Variability of mandibular length in species of shrews and Myomorpha from the province of Zeeland, the Netherlands

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Abstract: Several studies have suggested that the variability in the size of shrews is less than in voles and true mice, as shown by the range differences of the mandibular lengths, which can be used as a proxy for body size. A smaller variability of the length of the mandibular is directly related with the variability of the total body length of micro-mammals. Young shrews have body-measurements almost similar to adults, whereas rodent species' body-measurements seem to vary more. This raises the questions as to whether the variation of the mandibular length differences in shrews is smaller than in Myomorpha and if these differences can be quantified. To address this question, a total of 6037 specimens of 14 different species of micro-mammals retrieved from owl pellets, all collected in the Province of Zeeland, the Netherlands, were analysed to determine their mandibular lengths. Using owl pellets for the sample meant that this was not a random sample, but a selection made by the owls, i.e. their preferred prey. The results reveal that the coefficients of variation of the mandibles of the shrews are significantly smaller than those of voles and other Myomorpha. For three of the species of the subfamily of the red-toothed shrews (Millet's shrew (*Sorex coronatus*), pygmy shrew (*S. minutus*) and water shrew (*Neomys fodiens*)) the coefficients of variation are at least twice as small as the other - non shrew - micro-mammals. In the white-toothed shrews (bi-coloured white-toothed shrew (*Crocidura leucodon*) and greater white-toothed shrew (*C. russula*)) and the common shrew (*Sorex araneus*), these coefficients are also smaller, but less markedly so. The differences between the shrews and Myomorpha are also reflected in the ranges of the percentages of the mandibular lengths of shrews (90-107%), voles (68-117%) and other Myomorpha (79-119%). Factors that might explain the differences between shrews and Myomorpha are discussed in the conclusions.

Keywords: coefficient of variation, mandibular length, skewness, red-toothed shrew, white-toothed shrew, voles, true mice.

Introduction

Anyone who has analysed substantial quantities of owl pellets may have noticed the lesser variation in measurements of skulls and mandibles of shrew species compared to rodent species. However, up to this moment this observation has not been described in the literature, let alone substantiated with figures.

Analyses of owl pellets in the Netherlands are usually aimed at revealing the diet of the raptor and/or the distribution of the small mammals (e.g. Tinbergen 1933, Wilmink 1944, Schreuder 1945), with some of the latter studies expanding their focus towards dental variants or molar aberrations (e.g. Ruprecht 1961, Jentzsch 2006, Kapischke et al. 2009).

A first indication of size variability in shrews being smaller than in voles and true mice can be found in Husson (1962), who presented ranges of mandibular length for two species: the common shrew (*Sorex araneus*) (*n*=96; range 8.8-9.7 mm) and the common vole (*Microtus arvalis*) (*n*=117; range 11.5-15.5 mm) and from Reichstein (1978) who presented ranges of mandibular length for the house mouse (*Mus musculus*) (*n*=55; range 10.3-13.5 mm). These numbers result in differences of 9.3%, 29.6% and 26.7% respectively. It is important to mention here that Husson (1962) used the front side of the second tooth for measuring the mandibular length in shrews, instead of the front side of the alveolus of the lower incisor at the lingual side when measuring the mandibular length, as has been done in this article.

The differences in Husson's (1962) and Reichstein's (1978) findings raise questions about the differences in the variation of mandibular lengths between shrews (Eulipotyphla: Soricidae) and of small Myomorpha (Rodentia).

The variability of the total body length of micro-mammals, found or trapped outside the nest, is directly related with the variability of the mandibular length. Young shrews have almost adult body-measurements while rodent species seem to have more variable body-measurements. Almost a century ago Jackson (1928) remarked that it is the habit of young shrews to remain in the nest until they have almost reached maturity, which makes such youngsters so scarce in collections. The statement of Jeroen van der Kooij (personal communication) 'If you find a red-toothed shrew that is smaller than another one, you are dealing with a different species', hints in the same direction. This phenomenon of seemingly overlooking young shrews, is diametrically opposite the experience with other micro-mammals. A personal experience is the comparison of a range of head-body respectively tail lengths in a set of eight multi mammate rats (*Mastomys natalensis*) from two sites in Benin: Deme (100.1 - 133.6 and 97.1 - 117.4 mm respectively) and one specimen from Cotonou (52.0 and 52.0 mm respectively) (Bekker & Ekué 2004). Only after careful examination of the molar details, the specimen from Cotonou also turned out to be a multi mammate rat.

These considerations lead to the main hypothesis, that the variability in the populations of different species of shrews are expected to be lower than those of different species of small Myomorpha in the province of Zeeland.

Materials and methods

The selection of mandible specimens from the available material aims to maximize sample size (preferably from single locations) and, whenever feasible, consecutive years. This approach enhances the likelihood of achieving an optimal representation of the composition of the hunted population within a specific or consecutive year(s).

A large number of specimens (*n*=6037) of 14 different species of micro-mammals predominantly from barn owl pellets were studied. Samples contained at least 50 specimens per species, as suggested by Yablokov (1974). All owl pellets were collected in the province of Zeeland, the Netherlands, and were included in the terrestrial mammal collection of the Koninklijk Zeeuwsch Genootschap der Wetenschappen. Specimens available for this study belong to the following species of the red-toothed shrews (subfamily Soricinae): the common shrew (NHG26601-NHG26648), Millet's shrew (*Sorex coronatus*) (NHG26701-NHG26711), the pygmy shrew (*S. minutus*) (NHG26801-NHG26917) and the water shrew (*Neomys fodiens*) (NHG27001-NHG27062); as well as the white-toothed shrews (subfamily Crocidurina): the bi-coloured white-toothed shrew (*Crocidura leucodon*) (NHG27101-NHG27147) and the greater white-toothed shrew (*C. russula*) (NHG27201-NHG27206). Of the family Cricetidae, the bank vole (*Myodes glareolus*) (NHG27301-NHG27401),

Table 1. Numbers, by species, of the mandibulae studied across different regions in Zeeland: Schouwen-Duiveland (S-D), Tholen (T), Noord-Beveland (N-B), Walcheren (W), Zuid-Beveland (Z-B) and Zeeuws-Vlaanderen (Z-V); *: of five water shrews the location was missing.

	S-D	T	N-B	W	Z-B	Z-V	Total
Red-toothed shrews							
Common shrew	256	18	58	60	65	64	521
Millet's shrew	0	66	0	0	0	250	316
Pygmy shrew	250	45	31	64	9	61	460
Water shrew	0	17	4	28	7	31	92*
White-toothed shrews							
Bi-coloured white-toothed shrew	0	0	0	0	0	250	250
Greater white-toothed shrew	250	178	110	91	146	122	897
Voles							
Bank vole	62	19	49	51	62	179	422
Root vole	250	0	25	0	2	0	277
Field vole	0	125	66	67	66	59	383
Common vole	270	108	191	101	53	114	837
Common pine vole	0	0	0	0	10	254	264
True mice							
Harvest mouse	61	52	43	57	65	116	394
Wood mouse	78	114	131	80	115	78	596
House mouse	109	51	7	50	12	99	328

the root vole (*Alexandromys oeconomus*) (NHG27501-NHG27515), the field vole (*Microtus agrestis*) (NHG27601-NHG27617), the common vole (NHG27701-NHG27708) and the common pine vole (*M. subterraneus*) (NHG27901-NHG27950) were studied. Of the family Muridae, the harvest mouse (*Micromys minutus*) (NHG28001-NHG-28101), the wood mouse (*Apodemus sylvaticus*) (NHG28201-NHG28229) and the house mouse (*Mus musculus*) (NHG28301-NHG28366) were included.

Species per region

Not all the specimens of the studied species were present in all regions and/or evenly distributed in comparable numbers. At one end of the spectrum the bi-coloured white-toothed shrew, was only present in Zeeuws-Vlaanderen and the common pine vole, was only present in Zeeuws-Vlaanderen and Zuid-Beveland. At the other end of the spectrum three species of shrew (common shrew, pygmy shrew and greater white-toothed shrew), two voles (bank vole and common vole) and all three true mice (harvest mouse, wood mouse and house mouse) were present in all regions (Table 1).

Yablokov (1974) arranged the variability in mammals of structures, organs and body measurements in three classes, less than 10%, from 10 to 15% and at least 15%, respectively. Measurements in the <10%-class, where variability is smallest, were taken (in order of ascending variability) from the post-cranial skeleton, the skull and the body (*ibid.*). Using body length to assess the size of micro-mammals is thought to be unreliable for two reasons. First, living specimens, at the moment of investigation, almost always present themselves in postures with a more or less arched backbone. Secondly, in dead specimens the degree of relaxation after rigor mortis is not equal for all specimens. Yablokov (1974) estimates the variability of body weight in mammals to be at least at 15%; in micro-mammals it is not a reliable measure for body size, as total weight is directly dependent of the general nutritional status or, in females, of pregnancy.

Therefore, in this study, the mandibular length in shrews and in rodents was chosen as a proxy variable for size, which is also supported by the following considerations. First of all, mandibles are osteological elements that are prone to growth, without epiphyseal discs, between well-defined functional landmarks in shrews as well as in Myomorpha. In shrews the mandibular length has been defined as the condylar length, following Krapp & Niethammer (1990) (Figure 1a) and not the incisive length, as in shrews the attrition of the lower incisors can sometimes be several millimetres. According to Niethammer & Krapp (1982b) the mandibular length in Myomorpha is defined as the distance between the anterior-most part of the irregularity of the symphysis mandibulae and the posterior-most part of the condyle (Figure 1b). Although measurements at the skull, such as the condylobasal length, may be longer, the skull comprises multiple bone components with sutures in between, leading to potential inaccuracies in measurements. Furthermore, each single mandible makes the ultimate determination of the species indisputable. The mandible is a long, firm bone element, arising secondarily by ossification of the connective tissue surrounding Meckel’s cartilage (Langman 1976). Because of the robust nature of the mandible between its reference points for measurement (among other factors) this bone fragment seems less susceptible to post-mortem fractures.

All measurements were conducted using vernier callipers equipped with an analogue scale. This instrument can be read with an accuracy of 0.02 mm and was calibrated after each measurement. The measurement was taken after aligning the jaws of the callipers with the designated measuring points, while ensuring the mandible was lifted off the table.

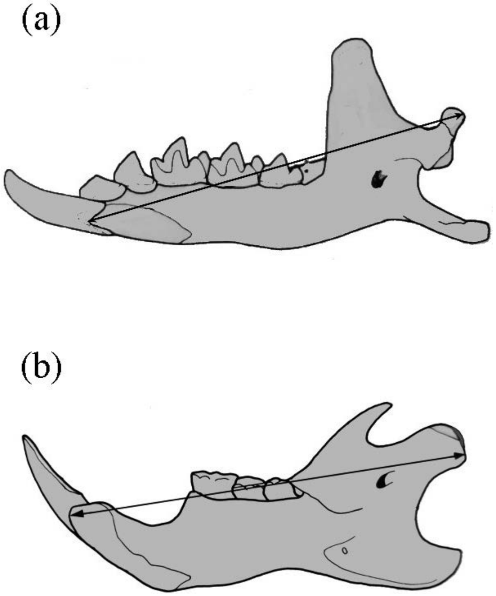

Figure 1. Measurement of mandibular length in (a) shrews (adapted from Krapp & Niethammer 1990) and (b) Myomorpha (adapted from Niethammer & Krapp 1982b).

Measurements were conducted on the right mandible, unless it was compromised by a fracture or was not available, in which case the left mandible of the same specimen was used.

To compare the measurements of all species in one frame, box plots of the percentages of the species measurements towards the species mean are presented in an overall comparison. Graphical methods are employed here to enhance the visual clarity (see Figure 2).

In addition, the traditional indices for a large series of measurements, such as the number of observations in a sample (*n*), the range (R), the population mean (μ), the population median (ų) and the standard deviation (sd) are presented, following Kirk (1999) (Table 2). Pearson’s (sk_p) formula (sk_p = 3*(μ - ų) / sd) was employed to measure skewness.

A negative value of sk_p indicates that the tail of the distribution is on the left side, which means that the distribution extends towards

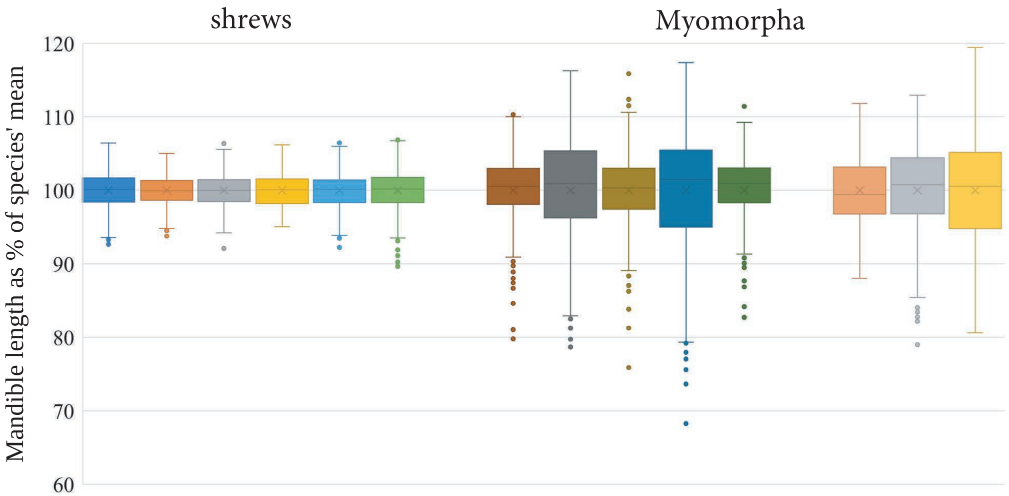

Figure 2. Boxplots of mandibular lengths of micro-mammals, as percentages of the species' mean. From left to right: shrews: common shrew (blue), Millet's shrew (orange), pygmy shrew (grey), water shrew (yellow), bi-coloured white-toothed shrew (light blue) and greater white-toothed shrew (light green) and Myomorpha: bank vole (brown), root vole (dark grey), field vole (sepia), common vole (dark blue), common pine vole (dark green), harvest mouse (orange), wood mouse (grey), house mouse (yellow).

Table 2. Key figures of mandibular lengths (in mm) in micro-mammals; CV: coefficient of variation, sd: standard deviation.

	n	CV (sd)	Skewness	Mean mandibular length in mm (and range)
Common shrew	521	2.46 (0.24)	-0.01	9.79 (9.11-10.42)
Millet's shrew	316	2.14 (0.20)	-0.09	9.42 (8.83-9.89)
Pygmy shrew	460	2.20 (0.16)	0.05	7.49 (6.90-8.01)
Water shrew	92	2.20 (0.25)	-0.12	11.19 (10.63-11.88)
Bi-coloured white-toothed shrew	250	2.54 (0.27)	-0.19	10.48 (9.67-11.16)
Greater white-toothed shrew	897	2.63 (0.27)	-0.22	10.35 (9.28-11.08)
Bank vole	422	4.57 (0.62)	-0.30	13.50 (10.77-14.89)
Root vole	277	7.38 (1.12)	-0.38	15.14 (11.91-17.60)
Field vole	383	5.05 (0.75)	-0.18	14.87 (11.27-17.21)
Common vole	837	7.94 (1.0.7)	-0.55	13.51 (9.22-15.86)
Common pine vole	264	4.58 (0.63)	-0.63	13.72 (11.35-15.29)
Harvest mouse	394	4.44 (0.40)	0.39	9.12 (8.03-10.20)
Wood mouse	596	6.18 (0.84)	-0.37	13.52 (10.68-15.27)
House mouse	328	6.68 (0.75)	-0.23	11.30 (9.11-13.49)

more lower values and vice versa. To compare the variability of different species the coefficient of variation (CV) was calculated as:

$CV = sd / \mu * 100$

To test for differences between the coefficients of variation of shrews and Myomorpha, data were measured on a continuous scale using a Student's two-sample *t*-test.

Results

The coefficients of variation of the mandible lengths of the shrews (range of CV 2.14-2.63) were smaller than those of the Myomorpha (range 4.44-7.94) (*t*-test, $t=0.00016$, $P<0.05$) (Table 2). Boxplots of the percentages of the mandibular lengths with whiskers of 90-107% for shrews and of 68-117% for voles and 79-119% for true mice (including outliers) for all 14 studied micro-mammals underline these statistical outcomes (Figure 2).

The skewness indices for shrews are negative, with exception of the pygmy shrew, and all are fairly symmetrical. For voles these values are between -0.63 and -0.18 (negatively skewed). The skewness for the harvest mouse, is positive (0.39) and fairly symmetrical. For the wood mouse and the house mouse the values are negatively skewed (see Table 2).

Discussion

The results clearly show that the variability of the mandibular length in the six species of shrews hunted by owls is smaller than those of species of other micro-mammals. For the investigated species of red-toothed shrews (common shrew, Millet's shrew, pygmy shrew and water shrew), the coefficients of variation are at least half as small as the other (non-shrew) micro-mammals except for the common shrew (see Table 2). In the white-toothed shrews (and the common shrew) these coefficients were less than 60% of them (see Table 2). The coefficients of variation of the mandible lengths of the shrews are significantly smaller ($P<0.001$) than those of the Myomorpha. The conclusions are, however, based on the species investigated, and do not necessarily apply to other shrews.

There are several factors that can explain the size variability in the hunted populations of micro-mammals. The first is growth during the pre-adult (sub-adult) period. Newborn micro-mammals (shrews and Myomorpha) are pink, more or less bean sized and typically meet the criteria of 'nestlings': hairless, large heads, extremities with fused toes, closed eyes and sealed ears (Bradley 2017, Burgin & He 2018). In that very first week competition in large litters of shrews (of between 6-9) is high and the smallest and weakest succumb (Churchfield 1990). Before the periods of leaving the nest, the opening of the eyes and ears, the completion of hair cover, the eruption of incisors, weaning and the intake of solid food, are all significant events that are reached before the third or fourth week[1]. Young shrews grow very rapidly until day 18 and then stop growing exponentially; at that moment the young are nearly as large as the mother. Fully weaned and with the start of solid food consumption at 20-25 days, the young grow to full size in about 30 days (Burgin & He 2018). On the other hand, Myomorpha have a much more extended growth curve. For example, at 43 days, bank voles weigh 13.7 g, and almost double their weight after one year (Bujalska & Gliwicz 1968). Another study showed that root voles gained approximately 150% in weight from between four to twelve weeks after birth. This period of intense growth in the condylobasal length of root voles persists up to the ninth month of their life, i.e. an increase of approximately 15% during the first nine months (Gebczyńska 1964). In 1-2 month old common voles an almost doubling

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[1] References for common shrew (Hausser et al. 1990, Burgin & He 2018), pygmy shrew (Hutterer 1990), water shrew (Spitzenberger 1990, Burgin & He 2018), bi-coloured white-toothed shrew (Krapp 1990), greater white-toothed shrew (Genoud & Hutterer 1990, Genoud & Perrin 1994), bank vole (Viro & Niethammer 1982), root vole (Frank & Zimmermann 1956, Tast 1982), field vole (Krapp & Niethammer 1982), common vole (Niethammer & Krapp 1982a), common pine vole (Niethammer 1982, Schröpfer 1977), harvest mouse (Böhme 1978, Ishiwaka & Mori 1999), wood mouse (Niethammer 1978, Owen & Trees 1998) and resp. house mouse (Reichstein 1978, Owen & Trees 1998).

of the weight has been registered after ca. one year, with the condylar basal lengths increasing by ca. 17% (Frank & Zimmermann 1957). Wood mouse and house mouse, which are weaned at 25-30 days, show a fast weight gain until day 50, after which their rate of weight gain decreases (Crowcroft & Rowe 1961).

In summary, Myomorpha continue to experience growth beyond the first month of their life, with their mandibles continuing to grow thereafter, surpassing the growth observed in shrews. This is an important factor in explaining the size variability.

Another factor that can account for size variability is sexual dimorphism, i.e. differences in the (mean) size between the sexes, or greater variability within either of the sexes. Sexual dimorphism in size might explain the size differences of mandibles in micro-mammals.

The owl pellet material used in this study was not differentiated according to sex, although in some species sex determination is occasionally feasible through the examination of the pelvis or scapulae from both *Sorex* and *Neomys* (Dolgov 1961). Overall, sexual dimorphism in common shrews is generally considered to be negligible (Polly 2007, White & Searle 2009). Zidarova (2015) showed no significant differences in the mandibular length between females and males in common shrews, pygmy shrews, water shrews and bi-coloured white-toothed shrews. In greater white-toothed shrews differences in mandible size were detected between sexes, with males exhibiting significantly larger mandibles than females (Sánchez-Chardi et al. 2018). This sexual size dimorphism in mandible size may contribute to the slightly higher coefficient of variation for greater white-toothed shrews (2.63) found in this study for the total hunted population. In several species of voles there is a sexual dimorphic difference in size. Although this significantly affects the average value of four somatic features, all of which attain higher values in male, than in, female Pannonian root voles (*Alexandromys oeconomus mehelyi*), this effect could not be demonstrated in the mandibular length (Baláž et al. 2021). On average the values, especially the length (and the height) of the mandible for adult and sub-adult females of *bank vole,* are higher than those for males (Csanády & Mošanský 2021a). A morphometric analysis of the common vole (Csanády & Mošanský 2021b) revealed sexual differences in the measured cranial traits, with the most pronounced disparity observed in the length of the mandible: values for adult males of this species were higher than those for females.

In wood mice, sexual dimorphism also has been registered for mandibular length: mean values in males exceeded those of females (Chassovnikarova & Markov 2007). Measurements of lower mandibular lengths in house mice exhibit sexual dimorphic outcomes across various populations, with results that are unequivocal (Csanády & Mošanský 2018): for adult males from Slovakia higher mean values in the mandibula length were found for house mice, while the Austrian population of this species showed a longer average mandibula length in adult females. All these sexual size differences in mandibular lengths contribute to higher (>4.44) coefficients of variation for Myomorpha, compared to the more modest coefficients in shrews, as listed in Table 2.

From day 7 until day 21 young greater white-toothed shrew can be observed ‘caravanning’ outside the nest (Jenkins 1977, Genoud & Hutterer 1990). In this behaviour each shrew youngster grasps the base of the tail of the preceding individual, with the mother running along with the young trailing in a line behind her (Churchfield 1990). Caravanning is well documented among several species of captive shrews (Burgin 2018) and has also been observed in the wild (Harper 1977). Available photographs of caravanning shrews show leading mothers with small youngsters (Genoud & Hutterer 1990, Burgin 2018). This behaviour could theoretically lead towards a greater proportion of youngsters being at risk, and, in the end, to a greater proportion of small mandibles in owl pellets; yet, as the low coefficients of variation show (Table 2), this was not the case for shrews. An explanation for this discrepancy could be the continuous twittering of the leading individual (Harper 1977), a behaviour that can easily provoke aerial attacks of owls at the leading individual. Assuming the owls claws only grasp one shrew at the time, this 'self-sacrificing' behaviour of continuous twittering contributes towards prey selection of older individuals over young shrews. Myomorpha accompany their offspring outside the nest, but there are no reports of caravanning events as displayed by shrews. Thus, by venturing outside the nest, young Myomorpha are evenly at risk at being preyed upon by owls compared to older individuals. Therefore, the behaviour of caravanning in shrews, resulting in a preference by hunting owls of adult individuals instead of youngsters, could be a partial explanation of the smaller variability of mandibular length in shrews than in other micro-mammals.

The left-skewed distribution observed in almost all the investigated micro-mammals found in owl pellets (as indicated by the negative skewness values in Table 2) can be contributed to the population structures being dominated by young individuals. The skewness values of the three studied *Sorex* species are all close to zero: the common shrew and Millet's shrew are both just negative while the pygmy shrew is just positive. An explanation for the right-skewed distribution of the harvest mouse (skewness: 0.39) could be the marked seasonal fluctuation in the numbers of harvest mice taken by barn owls, rising in autumn and going down in spring (Buckley 1977, Darinot 2016). Besides, a high mortality of young individuals, in some years up to 80% of litters in their nests, which are usually located high (up to ca. 1 m) in reeds (*Phragmites australis*) and other grassy vegetation or shrubs, can succumb to poor weather conditions in autumn (Harris 1979) and are therefore not accessible to hunting owls. Both these factors can contribute to a harvest mouse population with a higher number of adult specimens with, on average, longer mandibles.

Conclusions

Based on a large sample of remains found in owl pellets, this study demonstrates that the variability of mandibular length in the hunted populations of all the studied species of shrews (common shrew, Millet's shrew, pygmy shrew and water shrew) is significantly smaller than those of eight studied species of other micro-mammals. For the red-toothed shrews investigated the coefficients of variation are at least half that of the other (non shrew) micro-mammals. The boxplots (shown in Figure 2) illustrate the statistical outcomes. The conclusions are however based on those species that were found in owl pellets in the province of Zeeland and may not apply to other red-toothed shrews.

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Samenvatting

Variabiliteit in de lengte van de onderkaak bij spitsmuizen en woelmuizen en ware muizen uit de provincie Zeeland

Verschillende studies suggereren dat de variabiliteit in grootte bij spitsmuizen kleiner is dan bij woelmuizen en ware muizen, wat onder meer blijkt uit de verschillen in range van de onderkaaklengtes. De onderkaaklengte wordt in deze studie gebruikt als een afgeleide voor de lichaamsgrootte. Jonge spitsmuizen hebben in de levensfase buiten het nest bijna volwassen lichaamsafmetingen, terwijl kleine knaagdieren meer variërende lichaamsafmetingen lijken te hebben. De vraag die hier rijst is: kan de variatie van de lengteverschillen in de onderkaak bij spitsmuizen en bij kleine knaagdieren (Myomorpha: woelmuizen en ware muizen) worden bevestigd en zijn deze verschillen te kwantificeren? Om deze vraag te beantwoorden, werd de onderkaaklengte van 6037 exemplaren van 14 verschillende soorten kleine zoogdieren bepaald. Deze onderkaken waren afkomstig uit braakballen van uilen en waren alle verzameld in de provincie Zeeland. Als gevolg van het gebruik van braakballen was dit geen willekeurige steekproef uit de populaties als geheel, maar een selectie gemaakt door de uilen, dus van de bejaagde populatie. De resultaten tonen aan dat de coëfficiënten van de variantie bij spitsmuizen significant kleiner zijn dan die van de woelmuizen en ware muizen. Voor drie van de onderzochte soorten van de onderfamilie van de roodtandspitsmuizen (tweekleurige bosspitsmuis, dwergspitsmuis en waterspitsmuis) zijn die coëfficiënten meer dan twee keer zo klein als bij de andere, niet-spitsmuissoorten. Bij de wittandspitsmuizen (huisspitsmuis en veldspitsmuis) - en ook bij de gewone bosspitsmuis - zijn deze coëfficiënten ook duidelijk kleiner, maar minder dan twee keer zo klein. Deze verschillen tussen de spitsmuizen en de woelmuizen en ware muizen worden ook weerspiegeld in de uitersten van de percentages ten opzichte van de soortgemiddelden van de onderkaaklengtes van spitsmuizen (90-107%), woelmuizen (68-117%) en ware muizen (79-119%). Onder de factoren die de verschillen in variabiliteit van de onderkaken tussen spitsmuizen en kleine knaagdieren kunnen verklaren, kan als eerste genoemd worden het doorgroeien van kleine knaagdieren na de eerste levensmaand, terwijl de spitsmuizen na die periode nog nauwelijks groeien. Verder vertonen roodtandspitsmuizen

nauwelijks geslachtsdimorfie, terwijl bij kleine knaagdieren een geslachtsdimorfie in de literatuur is aangetoond. Ook wordt aandacht gevestigd op risicovol gedrag bij volwassen vrouwelijke spitsmuizen door karavaanvorming: het gedrag waarbij jonge spitsmuizen zich vastbijten in de staartwortel van hun voorganger en de voorste aan die van het volwassen vrouwtje. Doordat het vrouwtje bij het voortgaan steeds geluid maakt, loopt juist dit exemplaar een grotere kans ten prooi te vallen aan (kerk)uilen, terwijl de jonge exemplaren dit moment van potentiële predatie juist overleven.

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