example
Year 3	2	As per Year 1 – ideally in same months	
Year 5	2		

8.12 The following information should be recorded on each visit:

- Assessment of habitat suitability and mapping of this, where there is variation within the Release Site or CTS – the assessment needs to be done consistently between years, so should be based on defined habitat categories, e.g. those described in Dean (2021) or bespoke site-specific categories that are clearly defined
- Any recommendations for changes to habitat management to maximise the chances of success
- Field signs confirming the presence of water voles within the Release Site (see Dean (2021) for a description of field signs)

- *Year 0*: Extent of evidence of presence of water voles within the Release Site (i.e. is there evidence of presence throughout the Release Site or only in certain locations)
- *Years 1, 3 and 5*: Extent of evidence of presence of water voles within the Release Site and other parts of the CTS
- Number of latrines within the Release Site – this should be a total count in a defined area, rather than an estimate or assignment to a category of relative density (see Section 2, Glossary of Terms), as the comparison of absolute numbers between years will be required to determine success against the general objectives
- Note: latrines are piles of droppings left by water voles to mark their territory – see Dean (2021) for further guidance on identifying latrines
- *Year 0*: Any evidence that water voles have started to occupy habitat beyond the Release Site (although surveys beyond the Release Site are not necessarily required in Year 0 unless no evidence of water voles is recorded within the Release Site)
- *Years 1, 3 and 5*: Number of latrines (total count) within defined parts of the CTS beyond the Release Site
- Field signs of the presence of American mink
- Any limitations to the surveys

8.13 The presence of latrines within the Release Site in any year demonstrates attempted breeding, but successful breeding can only be inferred if either:

- 1) There is at least a 50% increase in the number of latrines between early season and late season surveys in the same year (which could be determined in Year 1); or
- 2) There are latrines present in Years 3 or 5 following the release (given the lifespan of individual water voles this will suggest successful breeding of both the release cohort and their offspring).

8.14 Note that if successful breeding is not determined through Year 1 surveys, it may be appropriate to consider repeating these surveys in Year 2 as this may indicate a failure of the conservation translocation.

Determining success against general objectives

8.15 The results of the monitoring surveys described above will allow determination of success against the general objectives, as described in Table 3, and any remedial measures required (e.g. changes to habitat management) if the objectives have not been achieved.

Personnel

8.16 The monitoring surveys should be undertaken by experienced water vole surveyors. To aid with the collection of consistent data, it is advantageous for the surveys in different seasons and years to be undertaken by the same individual.

8.17 The individuals (or organisation) responsible for undertaking the monitoring should be identified at the outset of the project to maximise the likelihood of it being completed. The nominated individual(s) or organisation is also responsible for dissemination of results.

8.18 The IUCN Guidelines actively encourage local community involvement in monitoring as a way of engaging their interest and support. Projects should take opportunities to involve the local community whilst also ensuring quality and consistency of the data. See Section 10.

Table 3: Demonstrating success of water vole conservation translocations

General Objective	Monitoring results indicating success	
Survival of sufficient individuals within the released colony to allow establishment	c.100% survival of individuals during the release (including the transportation of animals to the Release Site)	
	Water voles still present at the Release Site in Year 0 and Year 1 monitoring, demonstrating overwinter survival and establishment	
Successful breeding within the Release Site	Increase in the length of occupied habitat and/or number of latrines between early season and late season surveys (ideally by Year 1, but otherwise by Year 2) OR water voles still present at the Release Site in Year 3 (assuming that it cannot have been colonised by water voles from the surrounding area)	
Expansion of the released colony	Year 3	Increase in local distribution (beyond Release Site) and/or number of latrines between Years 1 and 3
		At least 10% of the Release Site occupied at 'High' relative density
	Year 5	Increase in local distribution and/or number of latrines between Years 3 and 5
		Present throughout the Release Site at, on average, 'Moderate' or 'High' relative density
		All habitat within the CTS occupied at, or approaching, carrying capacity

Dissemination of monitoring results

8.19 In order for the monitoring to inform future water vole conservation translocations it is essential that there is a central point for the collection of data from different projects.

8.20 The results of the monitoring should be provided in an agreed format to PTES on an annual basis and within six months of completion of each year's surveys. The information to be provided must include the items listed in Paragraph 7.9 (Year 0) and Paragraph 7.12 (Years 1, 3 and 5) above, as well as additional monitoring results relating to project-specific objectives. Details of the survey methods, dates, level of effort and personnel should also be provided.

8.21 PTES will add the data into a spreadsheet of all conservation translocations. This will be updated regularly. The only publicly available data will be location (to the nearest tetrad, rather than specific grid references), year of release, and number of animals released. Other data will be kept confidential and only used to inform relevant research projects and future iterations of these guidelines.

8.22 By ensuring all data collection follows a standard methodology and is uploaded to a structured central database, the risk of detail being lost due to a change in project personnel over time is minimised.

Ongoing monitoring beyond Year 5

8.23 Once a conservation translocation has been determined to be successful and has achieved its objectives (assumed to be by Year 5 in most cases) the site should be registered as part of the National Water Vole Monitoring Programme (NWVMP) with PTES¹³. This will mean that annual monitoring continues but with a different survey design due to the focus being on informing an understanding of the national status of water voles, rather than determining success or failure of a specific conservation translocation. The monitoring can be done by a member of the project team that undertook the release, or by one of the network of volunteers already signed up with PTES.

Genetic monitoring

8.24 The IUCN Guidelines state that: *‘Where genetic issues are identified as being critical to the success of a translocation, monitoring can be used to assess genetic diversity in establishing populations or the effects of reinforcement or other management.’* DEFRA’s Guidance states that *‘Genetic monitoring is costly and so it is mainly appropriate for translocations where genetic issues have been identified as critical to the project’s success’*.

8.25 Research is currently proposed to assess the genetic structure of reintroduced water vole populations. At this stage it is considered unlikely to be necessary to include any form of genetic monitoring as part of individual conservation translocation projects, unless the outcomes of research dictate otherwise.

Health and mortality monitoring

8.26 The IUCN Guidelines identify the possible need for health and mortality monitoring, which *‘assesses the extent that an establishing population is experiencing disease, or adverse welfare conditions or mortality, as a basis for identifying underlying causes’*. This may be appropriate in some specific cases for investigating a failure, for example through post-mortem analysis of dead animals at Release Sites. However, identifying diseases within the population would require a trapping programme which is likely to be very labour intensive and is unlikely to be appropriate for most conservation translocation projects.

¹³ <https://ptes.org/get-involved/surveys/countryside/national-water-vole-monitoring-programme/>

Monitoring at donor sites where water voles have been captured from the wild

- 8.27 Where water voles have been captured from the wild as a donor population for the conservation translocation (as opposed to being sourced from captive-bred populations) one of the project-specific objectives will be that there is no detrimental impact on the conservation status of the donor population in the long-term (five years post trapping).
- 8.28 Water voles should still be present at the donor site and in the surrounding area (up to 2km), at the same relative density (or higher) as was present prior to trapping taking place by Year 5. This will need to be determined by additional field sign monitoring at the donor site in Years 1, 3 and 5 following trapping (although monitoring may be unnecessary in Year 5 if Year 3 monitoring shows that the objective has been achieved).
- 8.29 In addition, there should be no decrease in the number of known sites where water voles are present within the 10km grid square where trapping took place, nor within adjacent squares. This should be determined with reference to national datasets or county distribution maps (where available). Whilst the trapping may not have caused the decline it will be important to understand whether the status of water voles has changed at the donor site and in the surrounding area.



9. Mink Control and Eradication

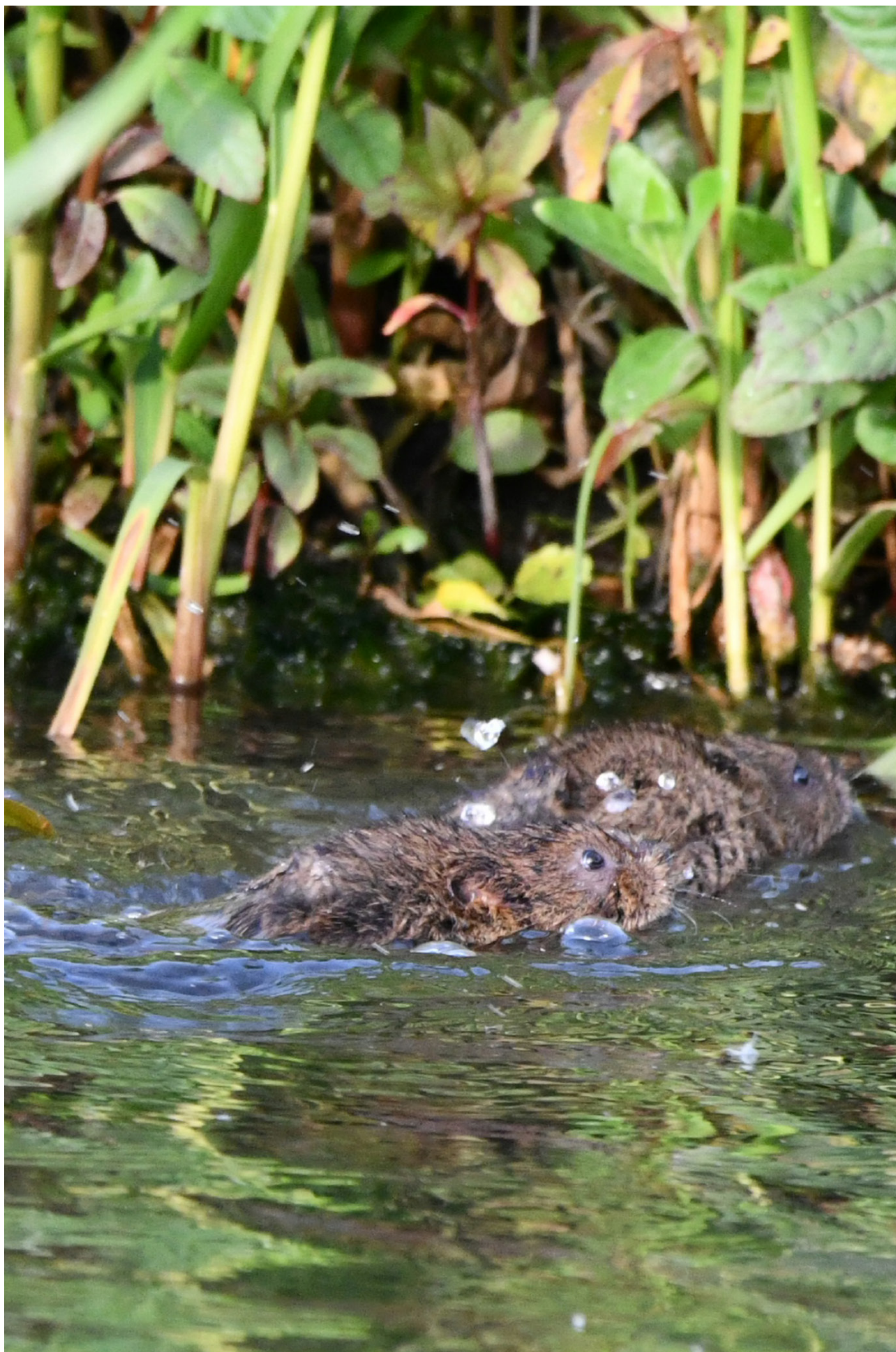
- 9.1 Given the impact of invasive American mink predation on water vole populations, the lethal control of this species will be a major factor in allowing the successful establishment of a water vole colony at all stages of a release (Strachan, *et al.* 2011; Barreto, *et al.* 1998; Rushton, *et al.* 2000).
- 9.2 Comprehensive, catchment-scale mink control has been demonstrated to be a highly effective means of eradicating mink from a given geographical area (Martin 2022; Martin and Lea 2020; Chapter 26 in Gaywood, *et al.* 2016), and in maintaining that area's 'mink-free' status over time due to continued mink control on a landscape scale.
- 9.3 Lethal control of mink must be undertaken where evidence of this species is recorded, or where there is no history of long-term mink control at a catchment scale. Mink are cryptic and highly mobile, therefore a lack of field signs should not be relied upon as them being likely absent.
- 9.4 It is therefore imperative that mink control at any proposed water vole CTS, and in the wider landscape (at least 10km beyond the CTS), commences on the ground at least one year prior to the first release of water voles (and ideally two or more years) and there is a commitment for it to continue for the foreseeable future, or until mink are eradicated from that region. Trapping should be undertaken throughout the year wherever possible, and where conditions permit, and must include both the pre-mating early spring season and autumn dispersal season to ensure impact on the breeding mink population.
- 9.5 Local mink monitoring and control programmes should be registered on a national database to provide confidence and oversight of its effectiveness, and to support other mink control or eradication initiatives. In geographical areas where the Waterlife Recovery Trust¹⁴ project or the Scottish Invasive Species Initiative¹⁵ are active, co-ordination with their work and activities is recommended; in other geographical areas, traps and captures/dispatches should be registered using the MinkMApp¹⁶.
- 9.6 Where possible 'smart' traps should be deployed which utilise technology to alert a user when the trap has been triggered, thereby enabling the trap to be deployed in active mode from the outset and to continue monitoring mink presence with minimal user effort, whilst ensuring high animal welfare standards both for a captured mink, but also any bycatch species (Martin 2022).
- 9.7 In areas where mink control has not previously been undertaken it may be prudent to initially deploy smart traps at a density of approximately one per 2-5km of waterway; this density is suggestive and will vary depending upon numerous factors (Martin and Lea 2020) both within the CTS and the wider landscape, including the type of mink trap being used (clay tracking, or smart trap) and whether or not the Release Site is located within an ongoing catchment-scale mink control/eradication programme.

¹⁴ <https://www.waterliferecoverytrust.org.uk>

¹⁵ <https://invasivespecies.scot>

¹⁶ <https://minkmapp.uk>

- 9.8 The use of smart rafts is recommended due to the efficiency of detecting and capturing transient mink. However, it is recognised that such traps may not be the best option in some areas, for example where there is no network coverage for a trap alarm to send a notification, or where there is significant risk of repeated capture of other species such as water voles or pine martens (*Martes martes*). It may be possible to design and fit excluders to traps to minimise capture of non-target species. Several designs of water vole excluder have been developed, although as yet there is insufficient data to allow a specific design to be recommended. Alternatively, a plan for regular and systematic checking of clay footprint tunnels prior to deploying live traps, and daily checking of active live traps should be devised and rigorously followed.
- 9.9 Ideally a proposed CTS should be mink-free (no mink captures despite continued trapping effort) for at least one year prior to release of water voles. Should mink continue to be captured within the 10km buffer area surrounding the CTS after 12 months of ongoing, rigorous mink control, it may be appropriate to postpone the water vole release until mink numbers have been significantly reduced.
- 9.10 Mink control must not be discontinued after the release of water voles unless mink have been eradicated from the region. Continued catchment-scale control will ensure ongoing protection for the colony, although it may be possible to reduce the density of smart raft traps to aid surveillance and mink control over a wider geographical area. This will again be dependent on multiple factors, and consultation should be had with other stakeholders.
- 9.11 How to find out if there is local mink control ongoing in any location, or the setting up of a co-ordinated, landscape-scale mink control programme is beyond the scope of these guidelines. Results from the Waterlife Recovery Trust suggests that one smart raft per 18km¹⁷ is sufficient for likely eradication in a county within five years (D. Tansley, pers comm). However, deploying mink traps at this density would require a significantly longer lead-in time prior to releasing water voles within the area. Further information may be found on the Waterlife Recovery Trust website www.waterliferecoverytrust.org.uk.



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10. Social Aspects

Pre-release

- 10.1 As with any conservation translocation, it is important to ensure that landowners and land managers both within the CTS and adjacent areas, are aware of the proposal and understand the implications. Water voles are herbivorous and are therefore likely to generate fewer social issues than certain other species, although their protected status may be of concern to some stakeholders, particularly those involved in watercourse management or considering a development project.
- 10.2 The control and eradication of American mink can be controversial for some conservation organisations and volunteers. The reasons underpinning this requirement need to be carefully explained to those involved. Locations of mink traps must be kept confidential.
- 10.3 It is important that all relevant stakeholders are involved at an early stage, are kept informed and any concerns are addressed.

During the release

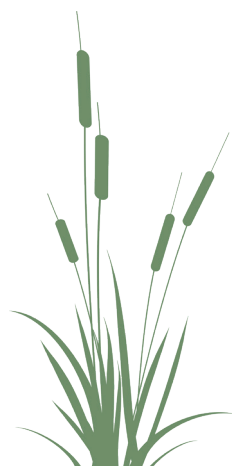
- 10.4 The specific location of the Release Site should be kept out of the public domain until the release has been completed and any release pens removed.
- 10.5 There may be public interest at the time of the release and it can be a useful way of promoting water vole conservation and the specific conservation translocation project. It can be helpful for the overall aims of the project to allow stakeholders and local volunteers to observe the release. However, the number of people involved should be minimised to reduce stress levels for each individual animal. Handling of water voles should be minimised and should only be undertaken by those with appropriate experience, and only where necessary. The release of captive-bred water voles will generally require very little, if any, handling of the animals during the release itself.
- 10.6 Local conservation volunteers, with appropriate instruction and training, can be used to assist with daily checks of pens and the provisioning of them. They should not undertake any tasks requiring handling of the animals.

Post-release

- 10.7 Local conservation volunteers, with appropriate instruction and training (and with the relevant licences, if required), can also undertake post-release monitoring. This can be a useful way of engaging with the local community and encouraging an ongoing legacy of water vole monitoring beyond the completion of the conservation translocation project.

11. Document Review and Areas for Further Research

- 11.1 This document should be reviewed after five years and updated as necessary. The review should be informed by the results of monitoring from recent water vole releases that have collected data that is consistent with the approach set out in these guidelines. In particular, the data could be used to further refine the recommended minimum numbers of water voles to be released. It may also allow a refinement of the protocol for releasing water voles at urban or upland sites, or in non-linear wetland habitats or terrestrial habitats.
- 11.2 Further research is required to better understand the genetics of captive-bred water voles and the implications for releases.
- 11.3 Further research is required to better understand the extent to which culverts, tunnels or bridges of different types, sizes and lengths result in the fragmentation of water vole populations.



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Appendix 1: Case Studies

Case study reference:	Reason for inclusion
Case Study 1: Reintroduction of water voles to the Upper Thames catchment	A controlled, replicated trial testing the effect of habitat abundance and quality on establishment success.
Case Study 2: Water vole reintroduction to the Meon Valley	A landscape-scale, multi-year reintroduction (over 2,800 water voles) tied to the conservation of a chalk stream.
Case Study 3: Barn Elms: the first water vole reintroduction	The earliest documented UK reintroduction. Demonstrates the value of pre-release disease screening, and the vulnerability of an isolated urban population lacking metapopulation support.
Case Study 4: The Trossachs Water Vole Reintroduction Project	An upland, forestry-led reintroduction across 15 sites.
Case Study 5: Reintroduction of water voles to the North Tyne catchment, Northumberland	An upland reintroduction from a confirmed mink-free baseline.

Case Study 1:

Reintroduction of water voles to the Upper Thames catchment

The Upper Thames water vole reintroduction project was undertaken by the Wildlife Conservation Research Unit (WildCRU) at University of Oxford between 2005 and 2007 to test the effect of habitat abundance and quality on the success of a reintroduction.

Objectives

- To reverse local extinction of water voles in Oxfordshire by re-establishing populations of water voles along historically occupied rivers in the Upper Thames region, from which water voles were absent in 2005.
- To test how habitat abundance and quality affect initial establishment and longer-term success of reintroductions.
- To derive generally applicable lessons for reintroduction ecology and inform future conservation efforts using a rigorous, standardized release approach.

Study area and site selection

Twelve river stretches within the Upper Thames catchment were selected as replicate release sites. Each stretch was 800m in length and represented a gradient of riparian habitat abundance and quality to examine habitat effects on reintroduction outcomes. The broad categories for habitat abundance were 'wide' margins of riparian vegetation adjacent to the watercourse (between 3-6m of emergent and bankside vegetation measured perpendicular to the watercourse) and 'narrow' margins of up to 3m of vegetation measured perpendicular to the watercourse.

Preparation and release protocols

- The project engaged with landowners, communities, volunteers and conservation partners to reduce local extinction risks and create better-connected habitat networks.
- Mink control was implemented using mink tracking rafts and targeted trapping where mink presence threatened reestablishment, commencing in advance of the water vole release occurring. For some catchments the mink control was well established due to a parallel research project on the experimental control of mink, however for other catchments the mink control was initiated for this work and commenced the previous year in late summer.
- Habitat enhancements focused on increasing dense, continuous riparian vegetation to provide cover and food resources for voles, achieved by installing fencing where necessary at the appropriate perpendicular distance from the water course to protect the vegetation from stock grazing.

- Cohorts of 44 captive-bred water voles were released into each 800m stretch to standardize founding numbers across sites. This number was derived from population modelling based on parameters obtained in previous capture-mark-recapture studies, indicating that 800m with the minimal habitat width would support a release population of 44 voles with a 75% probability of population survival over 50 years.¹
- Water voles had been born the previous summer and overwintered in captivity, so were adults of breeding age and size. They were introduced to large soft-release pens measuring 120cm² by 60cm high, dug into the bankside at 40m intervals. The sex ratio of animals being released was 1:1, and each pen had one male and one unrelated female introduced simultaneously.
- Releases at different sites were undertaken in each of the three years of the project: 2005, 2006 and 2007 (only one release per site). All releases were undertaken during the first two weeks of May.

Monitoring methods

- All individuals were microchipped prior to release for individual identification. Monitoring was done via live-capture trapping for one week per month, per site for five months post release, with juveniles captured on site being microchipped at first capture.
- Short-term survival and dispersal were assessed by recording both the initial release location, and subsequent capture locations of individuals, plus traditional sign surveys including presence of burrows, latrines and feeding signs.
- Short-term population changes were measured using repeated standardized capture-mark-recapture surveys during the year of release (Year 0) to estimate post-establishment survival rates and density changes over time. A single field sign survey was conducted in the appropriate season in the following year (Year 1) to assess overwinter survival, and thereafter all sites were monitored on a three-yearly rotation by the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT). Those surveys continue to the present time.
- Habitat surveys quantified vegetation abundance and bank features to correlate site characteristics with demographic outcomes.

Outcomes

- Seven of the twelve releases resulted in populations becoming established and spreading in the first year post-release. Five of the release cohorts failed to persist and were ultimately lost. One of these losses was due to unseasonal late spring flooding.

¹ This calculation was updated to include the results from the Upper Thames work and to provide a higher probability of survival over a 100-year period for the Minimum Viable Population modelling work described in Box 3, used to inform these guidelines.

² Subsequent knowledge obtained highlights the need for landscape/catchment scale control of mink in perpetuity, or more ideally, complete eradication of mink.

- Of the release sites, three were located within 2km of each other at sites along the River Windrush and coincided with a catchment for which mink control was well-established before the releases occurred. Those populations still persist today and have spread along the catchment to form a Local Key Area for water voles. Two further sites were again located within 5km of each other. Although one was initially lost due to unseasonal late spring flooding, both currently maintain low populations of water voles. The remaining two sites which were deemed successful in the shorter-term, again both within 5km of each other, have since succumbed to mink predation in the intervening years.
- Sites with higher vegetation abundance showed greater survival of release cohorts and higher post-establishment survival rates and densities, demonstrating a strong positive relationship between riparian vegetation and reintroduction success.
- Failures were commonly associated with an inability to maintain mink control. Whilst initial control efforts were very good, as fewer mink were captured so regular monitoring of raft tracking plates by landowners tailed off, thereby allowing mink to recolonise some areas without detection. This highlighted the essential requirement for long-term and widescale invasive predator management alongside habitat restoration.

Lessons learned and recommendations

- Prioritise habitat quality: Wide swathes of dense, continuous riparian vegetation and natural bank profiles are important predictors of initial establishment success and long-term population density.
- Robust predator management is vital: Mink control must operate at an appropriate spatial scale and be sustained through the critical early years to prevent rapid re-colonisation by mink and resultant failure of the reintroduced cohort.
- Metapopulations and landscape coordination: Reintroductions are more likely to deliver lasting recovery when creating a metapopulation over a larger area, and they are embedded in catchment-scale restoration and partner networks that reduce threats across connected waterways.
- Partnerships with local wildlife trusts, landowners, and river catchment groups supported site selection, habitat work, mink control, and volunteer monitoring, improving both logistics and local stewardship.
- Catchment projects such as wider “mink-free” or connectivity initiatives amplified local release successes by creating safer corridors for dispersal and recolonisation across the Upper Thames tributaries.

Reference:

Moorhouse, T.P., Gelling, M., Macdonald, D. W. (2015). Water vole restoration in the Upper Thames In: Macdonald, D.W. and Feber, R. E (2015) Wildlife Conservation on Farmland: Managing for Nature on Lowland Farms. Oxford University Press.

Case Study 2:

Water vole reintroduction to the Meon Valley

The Meon Valley Partnership was formed to drive forward the conservation of the River Meon as a nationally important chalk stream designated as a Local Wildlife Site. Through the partnership, the South Downs National Park Authority, Hampshire and Isle of Wight Wildlife Trust, Environment Agency and other partners collaborated to reintroduce water voles to the Meon.

Objectives

- To restore a locally extinct species which had been extirpated through a combination of habitat loss and American mink predation.
- To re-establish a self-sustaining population of water voles throughout the river valley including in the South Downs National Park.
- To restore and enhance river ecosystem health by stabilizing banks, diversifying bankside vegetation and improving habitat to promote a richer biodiversity.
- To engage landowners and the local community in long-term river and habitat stewardship.

Release sites

Seventeen locations within the Meon Valley were selected for release sites. These provided a mixture of different riparian habitats within a chalk stream and spring-fed riverine environment, including along water courses flowing through meadows, along ditches, reedbeds and wet-meadow systems.



Preparation and release protocols

- The project relied on significant cooperation between stakeholders, including local landowners, volunteer groups, conservation agencies and the local community.
- Preparatory work commenced in 2009 with coordinated mink control using surveillance rafts and trapping, building on earlier ad-hoc trapping by landowners and fishing clubs. Ongoing communication via bi-monthly calls to landowners ensured that any required repairs to the rafts were undertaken and that trapping effort was maintained. Monitoring and reporting by landowners identified faster recolonisation by mink in the mid and lower reaches of the catchment, likely due to proximity to other watercourses, which prompted increased trapping effort both in the catchment and across



adjacent waters. Awareness of and involvement with the proposals to reintroduce water voles were beneficial in maintaining trapper enthusiasm.

- Habitat enhancements focused on restoring a natural river channel along the Meon and creating a more naturalised meandering channel. Bank management tree works, cattle-exclusion fencing and bank revegetation was also undertaken to improve the habitat for water voles, and advice on future habitat management was provided to support landowners, both at the release sites and elsewhere throughout the river valley.
- The first cohort of water voles was released in 2013, with subsequent releases to different sites within the Meon Valley in June and August each year until 2018.
- The number of animals released at each location ranged from 10 to 600 individuals, dependent upon the length or area of habitat available. In total more than 2,800 water voles were released.
- Water voles were predominantly captive-bred although some were translocated from wild populations. Release was undertaken following a soft-release protocol.



Monitoring methods

- Post-release the sites were regularly monitored via field sign surveys. This included the use of 'latrine rafts'. Monitoring was extended into the wider habitat where releases did not occur. Camera trapping formed part of this survey programme which generated valuable data as well as footage of water voles and other wildlife that was used in project comms.
- A full survey conducted in 2024 found water vole presence at 27 sites along the Meon River and its tributaries.



Outcomes

- Monitoring concluded that this reintroduction was a success in the long-term, with water voles present in 2024 (six years following the final release in the Meon Valley) at 27 different sites.
- A variety of other species were also recorded as present along the river during the 2024 monitoring survey.

Lessons learned and recommendations

- Ecosystem-wide landscape-scale projects work and can result in restored riverine habitat and a healthy river. The ambition to reintroduce a locally extinct and much-missed species acted as a catalyst for both mink control and habitat enhancement, which also benefitted a range of other species.
- Sustained mink control before and during the project was crucial, and ongoing mink control was noted in the 2024 monitoring report.
- Planning and management of the release programme is vital to aid likely success and record outcomes. Site preparation prior to release and a soft-release protocol were considered essential in improving the chances of success, with long-term monitoring to catalogue survival, settlement and colony/population establishment.
- Long-term commitment and collaboration with all partners and organisations throughout the duration of the project and beyond was crucial to the success of the project. Some release sites were under the management of project partners such as Hampshire County Council whilst others were owned by individuals with which the partnership had already engaged. These acted as a nucleus from which to engage neighbouring landowners not previously involved.
- Ecosystem restoration can be driven by a single species.

With thanks to Ali Morse for her input

Case Study 3:

Barn Elms: the first water vole reintroduction

Barn Elms, the Wildfowl and Wetlands Trust (WWT) London Wetland Centre, was a major urban wetland restoration project to which water voles were restored in 2001 in one of the first projects of its kind.

Objectives

- To undertake a controlled reintroduction of water voles to a managed reserve where ongoing monitoring could occur.
- To increase public awareness of the plight of water voles.
- To identify parasites and pathogens of primary concern to water vole survival or public health, and health factors predictive of water vole survival via pre-release health screening.

Release sites

Barn Elms constituted a mosaic of well-established wetland habitats that were transformed in the late 1990s in a loop of land by the River Thames, which was formerly Victorian reservoirs in Barnes, London. The habitat included wetland, reedbeds, marshland and wet ditches.

Preparation and release protocols

- The initial release involved 109 captive-bred animals descended from fish-farm stock on the River Itchen, with a further 38 individuals translocated from a water treatment works in Reading on the Kennet and Avon Canal.
- Water voles were released in groups of 6-15 individuals between late May and late July 2001.
- A small reinforcement release was undertaken in 2003, with further 'minor reinforcements' in subsequent years.
- Releases occurred via both soft- and hard-release. The soft-release cages were solid aluminium pens which were pressed into the earth and from which animals could dig out of within a very short period.
- Predator control was established prior to the initial release to safeguard the breeding bird populations, although there remained a risk from both urban foxes and aerial predators. No specific mink control was undertaken.

Monitoring methods

- Monitoring was conducted via live-trapping sessions during autumn of 2001 and spring/early summer 2002, for five days to understand initial survival and survival over winter.
- In subsequent years, monitoring was undertaken via traditional field sign surveys.

Outcomes

- Water voles continued to be distributed throughout Barn Elms in 2024, 23 years after the initial release, with some expansion of the population to the adjacent Beverley Brook on the opposite side of the Thames.

Lessons learned and recommendations

- Barn Elms is relatively isolated, with little connectivity to the wider riparian landscape. Although water voles continue to persist, historically there were questions relating to how long they would remain present due to a paucity of genetic variation, and an inability to rely on a wider metapopulation to withstand natural stochastic events. The population may therefore still be vulnerable.
- Predator control was already occurring on site prior to the reintroduction, albeit for the protection of breeding birds on the reserve. This included installation of a predator-proof fence as well as pest control measures.
- Public engagement increased support for water voles. Post-reintroduction, water voles could often be spotted from the visitor café and have been a regular feature on the WWT website.
- Through pre-release health surveillance, the importance of red blood cell production was identified as a possible factor influencing survival. This may be due to the importance of haemoglobin in efficient oxygen uptake for a species which relies on diving as a primary defence mechanism.
- Several parasites and pathogens were identified in water voles for the first time, including *Cryptosporidium* spp., and helminth species including *Entamoeba* and *Trichostrongylus*. Over 20% of captive-bred animals were infected with *Strongyloides* (a gastrointestinal nematode worm) before release, and although this did not impact individual survival, it emphasised the need for further information on the parasite and pathogens associated with water voles, and how these might impact individual survival and overall fecundity during release.

Would the original reintroduction meet the recommended criteria of these guidelines?

Although some pertinent information is lacking from the first documented reintroduction at the London WWT Centre, it is interesting to look at how this site compares with the recommended criteria set out in these guidelines.

Whilst in terms of the availability and quality of habitat, Barn Elms does meet the criteria for site selection, it is questionable as to whether water voles would have to disperse overland, potentially via the River Thames, to expand their population range outside the Wetland Centre. It is, however, assumed that this has occurred, due to recorded presence of water voles on Beverley Brook, south of the Wetland Centre, in subsequent years. It is unknown at which point(s) such migration occurred, and whether it would have happened without ‘top-up’ releases in subsequent years.

Mink control was much less well coordinated when this reintroduction occurred, and there is no evidence as to whether it was explicitly carried out in advance of the release. Predator control was however undertaken, including maintenance of a predator-proof fence around part of the site to reduce the impacts of urban foxes on the bird population. Today south London is incorporated into further rollout of the Waterlife Recovery Trust mink eradication project (linking up with the North London trap deployment) and therefore benefits from landscape-scale trapping effort.

The size of the release cohort was, per individual release, much lower than is now recommended, although subsequent releases were carried out within the following weeks. There is no evidence to allow an assessment of the impact that this staggered release would have had on territory establishment. Similarly, the actual release of individuals was via a mixture of soft- and hard-release methods, but there is no means by which the impact of release method on survival of an individual can be established.

Post-release monitoring was primarily undertaken via re-trapping of water voles around the site. No licence was required as this release occurred prior to water voles gaining full protection in 2008, although animals which were screened for the disease research work being conducted by the Wildlife Conservation Research Unit at the University of Oxford were covered under Home Office licence. Subsequent monitoring has been undertaken via field sign surveys, with anecdotal evidence suggesting that the water vole population is still present, and that there has been evidence in the off-site Beverley Brook to the south.

Overall, the reintroduction project at Barn Elms has proved successful in that water voles persist both on site and in the wider landscape. Interestingly, the habitat requirements from these guidelines were broadly met in this initial project, reflecting the long-term understanding of the type and volume of habitat required to support a water vole population, although that understanding has been honed in the intervening years in terms of the additional benefits derived from having wider swathes of riparian vegetation, and the required connectivity between habitat patches to facilitate dispersal and metapopulation dynamics.

In terms of the release protocol for individual animals, evidence has moved the practice away from hard-release and towards soft-release of individuals, or sibling groups. It is unclear whether landscape-scale mink control from the outset of the project would have made the top-up releases in subsequent years redundant, but the rollout of the London smart mink trap network will benefit this population in the future.

Reference:

Mathews F, Moro D, Strachan R, Gelling M, Buller N (2006) Health surveillance in wildlife reintroductions. *Biological Conservation* 131: 338 - 347.

Case Study 4:

The Trossachs water vole reintroduction project

The Trossachs Water Vole Reintroduction Project was undertaken by Forestry and Land Scotland (FLS), in partnership with other organisations within Queen Elizabeth Forest Park, with releases between 2008 and 2011. The project sought to demonstrate how extensive re-structuring within a large commercial conifer forest to create productive wetland habitat could be applied to form the basis of a water vole reintroduction programme.

Objectives

- Define the conditions and procedures required to re-establish water vole populations in water catchments where they have recently become extinct and inform future reintroduction projects.
- Successfully re-establish water voles in an upper water-catchment including newly created and restored habitats in Cowal & Trossachs Forest District.
- Raise public awareness of water vole conservation, this reintroduction project and the contribution of partner organisations, through interpretation and education.

Project area

The reintroduction project followed extensive habitat restoration works within Queen Elizabeth Forest Park which aimed to restore riparian habitat and to create new wetlands. Water voles had been present in this area in the recent past (with some burrow systems still present), but surveys showed no current occupation within the project area, and it is thought that they had become locally extinct through a loss of habitat and the effects of mink predation. Fifteen release sites were utilised in total, allowing for a landscape-scale reintroduction.



Preparation and release protocols

- The project involved several partners with FLS leading as the landowner supported by Loch Lomond and the Trossachs National Park Authority (LLTNPA), NatureScot and the Royal Zoological Society of Scotland. Derek Gow Consultancy carried out water vole housing and breeding and provided expert advice.
- Habitat in the project area was prepared via the Forest Habitat Networks and work carried out by FLS to improve riparian habitats and create new wetlands. This work was part of broader efforts from FLS and not specific to the water vole project but created the suitable habitat for the water vole project to be conceived and carried out. Work focused on removing planted conifers from riparian areas, creating new ponds and lochans and re-seeding these areas with appropriate native plant species.
- Mink control was carried out for several years in the area before the project's inception and was then increased in the run up to and during release years. Mink control was initially done with bankside traps at known hotspots but transitioned to the use of mink rafts in 2007 giving fuller coverage of the project area. Initially 17 rafts were deployed with this rising to 72 rafts during the release years. Mink were successfully cleared from the project area and captures in subsequent years were on the periphery of the project area.
- Mink control continued and expanded for several years after the releases themselves were completed and peaked at around 95 rafts deployed across the landscape extending well beyond the initial project area. These included rafts operated by third parties such as local estates who had a common interest in controlling the number of mink present.
- Fifteen release sites were utilised in total. These were selected based on the habitat suitability for water voles, the potential for water voles to colonise adjacent habitat, the potential for water voles to disperse between the sites and the ability to defend the locations from mink. In total 1,178 water voles were released between 2008 and 2011 with the majority being released in the first two years.
- Water voles were sourced from a development in Kilgarth and subsequently bred in captivity by Derek Gow Consultancy. Water voles were sourced from an additional second location for breeding and releases in the latter two years of the project with a view to improving genetic diversity.
- Releases were conducted from mid-May through to August (depending on the year) and were carried out in all cases via soft release in suitable pens. Release pens were situated within 2m of the water's edge and in good water vole habitat but taking into account the risk of fluctuating water levels. Pens were typically 50m apart, but this was reduced to 20-30m in particularly good habitat. Pens were designed to give good protection from predators with particular regard to pine martens which are numerous locally.

Monitoring methods

- Monitoring was carried out at all release sites each year (following release) via full surveys of the locations as per the Water Vole Conservation Handbook between the months of April and October. Detailed records of field signs were kept and occupancy also recorded via digital mapping.
- Potential dispersal areas were also surveyed each year following a desk-based assessment of habitat

aiming to identify areas which could be colonised within 3km of release sites. Surveys of these areas also included a clear assessment of the habitat, and this was recorded via digital mapping. Areas considered to be suitable for water voles were included in surveys for future years while areas considered to be unsuitable were discounted from any future survey effort.

- While release sites received full water vole surveys, all other sites were surveyed via a presence/absence method. This method is very similar to a full survey with the main difference being that it is less intensive and does not seek to find every field sign. Once it is clear an area is occupied it is moved over quickly until the habitat changes significantly or field signs become sparse or absent. Areas are recorded on maps as occupied, unoccupied or 'possible' where it is unclear (e.g. burrows found but no latrines or footprints). 'Possible' areas are given a full survey where resources allow.
- By recording the results of surveys digitally it was possible to view the expansion of water voles across the landscape via yearly maps and to have a clear record of habitat assessments to plan future surveys. The scale of surveys was made possible by the assistance of LLTNP volunteers and staff alongside the work of project officers.

Outcomes

- Only three of the original fifteen release sites did not retain water voles. In some of these cases adjacent habitat was occupied suggesting the released animals may have moved to preferable habitat rather than the release failing entirely.
- By 2015 (four years after the last release) water voles were shown to be present in at least 60 different 1km squares across the local landscape, having previously been absent from the area entirely. The occupancy is likely to be more extensive as the mapping is limited by available survey effort.
- As the aim of the project was to re-establish water voles in the water catchment this outcome is considered a success. There is now a clear landscape-scale metapopulation which has persisted for many years and appears to be robust.
- Mink control was continued long after releases and this will likely have been critical to the success of the project. It was vitally important to identify the main routes of ingress into the wider project area and defend these with the remaining area then remaining largely mink free. The project is assisted in this regard by the topography of the area with hills and mountains screening the western and southern edges leaving the rivers on the east as the main points of concern.

Lessons learned and recommendations

- Assessing the carrying capacity of the habitat was difficult as it is 'upland' in nature but is considerably more productive than other upland sites in Scotland (being only 100-150m above sea level). It is possible that more water voles were released at some release sites than they could sustain. This may have assisted the rapid expansion of water voles into adjacent habitat, but an unknown number may have been predated in the process.

- Future projects in Scotland should make as comprehensive an assessment of carrying capacity as possible before deciding on release numbers as well as considering connectivity with nearby suitable habitat. The releases in the Trossachs have been successful in establishing a long-term metapopulation but it may be beneficial to aim for lower density releases, particularly where habitat is less favourable.
- Maintaining habitat in the long term is essential. If scrub encroachment or conifer regeneration is allowed in wetland areas, the habitat will become degraded over time in terms of its suitability for water voles.
- Water voles have now expanded across the landscape into areas beyond FLS landownership. While it has been possible to a degree to expand mink control by providing local landowners with equipment this is tenuous and relies on their willingness and their own desire to control mink (for example where the landowner operates a fishery or is a conservation NGO). For truly long-term catchment-scale mink control some consistent public funding is required. Without this, the expansion of water voles across the landscape will be limited and occupation may even decline once more.
- For large-scale survey effort, the support of volunteers is vital as this amount of staff time would likely be unaffordable. Without the extensive efforts of LLTNP volunteers the full extent of water vole presence (and therefore success of the project) would remain unknown.
- This project was fortunate in that a large amount of habitat had recently been made much more suitable for water voles, and these areas were often within dispersal distance of each other allowing for a landscape-scale metapopulation to form. It is vitally important for future projects to understand the suitability and connectivity of habitat beyond their immediate release areas if landscape-scale restoration is an aim of the project.

With thanks to Ryan Greenwood for his input

Reference:

Gaywood MJ, Boon PJ, Thompson DBA, Strachan IM (eds). 2016. The Species Action Framework Handbook. Scottish Natural Heritage, Battleby, Perth.

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Case Study 5:

Reintroduction of water voles to the North Tyne Catchment, Northumberland

The Restoring Ratty – Bringing Water Voles Back to Kielder reintroduction project was delivered by a partnership between Northumberland Wildlife Trust, Forestry England (FE) and Tyne Rivers Trust between 2016 and 2022. The project aimed to reintroduce a sustainable population of water voles across the Kielder Forest area of Northumberland.

Objectives

- Establish a sustainable population of water voles within Kielder Water and Forest Park through a captive breeding programme.
- Maintain a mink-free project area with a 6km buffer zone.
- Engage local communities, volunteers, visitors and landowners to ensure long-term support for the species.
- Create effective partnership structures and forward plans to enable natural colonisation beyond Kielder Water and Forest Park.

Project area and site selection

Covering 60,000ha and straddling the Northumberland–Cumbria boundary between the Scottish Border and Hadrian’s Wall, Kielder Forest is the largest forest in England and one of the largest planted forests in Europe. It also contains the largest man-made lake in northern Europe.

Established in 1926 as a conifer plantation to provide a timber supply for the nation, Kielder Forest is now a more diverse forest supporting a wide range of habitats and species. Of particular relevance to this project are the extensive riparian habitats created through improved forestry planning and operations. Approximately 800ha of forest are restructured annually through felling and replanting, helping restore significant areas of riparian corridor suitable for water voles.

Previous comprehensive mink monitoring (supported by the National Lottery Heritage Fund Kielder’s Water Vole Heritage Project) confirmed that mink were absent or present in very low numbers. Combined with



existing environmental records and recollections from local residents who remembered historic water vole populations, the area was deemed suitable for reintroduction.

Release sites were selected based on:

1. Habitat suitability – extensive grassland alongside streams or ponds with suitable banks for burrowing. Many sites had riparian strips of at least 20m wide, often more. As the project progressed, preference was given to sites with narrow streams and ditches.
2. Access – sites needed to be near forest roads for the transport of release pens. Further natural colonisation post-release would allow voles to spread into areas of high-quality habitat that were not accessible by road.
3. Proximity to other sites – release locations were kept within 2km of each other to support development of a metapopulation. Initial releases were made in the parts of the forest furthest from potential mink incursion routes.

Preparation and release protocols

- Two years of mink monitoring was delivered using traditional mink rafts checked by staff and trained volunteers. No mink were detected during this period.
- Public engagement, including an oral history project, gathered local knowledge and memories of mink and water voles in the area.
- Donor populations were identified and surveyed. Water voles were captured in late summer prior to the first release, focusing on individuals under 160g as these were considered unlikely to survive winter. A total of 16 voles were taken from the North Pennines and North York Moors, supplemented with individuals from the Trossachs project to form the initial captive breeding population. Additional voles were obtained during the project from the North Pennines and Aberdeenshire to maintain genetic diversity.
- Captive breeding was undertaken by Derek Gow Consultancy from this source population.



Water voles were released in both June and August for each year of the project. Release numbers varied by site but were never fewer than 30 animals.

- Soft release pens were placed approximately every 20m along streams or ditches, typically near pool areas.
- Pens were half filled with straw, and voles were placed in pairs or sibling groups.
- Each vole received one piece of carrot and a quarter apple. Pens were covered with brash for shelter.
- Baffles with small exit holes were added after three days (sibling groups) or four days (pairs).
- Pens were checked regularly and supplemented with food until removal.
- Pens were removed after seven days (sibling groups) or eight days (pairs), following a final occupancy check.
- A small number of older males were hard released for engagement activities.

Monitoring methods

- June release sites were monitored using standardised field surveys in August/September of the same year, then twice annually until the end of the Lottery-funded project.
- August release sites were surveyed the following year, then twice annually thereafter (with COVID-19 causing some disruption).
- Adjacent high quality habitats were monitored when capacity allowed or when incidental records were reported.
- In the fifth year, the project partnered with a Newcastle University MSc student to develop an occupancy model examining habitat features influencing vole presence. Twenty sites—including release sites and nearby suitable habitats—received six independent surveys.
- After Lottery funding ended, monitoring capacity reduced, with twice yearly surveys focused on the 20 identified occupancy model sites. Additional monitoring occurred when resources allowed.
- All water vole surveys were completed by trained staff, contractors and volunteers.
- Habitat surveys were undertaken at all release and monitoring sites to assess land use, vegetation structure and watercourse morphology.
- Mink monitoring and control continued throughout the project area and a wider 10km buffer using traditional mink rafts and trail cameras. Smart rafts were not used due to poor mobile reception.

Outcomes

- 2,085 water voles were released as part of the project. Water voles are now present across large areas of Kielder Forest, functioning as a metapopulation. Some sites that have shown positive occupancy for several years may have a survey season with no signs but are typically recolonised in subsequent years.
- Dispersal and colonisation are occurring. Water voles have been sighted up to 12km from the nearest release site. While these sightings do not confirm colonisation, they will be investigated further in 2026. Confirmed colonisation, evidenced through breeding signs, has been recorded 7km from the nearest reintroduction site.

- June releases were more successful at maintaining populations into subsequent years than August releases. Several sites that initially failed were later recolonised from neighbouring colonies within the metapopulation.
- Mink activity has increased since the return of water voles. Twelve mink have been caught within the project area and buffer zone. Based on timing and age/sex class, most appear to have been dispersing individuals. One exception was a cluster of four mink—including adults and juveniles—caught within a week at a reintroduction site. That site has since been recolonised by voles from elsewhere in the metapopulation. Forestry England has now taken over mink control of its land, which is undertaken by FE Wildlife Rangers.
- Kielder was designated a Regional Key Area in 2020 as part of the National Water Vole Database and Mapping Project.
- A strong project partnership has enabled continued action beyond the funded period, including ongoing mink control and water vole surveys. The Naturally Native project undertook mink control and water vole surveys for three years between 2021 and 2023. The reputation gained through Restoring Ratty has also helped secure new funding for the development of a North East Water Vole Recovery Strategy and a Northumberland Water Vole Recovery Action Plan.

Lessons learned and recommendations

- Upland water voles use habitat differently from expectations. They were frequently found far from the watercourse, within extensive areas of wet grassland. Surveying such large, complex habitats is significantly more time consuming than linear stream surveys. Further research is needed to understand upland water vole ecology and to refine monitoring techniques.
- Although the project area was mink-free before reintroductions, mink activity increased afterwards, necessitating more intensive monitoring and control work than anticipated.
- Using a metapopulation approach is essential when reintroducing water voles to areas isolated from existing populations. However, long-term success requires a regional strategy for mink eradication. Without it, the population will require permanent protection. Ultimately, the aim is to link the new population with the donor population 40km away but achieving this has required regional coordination that has taken considerable time to establish.
- This project would not have been possible without volunteers. The Kielder area is a remote area with a small population. The project had a small team of highly dedicated volunteers which undertook most of the mink monitoring and water vole surveys. Without these volunteers the cost of the project would have increased significantly.
- A strong, stable partnership is critical. It has enabled the continuation of core mink monitoring and water vole surveys beyond the end of the funded project, ensuring ongoing protection and data collection.

With thanks to Graham Holyoak for his input

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