Water vole reintroduction projects – the lessons and the success factors

This article summarises lessons from a sample of water vole reintroduction projects. A longer version of the article is at ECOS *28 (1) on www.banc.org.uk*

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The endemic subspecies of the Northern water vole (*Arvicola terrestris amphibius*) was once such a familiar aspect of riparian Britain that Kenneth Grahame based his *Wind in the Willows* character Ratty on this species. Although widely referred to in modern times as water-rats they were once accorded a variety of other titles such as Crabers, Water dogs, British beavers and Campagnols.[1]

Field signs of water vole

The water vole is the largest of the three vole species native to mainland Britain. Although mature adults in lowland England can weigh up to 350 grams fully grown, Scottish specimens are commonly much lighter in weight with a large individual weighing 265 grams. Unlike its European counter-part (*Arvicola terrestris Sherman*) British water voles normally inhabit riparian fringe habitat and are seldom found in substantial landlocked populations. Water voles can mate on land or in water and females in England can produce between 3-5 litters averaging around 20 offspring per annum in captivity. This figure is in stark contrast to the reproductive capacity of upland Scottish populations which have been recorded as producing only two litters of two offspring per annum.[2] Early litter females are capable of reproduction in their year of birth.

Field signs of water vole presence such as stems of plant material cut at a distinctive 45-degree angle, excavated or gnawed tubers, latrines, feeding platforms, tracks, runs and burrows are easy to observe where they are common. Water vole feeding activity may play a role in the dispersal of some food plant species such as yellow flag iris (*Iris pseudacorus*) whose naturally gnarled root systems are easily separated by gnawing.

Stephanie Ryder writing in 1962 stated that " *wherever there is good water contained in firm banks…you may be sure to find signs of water vole habitation*" and until comparatively recently this was still widely perceived to be the case. In 1990 a series of national surveys funded by the Vincent Wildlife Trust[3], identified a serious constriction in the national range of the water vole and subsequent repeat surveys[4] now suggest that this species may have disappeared from over 90% of its former range.

Impacts on water vole and its population decline

This steep decline is linked directly to the intensification of agricultural practice over the course of the last century. Extensive wetland drainage, overgrazing of riparian vegetation by domestic livestock and arable cultivation to the edge of watercourses have been

coupled with substantial river, stream or ditch canalisation programmes and unsympathetic annual dredging regimes. The impact of these processes has been compounded by bank side reinforcement programmes employing concrete or metal pilling, the successful colonisation of introduced North American mink (*Mustela vison*) – a predator against which they have no developed defence - and an associated range of further incidental factors such as accidental poisoning or sporadic human persecution.

As a result of the above water voles are now legally protected under Schedule 5 of the Wildlife and Countryside Act but this legal protection although preventing their reckless destruction can do little to halt their continued decline. The national distribution of this species is highly fragmented and in many counties they are already extinct. Current predictions are that this situation will worsen leading to further countywide extinctions by 2010. Where extensive populations of water voles still occur, species recovery incentives are generally focused on improving and extending tracts of suitable habitat coupled with the co-ordinated destruction of mink. Where significant vole populations are no longer extant a more active process of restoration to support, restore and rejoin relict populations will be essential if this species is to recover.

It is against this back-ground that water vole restoration utilising either translocated animals or captive bred offspring has become an identified component of the national Biodiversity Action Plan (BAP) for this species.[5] Water vole translocations (the direct movement of wild caught animals from one site to another) – which have commonly been practised as a component of human development projects - are problematic due to the low number of animals frequently involved, their high territorial fidelity[7] and their short reproductive lifespan. The sourcing of sufficient offspring from healthy donor populations (harvesting) might be a mechanism for providing future release stocks but this - as yet un-quantified - process can only be employed if the security of donor populations can be guaranteed. Water voles are known to be predated by a range of 'native' predators such as red foxes (*Vulpes vulpes*), otters (*Lutra lutra*) stoats (*Mustela erminea*), pike (*Esox lucius*), grey herons (*Ardea cinerea*), brown rats (*rattus norvegicus*) and domestic cats.[8] In a population study on the river Itchen – where no mink were present - the average seasonal mortality of a robust water vole population was estimated to exceed 70%.

Steps towards recovery

The first large scale water vole breeding project began in 1994 at the New Forest Nature Quest with the express aim of developing a sustainable methodology for reproducing this species consistently. Although breeding attempts had been successful in a study population at Queen Mary and Westfield College[9] no effort had been made to reproduce this short-lived species in sufficient numbers to render reintroductions possible. Even though this was not a conservation priority action at that time it is a fundamental error in any recovery process for an endangered species to leave the development of a captive breeding component until individual founders are in short supply. Genetic diversity will by this stage be extremely low and if husbandry protocols have to be developed from scratch any resultant human errors can be critical to the survival of the species.[10] For this

reason captive breeding as a component of an overall conservation package is best refined when an initial threat is perceived as part of any process of general biological research.

The first monitored reintroduction of water voles was trialled at the Barn Elms Wetlands Centre in 2001. Although a few older animals were utilised for this project the bulk of the released population of 147 were captive bred juveniles in their year of birth. These animals were all fitted with individual microchips and were selected to ensure an average release weight of around 108 grams. Animals released at Barn Elms in July and recaptured in late summer had more than doubled their body weight and one female released weighing 90 grams produced a litter in a trap when captured in October (Strachan.R. Pers comm). Under a suite of good habitat conditions water voles can obtain a weight gain of 1.2grams per day attaining breeding condition in a single season.

Juvenile water voles were released on both a hard (straight into areas of tall vegetation with no subsequent support) and soft (from release pens dug into the ground with food support for a time) release basis. Preliminary results from this and subsequent projects suggest strongly that the latter option is more effective. (Strachan.R. Pers comm). If maintained together juveniles can be released in sibling groups of up to four animals. Various different styles of release pens have been trialled successfully but they all operate on the principal that the voles dig to freedom through an open earth floor whilst providing temporary cover from predators. Release cages must be supplied with abundant bedding and chopped apples for both food and moisture. They should be dug well into the ground immediately adjacent to the waters edge and screened from the sun with dense vegetation. Water voles are a physically robust species but in common with most riparian mammals they have an extremely dense fur coat and if subjected to stress during periods of extreme heat they can die rapidly. Chopped apple – a quarter per animal – must always be included for consumption to provide moisture during transport and release. Water voles will commonly continue to utilise well-sited release pens as latrine and feeding areas for some time following release.

The timing of release for juveniles should coincide with late spring/early summer vegetative food and cover abundance. Care should be taken that water level stability is guaranteed in potential release sites as severe fluctuations either way can be a critical factor in the success or failure of a colony (Strachan.C. Pers comm). Failure to achieve this threshold in their year of birth is best remedied by holding over winter and releasing as breeding adults in spring. Releases of both juveniles (in their year of birth) and breeding adults (late litter offspring over-wintered and released in the spring) have been trialled and worked well. The release of small populations of individuals exceeding these age groups produces poor breeding results (Gow and Holder. In preparation).

At the time of writing the authors have participated in the production of over 3000 animals for over 20 translocation/reintroduction/supplementation projects in England. To date one release has failed due to a variety of external factors, seven have successfully established vigorous populations some of which are expanding rapidly, two are indeterminate and ten are too recent to adequately assess. Animals provided historically

from this captive breeding programme have established an additional two low-level populations (R.Strachan. Personal communication) which are still extant and a similar captive breed and release project run by Bristol Zoo on a site near the Royal Portbury docks (Eyre. Pers comm) has been highly successful. The best of these projects in large wetland complexes – Pagham harbour and Barn Elms - have within a few years seen released populations of captive bred animals expand rapidly to colonise the entire available reintroduction zone.

Requirements for successful restoration

In conclusion it must be clearly stressed that this captive breeding and release process is currently an effort in the refinement of technique. The two keys to successful water vole restoration are the availability of large-scale mosaics of sustainable wetland habitat and the effective long-term control of North American mink.[11] Both these criteria are obviously reliant on significant cooperative partnerships and until recently is was difficult to envisage how these could be effectively secured. The development of the Chichester Costal Plain sustainable farming partnership provides a tantalisingly, intelligent example of how this can actually be achieved.[12] This remarkable venture has seen a consortium of organisations combine to create through agri-environment schemes a 8,400ha project site within which the availability of water vole habitat has trebled in a very few years. This has been accomplished by the restriction of livestock in riparian corridors by fencing, the creation of field margin junction ponds and the restoration of existing farm ponds. This project has employed a simple but highly effective “mink raft” system designed by the Game Conservancy Trust to target, eliminate and the re-monitor for the presence of this alien predator. Water voles from our captive breeding project released into this site in May 2002 have now combined with few relict populations to colonise most of the available habitat within the project area.

The fact that the once common and widespread water vole has suffered in excess of a 90% range decline in the British Isles is a damning indictment of many previous damaging land-use practices. It is however a robust species capable of incredible regeneration where the circumstances are suitable. There are grounds for considerable optimism that even at this late stage, the water vole’s declining fortunes can still be reversed by coordinated action.

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Many factors can attribute to the success or failure of a reintroduction. Predators, food, pathogens, competitors, and weather can all affect a reintroduced population's ability to grow, survive, and reproduce.Â Thus, reintroduction programmes have to be planned carefully, ensuring that the animals have the necessary survival skills. Biologists must also study the animals after the reintroduction to learn whether the animals are surviving and breeding, what effects the reintroduction has on the ecosystem, and how to improve the process.Â Siberian Tiger Re-population Project was proposed in 2009 to reintroduce Amur tigersback to their former lands and including the former ranges in Central Asia once inhabited by their closest relatives, the Caspian tigers. Species reintroduction is the deliberate release of a species into the wild, from captivity or other areas where the organism is capable of survival. The goal of species reintroduction is to establish a healthy, genetically diverse, self-sustaining population to an area where it has been extirpated, or to augment an existing population. Species that may be eligible for reintroduction are typically threatened or endangered in the wild. However, reintroduction of a species can also be for pest control... Download Citation | Water vole reintroduction projects - The lessons and the success factors | This article summarises lessons from a sample of water vole reintroduction projects. | Find, read and cite all the research you need on ResearchGate.Â In the UK, attempts are being made to repair fractured populations and re-introduce this mammal into protected wetlands [30,31]. An emerging factor in achieving both of these objectives is the gut microbiota, whose composition in water voles has not been explored. Parasites, Drugs and Captivity: Blastocystis-Microbiome Associations in Captive Water Voles. Article. Full-text available.Â The authors provide an overview of Water Vole reintroductions from 2001 to 2014. View. Show abstract.