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THE USE OF SPACE BY TRANSLOCATED EDIBLE DORMICE, *GLIS GLIS* (L.), AT THE SITE OF THEIR ORIGINAL CAPTURE AND THE SITE OF THEIR RELEASE: RADIO-TRACKING METHOD APPLIED IN A REINTRODUCTION EXPERIMENT

ABSTRACT: A study was made of the use of space by two groups (each of 6 animals) of adult edible dormice (*G. glis*) at the sites of their origin and where they were released. The reintroduction took place in Szczeciński Landscape Park (north-western Poland; 53°17'N, 14°46'E). The source sites for the animals were in the Sierakowski Landscape Park (western Poland; 52°38'N, 16°07'E) and a nature reserve "Buczyna Szprotawska" in south-western Poland (51°30'N, 15°40'E). All three sites had dense and extensive mixed forests. At release and source sites, dormice were radio-tracked during 10 successive nights between 20.00 and 05.00 at 1-hour intervals. At the source sites, the mean distance travelled per night and mean home range (95% Minimum Convex Polygon) (MCP) tended to be larger in males than in females but not significantly. At the release sites, the mean distance travelled per night and mean home range were significantly larger in females than in males. The mean distance travelled per night by males and their mean home range size did not differ significantly between source and release sites (although distances were larger at the source sites (source: 458 m; release: 265 m) and home ranges larger at the release sites (source: 1.3 ha; release: 1.8 ha). In contrast, the mean female distance travelled per night (source: 214 m; release: 404 m) and mean home range (source: 0.3 ha; release: 3.5 ha) were significantly larger at the release site than at the source sites.

KEY WORDS: *Glis glis*, reintroduction, sex differences, home range, distance travelled

1. INTRODUCTION

Variation in home range size among mammals is a function of body mass, habitat productivity, diet, climate, intraspecific competition and predation risk (Harestad and Bunnell 1979, Swihart *et al.* 1988). Differences between resource requirements of the sexes result in female home ranges being dependent on food and nest resources, whereas male home ranges are more influenced by spatial distribution of females (e.g., Greenwood 1980, Dobson 1982, Ostfeld 1985, 1990). Male rodents are generally more mobile than females (Ostfeld 1985, Armitage 1987) and have a greater tendency to disperse (Boonstra *et al.* 1987, Caley 1987). Consequently, there may be significant differences in space utilization between the sexes. In many rodent species, with polygynous or promiscuous mating systems, males move over larger areas than females (e.g. Ostfeld 1985, 1990, Boyce and Boyce 1988, Ims 1988, Gaulin and Fitzgerald 1988, Lambin and Krebs 1991, Lambin 1994, Wauters *et al.* 1990).

Differences in home range size and distance travelled during a night have been found in species of the family Gliridae: in *Muscardinus avellanarius* (L.) (Bright and Morris 1992, Juškaitis 1997), in *Eliomys quercinus* (L.) (Vaterlaus-Schlegel 1997) and in *Glis glis* (Morris and Hoodless 1992, Jurczyszyn and Zgrabczyńska 2002, Properzi *et al.* 2003). Data obtained in Poland from two distinct populations suggest that the edible dormouse has a promiscuous mating system (Jurczyszyn and Zgrabczyńska in prep.).

The edible dormouse has become nearly extinct in some parts of Poland (Jurczyszyn and Wołk 1998, Pucek and Jurczyszyn 2001) therefore an effort was made to reintroduce this species into suitable habitats in the north-west of the country. Reintroductions provide an opportunity to study how relocation of dormice influences their pattern of space use.

This paper compares the use of space by edible dormice of both sexes, which were studied first in their source sites and subsequently at their release sites. It could be predicted that there would be differences between dormouse spatial utilization in the source sites (with established relations between individuals) and at their release sites (where intraspecific and intrasexual relations had only just started to develop).

It was expected that: 1) size of home range and distances travelled by animals of both sexes would be smaller in the source sites than at the release sites, 2) in source sites home ranges and distances covered per night would be larger in males than in females, but in the release sites differences between the sexes would be smaller or even absent (because individuals of both sexes will be preoccupied with establishing their new home ranges).

2. STUDY AREA

The reintroductions took place in woods called "Bukowa Forest" (BF) which are a part of the Szczeciński Landscape Park (north-western Poland; 53°17'N, 14°46'E). The source sites for the animals were in the Sierakowski Landscape Park (SLP) (western Poland; 52°38'N, 16°07'E) and a nature reserve "Buczyna Szprotawska" (BSz) in south-western Poland (51°30'N, 15°40'E). All three sites had dense and extensive mixed forests, mainly dominated by beech trees (*Fagus sylvatica* L.) with additional oak (*Quercus petraea* (Matt.) and *Quercus robur* L.), pine (*Pinus sylvestris* L.), larch (*Larix decidua* Mill.), black locust (*Robinia pseudoacacia* L.), maple (*Acer platanoides* L.) and hazel (*Corylus avellana* L.) covering dozens or hundreds of hectares. The distances between the sites are as follows: BF – SLP = 120 km, BF – BSz = 210 km, SLP – BSz = 120 km.

3. METHODS

Studies were conducted in 2003 and 2004, in the second half of August and in September. Dormice were caught in live traps. Six dormice (3 males and 3 females) in BSz in 2003 and the same number (and sex ratio) in SLP in 2004 were fitted with radio-transmitter collars, equivalent to no more than 5% of the animal's body mass. Females chosen for radio-tracking were neither pregnant nor lactating during the year of study. Males had visible testes, suggesting that they participated in reproduction (although when males were released at BF, their testes were noticeably small).

At each of the source sites, dormice were radio-tracked during 10 successive nights between 20.00 and 05.00 at 1-hour intervals. Then the dormice were trapped and transported to the BF, where they were released after one week of acclimatization. Animals were introduced to those parts of BF, which were without dormice. At the release site they were also radio-tracked for 10 successive nights between 20.00 and 05.00 at 1-hour intervals. Areas of several hectares in SLP, BSz and BF were marked out enabling a record to be made of position fixes to the nearest 10 meters. Home range size was calculated by the Minimum Convex Polygon (MCP) method by using 100% and 95% of position fixes – those that were closest to the median location of all fixes – of each animal. Distances travelled per night were calculated as the sum of straight-line distances between successive radio fixes of each animal. The Wilcoxon matched-pairs

Table 1. The mean distance and home range area (95% MCP) of edible dormice in source sites BSz (mixed forest) and SLP (mixed forest); U-test = Mann-Whitney U-test. See Methods and Study area.

Site	Distance (m)					Home Range MCP 95% (m^2)				
	n	Male	n	Female	U-test	n	Male	n	Female	U-test
Bsz	3	344.1	3	139.4	z = 1.96 *P* = 0.08	3	8237	3	1543	z = 1.96 *P* = 0.08
SLP	3	571.0	3	289.4	z = 0.65 *P* = 0.66	3	18697	3	4772	z = 1.96 *P* = 0.08
U-test		z = 0.22 *P* = 0.66		z =1.55 *P* = 0.08			z =1.09 *P* = 0.38		z = 1.96 *P* = 0.08	

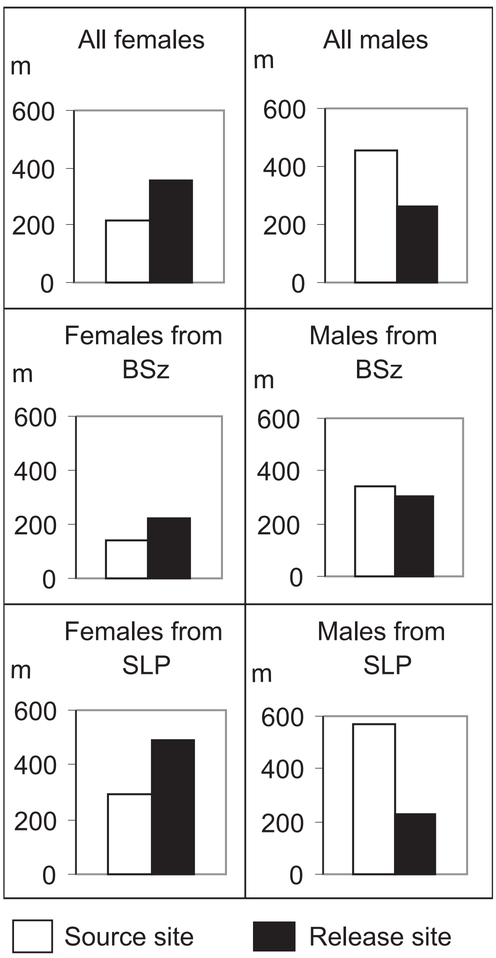

Fig. 1. Mean distance travelled by edible dormice in the source sites (BSz, SLP) and in the release site (BF). (see Methods and Study Area)

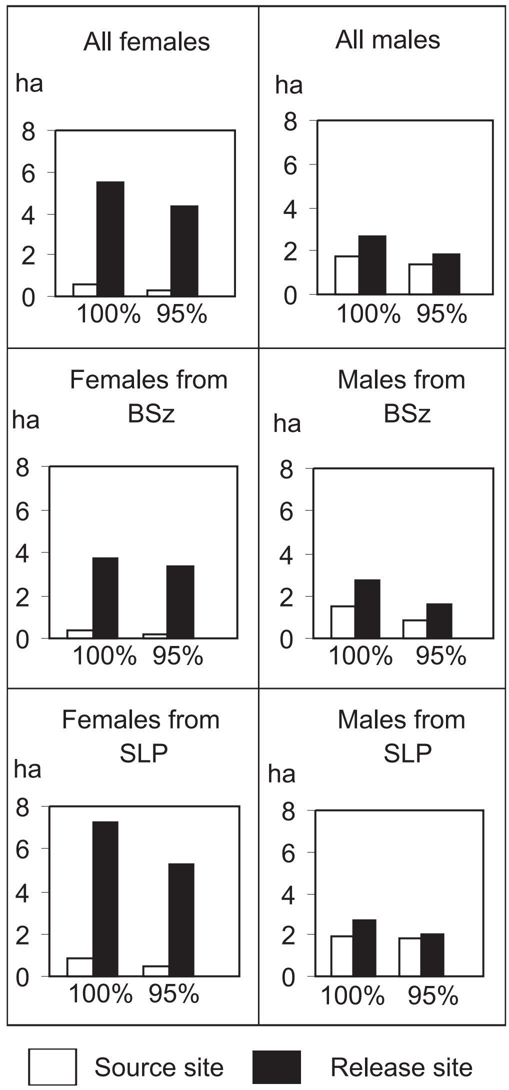

Fig. 2. Mean home range (ha) of edible dormice (100 % MCP and 95% MCP) in the source sites (BSz, SLP) and in the release site (BF). (see Methods and Study Area)

signed ranks test was used for comparisons of home ranges and distances travelled between data sets for the same individuals. A Mann-Whitney U test was used for comparing data from two different groups of dormice (Statistica 6.0, Statsoft Inc. 2002 and analizaTOR 2.0, Desmodus UI 2005). For computation of MCP and distances travelled, the software Via TRACK 1.0, Desmodus 2001 UI was used.

4. RESULTS

Dormice (both males and females) travelled longer distances and had larger home ranges (MCP 95%) in SLP than in BSz although the differences were not statistically significant (Table 1).

At both the source sites, the mean distance travelled per night and mean home range (MCP 95%) were larger (but not significantly) in males than in females (Table 1).

The mean distance travelled per night by the males were larger at the source sites than at the release site but this difference was not statistically significant (Wilcoxon matched-pairs signed ranks test: z = –0.08, $P = 0.09$) (Fig. 1). In contrast, the mean male home range (100% MCP and 95% MCP) were larger at the release site, but the difference was also not significant (Wilcoxon matched-pairs signed ranks test: for 100% MCP – z = 1.84, $P = 0.142$ and for 95% MCP – z = 1.84, $P = 0.142$) (Fig. 2).

The mean distance covered per night by females and the mean female home range (100% MCP and 95% MCP) were significantly larger at the release site than at the source sites (Wilcoxon matched-pairs signed ranks test: for distances – z = 2, $P < 0.036$, for 100% MCP – z = 2,16, $P < 0.036$, for 95% MCP – z = 2.32, $P < 0.036$) (Figs 1 and 2).

At the release sites, the mean distances travelled per night were larger in females than in males (Mann-Whitney U test: z = 2.24, $P = 0.03$) (Fig. 1). More specifically, females from SLP travelled twice as far as males from SLP and BSz, and females from BSZ travelled shorter distances than males from BSZ, but a little further than males from SLP.

At the release site, the mean home range (100% MCP and 95% MCP) was larger in females than in males (Fig. 2), however only the difference between 95% MCP was significant (Mann-Whitney U test: for 100% MCP – z = 1.92, $P = 0.066$, for 95% MCP – z = 2.4, $P = 0.02$).

The body mass at the beginning of acclimatization in the release sites did not differ between males and females (Mann-Whitney U-test: z = 0.16, $P = 0.09$).

5. DISCUSSION

At source sites – in the nature reserve “Buczyna Szprotawska” (BSz) and in Sierakowski Landscape Park (SLP) – male edible dormice tended to move over larger areas and travel longer distances than females during their nocturnal activity. This result supports the predictions behind this study and agrees with results of other studies on *G. glis* made in England (Morris and Hoodless 1992), Italy (Properzi *et al.* 2003) and Poland (Jurczyszyn and Zgrabczyńska 2002).

At release site in the “Bukowa Forest” both sexes of edible dormouse expanded their home ranges in comparison with the source sites. However, in females, the range of this expansion was considerably larger. Furthermore, females used larger home ranges and covered longer distances than males. It is difficult to find a clear and comprehensive explanation as to why these proportions changed so dramatically at release site. It is common knowledge that, in certain conditions, female home ranges of polygynous or promiscuous mammals are not smaller than those of males. For example, this was so in some *Microtus* species during the nonbreeding season (Gaulin and Fitzgerald 1988), *Sciurus vulgaris* L. in some resource-limited habitats such as Norway spruce forests with poor seed production (Wauters *et al.* 2005) and in some macropod marsupials living in less productive habitats (Fisher and Owens 2000). During reintroduction of *G. glis* to the “Bukowa Forest”, most beeches and oaks masted in all the study sites. They provided enough food for dormice in both years, therefore food resources did not cause the increase in female home ranges. It seems more likely that female edible dormice moved over bigger areas because they were searching for the best home ranges in the new place. High quality habitats (food and shelters) seem to be the main resource they need, as in many other mammalian females (Ostfeld 1990), and probably such a habitats are desirable all the time, regardless of when a mating period occurs. In this context it is interesting that observations made by Piłacińska (2005), that females of *Apodemus agrarius* choose areas in the beginning of winter that will be suitable for future reproduction, although mating does not take place until early spring. Perhaps the same "forethought" evolved in female edible dormice?

It seems that males had smaller home ranges that females at the release site for two reasons:

1) there was too little time to establish "normal" spatial relationships between sexes
2) males did not try to spread their ranges over female areas, as they do when females are in mating condition (Jurczyszyn, Zgrabczyńska in prep.); because reintroductions took place several weeks after the mating period of *G. glis* (Jurczyszyn 2004).

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