



## The distribution of the hazel dormouse (*Muscardinus avellanarius*) in Sweden

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### Abstract

The geographic range of the hazel dormouse (*Muscardinus avellanarius*) in Sweden has never been documented. This review indicates that the species' distribution is within the area that was expected, with the main concentration being further west than was previously known. Populations seem to be relatively large and stable throughout most of the Boreal region, with the total population in at 2 million adults. The hazel dormouse is present in a greater variety of habitats than was expected, especially in the central portion of its range. Population densities seem to be low with a few adults per hectare in the Boreal region of the country, but very high in parts of the Continental region with up to 15 (in some areas more than 20) adults per hectare. The hazel dormouse is stable and widespread in large, contiguous forested areas with long continuity of forest in the southern part of the Boreal region in Sweden. The lack of suitable habitats in the Continental region of the country is a serious threat to the species' survival here and it can probably only survive in protected areas.

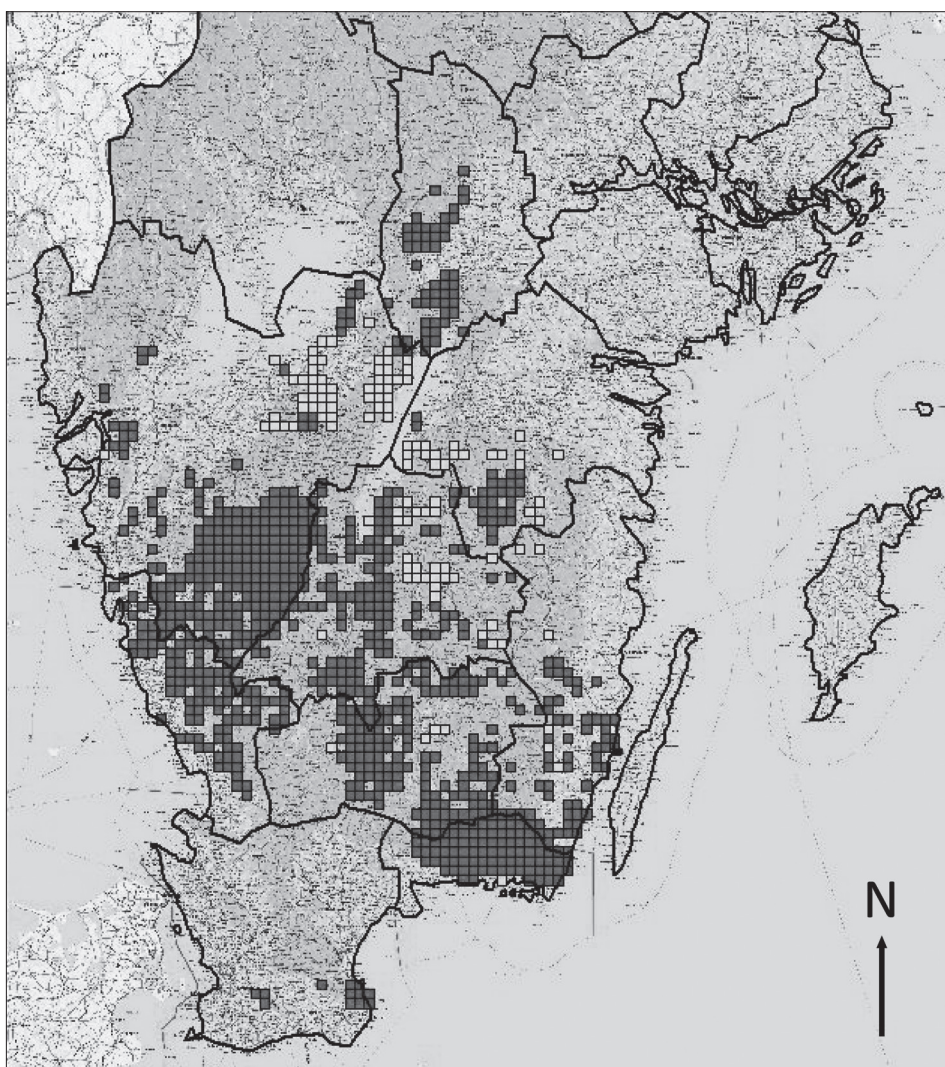
**Keywords:** dormice, population density, geographic range, habitat requirements

### 1. Introduction

The hazel dormouse *Muscardinus avellanarius* is one of the rarest inhabitants in the county district of Skåne. It was found 1845–1847 for the first time in Sweden in Skåne County near the Esperöd national nature reserve (Nilsson 1847). One of the present authors, Christer Persson, has worked at the County Administrative Board of Skåne during the past 25 years dealing with nature conservation and protecting habitats for endangered species. The County Board has made great efforts to secure the presence of the dormouse in the County (Persson & Berglund 1992, Larsson 1993, Larsson & Risinger 1993, Lagerlöf 2001, Persson & Berglund 2002, Persson & Berglund 2009). The other author, Boris Berglund, has compiled an inventory of sites for the dormouse in Sweden during the last 35 years, but has only published a few reports (Berglund 1978, Berglund 1994, Berglund 1996, Berglund & Wretenberg 2009, Berglund & Lindholm 2010, Berglund & Persson 2011). Berglund has been engaged by the counties several times as an expert on dormice.

Sweden has been a member of the European Union since 1995 and is part of the Natura 2000 network. The hazel dormouse is listed under appendix 4 in the EU Habitats Directive (Council Directive 92/43/EEC of 21 May 1992). Article 11 says that member states shall undertake surveillance of the conservation status of the natural habitats and species referred to in Article 2 with particular regard to priority natural habitat types and priority species. Since there is no comprehensive documentation of the presence of the hazel dormouse in Sweden the County Administrative Board of Skåne chose to publish a brief summary of the

data Boris Berglund has collected over the years as a basis for reporting to the EU on the species' status in the country (Berglund & Persson 2011). This work has been conducted mainly on a voluntary basis, but also partly on behalf of the County Administrative Board of Skåne, Halland, Jönköping and Örebro, the Swedish University of Agricultural Sciences in Uppsala (SLU), the Swedish Society for Nature Conservation (SNF), Gothenburg and Borås City and the council districts of Ulricehamn, Svenljunga, Mark and Tranemo.



**Fig. 1** Records of the hazel dormouse (*Muscardinus avellanarius*) in Sweden from 1977 to 2011 on a  $5 \times 5$  km grid (dark squares: own data; light squares: supplementary data from literature). Scale approx 1:3 000 000.

## 2. Material and methods

This report is based on the examination of previous findings (Nilsson 1847, Brehm 1874, Arwidsson 1926, Hansen 1942, Dahm 1945, Hallander 1946, Bliding 1951, Christoffersson 1964, Rytterås 1971, Rytterås 1974, Berglund 1978, Ahlén 1990, Berg 1990, Berglund 1994, Berg 1996, Berg 1997, Berg & Berg 1998, Berg & Berg 1999, Berglund & Wretenberg 2009, Danielsson et al. 2009, Berglund & Lindholm 2010, Berglund & Persson 2011) as well as random surveys, including searching for dormouse nests in environments considered suitable for the species. In areas where many signs of dormice have been located, Berglund has conducted in-depth studies and detailed inventories, particularly in the county district of Skåne. Most of the findings have been documented on topographical maps and carefully described (height above ground, size, construction material, description of the habitat etc.) in handwritten records. There is also very extensive photographic documentation of findings in recent years. Berglund has documented findings of the dormouse from 891 atlas squares ( $5 \times 5$  km) in Sweden, corresponding to an area of 22,275 square kilometres. Each atlas square can contain from one to approximately 1,100 records of the dormouse. The data is in some cases verified with a collection of nests, some of them about 30–35 years old (Berglund & Persson 2011).

The dormouse population size is estimated from own data from nest counts and from Official Statistics of Sweden (Swedish University of Agricultural Sciences Umeå 2011). The total area of productive forested land in Sweden 2010 was 22 477 000 ha. The area of productive forest land in the distribution area of the hazel dormouse (Götaland and Örebro County in Svealand) in 2010 was 5 524 000 ha. The forest types in the distribution area are pine (*Pinus sylvestris*) 24.6%, spruce (*Picea abies*) 38.2%, mixed conifer 12.9%, conifer/broadleaf 6.6%, other broadleaf 9.1%, valuable broadleaf 4.1% and other 4.5%. About 80% of forest tracts in Sweden exceed 50 ha in area.

The results are divided into bio-geographic regions as defined in a Report on the Conservation Status of Habitat Types and Species, required under Article 17 of the Habitats Directive by the European Commission, which divides Europe into seven terrestrial bio-geographic regions (Alpine, Atlantic, Boreal, Continental, Macaronesian, Mediterranean, Pannonian).

## 3. Results

During the period 1977–2011 the hazel dormouse has been found in eleven historical provinces which incorporate 9 of the 21 counties in Sweden. It has a large and stable presence in the southern part of the Boreal region in Sweden, particularly in the Halland County and Västra Götaland County.

The estimated average density of the hazel dormouse populations in Sweden is 1 adult/ha (own unpublished data). There are at least 2 000 000 ha (a very low estimation) of suitable habitats for the hazel dormouse and the national population should therefore be at least 2 000 000 adults in spring. Populations are declining mainly in the Continental region in Skåne County in the southernmost part of the country. The situation of the species can briefly be described as follows:

The Continental biogeographical region

- Skåne County – two isolated metapopulations. Almost non-existent on Romeleåsen (the municipality of Lund) and small, stable populations in forested parts of Österlen (the municipality of Simrishamn).

The Continental/Boreal biogeographical region

- Blekinge County – large and stable populations.
- Halland County – large and stable populations.

The Boreal biogeographical region

- Kronoberg County – large and stable populations.
- Kalmar County – stable populations.
- Jönköping County – large and stable populations.
- Östergötland County – stable populations.
- Västra Götaland County which contains
  - The historical province Bohuslän – decreasing (Svartedalen area), stable (Bredfjället area), other parts unknown.
  - The historical province Dalsland – decreasing (Kroppefjäll area), other parts unknown.
  - The historical province Västergötland – large and stable populations.
- Örebro County which contains
  - The historical province Närke – stable populations.
  - The historical province Värmland – stable (Degerfors area), decreasing in (Karlskoga area), other parts unknown.
  - The historical province Västmanland – stable (Kil area), decreasing in other areas.

#### 4. Discussion

The hazel dormouse is often found in young forest plantations, power line corridors, in clearings and woodland margins as well as in bushy and poorly maintained pastureland. In some parts of the country it has been found in habitats that are not consistent with what was previously known in Sweden (Berglund & Persson 2011, p. 117, 135, 147, 148, 150, 151 and 166). The hazel dormouse has in some cases been found in areas dominated by coniferous forest (*Picea abies*), often near lake shores with *Phragmites communis* and near the edge of bogs with *Salix* sp. and *Rubus idaeus*. These areas often lack hazel (*Corylus avellana*) and it seems that the presence of *Salix* sp. is important for dormice in these habitats. This suggests that the hazel dormouse can survive in very nutrient-poor areas and that more detailed investigations in these areas are needed.

The northernmost places in the country where findings have been made are in the central part of Örebro County as well as in the north-eastern part of Västra Götaland County. The southernmost findings are from the municipality of Simrishamn in the south-eastern part of Skåne County. Recent annual inventories show the main occurrence of the dormouse is in the counties of Halland, Kronoberg, Jönköping, Blekinge and Västra Götaland. Many observations are completely new in previously unknown areas and it is therefore impossible to draw any firm conclusions as to the development of the dormouse population. The observations are however an excellent basis for future monitoring of the species.

Knowledge of current occurrences and status is generally good in Sweden, but less so in some areas particularly in the north-western parts of Västra Götaland County (the historical provinces Bohuslän, Dalsland and Värmland), where data is deficient. Within the dormouse's greater area of occurrence, e.g. in the counties of Blekinge, Småland, Halland and Östergötland, there are both large and small gaps in distribution. The species is absent in the western part of Blekinge County, large parts of the south-western part of Kronoberg

County and in the southern part of Halland County, which in turn means that the populations in Skåne County are completely isolated.

There are now so many new observations of the hazel dormouse in Sweden that it no longer meets the IUCN criteria for red listing here. However, the species is listed under appendix 4 in the EU Habitats Directive which means that it is protected according to the national laws of the countries within the EU (Council Directive 92/43/EEC of 21 May 1992)

In Sweden, the hazel dormouse is most endangered in Skåne County. Here it is completely isolated from other populations and confined to two well-defined geographical locations in the southern part of the county, partly on the south-westerly slopes of Romeleåsen in the municipality of Lund and partly at Österlen in the municipality of Simrishamn. A third metapopulation probably occurred before 1977 in the municipality of Sjöbo. A dormouse nest (thought to have been constructed by a male) was collected from the municipality of Sjöbo by Boris Berglund in 1977 (Oremöllan, Heinge), but the species has not been observed there since. The areas where the two present meta-populations are located comprised, at most, approximately 12 and 120 square kilometres respectively during the period 1977–2011. The distance between the two locations is just over 40 kilometres. Despite thorough investigations in all other parts of Skåne dormice have not been found anywhere else.

Both meta-populations in Skåne County live in dense cluster systems of habitats, which are connected to a greater or lesser extent and are overlapping, scattered or fragmented depending on the size of the habitat and structure of the vegetation. A much greater density of individuals is found in deciduous woodland areas with significant heterogeneity than in homogenous plantations with only one type of tree covering, where the species has either disappeared completely or been forced out towards the perimeter zones. In some extreme cases within optimal habitat locations in Skåne County, 20–30 nests and foraging dormice have been observed within one hectare of land (Bäckhalladalen nature reserve, Gladsax hallar and Rörums käsk) in the municipality of Simrishamn. In many other good habit locations three to seven nests and individuals per hectare have been recorded (e.g. Bilarp, Hägnaden, Grönland, Dörröds fålad and Kullaklint in the municipality of Lund and Esperöd nature reserve, Stenshuvud national park, Svabesholm nature reserve, Kortelshuvud, Snogabjer, Nygård, Framnäs, Vik, Rörums backar, Rörums fure, Ekevall and Baskemölla in the municipality of Simrishamn). The latter figures correspond with those published by other authors, i.e. up to a maximum of seven animals per hectare in really good habitats. On Romeleåsen in the municipality of Lund, in recent years dormice have only been observed infrequently in a couple of locations north and south of the Dörröds fålad nature reserve, but not within the reserve itself. Previously it was a typical animal here. The reason for this alarming decline is probably due to the extensive clearing of thickets of bramble (*Rubus* sp.) and honeysuckle (*Lonicera periclymenum*) from around the stems of the remaining shrubs, mainly hazel and juniper (*Juniperus communis*). Now all that remains are the exposed stems. The former diverse deciduous forest has been converted into single species woodland, and thickets of predominantly brambles and honeysuckle are now totally absent.

The dormouse can be regarded as an excellent indicator that an area (or a significant part of it) once had a heterogeneous woodland character over a long period of time. Where the species is found, there is a large diversity of shrub and tree species with elements of forest margins and a rich variety of dense thickets. What is crucial in locations where the dormouse can still be found, is the availability of access to refuge where there is the possibility of survival during critical periods and where the surroundings are subjected to a minimal amount of change which otherwise would render them unsuitable. The dormouse is a species that has little ability to



spread and is thus extremely sensitive to changes in land use. Today there are many large forest areas in the county district of Skåne that give the impression of being “dormouse friendly” but nevertheless lack populations of the species. The explanation probably lies in the historic perspective as large parts of Skåne County were formerly more or less without forests and therefore unsuitable habitat for this species. During recent times, intensive forestry has reduced the biological diversity and only provided access to single-species’ habitats in which the hazel dormouse is unable to survive other than in a few particularly favourable areas. A prerequisite for the long-term survival of the dormouse is primarily the availability of large, inter-connected forest areas of the right structure where no effective barriers exist for their dispersal and distribution. The hazel dormouse shuns open areas, which means that public highways, buildings, large streams, well-maintained pastureland and cultivated land all obstruct the animal’s movements and compromise its distribution. In smaller woodland areas, which are surrounded by effective dispersal barriers, the species can only survive if the area contains a large diversity of trees and shrubs and is not disturbed by intensive forest management.

During the last 20 years The County Administrative Board of Skåne, with financial support from the Swedish Environment Protection Agency, has taken steps to prevent the decline of dormice in the county. Several forest properties with dormouse populations have been acquired and declared as national nature reserves (NNR) and their management has been adapted for the benefit of the dormouse. The ambition is to secure a network of protected areas big enough to harbor viable populations of the hazel dormouse and many other species that depend on this kind of habitat.

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