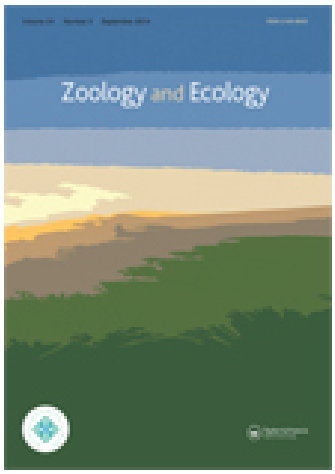

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New mammal species for Latvia, the root vole (Microtus oeconomus)

Linas Balčiauskas[a]

[a] Nature Research Centre, Akademijos 2, LT-08412 Vilnius-21, Lithuania

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New mammal species for Latvia, the root vole (*Microtus oeconomus*)

Linas Balčiauskas*

Nature Research Centre, Akademijos 2, LT-08412 Vilnius-21, Lithuania

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In the summer of 1989, a single adult male root vole (*Microtus oeconomus*) was trapped in the meadow at Kovališki, Latvia. It was registered in the site, characterised by low small mammal diversity (nine species, Shannon's $H = 0.97$). Among three sampled habitats in the Kovališki site, meadow had most diverse small mammal composition, while forest and swamp were characterised by three species each in the period of 1984–1990. This is the first record of *M. oeconomus* for Latvia, thereby also expanding the known distribution range. This finding is very much in line with the north and eastward spread of the species in Lithuania, an expansion that started in the Nemunas Delta and, at least partly, tied to land abandonment in the years since the 1990s creating suitable habitat for *M. oeconomus*. Its distribution in Baltic countries is still however limited to Lithuania and, possibly, closely adjacent areas in Latvia. Old records of *M. oeconomus* from Estonia were not confirmed in the last decades.

1989 metų vasarą Latvijoje, Kovališki vietovėje, mušamaisiais spąsteliais pievoje buvo sugautas suaugęs pelkinio pelėno (*Microtus oeconomus*) patinas. Jo radimvietei būdinga nedidelė smulkiųjų žinduolių įvairovė (9 rūšys, Šenono įvairovės rodiklis $H = 0{,}97$). Iš trijų Kovališkėse tirtų biotopų pieva pasižymėjo didžiausia smulkiųjų žinduolių įvairove, nes miške ir pelkėje 1984–1990 metais buvo užregistruota tik po tris rūšis. Ši pirmoji *M. oeconomus* radimvietė Latvijoje praplečia žinias apie rūšies paplitimą ir patvirtina jos plitimą Lietuvoje nuo Nemuno žemupio į rytus ir į šiaurę. Arealo plėtra gali būti susijusi su apleistos žemės plotų didėjimu po 1990-ųjų, kartu didėjant rūšiai tinkamų buveinių plotui. *M. oeconomus* paplitimas Baltijos šalyse dabar apima Lietuvą ir artimiausias pasienio sritis Latvijoje. Seni duomenys apie *M. oeconomus* radimvietes Estijoje nėra patikimai dokumentuoti, žvėreliai paskutiniaisiais dešimtmečiais neužregistruoti.

Keywords: Latvia; root vole; distribution range

Introduction

The root vole (*Microtus oeconomus*) is a Holarctic species, with its European range extending from Germany and Fennoscandia through Poland, Belarus and northern and central parts of European Russia. Relict populations also exist in the Netherlands, Southern Scandinavia, Austria, Slovakia and Hungary (Van Apeldoorn 1999; Shenbrot and Krasnov 2005; Linzey et al. 2008). The species was reported as absent in Latvia and Estonia (Van Apeldoorn 1999; Zorenko 2008) and Lithuania (Rácz, Gubányi, and Vozár 2005), the latter information being erroneous. Actually, *M. oeconomus* was recorded in Estonia in 1947 (possibly, not properly documented) and 1970 (A. Miljutin (personal communication; Masing 1999)), yet has not been found since then and was always extremely rare. Erroneous is also *M. oeconomus* distribution map presented in Linzey et al. (2008) with species range shown covering south-eastern part of Latvia, as the only known observation of the species in this country is presented here for the first time.

In Lithuania, *M. oeconomus* was considered as a very rare vole species 50 years ago. The spread of the species eastwards and northwards is well documented (Balčiauskas, Balčiauskienė, and Baltrūnaitė 2010) and, in the years since 1999, *M. oeconomus* has colonised most of northern Lithuania, albeit its proportion in the small mammal composition remaining low. *M. oeconomus* has not yet been registered in north-eastern Lithuania (Balčiauskas and Juškaitis 1997; Mažeikytė 2002, 2003; Šinkūnas 2006; EPA 2009). In the very east of Lithuania, a few individuals of *M. oeconomus* have been trapped alongside the shores of lakes, although most studies have not found the species (Balčiauskas and Juškaitis 1997; Balčiauskas 2005; Balčiauskas and Gudaitė 2006; Šinkūnas 2006).

A small mammal monitoring project was conducted near Ignalina Nuclear Power Plant in Lithuania in the period 1981–1990, the study also covering nearest environs in the two neighbouring countries, Latvia and Belarus. However, little data were published (Balčiauskas 1989, 2005; Balciauskas and Angelstam 1993; Balčiauskas and Juškaitis 1997) and data were never analysed in the respect to the country. When writing an overview of *M. oeconomus* distribution changes (Balčiauskas, Balčiauskienė, and Baltrūnaitė 2010), the database was not available for analysis as data were stored in DOS based R:Base ver. 2.0. Though conversion is possible (R:BASE Technologies, Inc. 2014), we are not using R:Base Windows versions. Just after data were transferred to MS Windows supported software (MS Excel and MS Access), analysis by country revealed the presence of *M. oeconomus* in Latvia.

*Email: linasbal@ekoi.lt

The aim of this paper is to present data on the small mammal species composition in the cross-border area of Lithuania, Latvia and Belarus along with the record of a new mammal species for Latvia, the root vole (*M. oeconomus*).

Materials and methods

A small mammal monitoring project was conducted in the region of Ignalina Nuclear Power Plant in the period 1981–1990 and encompassed eight research localities (Tilžė, Sniečkus, Vyšniava, Vosyliškės and Motiejūnai in Lithuania, along with, Mialka and Ryčany in Belarus). The project was also conducted in Latvia at Kovališki (near the Lithuanian–Latvian border) in the period 1984–1990 (Figure 1). Trapping sessions were carried out in spring (April–May), summer (June–July) and autumn (September–October). In 1990, however, sessions were limited to only spring and autumn. In all, out of the total trapping effort equal to 58,200 trap nights (Balčiauskas 2005), 9000 were conducted in Latvia. Snap traps were set in two standard lines per habitat, each line consisting of 25 traps, with a distance 5 m between traps. Traps were left in position for three days.

Three habitats (forest, wetland and meadow/pasture) were investigated at each site. In Kovališki (55°42′N, 26°49′E), habitats investigated were: (1) natural unmoved meadow, (2) middle-aged, sparse dry birch forest with tall grass cover and (3) swamp, overgrown with deciduous trees, mainly black alder, with a well-expressed grass layer.

Trapped mammals were identified, measured and dissected. Identification was done according to Ogniov (1950), Niethammer and Krapp (1982), Pucek (1984) and Prūsaitė (1988). *M. oeconomus* was identified by the first mandibular molar having six closed loops.

Small mammal communities were characterised by their diversity, as Shannon's H, on the base of $\log_2$ transformed data and dominance as Simpson's c (Krebs 1999). Differences in small mammal diversity in different sites, habitats and countries were tested using $H \pm SD$, $c \pm SD$ and the significance of difference calculations were performed in the freeware DOSBox ver. 0.74, running DivOrd program ver. 1.90 (Tóthmérész 1993). Differences in species composition of the

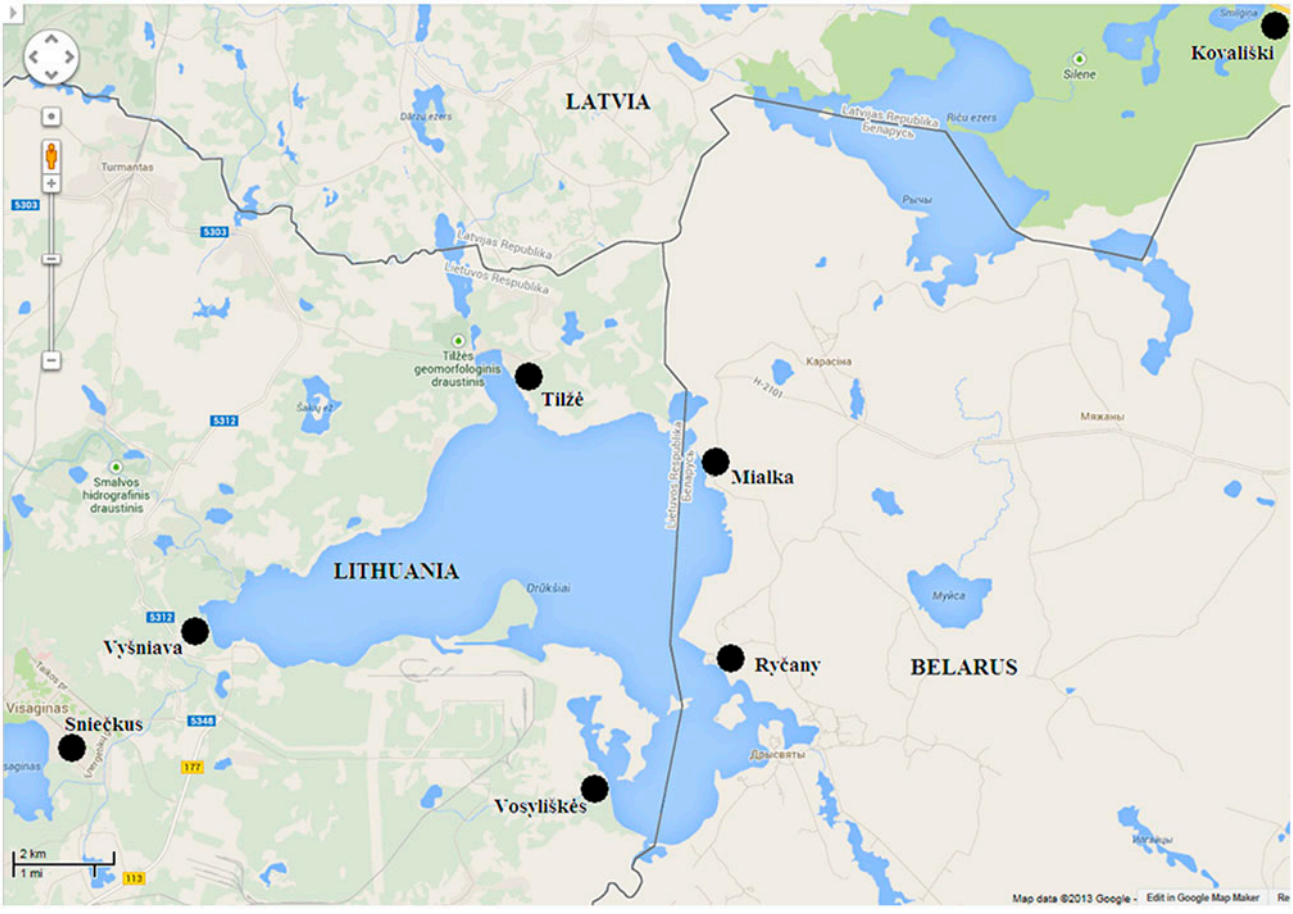

Figure 1. The study area in Latvia (1984–1990), Lithuania and Belarus (both 1981–1990). The Motiejūnai site is not shown in the figure and was located further south-west (55°3′N, 26°1′E).

communities were tested using Friedman ANOVA and χ^2 test. All differences with $p > 0.05$ were considered non-significant. Calculations were carried out with Statistica for Windows, ver. 6.0 software (StatSoft, Inc. 2004).

Results

Over the seven years of the project in Latvia, amounting to a trapping effort of 9000 trap nights, a total of 356 small mammals, belonging to nine species, were trapped at Kovališki, near the Lithuanian border. The species were common shrew (*Sorex araneus*), pygmy shrew (*S. minutus*), striped field mouse (*Apodemus agrarius*), yellow-necked mouse (*A. flavicollis*), harvest mouse (*Micromys minutus*), bank vole (*Clethrionomys glareolus*), common vole "complex" (*Microtus arvalis*/*rossiaemeridionalis*), short-tailed vole (*M. agrestis*) and root vole (*M. oeconomus*). The small mammal species assemblage at the site is characterised by a rather poor diversity, as in most years the Shannon's H was < 1 (Table 1). The site is also characterised by a very high level of dominance by a single species, with Simpson's c in most years >0.80.

The diversity and dominance in the small mammal species composition differed significantly between countries. Rényi diversity ordering (according Tóthmérész 1998) produced non-intersecting curves, showing the highest small mammal diversity in Lithuania and the lowest in Latvia (Figure 2(A)). Differences between Shannon's H between countries are all significant at $p < 0.001$. The same level of significance, $p < 0.001$, was characteristic to the level of dominance in the small mammal assemblage, where the highest level of dominance was found in Latvia, an intermediate level in Belarus and the lowest level in Lithuania.

Differences in the numbers of trapped individuals were also significantly different (Friedman ANOVA, $\chi^2_{9,2} = 16.22$, $p < 0.0003$). Latvia was characterised by highest proportion of bank voles (see Table 1, higher than in Lithuania, $\chi^2 = 72.48$, $p < 0.0001$ and in Belarus, $\chi^2 = 8.84$, $p = 0.003$). This was compensated by a smaller proportion of shrews (7.30% vs. 13.90% if compared to Lithuania, $\chi^2 = 11.89$, $p = 0.0006$ and vs. 12.06% if compared to Belarus, $\chi^2 = 6.30$, $p = 0.012$), *Apodemus* mice (5.90% vs. 11.81% if compared to Lithuania, $\chi^2 = 9.95$, $p = 0.002$ and vs. 8.04% if compared to Belarus, $\chi^2 = 1.34$, NS) and *Microtus* voles (2.25% vs. 10.87% if compared to Lithuania, $\chi^2 = 15.25$, $p = 0.0001$) in Kovališki.

High numbers of *C. glareolus* in the forest and the swamp were responsible for a high level of dominance and low level of diversity obtained in Kovališki. The small mammal community in the meadow, however, was quite diverse and polydominantic (Table 2). It was significantly more diverse than in the forest and the swamp (Figure 2(B)). While the number of trapped small mammal species was equally low in the forest and the swamp, other parameters were significantly higher in the small mammal community in the swamp (all mentioned differences significant at $p < 0.001$).

Of the 11 *M. oeconomus* individuals trapped, eight were in Belarus, two in Lithuania and one in Latvia. The single *M. oeconomus* trapped in Kovališki was in the summer of 1989, when the number of species in the small mammal assemblage in Kovališki was highest. The trapped specimen was an adult male, with a body weight of 30.5 g, body length of 100.2 mm, tail length of 32.5 mm, hind foot length of 17.7 mm, ear length 11.6 mm and testes 10.9 × 7.5 mm, the individual being just after reproduction. In this particular case, the relative abundance was 2 individuals/100 trap nights.

Table 1. The composition of small mammal communities (sum of trapped individuals in all investigated habitats) in Kovališki, Latvia (1984–1990), and neighbouring areas of Lithuania and Belarus (1981–1990).

	1984	1985	1986	1987	1988	1989	1990	Latvia, total	Lithuania, total	Belarus, total
Neomys fodiens	–	–	–	–	–	–	–	–	2	1
Sorex araneus	2	4	4	2	4	5	4	25	298	128
S. minutus	–	–	–	–	–	1	–	1	26	6
Arvicola terrestris	–	–	–	–	–	–	–	–	3	–
Clethrionomys glareolus	44	58	43	27	13	80	35	300	1432	860
Microtus agrestis	–	–	1	–	–	2	–	3	75	5
M. arvalis			1		1	2	–	4	178	7
M. oeconomus	–	–	–	–	–	1	–	1	2	8
Apodemus agrarius	–	2	1	–	–	1	1	5	80	24
A. flavicollis	3	1		3		5	4	16	194	66
A. sylvaticus	–	–	–	–	–	–	–	–	3	–
Micromys minutus	–	–	–	–	1	–	–	1	33	13
Mus musculus	–	–	–	–	–	–	–	–	17	1
Rattus norvegicus	–	–	–	–	–	–	–	–	1	–
Sicista betulina	–	–	–	–	–	–	–	–	2	–
Number of species	3	4	5	3	4	8	4	9	15	11
Number of individuals	49	65	50	32	19	97	44	356	2346	1119
Shannon's H	0.57	0.64	0.75	0.78	1.29	1.11	1.02	0.97	1.98	1.27
Simpson's c	0.82	0.80	0.82	0.75	0.52	0.69	0.65	0.72	0.40	0.61

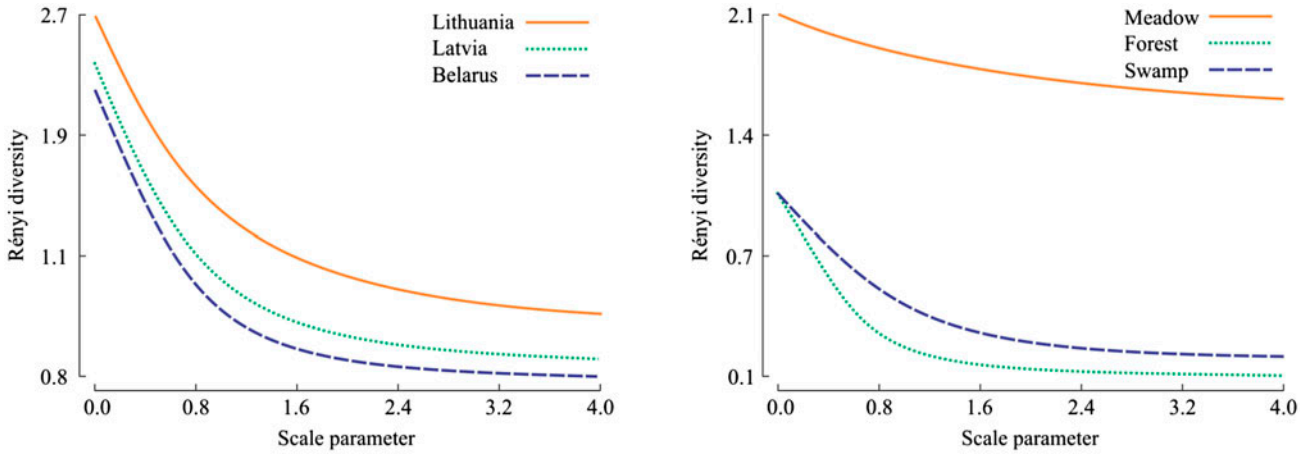

Figure 2. Comparison of small mammal diversity in the INPP region: A – in Latvia (1984–1990), Lithuania and Belarus (both 1981–1990), and B – in meadow, forest and swamp in Kovališki, Latvia (1984–1990). Non-intersecting curves show statistically significant differences in diversities compared, irrespective of the influence of rare or common small mammal species.

Table 2. The composition of small mammal communities (sum of trapped individuals) in the investigated habitats, Kovališki, Latvia (1984–1990).

	Meadow	Forest	Swamp
Sorex araneus	6	3	16
Sorex minutus	1	–	–
Clethrionomys glareolus	7	75	218
Microtus agrestis	3	–	–
M. arvalis	4	–	–
Microtus oeconomus	1	–	–
Apodemus agrarius	4	–	–
Apodemus flavicollis	–	1	15
Micromys minutus	1	–	–
Number of species	8	3	3
Number of individuals	27	79	249
Shannon's *H*	2.68	0.33	0.67
Simpson's *c*	0.18	0.90	0.77

The individual trapped in Latvia constituted the first record of the species for this country, thereby also expanding the known distribution of the species.

Discussion

The discovery of *M. oeconomus* in Latvia does not discredit our conclusions regarding the spread of *M. oeconomus* north-eastwards through Lithuania since the 1990s (Balčiauskas, Balčiauskienė, and Baltrūnaitė 2010). We found this process at least partly related to changes in land use, abandoned agricultural areas becoming overgrown with grass, weeds and shrubs. As such, territories fulfil the ecological requirements of the species (moist sedge meadows and reed beds with good cover and sufficient food resources); thus, former agricultural areas are now suitable for the existence of *M. oeconomus* (Balčiauskas, Balčiauskienė, and Baltrūnaitė 2010). Land abandonment is seen as the most characteristic trend in landscape change, and in Latvia this has happened particularly in the period since 1990, when land has been returned to its previous owners or their descendants after following independence from the Soviet Union (Ruskule et al. 2013). In different areas of Latvia in 1995–2000, abandoned land accounted for 7.6–23.4% of total area and wet natural meadows 1.1–3.1% of the landscape. Significant increase in the amount of abandoned land was shown to be still occurring until 2000 (Aunins and Priednieks 2003). Similar landscape changes are also characteristic to Estonia (Kana, Kull, and Otsus 2008). However, in several localities across Latvia from south to north in 2006, and at the Kovališki site in 2007, no further *M. oeconomus* individuals were registered (Balčiauskas, Balčiauskienė, and Baltrūnaitė 2010; Baltrūnaitė 2010). Thus, despite suitable habitat for the species, *M. oeconomus* distribution in the Baltic countries is still limited to Lithuania and the immediate area across the border in Latvia.

Conclusions

M. oeconomus is a new mammal species in Latvia, registered in 1989. This record has not previously been published due to a lack of analysis of long-term data with respect of the country. The presence of suitable habitat in Latvia allows an assumption to be made that spread of the species registered in Lithuania over the last 50 years has finally reached the neighbouring country. The numbers and habitat distribution of *M. oeconomus* in Latvia deserve deeper investigation.

Acknowledgement

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