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DEMOGRAPHIC AND MORPHOMETRIC PARAMETERS OF THE YELLOW-NECKED MOUSE (*APODEMUS FLAVICOLLIS*) IN LATE AUTUMN–EARLY SPRING IN LITHUANIA

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220 individuals of the yellow-necked mouse (*Apodemus flavicollis*) were trapped in northeastern Lithuania from October to April in 2004–2009. From autumn through winter till spring, especially from December till April, numbers of *A. flavicollis* and their share in a small mammal community were declining (29.4% and 1.9%, respectively). In February–April no juvenile individuals were present in the population. For adults, the growth of body mass stopped in January–February. The depression of body mass growth in subadult individuals lasted from October till January; and through this period body mass declined by 10 percent. Cranial growth in adult and subadult *A. flavicollis* individuals also experienced winter depression. In adults, the growth of 12 out of 17 skull characters was suspended from December, January or February, though differences between measurements in consecutive months were not reliable statistically. In subadults, growth depression of three skull characters from February till April was reliable statistically.

Key words: *Apodemus flavicollis*, autumn–spring period, body mass decreasing, cranial growth depression.

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INTRODUCTION

Data on the yellow-necked mouse (*Apodemus flavicollis* (Melchior, 1823)) from Europe, especially about species abundance and distribution or interactions with other rodent species, are extensive (Adamczewska 1961, Bergstedt 1965, Jensen 1975, Grüm & Bujalska 2000, Horváth & Wagner 2003, Koshev et al. 2005, Suchomel 2006, Bujalska & Grüm 2008). Studies on these mice in winter, in particular about decreases in abundance and density, are not so numerous (Pucek et al. 1993, Bujalska & Grüm

2006, Vukicevic-Radic et al. 2006a, b, Suchomel 2007). For example in Poland, despite old traditions in small mammal research, only a few publications considering winter survival of *A. flavicollis* have been published so far. Three of them are based on the same data set sampled in the Białowieża Forest, and the rest are also from NE Poland (Pucek et al. 1993, Jędrzejewski & Jędrzejewska 1996, Stenseth et al. 2002, Bujalska & Grüm 2006).

A. flavicollis and the bank vole (*Myodes glareolus*) are dominant small mammal species in the forests of Lithuania. Data on the share of *M. glareolus* and common vole (*Microtus arvalis*) in a small mammal community, as well as growth stunting in these species studied in October–April in NE Lithuania were published (Balčiauskienė et al. 2009a, b).

In the present paper we analyse several demographic and morphometric parameters (numbers and share in a small mammal community, age and sex composition, breeding activity and individual growth) of *A. flavicollis* in a late autumn–early spring period in NE Lithuania. Results of the study will add to knowledge of winter biology of this species.

MATERIAL AND METHODS

The material was collected in 2004–2009 near Lake Ilgelis, Zarasai district, northeastern Lithuania (Balčiauskas, Gudaitė 2006), using a standard method of snap-trap lines with 25 to 50 traps. Small mammals were trapped from October to April, with two trapping sessions lasting 1–3 nights each month. Relative abundance of mice was expressed as individuals per 100 trap/days from the first day catch.

Winter weather was assessed using data from the nearest meteorological stations in Zarasai and Utena (LHS 2009). In the first two years of investigation started in 2004, negative average monthly temperatures were recorded in December, January, February and March. Negative temperatures in the last three winters were short-lived and lasted only one month in 2006/07 and 2007/08 or two months in 2008/09 (see Balčiauskienė et al. 2009b). Thus, we defined the

Table 1. Share, age and sex composition of *A. flavicollis* in October–April 2004–2009.

Year	Small mammals trapped, N	*A. flavicollis*						
		Males	Females	Adults	Subadults	Juveniles	n	%
2004/2005	118	5	5	7	3	0	10	8.5
2005/2006	218	14	13	17	10	0	27	12.4
2006/2007	385	30	11	15	14	12	41	10.6
2007/2008	447	61	42	42	46	15	103	23.0
2008/2009	554	18	21	20	14	5	39	7.0
Total	1722	128	92	101	87	32	220	12.8

Table 2. Monthly shares and relative abundance of *A. flavicollis* in October–April 2004–2009.

Month	Small mammals trapped, N	*A. flavicollis*, n	*A. flavicollis*, %	Relative abundance, ind. 100 trap/days
October	201	59	29.4	8.2±3.77
November	356	98	27.5	6.1±2.29
December	409	34	8.3	2.8±0.91
January	226	13	5.8	0.8±0.66
February	171	9	5.3	0.7±0.32
March	92	2	2.2	0.1±0.13
April	264	5	1.9	0.2±0.20

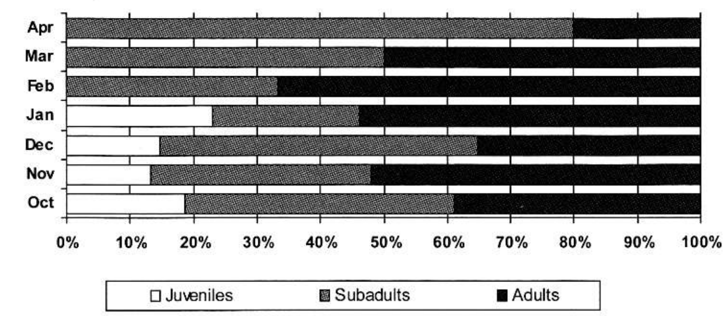

Fig. 1. Dynamics of the age structure of *A. flavicollis* population in October–April 2004–2009.

first two winters as harsh or cold and the last three as mild.

A total of 220 *A. flavicollis* individuals were trapped (Table 1). After weighing and measuring, mice were dissected and divided into three age categories: juveniles, subadults and adults, based on their reproductive status and the presence of *gl. thymus* (Balčiauskas 2005). Juvenile individuals were characterised by a closed vagina, thread-like uterus or hardly visible abdominal testes. Subadult animals had developed, but inactive reproductive organs – small nipples and a closed vagina in females and abdominal testes in males. Adult animals were characterised by scrotal testes, pregnancy, open or plugged vagina.

Skulls were cleaned with *Dermestes* larvae. To evaluate cranial growth, we used 17 skull characters (Balčiauskienė 2007) measured under a binocular microscope with a micrometric eyepiece with an accuracy of up to 0.1 mm. The following skull characters (8 mandibular and 9 maxillary) were measured: X_1 – total length of mandibula at *processus articularis*, excluding incisors; X_2 – length of mandibula, excluding incisors; X_3 – height of mandibula at, and including, the first molar; X_4 – maximum height of mandibula, excluding coronoid process; X_5 – coronoid height of mandibula; X_6 – length of mandibular diastema; X_7 – length of mandibular tooth row; X_8 – length of molar M_1; X^9 – length of *nasalia*; X^{10} – breadth of braincase measured in the widest part; X^{11} – zygomatic skull width; X^{12} – length of cranial (upper) diastema; X^{13} – zygomatic arc length; X^{14} – length of *foramen incisivum*; X^{15} – length of maxillary tooth row; X^{16} – length of molar M^1; X^{17} – incisor width across both upper incisors (Balčiauskienė 2007).

RESULTS

During five trapping periods 220 individuals of *A. flavicollis* were trapped, comprising on average 12.8% of all small mammals, with a minimum of 7.0% in 2008/2009 and a maximum of 23.0% in 2007/2008 (Table 1).

The population was prevailed by males (58.2%), though the difference from 1:1 sex ratio was not significant ($\div^2=2.97$, $p<0.10$). By months, male dominance was mostly expressed, but not significant, from November (55.9%) to February (66.7%).

Numbers and shares of *A. flavicollis* in a small mammal community were sharply diminishing towards spring. From December onwards, their share in the community diminished almost fivefold. Based on 65 trapping sessions, relative abundance of *A. flavicollis* was low – 2.2±0.55 individuals per 100 trap/days. It was bigger in late autumn and went down in spring (Table 2).

Juveniles were present in the population from October till January with a share not more than 25%. In the most of the study period, adult mice comprised over 50% of the population. Subadult share grew from January onwards and in April reached 80% (Fig. 1).

The body mass of adult mice grew from October till December; later growth stopped (individuals in January–February were characterized by a smaller body mass), while body length kept growing (Table 3). In March and April just single adult specimens were trapped, and the one from

Table 3. Monthly averages of body mass (Q, g) and body length (L, mm) in *A. flavicollis* in October–April 2004–2009.

Month	Adults			Subadults			Juveniles		
	N	Q	L	N	Q	L	N	Q	L
Oct	23	36.4±1.16	102.9±1.56	25	30.4±0.71	97.9±1.15	11	24.4±0.50	92.4±1.62
Nov	51	39.2±0.91	104.0±0.96	34*	30.4±0.85	95.9±1.00	13	24.5±1.27	88.5±1.12
Dec	12	42.0±2.28	106.5±2.79	17	29.1±0.79	101.0±1.51	5	26.2±2.24	94.5±2.81
Jan	7	41.5±2.95	108.7±2.74	3	27.0±1.28	100.5±4.04	3	24.2±0.60	94.1±2.63
Feb	6	40.2±2.94	113.9±3.26	3	37.7±0.67	107.7±4.83	0		
Mar	1	48.5	127.0	1	26.5	94.9	0		
Apr	1	40.0	98.8	4	31.6±2.21	105.4±2.46	0		
Average		39.2±0.67	105.1±0.80		30.3±0.46	98.5±0.70		24.7±0.63	91.3±0.94

*n=33

March 2005 was a big male that already started its breeding season. The minimum body mass of adult *A. flavicollis* in the period of October–February was 26.5–34.5 g, which showed that the latest breeders were quite small mice individuals, while the maximum body mass was 49.5–55.5 g.

In October–April the body mass of subadult mice did not grow over 30 g. From October till January subadult *A. flavicollis* individuals lost over 3 g (ca. 10%) of their body mass, but their body length was increasing. We found that the minimum body mass of subadult *A. flavicollis* in October–January was only 16.5–25.4 g, while the maximum body mass was 29.5–42.0 g

From October till January juvenile *A. flavicollis* were characterized by the minimum body mass in the range of 15.5–23.0 g, and the maximum body mass of 25.0–34.5 g. The number of trapped juveniles was small in December and January, so we cannot make conclusions on their body mass or length dynamics.

Table 4. Growth dynamics of skull characters (mm) in *A. flavicollis* adults in October–April 2004–2009

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Growth stopped from
X_1	13.1±0.10	13.1±0.07	13.4±0.16	13.3±0.18	12.9±0.20	15.1	12.6	Dec
X_2	12.0±0.10	12.1±0.08	12.5±0.14	12.6±0.20	12.2±0.22	14.2	12	Jan
X_3	4.4±0.04	4.5±0.04	4.5±0.12	4.7±0.12	4.6±0.15	5	4.6	Jan
X_4	6.3±0.07	6.4±0.05	6.5±0.14	6.7±0.16	6.6±0.14	7.1	6.4	Jan
X_5	6.9±0.07	7.0±0.06	7.1±0.11	7.2±0.13	7.0±0.07	8.1	7	Jan
X_6	3.7±0.04	3.7±0.08	3.8±0.03	3.7±0.06	3.9±0.05	4.8	4	–
X_7	3.7±0.03	3.6±0.08	3.7±0.05	3.7±0.03	3.7±0.02	3.7	3.9	–
X_8	1.4±0.01	1.4±0.03	1.4±0.04	1.4±0.03	1.4±0.03	1.5	1.4	Dec
X^9	9.6±0.09	9.5±0.10	10.0±0.20	9.8±0.21	9.5±0.30	10.9	9.3	Dec
X^{10}	11.9±0.09	11.8±0.04	11.9±0.16	11.9±0.12	11.8±0.16	12.4	11.6	Jan
X^{11}	13.6±0.09	13.7±0.10	14.3±0.21	14.1±0.20	14.1±0.12	15.3	13.8	Dec
X^{12}	7.2±0.05	7.3±0.07	7.4±0.11	7.5±0.13	7.5±0.15	8.8	7.4	–
X^{13}	8.2±0.09	8.0±0.08	8.3±0.08	8.2±0.11	8.8±0.68	8.6	8.6	–
X^{14}	5.3±0.05	5.3±0.04	5.3±0.09	5.4±0.12	5.4±0.12	5.9	4.9	Jan
X^{15}	4.3±0.03	4.3±0.03	4.4±0.04	4.6±0.08	4.3±0.09	4.2	4.2	Jan
X^{16}	1.6±0.12	1.5±0.06	1.5±0.05	1.5±0.10	1.5±0.03	1.7	1.4	–
X^{17}	2.1±0.03	2.1±0.02	2.1±0.03	2.2±0.03	2.2±0.02	2.1	2	Feb

Note: – growth continued

Table 5. Growth dynamics of skull characters (mm) in *A. flavicollis* subadults in October–April 2004–2009

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Growth stopped from
X_1	12.7±0.10	12.7±0.09	12.6±0.13	12.9±0.16	13.4±0.08	12.8	13.0±0.14	Feb
X_2	11.7±0.11	11.6±0.09	11.5±0.11	11.7±0.24	12.5±0.14	11.6	12.0±0.21	Feb
X_3	4.2±0.04	4.3±0.04	4.2±0.07	4.3±0.11	4.5±0.03	4.4	4.4±0.07	Feb
X_4	6.0±0.06	6.2±0.05	6.2±0.06	6.3±0.11	6.5±0.03	6.1	6.4±0.14	Feb
X_5	6.6±0.07	6.7±0.05	6.8±0.05	6.8±0.12	7.1±0.09		6.8±0.11	Feb
X_6	3.7±0.03	3.7±0.03	3.7±0.05	3.9±0.06	4.0±0.03	3.8	3.8±0.04	Feb
X_7	3.6±0.02	3.7±0.02	3.7±0.04	3.7±0.06	3.7±0.08	3.8	3.6±0.02	*
X_8	1.4±0.02	1.4±0.01	1.4±0.02	1.4±0.03	1.4±0.03	1.5	1.4	*
X^9	9.0±0.09	9.2±0.10	9.3±0.07	9.6±0.14	9.7±0.32	9.7	9.6±0.11	Feb
X^{10}	11.6±0.06	11.8±0.07	11.7±0.09	12.0±0.18	11.8±0.11		11.6±0.41	Jan
X^{11}	13.1±0.14	13.4±0.12	13.3±0.16	12.9±0.13	14.0±0.13	13.6	13.2±0.05	Feb
X^{12}	7.0±0.07	7.1±0.06	7.1±0.07	7.1±0.13	7.6±0.11	7.0	7.1	Feb
X^{13}	7.8±0.08	7.9±0.09	7.9±0.07	8.1±0.13	8.4±0.12	8.3	7.5±0.06	Feb
X^{14}	5.1±0.06	5.1±0.05	5.1±0.06	5.2±0.20	5.2±0.16	5.2	5.3±0.16	–
X^{15}	4.2±0.03	4.3±0.03	4.2±0.04	4.3±0.14	4.3±0.11	4.2	4.4±0.08	–
X^{16}	1.4±0.02	1.5±0.02	1.5±0.01	1.5±0.06	1.5±0.08	1.6	1.4±0.03	Feb
X^{17}	2.0±0.03	2.0±0.02	2.0±0.03	2	2.1±0.08	2.1	2.1±0.06	–

Note: – growth continued, * no clear pattern

Table 6. Growth dynamics of skull characters (mm) in *A. flavicollis* juveniles in October–April 2004–2009

	Oct	Nov	Dec	Jan	Growth stopped from	Growth renewed from
X_1	12.4±0.14	12.4±0.20	12.2±0.16	12.4±0.16	Nov	Dec
X_2	11.3±0.12	11.4±0.21	11.2±0.24	11.2±0.11	Nov	
X_3	4.1±0.04	4.2±0.08	4.1±0.09	4.3±0.03	Nov	Dec
X_4	5.9±0.09	5.9±0.13	6.0±0.10	5.9±0.11	Dec	
X_5	6.5±0.08	6.5±0.10	6.4±0.09	6.4±0.19	Nov	Dec
X_6	3.6±0.06	3.6±0.08	3.6±0.05	3.6±0.09	Nov	
X_7	3.6±0.04	3.7±0.09	3.7±0.20	3.6±0.03	Dec	
X_8	1.4±0.02	1.5±0.07	1.4±0.02	1.4±0.03	Nov	
X^9	8.6±0.13	8.6±0.31	9.0±0.13	9.2±0.35	–	
X^{10}	11.4±0.09	11.6±0.11	11.7±0.06	11.9±0.14	–	
X^{11}	12.7±0.11	13.1±0.27	13.0±0.28		Nov	
X^{12}	6.8±0.08	6.8±0.18	6.8±0.11	6.9±0.21	Nov	Dec
X^{13}	7.6±0.09	8.0±0.16	7.6±0.19		Nov	
X^{14}	5.0±0.07	5.0±0.09	5.0±0.10	5.2±0.12	Nov	Dec
X^{15}	4.1±0.06	4.3±0.09	4.1±0.09	4.3±0.08	Nov	Dec
X^{16}	1.4±0.02	1.5±0.04	1.5±0.02	1.4±0.03	Dec	
X^{17}	1.9±0.02	2.0±0.03	2.1±0.06	2.0±0.08	Dec	

The dynamics of skull dimensions in various age groups of *A. flavicollis* is shown in Tables 4–6; the number of measured specimens is the same as in Table 3.

As to adult *A. flavicollis*, four cranial dimensions stopped growing from December, seven from January, one from February, and five kept growing without depression (Table 4). Differences between measurements in consecutive months were not reliable statistically.

In subadult *A. flavicollis*, three cranial dimensions continued to grow from October to April, one stopped growing from January, and 11 from February. Growth dynamics of X_7 (length of mandibular tooth row) and X_8 (length of molar M_1) had no clear pattern. Growth depression of three cranial characters, namely X^{11} (zygomatic skull width), X^{12} (length of cranial (upper) diastema), and X^{13} (zygomatic arc length), from February till April was reliable statistically ($p<0.01$, $p<0.02$ and $p<0.01$ respectively).

As towards spring juveniles of *A. flavicollis* disappeared (judging by a small body mass of subadults, juveniles possibly matured), not much could be found to characterize growth dynamics of their skulls (Table 6). Two characters, i.e. X^9 (length of *nasalia*) and X^{10} (breadth of braincase measured in the widest part), did not stop growing in winter. Four characters stopped growing in December and did not renew growth; the same was true for five characters which stopped growing in November. The rest six characters stopped growing in November but renewed their growth in December. Changes in measures were very small, mainly tenths of millimetre and smaller. In Table 6 these changes are lost as a result of rounded numbers, and these changes are not statistically significant.

We found adult *A. flavicollis* continuously present in autumn, winter and spring (with lower numbers in April), and the average body mass was near 40 grams, which indicated a possibility to breed. In November 2006, we trapped one pregnant female with 6 embryos and one male at the onset of breeding. In the end of October 2007, out of 19 adult females five were in the breeding process (open vagina) and one was in the very beginning of pregnancy. In November 2008 there were no breeding females, but five of six adult females had placental scars. In the middle of January 2009 we registered two big males at the onset of breeding.

DISCUSSION

It is known that food supply available to the population varies in quality and quantity between seasons and habitats. During summer rodent numbers increase due to breeding and reach the highest numbers in autumn. Reproduction ceases in autumn, and high winter mortality leads to low numbers of rodents in spring (Suchomel 2007). In the annual cycle of *A. flavicollis* population dynamics, abundance maximum usually occurs between August and October (Flowerdew 1985), i.e., in September (Horvįth & Wagner 2003). Jensen (1975), however, recorded that peak density in a beech forest occurred later, in November. In Germany, the same decline of *A. flavicollis* population was registered from autumn to spring and continued during early summer (Ylönen et al. 1991). In Serbia, maximum density of population of *A. flavicollis* was registered in June (47–85 ind./ha), and minimum density was registered in January (3 ind./ha) (Vukicevic-Radic et al. 2006b). Strong winter declines in the rodent community can be obviously explained by climatic conditions and predation. In NE Poland, a severe 2002–2003 winter resulted in the lowest percentage of *A. flavicollis* survival (Bujalska & Grüm 2006). *Apodemus* species could be more sensitive to a changing climate than *Myodes* (Ylönen et al. 1991).

We found that relative abundance declined all the time from November, when it was 8.2 ind. per 100 trap/days, till 0.1–0.2 ind. per 100 trap/days in March-April. Though in years with mild winters relative abundance was twice that in years with harsh winters (2.8 vs. 1.4 ind. per 100 trap/days), this difference is not reliable ($t=1.26$, $p>0.20$).

A. flavicollis starts breeding in late winter or early spring, e.g., in February or March (Adamczewska 1961). According to investigations of seasonal population dynamics in *A. flavicollis* in NE Poland (1994–2003) it was found that among 67 individuals caught in April 41 individuals were of body mass ranging from 9 to 20 g, which indicated an early onset of reproduction in the current year or winter breeding (Bujalska & Grüm 2008). According to Flowerdew (1985), the reproduction period of *A. flavicollis* lasts from February or March till October, but is possible also in winter months. In the years with abundant acorn yield and after it, probable winter mating increases. In Sweden the breeding period of A. *flavicollis* is the same – starts in late March–early April and lasts into October (Bergstedt 1965).

Out of 21 years of trapping in April in the Białowieża National Park, juvenile *A. flavicollis* were captured in 10 years, including 4 years with winter breeding and 6 years with an early onset of reproduction. Three springs following high mast years were characterized by the mean juvenile abundance 12 times higher than the average for all other years (Pucek et al. 1993).
In our sample from NE Lithuania, in February–April we had no juveniles and a very small number of subadult or adult mice. This corresponds to the extent of winter mortality in NE Poland, estimated for *A. flavicollis* in the range of 57–98% (Pucek et al. 1993). According to Bujalska & Grüm (2008), average survival from October to April is 22.6% (5.3–51.1%, depending on winter harshness).

Winter survival of *A. flavicollis* in NE Lithuania was worse compared to that of *M. glareolus* (Balčiauskienė et al. 2009a) or *M. arvalis* (Balčiauskienė et al. 2009b). The overall share of *A. flavicollis* in a small mammal community in October–April was just over 12 percent. While before December, the species was among dominants, comprising nearly one third of all individuals trapped, and till April this share was less than two percent (Table 2).

In NE Poland, nearly all *A. flavicollis* trapped in spring were owervintered adults; juveniles were caught in some years only and in low numbers (Pucek et al. 1993). It is known that in Poland, to the south of our investigation area, *M. glareolus* always survive better than *A. flavicollis* (Bujalska & Grüm 2008). Bujalska & Grüm (2008) point out that mature *A. flavicollis* females have a high survival rate, while survival of immature individuals is low. This results in a rapid decrease of the population following peak numbers in July. Our data confirm this statement, as a group of adult mice in NE Lithuania was always the biggest in numbers, with an exception of the 2007/2008 trapping season. Males were prevailing from October to February, while in March the sex ratio was 1:1, and in April females prevailed. All above-mentioned investigations were done in more favourable climate conditions than in NE Lithuania, and our yellow-necked mice had no access to oaks.

The long term monitoring of small mammals in NE Lithuania (April–October 1981–1990) revealed that *A. flavicollis* comprised 4.5–10.0% of the annually trapped small mammals (Balčiauskas, unpubl.). Average abundance of mice was 1.6±0.32 individuals per 100 trap/days in deciduous forests, 1.4±0.21 in coniferous forests, 0.6±0.11 in swamps and merely 0.2±0.06 individuals per 100 trap/days in meadows. Maximum abundance was 12.0 individuals per 100 trap/days. Low numbers of *A. flavicollis* in spring are characteristic of Lithuania. In 10 years of monitoring, only 2 juveniles (5.6%) and 3 subadults (8.3%) out of 36 spring-trapped individuals were found (Balčiauskas, unpubl.). Thus, winter breeding of *A. flavicollis* in our case is supposed to be a rare event.

The same population dynamics of *A. flavicollis* in Lithuania was found from the pellets of the Tawny Owl in 1999–2005. *A. flavicollis* were abundant in the pellets collected from August to December, while *M. glareolus* by numbers was dominating in the pellets collected in November to January and *Microtus* voles prevailed from March to July (Balčiauskienė 2006).

Investigations proved that reproductivity, abundance and, through these, *A. flavicollis* population dynamics are determined by habitat structure and concordant food availability (Horvịth, Wagner 2003). In a population of *A. flavicollis* Bobek (1973) demonstrated a decrease in survival rates at a high population density in *Tilio–Carpinetum* forest habitat. In cases when food is abundant in the habitat and there is winter reproduction, population size can grow even through the winter (Bobek 1973). Dependence of *A. flavicollis* mortality in winter on fruiting of oak and beech was shown also in Sweden (Bergstedt 1965).

Body mass provides information about habitat quality (Suchomel 2007). In our case, the average body mass of adult and subadult *A. flavicollis* showed that habitat conditions were good for over-wintering of animals, thus reduction of numbers towards spring is not connected with food shortage. To compare with the average body mass of *A. flavicollis* near Cracow, 26.3±6.20 g (Sawicka-Kapusta 1968), the mice we trapped in NE Lithuania were considerably heavier (33.6±0.52 g). In our sample, distribution of body mass groups is comparable to that described by Pucek et al. (1993) in NE Poland for the years without winter breeding (Table 7). A low number of mice with body mass <20g in our sample confirms the rarity of winter breeding for this species in NE Lithuania.

On the other hand, an inherent ability to move may have influenced *A. flavicollis* numbers in certain habitats. In Finland it was shown that *A. flavicollis* migrate between mature wood, woodlot and surrounding fields, resulting in almost total disappearance of this species from wood in June and July (Ylönen et al. 1991). High adaptability of the species to multiple habitats was also mentioned by Bujalska & Grüm (2005). In our case, the features of the studied territory exclude mast influence. According to other authors, *A. flavicollis* do not migrate in winter. Thus we suppose that the number of mice towards spring reduced due to low winter survival rates. The absence or a very low density of *A. flavicollis* may suggest low quality habitat or critical conditions in winter, but migration out of the territory is also possible. Prevailing of males may point out that the population is non-settled (Trubenovị & Miklós 2007).

Male surplus in trapping results is explained by greater activity of males in connection with reproduction. Widely-spaced traps have shown to catch a higher percentage of males also in *A. sylvaticus* (Bergstedt 1965). According to Ylönen et al. (1991), the dominance of males in *A. flavicollis* populations was characteristic in autumn, during migration from fields back to the woods. Due to their highly flexible demographic structure, which may shift as environmental conditions improve or decline in quality, populations of *A. flavicollis* are able to persist in different habitat types (Trubenovị & Miklós 2007).

We conclude that the habitat in the study site was sufficient for *A. flavicollis* to survive in winter; even more – breeding was registered in late autumn (November) and in winter (January) or early spring. Thus, prevailing of males was not related to migration process. We presume that changes in demographic structure were related to different survival in sex and age groups through October to April. Survival of *A. flavicollis* was worse than that of *M. glareolus* and *M. arvalis* in the same site (Balčiauskienė et al 2009a,b). Better survival of *M. glareolus* compared to *A. flavicollis* was characteristic also of NE Poland, and *A. flavicollis* was vulnerable to abundant *M. glareolus* populations (Bujalska & Grüm 2008). This could happen in our case, too.

We sum up that from autumn through winter till spring, especially from December till April, numbers of *A. flavicollis* and their share in a small mammal community were sharply declining. In February–April, the population had no juveniles and was dominated by adult, then subadult individuals. For adults, the growth of body mass went down in January–February, and for subadult individuals, the period of body mass decrease was even longer, from October to January, and decrease was greater (10%). The cranial growth

Table 7. Distribution of body mass groups of *A. flavicollis* in April in NE Poland (Pucek et al. 1993) and in October–April in NE Lithuania (our data).

	Percent of *A. flavicollis* in body mass groups, g					
	<14	14.1–19	19.1–24	24.1–29	29.1–34	>34
NE Poland (n=117)	12	1	0	13	22	52
Our data (n=220)	0	1	8	21	24	46

in adult and subadult *A. flavicollis* individuals also experienced winter depression. In adults, the growth of 12 out of 17 cranial characters was suspended from December, January or February, though differences between measurements in consecutive months were not reliable statistically. In subadults, growth depression of three cranial characters from February till April was reliable statistically.

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