Date: 2019-10-28	*Version:* 1	*Author:* E. Soininen, D. Ehrich (with contributions from S. Killengreen and J.-A. Henden to earlier versions)

Snap trapping of rodents

Motivation

State variables: Snap-trapping data of rodents within the intensive study design is used for the following state variables:

- Grey-sided vole and tundra vole abundance and demographic structure per season (spring/fall) and habitat (heath/riparian meadow) (state variable V32)

Snap-trapping data of rodents within the regional study design is used for the following state variables:

- Grey-sided vole and tundra vole abundance and demographic structure per season (spring/fall) (state variable V69)
- Norwegian lemming abundance and demographic structure per season (spring/fall) (state variable V70)

These state variables are central for the small rodent module, but also used by the arctic fox module (rodents are central prey for arctic and red foxes), tall shrub module (rodent herbivory is a driver for the balance of the vegetation between tall shrub stage and meadow stage).

Reference(s) to method: We conduct snap-trapping according to the widely used small quadrat method (Myllymäki et al. 1971).

Spatial study design

Snap-trapping of rodents is conducted in both COAT Varanger intensive design and regional design.

Intensive design: The intensive design includes 50 sampling sites, nested in five river valley sections. Each river valley section has 4-6 sites in meadow habitat and 4-6 sites in heath habitat. Komagdalen has three sections, while Vestre Jakobselv has two. The complete list of siteIDs included in the current data collection is:

locality	section	site_id
Komagdalen	komagdalen_ovre	ko_ko_m_a, ko_ko_m_b, ko_ko_m_c, ko_ko_m_d, ko_ko_m_e, ko_ko_hn_a, ko_ko_hn_b,ko_ko_hn_c, ko_ko_hn_d, ko_ko_hn_e
Komagdalen	Komagdalen_midtre	ko_km_m_a, ko_km_m_b, ko_km_m_c, ko_km_m_d ko_km_m_e, ko_km_hn_a, ko_km_hn_b, ko_km_hn_c, ko_km_hn_d, ko_km_hn_e
Komagdalen	Sandfjorddalen	ko_sa_m_a, ko_sa_m_b, ko_sa_m_c, ko_sa_m_d, ko_sa_m_e, ko_sa_m_f, ko_sa_hn_a, ko_sa_hn_b, ko_sa_hn_c, ko_sa_hn_d, ko_sa_hn_e, ko_sa_hn_f
Vestre Jakobselv	Torvhaugdalen	vj_to_m_a, vj_to_m_b, vj_to_m_c, vj_to_m_d, vj_to_hn_a, vj_to_hn_b, vj_to_hn_c, vj_to_hn_d
Vestre Jakobselv	Bearaveaijohka	vj_be_m_a, vj_be_m_b, vj_be_m_c, vj_be_m_d, vj_be_m_e, vj_be_hn_a, vj_be_hn_b, vj_be_hn_c, vj_be_hn_d, vj_be_hn_e

These sites are in the GPS-file “intensive sites meadow heath Varanger 2020.gpx”. The file is available in the COAT Box folder “Fieldwork/Varanger GPS files for fieldwork”.

Regional design: The regional design includes 101sampling sites, nested in 6 localities (Komagdalen, Vestre Jakobselv, Stjernevann, Ifjordfjellet, Bekkarfjord, and Nordkynn). The sampling in each locality covers an altitudinal gradient from the birch forest border to the mountain plateau. Each locality has sampling sites in two habitats; a dwarf shrub dominated grey-sided vole habitat and a lemming habitat which can consist of a hummock dominated mire or of more stony habitat with lush snow bed vegetation / fen vegetation (in Komagdalen and Vestre Jakobselv the plots are not numbered according to habitat). The sites are located close to the road (Stjernevann, Ifjordfjellet, Bekkarfjord, Nordkynn) or close to an ATV trail (Komagdalen, Vestre Jakobselv) and the trapping is carried out using motorized transportation. Number of sampling sites per locality varies from 11 to 25. The complete list of siteIDs included in the current data collection is:

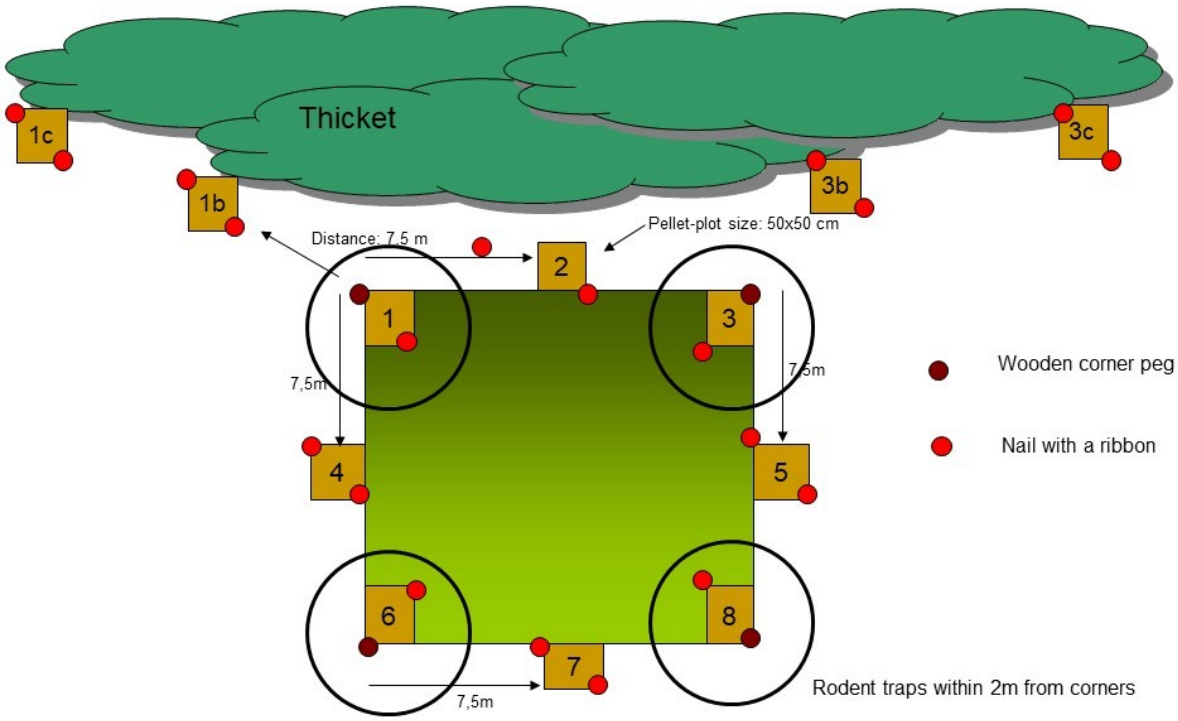
locality	section	site_id
komagdalen	komagvær	k1, k2, k3, k4, k5, k6, k7, k8, k9, k10, k11, k12, k13, k14
vestre Jakobselv	jakobselv	vj1, vj2, vj3, vj4, vj5, vj6, vj7, vj8, vj9, vj10, vj11
stjernevann		stg1, stg2, stg3, stg4, stg5, stg6, stg7, stg8, stg9, stg9, stg10, slt1, stl2, stl3, stl4, stl5, stl6, stl7, stl8, stl9, stl10, stl11, stl12, stl13, stl14
ifjordfjellet		ifg1, ifg2, ifg3, ifg6b, ifg8, ifg10, ifl1, ifl2b, ifl7, ifl8, st2h, st3h, st3k
bekkarfjord		bfg1, bfg2, bfg3, bfg4, bfg5, bfg6, bfg7, bfg8, bfl3, bfl4, bfl5, bfl6, bfl7, bfl8, bfl9, bfl10
nordkynn		hog1, hog2, hog3, hog4, hog5, hog6b, hog7b, hog8, hog9, hog10, hol1, hol2, hol3, hol4, hol5, hol6, hol7, hol8, hol9, hol10, hol13, hol14

These sites are in the GPS-file “regional snaptrapping sites storskala 2020.gpx”. The file is available in the COAT Box folder “Fieldwork/Varanger GPS files for fieldwork”.

Design within-site: Each site has a permanently marked 15*15m quadrat. The four corners of the quadrat are used as sampling plots for snap trapping. In the intensive design, the corners are labeled using the same numbering as for the pellet count plots, i.e. 1, 3, 6, and 8. In the regional design, the corners are not labeled. Three traps are placed at each corner, within a radius of 2 meters from the corner.

Temporal study design

The trapping is conducted over two trap nights (i.e. two checks) twice a year. The trapping dates for the intensive design are the 2nd to the 4th of July and the 2nd to the 4th of September. The trapping dates for the regional design are before the intensive trapping in the last week of June and after the intensive trapping in the two first weeks of September.



Positions of snap traps at a meadow site. Pellet plot numbers (1,3,6, and 8) are used to number the corners where rodent individuals are trapped.

Procedure

Three snap traps are placed within a radius of 2 meters from each corner of the sampling quadrats (i.e. 12 snap traps per sampling quadrat, see figure). The traps are placed along natural runways for rodents or in front of holes, and baited with raisins and oats. The traps are marked with colored stones. Where this is not visible enough, ribbons about 50cm above/away from the trap can be used. Try as far as possible to avoid plastic accumulation on plots.

Equipment needed

In the field:

- Snap-traps (12 per quadrat)
- Extra traps
- Raisins
- Rolled Oat flakes (Large)
- Spraypaint for marking rocks to indicate where the traps are and/or extra ribbon for marking
- Plastic bags / paper bags to collect the animals in
- Notebook, pencil

It is easier to weigh and sex the animals if two people work together (one writing, one recording). The following is not needed in the field but should be available at the cabin/car:

- Scale (measuring up to 100g, with 1g resolution)
- Small scissors
- Tweezers
- Small ruler (can be useful for Sorex species determination)
- "transport-kit" for undetermined Myodes heads to be transported to Tromsø (an easy way to do this is to have a plastic bottle with a relatively large opening, eg from Nestle Ice Tea, with 70% ethanol in it. Take pieces of gauze. Each head can be wrapped in gauze together with a small piece of paper with the date and place the animal was caught written with pencil)

Information recorded in the field

Record on which quadrats trapping has been carried out or possibly could not be carried out due for instance to late snow melt in spring.

For each day and each quadrat record: number of traps that have been triggered but have no animal in them.

For each trapped animal record: date, quadrat, corner (use corner numbers given by pellet plot numbering, see figure), and species. In the regional design, corner is not recorded – record date and site_id. Record rodents and shrews to species level. If it is not possible to recognize the species (e.g. when parts of the animal have been predated), record "rodent sp" or shrew sp". For shrews, note as comment, how sure you are. For birds, only record "bird".

For each trapped rodent, record in addition: sex, weight, reproductive status, lactation status (females only), number of embryos if pregnant (females only). Male reproductive status alternatives are *abdominal*, *scrotal* or *post-scrotal*. Female reproductive status alternatives are *closed*, *open*, or *pregnant* (i.e. for pregnant females categories open/closed are not recorded). To verify whether females are pregnant, all which are not clearly juveniles need to be opened. If a female is pregnant, record the number of embryos (placental scare are not recorded). Female lactation status are *nonlactating*, *lactating*, or *post-lactating*.

For identification of rodent species and reproductive status, and shrew species, see identification guides in the Appendix.

Data processing

All field observers are in charge of typing their data into digital format (unless otherwise agreed with the data set responsible).

For intensive data:

- Template datasheets are called "template_ snap-trapping_intensive.xlsx"
  and stored in the COAT Box folder Protocol/Data typing templates. The template file includes additional information on how to record specific types of observations in the template. Follow the datasheet exactly; use exactly the same column names, large/small letters, for factorial values do not add new categories etc.
- Additional datasheet listing the first trapping date per site is called "template_snap_trapping_dates.xlsx" (also in COAT Box folder Protocol/Data typing

templates). This is necessary to be able to include trapping sites where nothing was trapped into the dataset.
- A new file of each type is created for every year, locality (i.e. VJ or KO [KO including both KO and SA]) and sampling season. For example "VJ_2017_summer_data.txt" and "VJ_2017_summer_dates.txt".
- Observer: write the person dissecting the animal in the datasheet "template_ snap-trapping_intensive.xlsx" (for each rodent individual) and write the person who checked the plot in the datasheet "template_snap_trapping_dates.xlsx" (for each site)

For regional data:

- Template datasheets are called "template_ snap_trapping_regional_version_2019.xlsx" and stored in the COAT Box folder Protocol/Data typing templates. The template file includes additional information on how to record specific types of observations in the template. Follow the datasheet exactly; use exactly the same column names, large/small letters, for factorial values do not add new categories etc.
- Additional datasheet listing the first trapping date and observer per site is called "template_dates_snap_trapping_regional_version_2019.xlsx" (also in COAT Box folder Protocol/Data typing templates). This is necessary to be able to include trapping sites where nothing was trapped into the dataset.
- A new file of each type is created for every year and sampling season For example "Snap_trapping_regional_2020_spring.txt" " and "dates_snap_trapping_regional_2020_spring.txt".
- Observer: write the person dissecting the animal in the datasheet "template_ snap-trapping_intensive.xlsx" (for each rodent individual) and write the person who checked the plot in the datasheet "template_snap_trapping_dates.xlsx" (for each site)
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After completing a data file in excel, it should be saved as txt-file. Thereafter (unless otherwise agreed), data files are sent to dataset responsible who will quality-check them and store them in COAT data portal.

When in doubt, ask the dataset responsible (Eeva Soininen for intensive data, Dorothee Ehrich for regional data).

Training requirements and specialized skills

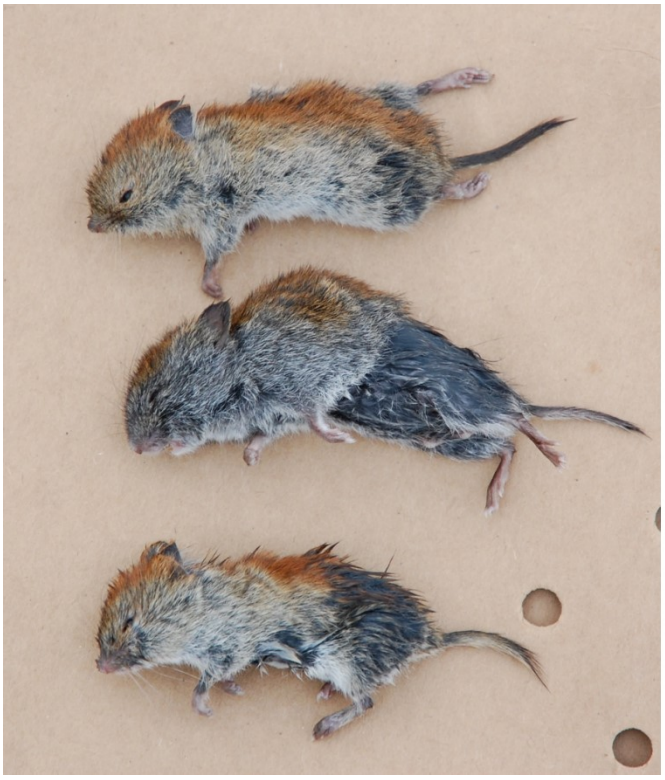
Field workers must be able to reliably distinguish the small rodent species lemming, tundra vole, grey-sided vole, and red-backed vole. They must further be able to distinguish reproductive status of rodents, and the most common shrew species present in the Varanger region.

References

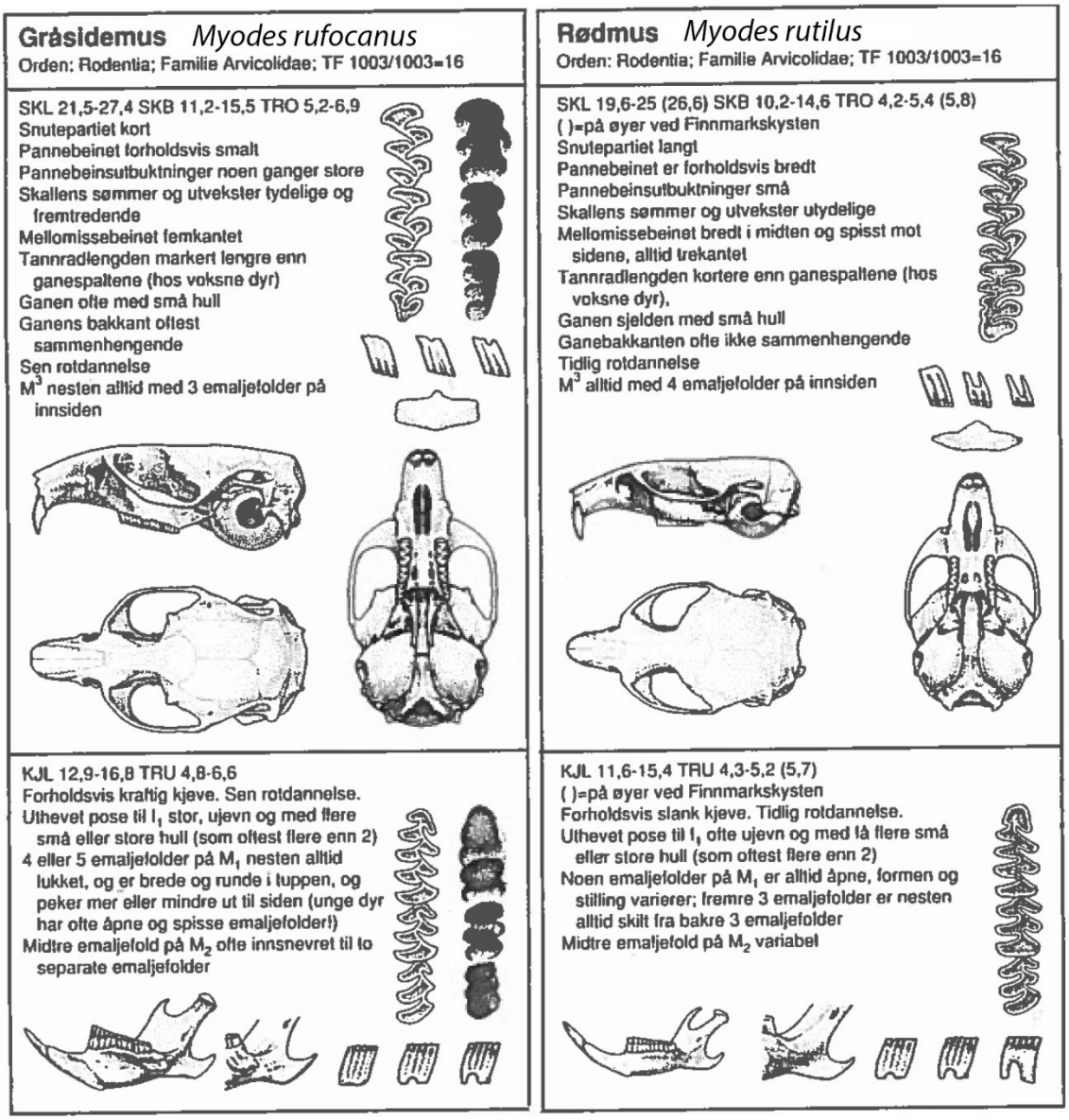
Myllymäki, A., Paasikallio, A., Pankakoski, E., & Kanervo, V. (1971). Removal experiments on small quadrats as a means of rapid assessment of the abundance of small mammals. In *Annales Zoologici Fennici* (pp. 177-185). Societas Biologica Fennica Vanamo.

Appendices: Identification guide – rodents and shrews Varanger

The most common rodent species present in the study sites are: Tundra vole (*Microtus oeconomus**),*** Grey-sided vole (*Myodes rufocanus*), and Norwegian Lemmings *(Lemmus lemmus*). Northern red-backed vole (*Myodes rutilus*) can also occur and may be expanding. The three abundant species are obvious to identify. Red-backed voles may be a bit difficult to distinguish from grey-sided voles, in particular small and/or wet individuals. The grey color of the grey-sided vole and the brighter red color on the back of the red-backed vole are the clearest characteristics of the species. Reb-backed voles have also a thicker tail with thicker fur relative to grey-sided voles. In case you are really unsure, it is possible to identify them based on the pattern of their molars (see next page). Or you can cut off the head of the vole, pack it with a label and put it in a bottle with ca 70% ethanol, and somebody will look at the teeth in Tromsø.



Pictures of some of the different vole species. Left panel: Two northern red-backed voles (top and bottom) and one grey-sided vole (middle). Right panel: Tundra vole



Identification of grey-sided vole (left) and red-backed vole (right) based on molars.

Rodent reproductive status

Sex: genitalia of grown-up males and females are easy to distinguish based on presence of penis/testes or nipples and vaginal opening. Juvenile individuals can be difficult to sex, especially because the female clitoris can resemble penis. Anogenital distance (i.e. distance between anus and penis/clitoris) can help; it is longer in males than females. Alternatively, the individual can be opened to verify presence of male or female reproductive organs.

Male reproductive status:
Abdominal: testes in abdominal cavity – juvenile individual
Scrotal: testes descended outside the abdominal cavity; visible and large
Post scrotal: testes in abdominal cavity – adult individual

Female reproductive status:
Closed: vaginal opening is closed
Open: vaginal opening is open
Pregnant: fetuses in uterus (in practice all except very small females need to be opened to verify whether they are pregnant or not)

Female lactation status:
Nonlactating: nipples small, almost not visible
Lactating: enlarged nipples, presence of milk
Post-lactating: nipples that have previously been enlarged but have shrinked

Shrews species

Sorex araneus - vanlig spissmus, krattspissmus - Common shrew
Body length 54-87 mm, tail length 32-56, hind foot length 10-15.

Characteristics: Clearcut well contrasted colour division on the side, with a light belly and dark back. Sometimes a bit black on the back towards the tail. This is the most common shrew in the area. It prefers the relatively more productive areas, such as meadows or willow thickets

Sorex caecutiens - lappspissmus - Masked shrew
Body length 44-70 mm, tail length 31-45, hind foot length 10.5-12

This is the other shrew, which is trapped regularly. It does not have such a clear subdivision between the darker back and the lighter belly as the common shrew. The transition is more gradual. Colours are more brownish and the pattern more diffuse. It can occur in less productive habitats than the common shrew, such as heath.

Sorex minutus - dvergspissmus - Pygmy shrew
Body length 42-64 mm, tail length 31-46, hind foot length 9-12

Upper part brown, going far down on the sider. Underpart lighter

Sorex minutissimus - knøttspissmus - Least shrew (not on Varanger according to IUCN, but recorded in Pasvik)

Body length 33-53 mm, tail length 21-32, hind foot length 7.5-9.

Neomys fodiens - vannspissmus - Water shrew

Body length 63-96 mm, tail length 44-88, hind foot length 16-21

Back almost black and underpart nearly white, sharply demarcated from the dorsal surface. Hind feet with a fringe of short, stiff hairs on the outer edge. The tail is slender and has a keel of short white hairs on the underside. This shrew is very characteristic, and not possible to mis-identify ☺

Simplified key to shrews

(From Olsen K.M. 1995. Spissmus I Norge. Fauna 278-289)

1. - Hind foot longer than 16 mm, tail flattened from the sides and rarely shorter than 60 mm, dark grey on the back and underparts almost white with a sharp colour border -> *Neomys fodiens*

   - Hind foot shorter than 16 mm, tail round and shorter than 60 mm, brown on the back andlighter on the belly, but without sharp border between the colours -> 2

2. - Hind foot longer than13 mm, back brown or dark brown, belly yellowish grey-brown -> Sorex araneus

   - Hind foot shorter than13 mm -> 3

3. - Hind foot shorter than 9 mm, tail shorter than30 mm - > *Sorex minutissimus*

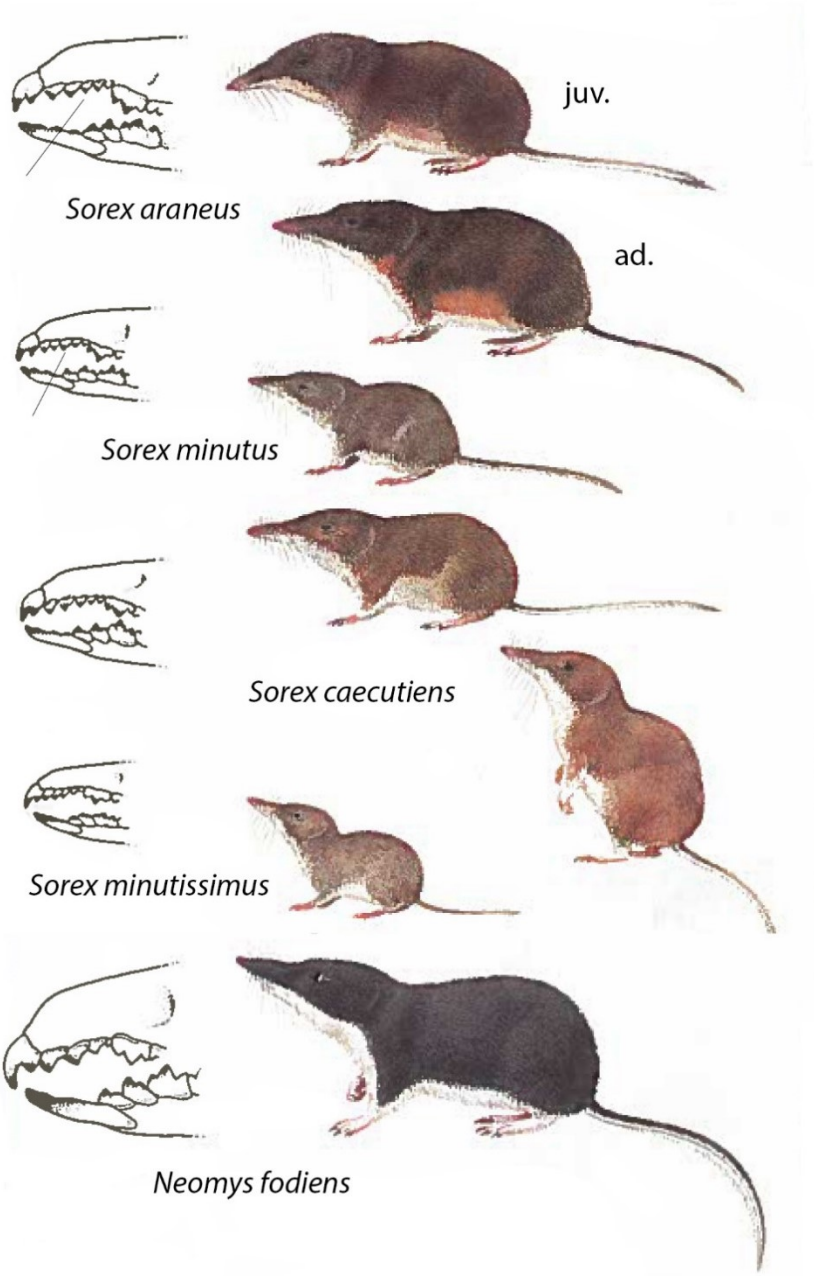
   - Hind foot longer than 9 mm, tail usually longer than30 mm -> 4

4. - The third intermediary tooth in the upper jaw is as large as the first two (see figure for comparison between *S. araneus* and *S. minutus*) -> *Sorex minutus*

   - The third intermediary tooth in the upper jaw is smaller than the first two -> 5

5. – The outer side of the hind foot is dark brown; there is often a clear light brown part on the side of the body (see figure for *S. araneus*); the division between the dark upper part and the light underpart of the tail gets less clear towrds the tip of the tail; the ears are hidden in the fur -> *Sorex araneus*

   – The outer side of the hind foot is yellowish white except for the dark heel; clearcut transition from the dark back to the light underparts; the division between the dark upper part and the light underpart of the tail is clear until the long black tuff of hairs at the tip; the ears are visible outside of the fur -> *Sorex caecutiens*


juv.
Sorex araneus
ad.
Sorex minutus
Sorex caecutiens
Sorex minutissimus
Neomys fodiens