



A comparison of demographic statistics between two populations of *Muscardinus avellanarius*, in the north of its UK range

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Abstract

Mark and recapture monitoring of *Muscardinus avellanarius* at two sites, towards the north of the species UK range, has been carried out by the Northwest Dormouse Partnership since 2005. In the UK *M. avellanarius* has previously only been studied in detail in the south of England. Populations in the north of England and north Wales were thought to be small, scattered and fragile. The study sites are: Bontuchel, Denbighshire: where dormice were discovered in the 1990s, and Wych Valley, Cheshire: where dormice were reintroduced in 1996 and 1997. With over 800 animals marked in 6 years, and 34 % recaptured, this is one of the largest studies of this type carried out with this species in the UK.

The population in north Wales shows demographic statistics comparable to populations in Europe, and appears to be stable. Multiple litters and breeding in young of the year have been recorded; events which the literature would indicate were unlikely in the north of the UK. In contrast, the reintroduced Cheshire population appears extremely fragile.

Keywords: mark and recapture, reintroduced population

1. Introduction

Two UK populations of the hazel dormouse (*Muscardinus avellanarius*) have been studied since 2005 by the North West Dormouse Partnership (NWDMP), using mark and recapture techniques. Monitoring is planned to continue until 2015, this paper presents some of the preliminary findings. Detailed study of this type has not been carried out before at the northern edge of the species UK range, and existing literature shows that the ecology of this species is variable across its global range. Previous studies of this type have focused on populations in the southern UK, or in Eastern Europe (Bright et al. 2006, Juškaitis 2008).

M. avellanarius has declined in numbers and distribution in the UK in the last 100 years (Bright et al. 2006). Today it is largely absent from the north of England, except for small populations in Cumbria and Northumberland, and reintroductions in Yorkshire and Cheshire (Fig. 1).

The species is believed to have become extinct in Cheshire early in the 20th century. It is still widespread in southern English counties, but here distribution is patchy. In Wales the species is widespread in the south east but, until recently, dormice were considered rare in the north and west of the country (Bright 1995, 2000). However, increased survey effort and better understanding of suitable habitat have revealed large populations in north Wales, particularly in Denbighshire (Hughes et al. 2010). The Welsh study site for this project is amongst the largest monitored populations in the UK, regularly rating in the top five sites for dormouse numbers recorded through the National Dormouse Monitoring Programme (PTES 2011).

The aim of the project is to assess population statistics for *M. avellanarius* at the two study sites, through collection of mark and recapture data, and comparison of statistics for the two populations.

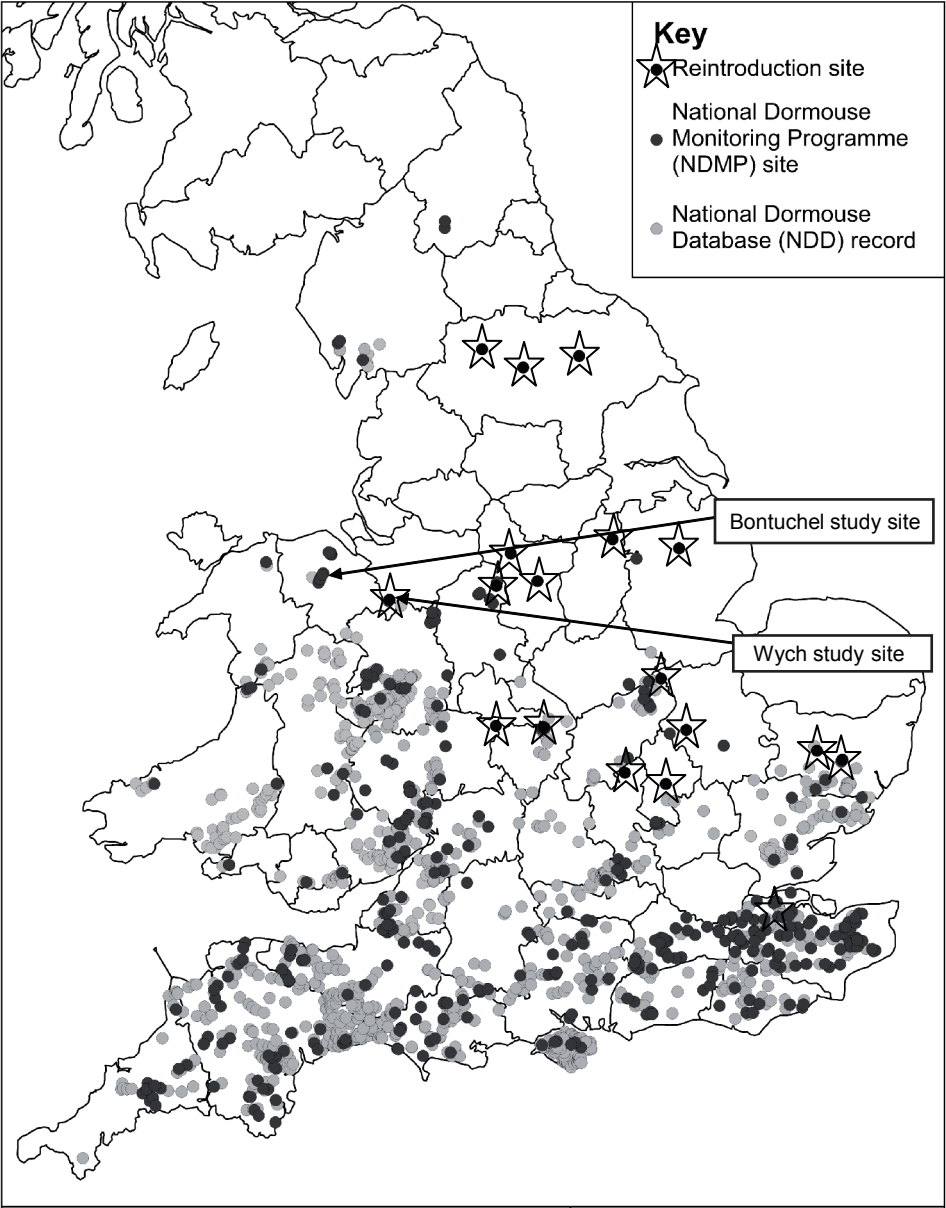


Fig. 1 UK Hazel Dormouse Records from the National Dormouse Monitoring Scheme 1988 to 2008, with project study sites marked. (Peoples Trust for Endangered Species 2008.)

2. Material and methods

Data used in this study were collected from two study sites over 6.5 years, from 2005 to 2011 (Fig. 1). The sites studied were:

- Bontuchel, Denbighshire: a planted ancient woodland site of approximately 75 ha that is now managed to restore native woodland. A wild *M. avellanarius* population was discovered there in the 1990s when dormouse nests were found in bird boxes.
- Wych valley, Cheshire: a semi-natural ancient clough woodland of approximately 30 ha, where dormice were released in 1996/97, as part of the English Nature Species Recovery Programme.

Monitoring methods followed the standard technique (using artificial nest boxes) established for the UK National Dormouse Monitoring Scheme (PTES 2011). Data collection evolved from established monitoring already in progress at both sites, using large numbers of dormouse nest boxes installed at an earlier date, arranged on irregular transects. At Bontuchel 232 nest boxes were used, and 227 at Wych; monitoring of all boxes was carried out four times per year: May, June, September and October.

Individual animals were marked using microchips (PIT tags), inserted in the field, under anaesthesia by a veterinary surgeon. Use of anaesthesia was considered to reduce stress on animals, improve accuracy of placement of microchips, and enable marking of younger/smaller individuals (S. Sanderson 2005, personal communication).

Descriptive statistics were used to summarise findings at each site, using IBM SPSS Statistics version 19. Life tables (Caughley 1977) were used to describe mortality and survival patterns of the populations. Capture and recapture data was analysed using Simply Tagging software version 2.0.1.27 (Pisces Conservation Ltd). Population estimates are derived from a Jolly-Seber model (Jolly 1965, Seber 1965).

3. Results

From 1945 dormouse records a total of 863 *M. avellanarius* were marked. Recapture rate at Bontuchel was 40%, and at Wych 30% (Tab. 1).

Tab. 1 Summary details of captures and recaptures of *Muscardinus avellanarius* at two UK study sites between May 2005 and June 2011.

	Bontuchel	Wych
Field surveys	26 sessions 2005–2011	26 sessions 2005–2011
Total dormouse records*	1459	486
Dormice marked	617	246
Sex ratio	49% female	49% female
	49% male	45% male
	2% unknown	6% unknown
Age at marking	53% marked as juveniles	53% marked as juveniles
Recapture rate	40% recaptured	30% recaptured
Mean recapture rate**	1.90	1.50
Maximum recaptures	13	7

* includes marked and unmarked animals (only animals weighing over 8g are marked).

** captures of marked animals/no. marked animals.

More animals were captured and marked at Bontuchel than at Wych from a similar number of boxes, suggesting a larger population at Bontuchel (though it must be noted that box density differs). Population estimation using a Jolly-Seber model supports this (Figs 2–3).

Sex ratio of animals captured at each site was approximately 1:1.

Capture data also showed particularly high recruitment at Bontuchel in autumn 2006 and 2009, but only in 2006 at Wych.

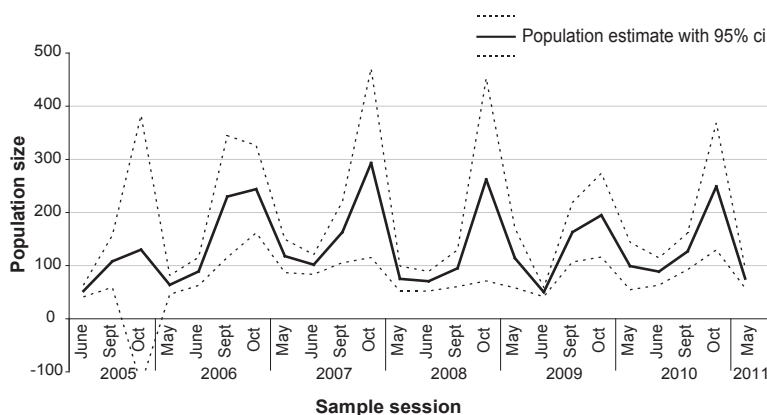


Fig. 2 Bontuchel population estimate with 95% confidence intervals.

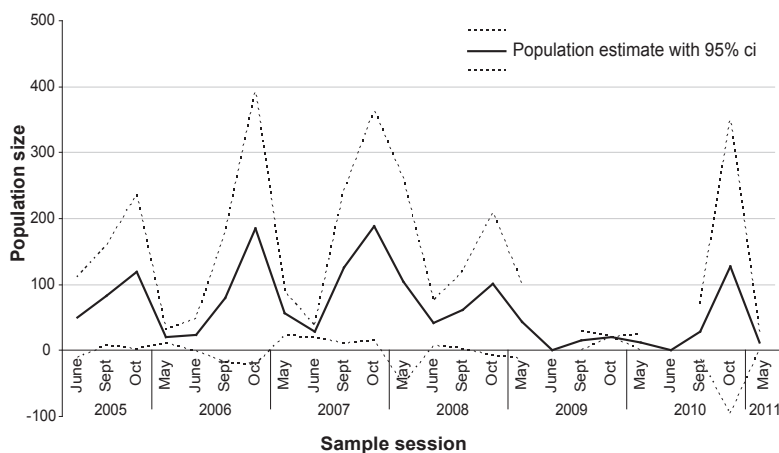


Fig. 3 Wych population estimate with 95% confidence intervals.

3.1. Population estimates

Population estimation graphs for the two sites (Figs 2–3) for the duration of the study showed similar annual patterns, characterised by a recruitment peak in autumn, followed by significant over-winter mortality. The population at Bontuchel appears to have been stable over the duration of the project, but at Wych a decline is evident from 2009 onwards, very little evidence of breeding activity was detected at Wych in 2009 or 2010.

3.2. Life Table

Age frequency data compared between sites showed no significant difference so a life table was constructed for animals marked as juveniles between 2006 and 2009 (Tab. 2). Mortality rate was found to be lowest in the second year of life for the pooled data, and for both sexes and both sites considered separately.

Tab. 2 Life table for *Muscardinus avellanarius* at the two UK study sites between 2006 and 2009, site data pooled.

Age	Frequency	Survival	Mortality	Mortality rate	Survival rate
0	360	1.000	0.797	0.797	0.203
1	73	0.203	0.117	0.575	0.425
2	31	0.086	0.058	0.677	0.323
3	10	0.028	0.025	0.900	0.100
4	1	0.003	0.003	1.000	0.000

3.3. Age Profiles

Analysis of age profiles showed that few animals survived beyond their 3rd year (age 2). Maximum life span recorded was 5 years at Bontuchel and 3 years at Wych. All the oldest animals recorded at Bontuchel were females. (Note: Table 2 contains a subset of data, and does not include the oldest recorded animals.)

3.4. Breeding behaviour

Data available to investigate breeding behaviour was limited. However, one instance of breeding in 'young of the year' was confirmed at Bontuchel, and six records indicative of multiple breeding by individual females in one season were observed there also. These were records of females found either pregnant, lactating or with young in May/June, and again in September/October.

A significant difference between month of breeding (for the months covered in this project) at the two sites was detected ($\chi^2 = 10.81$, $P < 0.05$, $df = 2$, $n = 106$). At both sites the majority of breeding events (60–70 %) were recorded in September. At Bontuchel approximately 25 % of the breeding events recorded occurred in June, and 5 % in October, whereas, at Wych a smaller percentage of breeding events happened in June, and a higher figure in October.

Several potential sources of error were identified in litter size data, due to survey timing, individual surveyors, and nest boxes containing animals from more than one litter. However, data indicates litters are significantly larger at Wych (mean 4.59) than at Bontuchel (mean 3.74) ($t = 23.747$, $df = 139$, $P < 0.001$).

4. Discussion

These results are only preliminary, more information is being obtained with each field season. Summary statistics (Tab. 1) and population estimates by site give an indication of comparative population sizes, with the Bontuchel population being larger than that at Wych. It is noted however, that the irregular box arrangement and differing sizes of the study sites mean this can only be inferred.

Life tables are available for *M. avellanarius* from Lithuania (Juškaitis 1999, 2008). Comparison of these with project data shows sample sizes to be comparable, and life spans similar. The life table for the combined data from our UK study sites shows a similar pattern to that for Lithuanian dormice born in August and September. In general mortality rates in life tables from this study are higher than those observed in Lithuania.

Population estimation and age profiles show peaks of recruitment at Bontuchel in 2006 and 2009, but only in 2006 at Wych. Since broad-scale weather conditions are unlikely to be significantly different between study sites due to their proximity (see Fig. 1), it is assumed that conditions favouring successful breeding (plentiful food through the season) are likely to occur in the same years at both sites, though it is acknowledged that microclimatic effects may result in differences in local food availability.

A population 'crisis' is observed at Wych in 2009: just 2 females (and no males) were recorded in June that year. The winter 2008/2009 appears to have affected Wych badly, with few animals surviving hibernation, despite high recruitment in autumn 2008. It would seem possible that in spring 2009 at Wych the dormouse population was so small that it was unable to respond to a good food year with high recruitment as was observed at Bontuchel. Further investigation of food availability and weather conditions might assist understanding the situation.

Maximum life span recorded is 5 years (surviving 5 winters), corresponding with studies in Lithuania and Moscow (Juškaitis 1999, Likhachev 1966) and studies in the south of the UK (Bright & Morris 2005). However, all three animals recorded reaching this age were females; other research has found males to be the longer lived sex (Juškaitis 2008).

The 'wild' / natural population at Bontuchel appears to be stable. The population at Wych appears smaller, and stable between 2005 and 2008, but shows a decline from 2009 and came close to extinction in June 2009 and June 2010. Therefore, the reintroduced dormouse population at Wych must be described as extremely fragile. A slight recovery may be underway in 2011 – continued monitoring will confirm this.

In the UK only *M. avellanarius* populations in southern England have been studied in detail and assumptions have been made about populations elsewhere in the UK. Populations, at the northern fringes of the species UK range, were assumed to be small, scattered and fragile.

Preliminary results from this study show the population at Bontuchel in north Wales exhibits demographic statistics comparable to populations in Europe, and appears to be in a stable state. It also appears to be comparable in size to the largest populations being monitored in the south of England through the UK National Dormouse Monitoring Scheme.

In general demographic statistics are similar at the two study sites, with the exception that life span was shorter at Wych. In addition this study has shown that female *M. avellanarius* produce multiple litters in some years in the region (multiple breeding was suspected at Wych before 2005), and that young of the year sometimes breed in this area too. Existing literature (Harris & Yalden 2008, Morris 2011) would indicate these events should be unlikely in the north of the UK.

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