The Mammal Society Research Report No. 1

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1997

The Mammal Society Research report No. 1
ISBN: 0 906282 59 4

Published in 1997 by The Mammal Society

The Mammal Society
Registered Charity No. 278918
Registered Office:
2B Inworth Street
London SW11 3EP

The Mammal Society

Look Out for Mammals

Report to WWF-UK

Investigation into survey techniques for recording water shrews (Neomys fodiens)

Charlotte Abyes* and Gillie Sargent

Supported by WWF

Amphibian, Reptile & Mammal Conservation Ltd
76a Ridgeway Ave
East Barnet
Herts EN4 8TL

*46b Market Place, Fallowden Way NW11 6JP

Contents

Abstract

A study into the effectiveness of different techniques for recording water shrews (*Neomys fodiens*) was undertaken in August 1997, at Lemsford Springs Nature Reserve in Hertfordshire, in order to determine the most appropriate method for surveying this generally under-recorded mammal.

The methods/techniques investigated comprised standard Longworth traps, feeding tubes and three types of refugia similar to those used in herpetological surveys. All materials were baited and visited three times during each 24 hour period to record all small mammals by direct observation (of animals captured in Longworth traps or disturbed under refugia) and by collection and analysis of droppings.

The survey showed that metal refugia had the highest use by water shrews and were significantly more effective than other refugia materials, feeding tubes or Longworth traps. The latter were, however, still the most useful technique where a complete record of all mammal species present was required.

The value of refugia searching as a technique for small mammals surveying has been highlighted and proposals are made for the wider dissemination of the data.

1. Introduction

In order to protect any species effectively, one has to know where they occur. Water shrews (*Neomys fodiens*) present considerable problems for those attempting to investigate changes in their distribution as, although the species is widespread it is patchily distributed and some populations may be ephemeral.

Water shrews are also difficult to record and do not leave many signs indicating their presence. Of the records submitted to the national atlas, where the nature of the record was stated, direct observation was the most frequent category of record in comparison to most other small mammals (Arnold, 1993).

Records of water shrews are scarce. For instance, of the 49 shrew records submitted to the Norfolk county Mammal Recorder in 1995, only 9 (18.4%) were of water shrews (Perrow, 1997).

Water Shrews may be declining but we are not, however, currently in a position to identify changes in either their distribution or population status (Harris *et al*, 1995). To improve our understanding of the distribution of water shrews, effective survey method(s) need to be identified which can be used by mammal surveyors.

2. Objectives

The objective of the survey was to compare the efficiency of five different survey techniques/materials for the recording of water shrews, with a view to recommending the most useful technique/material to promote the wider recording of this species.

3. Site Description

The project was undertaken at Lemsford Springs Nature reserve, a Hertfordshire and Middlesex Wildlife Trust reserve near Welwyn Garden City, Hertfordshire (National Grid Reference TL222 123), noted mainly for its ornithological interest in autumn and winter.

The reserve contains a variety of habitats within its 3.7 hectares. The aquatic habitat consists of disused, spring-fed water-cress (*Rorippa nasturtium-aquaticum*) beds, the River Lea, small ponds and marsh. Water feeding the water-cress beds flow over sand and gravel, and is rich in invertebrates, including freshwater shrimps (*Gammarus* spp.) and over 50 species of mollusc (HMWT, undated).

Although water-cress is still the dominant plant in the former beds, stands of butterbur (*Petasites hybridus*), tussock-sedge (*Carex paniculata*) and willowherb (*Epilobium* spp.) have begun to colonise parts of the site since it became a reserve in 1970. The River Lea is bordered by old willow (*Salix* spp.) pollards.

The reserve was chosen since water shrews were already known to be present and water-cress beds are known to present a habitat where high densities of the species can occur. The closed access policy of the reserve, combined with the support of the land owner, also enhanced the selection of the site.

4. Methodology

The survey techniques and materials trialled consisted of standard Longworth traps, white plastic "feeding" tubes (Wickes building Supplies, 300 mm x 40 mm £0.16) and three types of artificial refugia, similar to those used by herpetologists to attract poikliothermic reptiles.

The refugia comprised standard corrugated iron-sheeting (Asphaltic Roofing Supplies, 1.06 m x0.66 m, £3.50), black bitumen corrugated sheeting (Wickes Building Supplies, 1m x 0.94m, £3.50) and medium density wooden fibreboard (Wickes building Supplies, 1.22 m x 0.6 m, £2.59).

A white plastic bucket lid (300 mm diameter) was placed under each item of refugia to act as a feeding platform to hold the bait and to visibly retain any droppings from foraging mammals. The feeding tubes were covered at one end by muslin to allow maximum scent dispersal from the bait. Longworth traps were used in the usual manner, with bait and bedding material. Casters (blowfly pupae) were used to bait all traps, tubes and refugia.

A total of 20 "stations" were identified within the reserve (see map at the end of this report for exact locations). At each station one of each of the five survey techniques/materials was placed as close together as practical in order to minimise any differences in micro-habitats.

Materials were set out on 5th August 1997. Recording was undertaken in two periods between 6th to 9th August 1997 and from 11th to 13th August 1997 inclusive.

Visits were made in early morning (c, 0800 hours), early afternoon (c, 1400 hours) and evening (c, 2000 hours), and records were obtained by a combination of direct observation (of animals captured in Longworth traps or disturbed under refugia) and identification from the droppings (under refugia or left n feeding tubes).

The survey compromised a total of 700 "trap efforts" or 140 trap efforts per technique/material trialled. At each visit all the traps and refugia were cleaned of droppings and re-baited where necessary.

Throughout the survey period, the weather conditions were extremely humid and hot, with mid-day temperatures of >25°C and no precipitation.

5. Results

The droppings of shrews were distinguished on the basis of appearance, smell and the presence or absence of aquatic invertebrate remains. Very rarely do the scats of water shrews contain only the remains of terrestrial prey items, whilst common and pygmy shrew dropping do not contain the remains of aquatic prey (S. Churchfield, *pers. com.*).

A number of records were obtained where the species could not be determined from the droppings due to an absence of prey remains. Only records identified to species level are included within the results analysis below.

The survey recorded five species of small mammals (see Table 1). Apart from water vole (*Arvicola terrestris*) and common rat (*Rattus norvegicus*), which were both recorded by direct observation away from the stations, these five species are believed to represent the full species assemblage of small mammals present on the reserve.

Water shrew	106	(83.4%)
Common shrew	14	(11.0%)
Bank vole	3	(2.4%)
Wood mouse	3	(2.4%)
Pygmy shrew	1	(0.8%)

Table 1. *Analysis of results by species.* (n=127)

The high number of water shrew records was achieved by locating the project within the optimal habitat for the species in order to ensure a sufficient sample was available to compare the efficiency of the different survey techniques/materials.

The 127 positively identified mammal records obtained during the survey are analysed by survey technique/material (Table 2). Only the feeding tubes performed poorly, comprising a mere 7% of the total records. The survey techniques of refugia search and live trapping all performed well, with slightly higher numbers of mammal records from the metal refugia and Longworth traps.

Metal refugia	33 (26.0%)
Longworth trap	31 (24.4%)
Bitumen refugia	27 (21.3%)
Wooden refugia	27 (21.3%)
Feeding tube	9 (7%)

Table 2. *Analysis of results (all species) by survey technique.* (n=127)

A breakdown of all captures by species and survey technique/materials (Table 3) shows that the most effective method for recording water shrews in the use of metal refugia, which performed significantly better than either of the two refugia types (Chi-square $X^2 = 0.83$ at 2df. $P < 0.05$). If, however, it is important to obtain information about the complete species assemblage of a site, then the best choice of survey technique, based on this study, is to use Longworth trap which was the only method to record all five species present. Other mammal species are, however, regularly recorded under refugia during herpetological surveys in terrestrial habitats.

Species	Refugia :Metal	Refugia :Wood	Refugia :Bitumen	Longworth Trap	Feeding Tubes	Total
Water shrew	31	24	23	21	7	106
Common shrew	2	3	1	6	2	14
Bank vole	0	0	2	1	0	3
Wood mouse	0	0	1	2	0	3
Pygmy shrew	0	0	0	1	0	1
Total	33	27	27	31	9	127

Table 3. *Analysis of results by species and survey technique.* (n=127)

Although active both day and night, water shrew are know to be more active at night, especially just after sunset and just before sunrise, and least active in the afternoon (Churchfield, 1984). This is borne out by the highest number of records in early morning after the hours of darkness and the fewest obtained during the evening visit following the afternoon period of relative inactivity (Table 4).

AM	79	(74.5%)
PM	16	(15.1%)
EVE	11	(10.4%)

Table 4. *Analysis of water shrew records by visit.* (n=106)

The effectiveness of each survey technique/material is analysed by visits to detect any or avoidance of each method at different times of the day/night (Table 5).

Time	Refugia :Metal	Refugia :Wood	Refugia :Bitumen	Longworth Trap	Feeding Tube	Total
AM	22 (71.0%)	18 (75.0%)	19 (82.6%)	14 (66.7%)	6 (85.7%)	79
PM	6 (19.4%)	4 (16.7%)	2 (8.7%)	3 (14.3%)	1 (14.3%)	16
EVE	3 (9.6%)	2 (8.3%)	2 (8.7%)	4 (19.0%)	0 (0%)	11
Total	31 (100%)	24 (100%)	23 (100%)	21 (100%)	7 (100%)	106

Table 5. *Analysis of water shrew records by time and survey technique.* (n=106)

Although Table 3 confirmed metal refugia to be the most effective method of recording water shrews, this material has the highest heat conductivity which could prejudice its use during the day in hot weather conditions.

Examination of the results in Table 5, however, shows that the reverse occurred. Metal had highest use of all refugia types in the afternoon visit.

Longworth traps were used less by water shrews than refugia during the night but were most successful at recording water shrews during their relatively inactive period in the afternoon. The use of feeding tubes was generally low but they were most successful at night.

6. Discussion

Each of the survey techniques has a number of advantages and disadvantages associated with their use. In certain circumstances, such as at highly disturbed or sensitive sites, it may be necessary to utilise a less effective technique to achieve the required result.

The advantages and disadvantages of each technique are summarised below.

Summary of survey techniques

	Advantages	Disadvantages
Longworth trap	High occupancy rate	Expensive
	Provide animal "in the hand" for other studies (cf. feeding tubes or refugia)	Can quickly become occupied by non-target species in sub-optimal habitats
	Easiest method to record other small mammals present	Requires inspection 3 times /day
		Requires a licence from the relevant Statutory Nature Conservation Organisation
Feeding tube	Cheap	Very low occupancy rate
	Not tied to timed visits (cf. Longworth trap)	Confirmation of presence requires droppings (cf. refugia which can reveal both droppings and sheltering animals)
	Easy to conceal on highly disturbed sites.	Droppings may become trampled
	Light to carry on site	
	The only technique practical for use in a county-wide distribution survey, given constraints of cost and time with other methods	
Refugia	High occupancy rate	Heavy to carry on site
	Moderately cheap	Method most likely to be disturbed by the public
	Not tied to timed visits (cf. Longworth traps)	
	Records both sheltering Animals and droppings (cf. feeding tubes) and is the only method which could work without bait, although this needs testing droppings less likely to be trampled (cf. feeding tubes)	

Can record herpetofauna present (especially grass snake) at no extra cost

7. Conclusions

The survey has shown that all five techniques/materials record water shrews to a greater or lesser degree. The most appropriate method to use will depend on the objectives of a particular project, combined with the levels of material and time resources available. It is, therefore, essential that the objectives of all projects are carefully determined in advance.

Depending on objectives, the following recommendations can be made:

Quickest method of recording water shrew presence on a site	Metal refugia
Site defence, where the additional record of a grass snake, (Wildlife & Countryside Act, 1981, as amended), may be important	Metal refugia
Record water shrews on a site where other wildlife constraints (e.g. sensitive flora or illegal persecution of grass snakes) prevents use of refugia	Longworth trap
Record small species assemblage on a site, including water shrews	Longworth trap
Studies of water shrews requiring animals "in the hand"	Longworth trap
Record water on a site where disturbance prevents use of conspicuous refugia or expensive Longworth traps	Feeding tube
Large scale distribution studies of water shrews where material and time resources are restricted	Feeding tube

8. Dissemination

The following action is recommended to effectively disseminate the results of the project and to promote water shrew recording:

i.	Article to be published in *Mammal News*	Charlotte Aybes/ Mammal society
ii.	Paper to be submitted to *Mammal Review* after further work has been completed	Charlotte Aybes/ Mammal society
iii.	Complimentary copy of this survey report to be sent to county mammal recorders/ county mammal groups	Mammal society
iv.	Advice sheet about the identification of small mammal droppings to be prepared and sent to county mammal recorders/ county mammal groups	Sara Churchfield/ Mammal society

9. References

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10. Acknowledgements

The authors are grateful to Barry Trevis, Warden of Lemsford Springs Nature Reserve, for his guidance around the reserve; to Dr Sara Churchfield, for general advice about the ecology of water shrews and for the identification of all droppings and to Catherine Hockings for field assistance to prepare and set out the survey materials.

One of the authors (CA) was seconded to The Mammal Society, to conduct the field work, analysis and write the report, by Amphibian, Reptile & Mammal Conservation Limited who also provided transport and logical support. The project was also supported by WWF-UK.

Appendix

Summary of Capture Data

The following table summarises the capture data obtained during the project. Data are listed under the recording equipment used and only records identified to species level have been incorporated for analysis.

As discussed in the report, the droppings of shrews were distinguished on the basis of appearance, smell and the presence or absence of aquatic invertebrate remains. Only rarely do the scats of water shrews contain only the remains of terrestrial prey items (S. Churchfield, *pers. com*)

Station Number	Date	Visit	Species	Identification Method
Feeding Tubes				
2	11.8	AM	Common shrew	Droppings
7	12.8	AM	Water shrew	Droppings
7	13.8	AM	Common shrew	Droppings
7	13.8	AM	Water shrew	Droppings
9	6.8	AM	Water shrew	Droppings
9	9.8	AM	Water shrew	Droppings
19	7.8	PM	Water shrew	Droppings
19	9.8	AM	Water shrew	Droppings
19	12.8	AM	Water shrew	Droppings

Metal Refugia

1	8.8	AM	Water shrew	Droppings
1	9.8	AM	Water shrew	Droppings
1	12.8	AM	Water shrew	Droppings
1	13.8	AM	Water shrew	Droppings
2	8.8	PM	Water shrew	Direct observation
4	5.8	AM	Water shrew	Droppings
5	9.8	AM	Water shrew	Droppings
6	7.8	EVE	Water shrew	Direct observation
6	11.8	AM	Water shrew	Droppings
6	12.8	AM	Water shrew	Droppings
6	13.8	AM	Water shrew	Droppings
7	11.8	AM	Water shrew	Droppings
7	12.8	AM	Water shrew	Direct observation
7	12.8	PM	Water shrew	Droppings
7	13.8	AM	Water shrew	Droppings
8	8.8	PM	Water shrew	Direct observation
8	8.8	EVE	Water shrew	Direct observation
8	13.8	AM	Water shrew	Droppings
10	13.8	AM	Water shrew	Droppings
11	7.8	PM	Common shrew	Direct observation
11	9.8	PM	Water shrew	Direct observation
11	12.8	PM	Common shrew	Direct observation
11	13.8	PM	Water shrew	Direct observation
11	13.8	EVE	Water shrew	Direct observation
14	12.8	AM	Water shrew	Droppings
18	7.8	AM	Water shrew	Droppings
18	9.8	AM	Water shrew	Droppings
18	11.8	AM	Water shrew	Droppings
19	7.8	AM	Water shrew	Droppings
19	11.8	AM	Water shrew	Droppings
19	12.8	AM	Water shrew	Droppings
19	13.8	AM	Water shrew	Droppings

Wooden Refugia

1	9.8	AM	Water shrew	Droppings
1	9.8	PM	Water shrew	Direct observation
1	11.8	AM	Water shrew	Droppings
1	11.8	EVE	Water shrew	Droppings
1	12.8	AM	Water shrew	Droppings
1	13.8	AM	Water shrew	Droppings
2	8.8	AM	Water shrew	Droppings
2	9.8	AM	Water shrew	Droppings
2	11.8	AM	Water shrew	Droppings
2	12.8	PM	Water shrew	Direct observation
2	13.8	AM	Water shrew	Droppings
6	8.8	AM	Water shrew	Droppings

6	8.8	PM	Water shrew	Direct observation
6	9.8	AM	Water shrew	Droppings
7	8.8	EVE	Water shrew	Direct observation
7	9.8	PM	Water shrew	Direct observation
8	8.8	AM	Water shrew	Droppings
9	9.8	AM	Water shrew	Droppings
10	11.8	AM	Water shrew	Direct observation
11	9.8	AM	Common shrew	Direct observation
12	9.8	AM	Water shrew	Droppings
14	11.8	AM	Water shrew	Droppings
14	12.8	AM	Water shrew	Droppings
18	12.8	AM	Common shrew	Droppings
18	13.8	PM	Common shrew	Direct observation
19	12.8	AM	Water shrew	Droppings
20	9.8	AM	Water shrew	Droppings

Black Corrugated Bitumen refugia

1	13.8	AM	Water shrew	Droppings
1	13.8	EVE	Water shrew	Direct observation
2	8.8	AM	Water shrew	Droppings
2	9.8	AM	Water shrew	Droppings
2	11.8	AM	Water shrew	Droppings
2	12.8	AM	Water shrew	Droppings
2	13.8	AM	Water shrew	Droppings
4	7.8	EVE	Water shrew	Direct observation
4	11.8	AM	Water shrew	Droppings
5	9.8	AM	Water shrew	Droppings
5	11.8	AM	Water shrew	Droppings
6	9.8	AM	Water shrew	Droppings
7	7.8	PM	Water shrew	Direct observation
7	9.8	AM	Water shrew	Droppings
7	12.8	AM	Water shrew	Droppings
7	13.8	AM	Water shrew	Droppings
7	13.8	PM	Water shrew	Droppings
8	9.8	AM	Water shrew	Droppings
10	12.8	AM	Water shrew	Droppings
12	9.8	AM	Water shrew	Droppings
13	13.8	AM	Water shrew	Droppings
15	9.8	AM	Common shrew	Droppings
15	11.8	AM	Water shrew	Droppings
16	8.8	AM	Water shrew	Droppings
18	9.8	PM	Bank vole	Droppings
18	13.8	AM	Bank vole	Droppings
19	11.8	AM	Water shrew	Droppings

Longworth Trap

1	6.8	PM	Water shrew	Capture
1	6.8	EVE	Water shrew	Capture

1	8.8	AM	Water shrew	Capture
1	9.8	AM	Water shrew	Capture
1	11.8	EVE	Water shrew	Capture
1	12.8	AM	Common shrew	Capture
1	12.8	EVE	Water shrew	Capture
2	11.8	AM	Wood mouse	Capture
2	12.8	AM	Water shrew	Capture
2	13.8	AM	Water shrew	Capture
3	8.8	AM	Water shrew	Capture
5	7.8	PM	Water shrew	Capture
5	9.8	AM	Water shrew	Capture
5	12.8	PM	Water shrew	Capture
5	13.8	AM	Water shrew	Capture
5	13.8	PM	Water shrew	Capture
5	13.8	EVE	Water shrew	Capture
6	11.8	AM	Water shrew	Capture
7	9.8	AM	Water shrew	Capture
7	11.8	AM	Common shrew	Capture
8	11.8	AM	Common shrew	Capture
8	12.8	EVE	Bank vole	Capture
9	11.8	AM	Water shrew	Capture
10	11.8	AM	Water shrew	Capture
10	12.8	AM	Water shrew	Capture
13	13.8	AM	Wood mouse	Capture
14	13.8	AM	Common shrew	Capture
19	7.8	AM	Common shrew	Capture
19	8.8	PM	Common shrew	Capture
19	11.8	AM	Water shrew	Capture
19	13.8	PM	Pygmy shrew	Capture