

Are the Fens a national stronghold for Water Voles?

Evidence from the Cambridgeshire fens

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The Wildlife Trust for Bedfordshire, Cambridgeshire, Northamptonshire and Peterborough has been undertaking Water Vole *Arvicola terrestris* surveys in the Cambridgeshire fens since 2000. This has resulted in a set of records illustrating the value of the network of fenland drainage ditches for this nationally declining species. This article reports on this survey work and aims to demonstrate why the fens of East Anglia should be considered a national stronghold for Water Voles.

Background

The Water Vole was formerly common along the banks of waterways throughout mainland Britain. Over the last 30 years, however, the species has undergone one of the most catastrophic declines of a mammal ever recorded in the UK, and it is now one of Britain's most threatened native mammals (Strachan 1998).

The reasons for this decline commenced several decades ago, but it was really only in the late 1980s that a significant reduction in the population was described, following crucial survey work carried out by the Vincent Wildlife Trust (Strachan & Jefferies 1993; Strachan *et al.* 2000). By the mid-1990s this had led to the establishment of various studies investigating the causes of this decline. Indications from the most recent national survey work suggest that Water Voles now occupy only one fifth of the sites that were occupied during 1989-90. This means that the species is now limited to approximately 3,000 colonies across the whole of Britain, compared with estimates of well over a million colonies at the start of the 20th century (Strachan 1998).

The causes of this huge decline in numbers are now well documented (Strachan 1998; Jefferies 2003). Changes in both land use and riparian-habitat management have resulted in habitat



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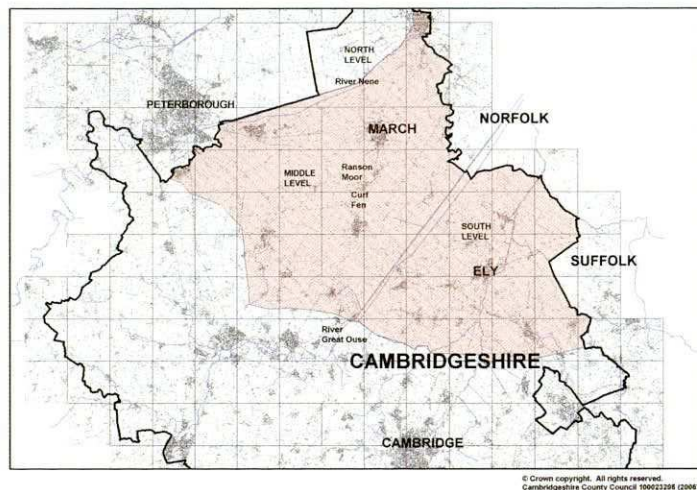


Figure 1 Cambridgeshire Fens Water Vole Survey Area.

loss and degradation, causing fragmentation and isolation of vole populations. This has led to an increased vulnerability to predation, especially by American Mink *Mustela vison*, which had, coincidentally, been spreading and consolidating their range throughout Britain during the 1970s and 1980s.

The dramatic decline of the Water Vole in Cambridgeshire from 1989 to 1997 was reported by Jefferies *et al.* (2004), based on the results from the national survey. Analysis showed a 95% decline in locations with positive signs, suggesting that a major crash in the vole population had occurred during this period. An analysis of the types of watercourse sampled in this survey showed that they were mainly rivers, streams and main fen drains, i.e. drains that were at least 5m in width; no surveys were made on minor drainage ditches less than 5m in width.

Green & Baker (2004) suggested that the national survey results significantly under-represented the state of the Water Vole population in Cambridgeshire because it had missed a significant population in the minor fen drainage ditches. It is known that Water Voles live in meta-populations (Stoddart 1970, 1971), which makes accurate survey results in the fens difficult, owing to the dense network of interconnected drains. A survey site may appear negative, when in fact the voles are present in a drain only a few metres away.

Nationally, current conservation efforts are concentrating on maintaining Water Voles in 'key sites', mainly around the coast of England. The conservation of Water Voles along water-

courses where Mink are found is thought to be impossible without control of the Mink, which is a costly and labour intensive activity. However, is this always true where there is a loose meta-population structure in an environment with a high degree of habitat connectivity?

Water Vole surveys in the Cambridgeshire fens

Figure 1 shows the area within the Cambridgeshire fens where significant Water Vole surveys have been undertaken since 2000.

The 2000 survey

The first major fens survey was a sample survey undertaken to look at the occurrence of Water Vole along the main drains ('fen rivers') managed by the Middle Level Commissioners (MLC) (Hillier 2000). It covered 16 watercourses and was designed as a catchment-wide survey, with 86 survey locations, each approximately 600m long, sited at regular intervals. Evidence of Water Voles was found at 22% of the locations sampled. Some of these were isolated locations, while others were concentrations of positive sites. The presence of Mink was recorded at only one drain. These results contradicted the 1997 national survey results from Cambridgeshire. However, they were in line with the results for the Anglia region as a whole, which recorded a 29% occupancy.

The 2001 survey

In response to the 2000 survey findings, it was decided to carry out a more detailed survey in four discrete areas, looking at all of the Internal Drainage Board (IDB) drains within the selected areas, as well as the 'fen rivers' (100km of watercourse in total). This survey was undertaken in 2001 (Hillier & Baker 2001), with alternate 500m sections of watercourse surveyed, thus giving a 50% coverage. This survey showed that there was at least an 82% occupancy by Water Voles in the four survey areas (range from 65% to 100%). For the first time, this confirmed the importance of the smaller IDB drains for Water Voles. Mink were recorded from only one drain.

Curf Fen and Ransommoor study 2003-2005

In order to try to understand more about the ecology of Water Vole populations in the fens, a longer-term study was required. At the same time, concerns had been expressed by some surveyors over the impact of ditch-maintenance regimes on Water Vole populations. The Middle Level Commissioners were also concerned that national guidelines on ditch management for Water Vole might conflict with their statutory drainage duties on ditch systems that have extremely shallow gradients, and they wanted to reconcile any potential conflict. The Wildlife Trust and Middle Level Commissioners, with the support of two Internal Drainage Boards, therefore agreed to look at the Curf Fen IDB and Ransommoor IDB areas in more detail. Figure 2 illustrates the two study areas, and shows the main ditches that are maintained by each IDB.

A three-year project (2003-2005) was initiated to investigate the two areas, which each had different ditch-management regimes (Ross 2006). Ransommoor had a maintenance regime that the MLC considered to be more sympathetic to the needs of Water Vole, as described by conservation best practice, whilst Curf Fen had a more intensive management regime. In both areas, machine-cleansing, or 'slubbing-out', occurred on a three-year rotation, while side-trimming (bank-reprofiling) work was carried out only as necessary. At Ransommoor flail-mowing was carried out in advance of both machine-cleansing and side-trimming works, with mowing confined to the bankside from which the machine was working, to afford better visibility. At Curf Fen, the maintenance regime included flail-mowing of most banksides every year.

The project aims were:

- to gather baseline survey data to provide an accurate picture

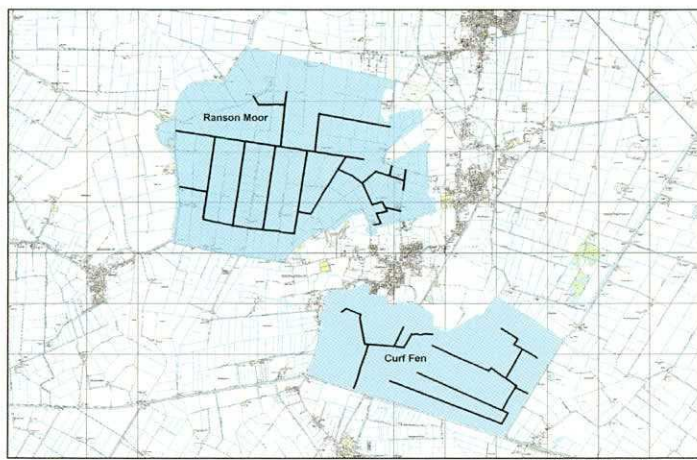


Figure 2 Ransommoor and Curf Fen study areas.

of current Water Vole activity and distribution patterns at both sites;

- to compare and contrast the impacts of the two different management regimes on the Water Vole populations.

Methods

At the start of the study, it was hoped to undertake a complete survey of all the ditches within both study areas each year. Unfortunately, it was not possible to achieve the desired level of coverage during 2003 and 2004, owing to the time it took to refine the survey methodology into an efficient operation and through lack of time. Experience gained from the first two years led to

IBD ditch at Wimblington, combining land drainage with good bankside and in-channel vegetation. Cliff Carson



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a number of refinements being made to the 2005 survey method, enabling more information to be gathered during field survey and also allowing complete coverage of both survey areas. In 2005, a handheld GPS unit was used to record very accurate locations of Water Vole signs; these were then analysed within the MapInfo GIS package. In addition to vole activity, information recorded during the survey included channel width, water depth, bank height, bank slope, and detailed notes of the vegetation present on both banks of each ditch section. Any incidental Mink and Brown Rat *Rattus norvegicus* signs were also recorded.

The methodology used for survey work broadly followed that set out in the *Water Vole Conserva-*



Surveying for Water Voles at Ransoonmoor using a canoe. Cliff Carson

tion Handbook (Strachan 1998). This included searching for latrines, grazed lawns, runs, burrows and feeding remains, as well as recording any sightings of individuals. However, the established methodology requires alternate 500m stretches to be surveyed for every 1km covered; this method is better suited for linear river stretches, as opposed to the complex networks of ditches that are typical of the modern fenland landscape. For this reason it was decided to survey whole ditches, rather than rigidly following a set distance. For recording purposes, ditches were divided into sections, a new section beginning whenever an intersection between ditches occurred; typically, sections were about 250m in length. At both sites all IDB-maintained ditches were selected for survey, together with an extensive number of the smaller side ditches, managed by farmers. The total number of ditch sections and total length of ditches in the survey area are shown in Table 1.

Table 1 Summary of ditch-section numbers and lengths surveyed at both sites.

	Curf Fen		Ransoonmoor	
	Number of ditch sections	Length (km)	Number of ditch sections	Length (km)
IDB-maintained ditches	57	12.49	83	21.86
Side ditches	46	14.74	96	25.24
Total	103	27.23	179	47.10

The established national survey methodology requires only one bank to be surveyed on any one particular channel. However, because of varying management regimes for different banks, both banks were surveyed. IDB-maintained ditches, where sufficiently deep water was present, were surveyed by canoe. This was found to be an extremely efficient method, more rapid than foot survey, and being at water level made it easier to spot Water Vole signs. The smaller side ditches, which generally had much lower water levels, were surveyed mainly on foot. For these ditches surveyors worked in pairs, walking on opposite banks, enabling surveyors to act as ‘spotters’ for their partner; with the more steep-sided ditches, it is incredibly difficult to see vole signs on the bank from which you are working. Working in pairs enabled the detection of many field signs that would otherwise have been missed, as well as reducing health and safety risks.

Table 2 Periods of survey for each year of the project.

	2003	2004	2005
Curf Fen	May/June	May/Oct	April
Ransoonmoor	Oct/Nov	June/July	April/May

April was found to be the optimum month for survey work within a fen environment. In this month, the voles are fully active and vegetation is still short enough to enable efficient survey. Later in the year, tall vegetation, especially Common Reed *Phragmites australis* and Stinging Nettles *Urtica dioica*, made surveying increasingly difficult.

Results

A summary of the results is presented in Tables 3 and 4. The subsequent discussion focuses particularly on the 2005 results, when a 100% coverage of the ditches was achieved, providing an extremely accurate snapshot of current Water Vole activity in the area. Table 3 gives those for the larger IDB-maintained ditches at both Curf Fen and Ransonmoor (generally 3-5m in width), while Table 4 gives those results for the smaller side ditches, managed by farmers (generally 1-2m in width).

Table 3 Summary of survey results for IDB-maintained ditches.

Curf Fen	2003	2004	2005
Length (km) of ditches surveyed	4.54	9.39	12.49
Length (km) of surveyed ditches with Water Vole activity	1.66	1.65	7.95
% length of surveyed ditches with Water Vole activity	36.6	17.6	63.7
Ransonmoor	2003	2004	2005
Length (km) of ditches surveyed	7.84	13.24	21.86
Length (km) of surveyed ditches with Water Vole activity	6.51	10.24	20.25
% length of surveyed ditches with Water Vole activity	83.0	77.3	92.6

Table 4 Summary of survey results for side ditches.

Curf Fen	2003	2004	2005
Length (km) of ditches surveyed	7.49	0	14.74
Length (km) of surveyed ditches with Water Vole activity	2.26	0	5.80
% length of surveyed ditches with Water Vole activity	30.2	0	39.3
Ransonmoor	2003	2004	2005
Length (km) of ditches surveyed	10.65	2.34	25.24
Length (km) of surveyed ditches with Water Vole activity	3.59	1.3	7.53
% length of surveyed ditches with Water Vole activity	33.7	54.3	29.8

These results demonstrated that the IDB-maintained ditches had a very high occupancy of Water Voles, with 93% at Ransonmoor and 64% at Curf Fen. Although the voles were less frequent in the side ditches, they still occurred along 39% of the Curf Fen ditches and 30% of those in Ransonmoor. Combining the figures gave an overall occupancy of 59% at Ransonmoor and 50% at Curf Fen.

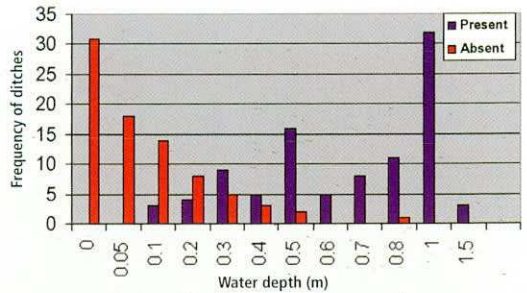


Figure 3 Relationship between Water Vole presence and ditch water levels.

A more detailed analysis was undertaken of the possible factors influencing the choice of ditch by Water Voles, including channel width, water depth, bank height, bank slope, and type of emergent and bankside vegetation. The only factor to show a significant relationship with Water Vole presence or absence was water depth.

The importance of having a reasonable depth of water for Water Voles cannot be overstated. The 2005 results showed a very strong positive correlation (Pearson's Product Moment Correlation Coefficient of $r=0.78$, where $n=179$, statistically significant at the 1% level) between Water Vole activity and water levels. Figure 3 illustrates the relationship found between Ransonmoor ditch water levels and the presence or absence of Water Voles. Ditches with a water level below 5cm had a complete absence of voles, and at 10-20cm it was still extremely unlikely that the animals would be present. A water depth of 30cm was the critical depth at which the voles occupied the ditches if other habitat conditions were suitable.

Another finding of the study was that the Water Vole population appeared to have a patchy distribution, with a few hotspots but with other areas where they were absent altogether. Sometimes two such contrasting areas were adjacent to each other, with no obvious reasons for one area being selected over the other. Surveys over the three years also appeared to show that the Water Voles would move in response to changing habitat conditions, whether as a result of natural factors or of management. Although the survey was not able to collect sufficient data to undertake a detailed analysis of the effects of management, there were two areas where data were collected both prior to and after major management work.

One area in the south-east of Curf Fen had Water Voles present in 2003. During autumn 2003, work included a mixture of slubbing-out of silt



Airfield ditch, Curf Fen. This ditch was cleared in a manner which was sympathetic to Water Voles in autumn 2005; in spring 2006 voles had returned. A Proud

Discussion

The surveys have demonstrated that the IDB-maintained, intermediate-sized ditches (3-5m wide) are the most favoured habitat, as these generally have permanent water of sufficient depth and at least some emergent and marginal vegetation. In these ditches, Water Vole occupancy is extremely high, although voles are usually present only in small numbers. These findings have been backed up by other detailed studies undertaken for the Wildlife Trust (Proud 2005).

Water Voles will also use the smaller farm ditches, when the habitat is suitable, although

and bank-reprofiling. In 2004, in the areas where bank-reprofiling only had occurred, the voles had moved to an adjacent unmanaged section of ditch. Along the section that had been cleared of silt, no evidence of vole activity was found in this or adjacent ditches. However, by the time of the 2005 survey, Water Voles had returned to all the ditches that had been worked in 2003.

In an area to the west of Ransonmoor, slubbing-out was undertaken over winter 2004/05. The survey results showed that there had been little change in the location of Water Voles between 2004 and 2005. In another example at Ransonmoor, the 2005 survey found voles present along two-thirds of one section where the bank had been reprofiled over winter 2004/05. Unfortunately, there were no results from this section in 2004 which would have enabled a determination of whether the population had declined.

In February 2006, a visit in the aftermath of major reprofiling work showed how it could have a significant negative impact on vole populations. Along one stretch, where high levels of vole activity had been recorded in spring 2005, before the work, all vole habitat on the worked side had been destroyed and the ditch had been taken over by Brown Rats. The removal of all emergent vegetation, and continued low water levels, had further made the ditch unattractive to voles. It will be interesting to discover whether the voles will recolonise and, if so, how long it will take them.

these provide a suboptimal habitat and are often prone to periods of drying-out, as a result of irrigation practices. In spite of this, they do provide additional potential habitat and so complement the IDB-maintained ditches.

The higher occupancy at Ransonmoor is thought to be due to the less intensive management regime and the greater connectivity between ditches, the voles at Curf Fen having to use less optimal habitat in the smaller side ditches to a greater degree.

Observations suggest that Water Voles are forming a loose, meta-population structure, with the distribution of voles changing both between years and within years in response to changes in habitat. The populations also appear to be fairly robust in the face of ditch-management practices, although that is not to say that these practices cannot be improved.

The results indicate that, when it comes to de-silting work, the current method employed (working just one side, over the winter, and placing removed material well away from the banks) has minimal impact on vole populations. Good levels of vole activity were observed along such ditches in the spring and summer following the work. However, bank-reprofiling can lead to a loss of habitat, forcing voles to seek alternative locations. While they have returned within two years in one case, there are others where a return may not happen. If suitable habitat is not available nearby, such work could result in the loss of small, isolated populations.

A national stronghold?

Recent surveys demonstrate the importance of the drainage-ditch network in the Cambridgeshire fens for Water Voles. As a rule of thumb, we expect on average 70% of IDB drains within a study area to have positive signs of Water Vole. Elsewhere in the Fens, surveys in Norfolk (S Henson, pers. comm.) and Suffolk (P Hemphill, pers. comm.) appear to paint a similar picture. Water Voles are present in a significant area of lowland England, and seem to be surviving well in spite of Mink and some potentially unsympathetic ditch-management activities. Although there are a few hotspots, the population appears to be widely distributed at low frequency, in a loose meta-population structure. The inter-connectivity of the drainage-ditch network appears to have allowed Water Voles to survive, when they have been lost from rivers and streams throughout the rest of the county and much of lowland England. Surely, the Fens should now be recognised as a national stronghold for this much-loved and threatened species.

The future

Although this article shows that Water Voles are surviving over a large area of the Fens, concerns remain. Despite the healthy distribution of the species across the Fens, it should be noted that in any particular ditch the Water Vole populations are usually small, and therefore still vulnerable to disturbance. Another concern is the apparent slow decline in colonies witnessed in some parts of the Fens, even though few signs of Mink are being found. Could it be that disturbance and loss of habitat from periodic ditch management could be taking their toll on the Fens population? Perhaps the voles are becoming more secretive? Or perhaps Mink are under-recorded and are in fact depressing vole populations?

One thing is clear: our current understanding of the ecology of this species in the Fens remains patchy. It is essential that more detailed research is undertaken, to inform the national Water Vole



Good quality Water Vole habitat at Purl's Bridge IDB ditch, Manea.
Cliff Carson

conservation strategy. The Wildlife Trust and IDBs have funded much of the survey work to date, but do not have the resources to undertake the necessary detailed studies.

Unanswered questions include:

- What is the trend in the Fens population?
- Are different patterns discernible in different parts of the Fens?
- What is the population structure within the fenland environment?
- Are Water Voles site-faithful or are they highly mobile and, if so, how far will they move in response to deleterious (but often temporary) changes to their habitat?

The authors believe that it is time that the national Water Vole steering group recognised the importance of areas beyond the national key sites, which are mainly coastal reedbed and grazing-marsh SSSIs. If the Fens have continued to support a population of national significance during a major period of Mink predation, might they not provide a better source of animals for recolonisation of large areas of lowland England than do isolated coastal sites? The waterways of the Fens are directly connected to many of the largest catchments in lowland England, so that, if Mink populations remain depressed as a result of expansion in the Otter *Lutra lutra* population, there is the possibility that a species with a large capacity to reproduce could naturally recolonise many of its former haunts.

To end on a positive note, a code of good prac-



Results of recent surveys show that Water Voles are present in the Fens in an extensive loose meta-population. Richard Revels

tice for the management of fenland drainage ditches has recently been produced and is now being adopted by the drainage boards within the Middle Level. Hopefully, Water Voles will continue to thrive in the Fens and begin the long, slow process of recolonising adjacent areas. Should you be travelling through the Fens, do not write off the landscape as a biological desert; 'Ratty' is probably all around you.

Acknowledgements

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References

Green, J, & Baker, M 2004 Water voles in Cambridgeshire. *Nature in Cambridgeshire* 46
Hillier, H W 2000 A Survey of Watercourses in the Middle Level Catchment Area in Cambridgeshire, to Determine the Current Distribution of Water vole *Arvicola terrestris*, Otter *Lutra lutra* and American Mink *Mustela vison*. A report for the Middle Level Commissioners. The Wildlife Trust for Bedfordshire, Cambridgeshire, Northamptonshire & Peterborough
Hillier, H W, & Baker, M 2001 A Survey of Selected Water Courses in the Middle Level Catchment Area to Determine the Current Distribution

of Water vole *Arvicola terrestris*. The Wildlife Trust for Bedfordshire, Cambridgeshire, Northamptonshire & Peterborough
Jefferies, D 2003 *The Water vole and Mink survey of Britain 1996-98 with a history of the long-term changes in the status of both species and their causes*. Vincent Wildlife Trust, London
Jefferies, D J, Strachan, R, & Strachan, C 2004 The catastrophic 99.8% crash of the Water vole (*Arvicola terrestris*) population of Cambridgeshire (v.c. 29) between 1989 and 1997. *Nature in Cambridgeshire* 46
Proud, A 2005 *County Farms Water Vole Survey 2004/05* (unpublished report). The Wildlife Trust for Bedfordshire, Cambridgeshire, Northamptonshire & Peterborough
Ross, A 2006 *Water voles in the Middle Level: a three-year study of Water vole populations at Curf Fen and Ransommoor, Cambridgeshire*. The Wildlife Trust for Bedfordshire, Cambridgeshire, Northamptonshire & Peterborough
Stoddart, D M 1970 Individual range, dispersion and dispersal in a population of water voles. *Journal of Animal Ecology* 39: 403-425
Stoddart, D M 1971 Breeding and survival in a population of water voles. *Journal of Animal Ecology* 40: 487-494
Strachan, R 1998 *Water Vole Conservation Handbook*. WildCru, Oxford
Strachan, R, & Jefferies, D J 1993 *The water vole in Britain 1989-90: its distribution and changing status*. The Vincent Wildlife Trust, London
Strachan, R, Strachan, C, & Jefferies, D J 2000 *Preliminary Report on the changes in the water vole population of Britain as shown by the National Surveys of 1989-1990 and 1996-1998*. Vincent Wildlife Trust, London
Woodroffe, G 1996 *The Water Vole*. The Mammal Society, London

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