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THE EURASIAN BEAVER POPULATION MONITORING STATUS IN THE CZECH REPUBLIC

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The Eurasian beaver is or will be an important large mammal in the Europe; at present there are about 1 million individuals on our continent. Our monitoring effort was aimed at observing the development of a large, stabilized beaver population and was primarily focused in the areas representing 3 different types of habitat occupied by beavers in the Czech Republic – flood-plain forest, agriculture landscape and small watercourses. The aim was to get detailed information about territory size, abundance, habitat and feeding requirements of the Eurasian beaver in our country. All signs of beaver activity were recorded, together with their GPS position. Using spatial analysis (based on kernel density estimates) density spot clusters were generated to indicate the proper location of each territory and its size.

A total of 246 beaver territories, with an average territory length of 1.7 kilometers, were found in the areas tracked; population abundance was estimated at between 1200–1300 individuals. One hundred and twenty eight territories (52%) were located in more or less proven flood-plain forests in the alluvial plains of medium-sized rivers. Sixty nine territories (28%) were evaluated as settlements in landscape of a purely agricultural character with intensively or extensively managed production areas in the vicinity of beaver-settled banks. A further 49 territories (20%) existed on the small watercourses of lower or middle positions or on the watercourses of sub-montane or mountain areas. The initial monitoring results will form baseline data to assess the future expansion and utilization of resources of the developing beaver population.

Keywords: monitoring, territory, habitat requirements

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Dabar jest, ili će biti važan veliki sisavac Europe; trenutno na našem kontinentu obitava milijun jedinki. Naš monitoring bio je usmjeren na promatranje razvoja velike, stabilne populacije dabra, i to primarno na područjima koja su predstavljala tri različita tipa staništa koja u Češkoj naseljava dabar – poplavne nizinske šume, poljoprivredne površine, i mali vodotokovi. Cilj je bio prikupiti detaljne informacije o veličini teritorija, gustoći, staništu i potrebama za hranom dabra u našoj zemlji. Zabilježeni su svi tragovi pojavljivanja dabra te njihova pozicija u GPS-u. Korištenjem prostorne analize (temeljene na procjeni gustoće jezgre) generirani su 'density spot clusters' da bi se označio položaj svakog teritorija i njegova veličina.

Na praćenom području zabilježena su ukupno 246 dabrova teritorija, prosječne veličine 1,7 km, gustoća populacije procijenjena je na između 1200 i 1300 životinja. U poplavnim nizinskim šumama u području srednje velikih rijeka bilo je 128 teritorija (52%). U potpuno poljoprivrednim područjima s intenzivnim ili ekstenzivnim upravljanjem u blizini obala koje dabar naseljava, bilo je 69 teritorija (28%). Sljedećih 49 teritorija (20%) nalazili su se na početnim ili srednjim dijelovima malih vodotoka, ili na vodotocima submontanih ili planinskih područja. Početni rezultati monitoringa bit će osnovni podaci koji će se koristiti u daljnjem širenju rastuće populacije dabra.

Ključne riječi: monitoring, teritorij, stanište

INTRODUCTION

Re-establishment of the Eurasian beaver population in the Czech Republic was partially spontaneous e.g. by migrations from neighboring countries (Poland, Austria, Germany). But also, targeted reintroduction has been carried out, 20 animals from Poland and Lithuania being released in central Moravia (in the Litovelske Pomoravi Region, see Fig. 1) in the years 1991–1996 (Vorel & Kostkan, 2005).

In the mid-eighties the first beavers (originating from Austria) appeared on the junctions of the rivers Moravy and Dyje (Šafář, 2002). Likewise, the west of Bohemia was settled by beavers originated from Bavaria (Anděra & Červený, 2004). The population in Labske udoli (northern Bohemia) was established by migrants naturally dispersing from a large indigenous population near Magdeburg in Germany (Vorel, 2003). At present we can talk about stable populations from central Morava to the junction of the rivers Morava and Dyje, in North Morava, Labske udoli and Western Bohemia. According to the last estimates the minimum present state is ca 2000 ex (Vorel *et al*. 2006).

A growing body of literature deals with methods of density and abundance estimation of beaver populations (Hay, 1959; Rosell *et al*., 2006). Generally, the accuracy of the different methods varies according to the aim of the study. The methods could be divided into two main groups – invasive and non-invasive. The first group involves trapping (both live and dead) and according to many authors (Hay, 1959; Peterson & Payne, 1986; Rosell *et al*., 2006) it provides the best estimate of colony size and composition, but is time consuming and in the case of dead-trapping also sacrifices animals. The second group involves observing and indirect beaver census, usually based on signs of beaver activity around the water. Because observing is also time consuming and needs experienced observers, some indirect methods were created. This methods based on a large scale measurement (with adequate errors) are especially useful if only the total number of families in the surveyed area is needed and sufficient. A frequently used method is an aerial survey of food caches (Hay, 1959; Easter-Pilcher, 1990; Broschart *et al*., 1989). This has proven to provide a reliable index of the number of active beaver (*Castor canadensis*) colonies. HAY (1959) also tested the reliability of other beaver signs and found that neither the number of lodges nor the number of scent marks can provide a reliable index, although the number of lodges is often used by many other authors (e.g. FUSTEC *et al.*, 2001).

The size of a beaver population can be estimated in several ways. The most common way is to count territories and multiply them by an estimated average number of individuals per family. In recent papers assessments of the average size of beaver groups are in the range of 3 – 7 (HAY, 1959; WILSSON, 1971; ZUROWSKI, 1988; HALLEY & ROSELL, 2003; HEIDECKE *et al.*, 2003; SIEBER, 2003; CAMPBELL *et al.*, 2005).

The strong territorial behavior of beavers plays an important role in population dynamics. Although in populations reaching the point of saturation of an area strong population pressure and intraspecific competition exist, the size of territory does not downsize. But thanks to this population strategy another effect occurs. During long-lasting and stable settlement distribution food resources are completely spent and this leads to partial fluctuation in the settlement (HARTMAN, 1994; HARTMAN, 2003). The transition point of the population dynamics is regionally changeable and depends on the differences of the occupied habitat, food supply and landscape. In comparable areas the transition point of the population dynamics is changeable and depends on the differences of the occupied habitat, food supply and landscape type. Approximately the decrease in the population growth occurs in around the 34th year from the first colonization (HARTMAN, 1994).

The aim of the article is to summarize the distribution, density level and abundance in the oldest and largest populations, primarily in the areas that represented 3 different types of habitats occupied by beavers in the Czech Republic. From a management point of view it is necessary to know the main recent population parameters and to be able to predict their expectant progress and use them to prevent potential conflicts.

METHODS

Study area

The field study was conducted in seven areas that posed 3 different types of habitats occupied by beavers in the Czech Republic – flood plain forest, agriculture landscape and small watercourses. In the focused areas (defined by the borders of Natura 2000 sites) all water ecosystems were checked to see if there were any beaver activity marks. More detailed information about study areas is shown in Tab. 1 and Fig. 1.

Data collection

Primary data – beaver activity signs in the study areas – were collected over the winter season from January to March in 2006/07. All fresh beaver activity signs found in the surroundings of the watercourses and water sheets were noted. All beaver activity signs were divided into 5 categories: grazing (rest of feeding activ-

Tab. 1. Main characteristics of monitored areas, see also Fig. 1

EVL	Name	General habitat chracteristic	Elevation	Length of waterbodies	Area	First occupation
			m above sea level	*km*	*square km*	*year*
CL	Cesky Les	small water courses	496–690	284,3	9	1991
LA	Labske udoli	flood plain forest	120–425	48,1	8	1992
ST	Straznicko	flood plain forest	165–170	54,0	2	1994
SP	Soutok – Podluzi	flood plain forest	146–168	353,0	97	1975
ND	Niva Dyje	flood plain forest	155–186	186,5	32	1986
CH	Chropynsky luh	agriculture landscape	190–210	152,7	32	1992
LP	Litovelske Pomoravi	flood plain forest	212–344	188,1	97	1991

ity), scent marks (territorial activity), trails (foot or tail prints), shelters (winter shelters) and building activities (dams and the like). The grazing was always counted and divided according to the diameter into 8 categories, and the tree species were

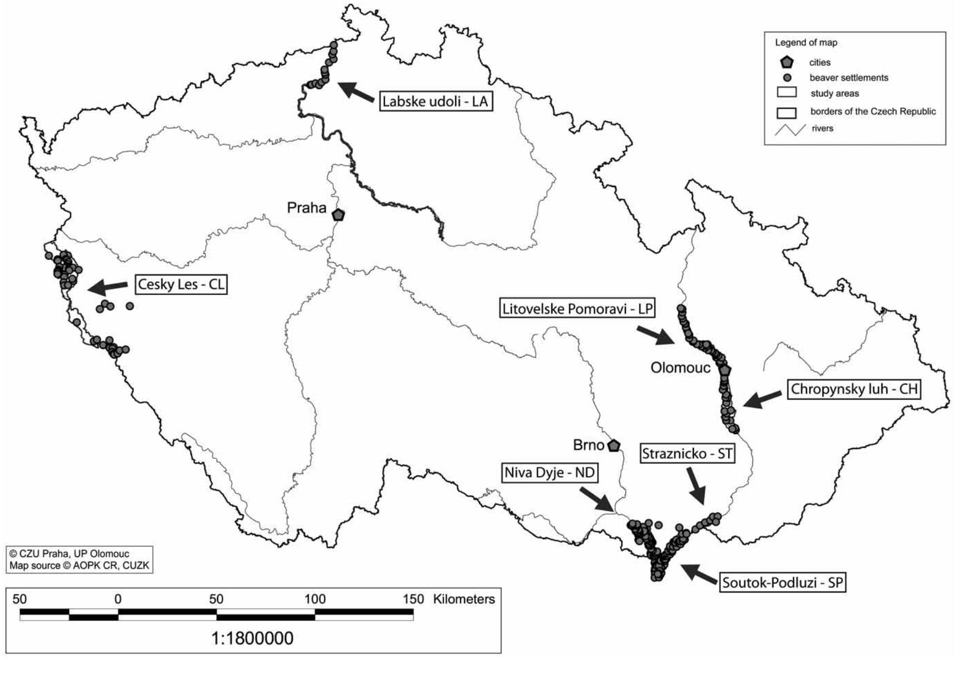

Fig. 1. Overview of areas where monitoring in winter 2006/07 was carried out (marked with arrows).

noted down, separately. The scent marks were counted and then divided into either active (identifiable by the human nose) or inactive status (older and washed, but still distinguishable visually). The shelters (burrow, lodge or semi-lodge) were assessed as actively used or non-active and fresh trails were noted and localized.

Each finding was considered one discrete point (location) in the space (using coordinates from GPS), and then the whole set of points was transposed to GIS layer.

Habitat characteristic

1. Habitat – the characteristic of the basic living environment of beavers regarding important landscape structures in the central Europe. Stages: flood plain forest, small watercourse, agricultural landscape.

2. Type of water environment – divided into eight categories. Stages: river, blind stream branch, brook, artificial channel, fish pond, sand pit, pool and marsh.

Data analyses

Territory distribution

To determine beaver territories, locations of beaver activity marks (*bam*), in a separate GIS layer, were used. Spatial analysis of the point pattern of *bam* indicated the density spot clusters of these locations, which represented places with high intensity of *bam*. The process was established in a Kernel density estimate, with use of Animal movement extension under GIS software ArcView 3.2. (HOOGE & EICHENLAUB, 1997). Two different smoothing parameters for kernel density estimators were used. First, selection of bandwidth (*bw*) was tested on *bam* within five isolated territories (without any neighbors) where the least square cross-validation method was used (HOOGE & EICHENLAUB, 1997). Then the *bw* was applied to territories in the surveyed areas, where clusters of higher density *bam* were detected. A second-order relationship between different categories of *bam* was again analyzed by mean squared error of kernel smoothing parameter under R project – Splancs module (BERMAN & DIGGLE, 1989; ROWLINGSON & DIGGLE, 1993). If the spatial correlation between actively used beaver shelters and other marks occurred, then limits of unimodal kernel utilization were used as ranges of the territory. The parts of water bodies within those ranges defined the territories (defended area used by single group of beavers – family, colony or unit of socialized migrants – *sensu* BEGON *et al.*, 2006). This process was based on the second-order kernel estimation.

Population abundance and density

To obtain the estimation of average abundance of population in all surveyed areas, we used the average number of beavers per territory as 5 ex. (*sensu* CAMPBELL *et al.*, 2005). Population density was acquired as the number of analyzed beaver territories (families) per total amount of surveyed water habitats in the studied area.

Territory length

Territory length was expressed as part of water bodies within the processed shapes.

Tab. 2. Basic population characteristics

EVL		CL Cesky Les	LA Labske udoli	ST Straznicko	SP Soutok – Podluzi	ND Niva Dyje	CH Chropynsky luh	LP Litovelske Pomoravi	Total
Number of territories	–	47	14	7	71	40	20	40	239
Mean territory length	km	1,28	1,73	2,26	2,01	1,56	1,70	1,84	1,70
Population density	terr./km	0,165	0,291	0,130	0,201	0,210	0,131	0,213	0,193
Population abundace – estimation	ex.	255	70	35	355	210	105	200	1230

Used statistics test

If a normal distribution (tested by Kolmogorov-Smirnov test) was determined then the t-test or ANOVA was used. For the rest, nonparametric statistics were applied.

RESULTS

Water habitat characteristics

In all the areas monitored, 246 beaver territories were found; with an average territory length of 1.7 kilometers (SD 811 meters) (details are shown in Tab. 2). There were significant differences between lengths of territories in the regions compared (ANOVA Current effect: $F[6, 246] = 3.5721$, $p = 0.00209$, see also Fig. 2). From the whole number of 246 beaver settlements, 128 (52%) were located in more or less proved flood-plain forests in the alluvial plains of medium-sized or big rivers. Sixty nine families (28%) were evaluated as inhabiting settlements in landscapes of a purely agricultural character with intensively or extensively managed production areas in the vicinity of the beaver-settled banks. A further 49 territories (20%) existed along small watercourses of lower or middle positions or along the watercourses of sub-montane or mountain areas. (Fig. 3).

Also the territory length in different habitat types was tested and the significant differences were found (ANOVA Current effect: $F[2,246] = 9.4759$, $p = 0.00011$; see Tab. 3 also Fig. 4). In the multiple comparisons we detected conclusive differences between length of territories on small water courses in relation to the others habitats (Post hoc test HSD – MSE = 5.53 – e05, for p-levels see Tab. 4).

Of the total length of water bodies (total 1266.7 km; see details in Tab. 5) more than 33.5% was used by beavers (see Tab. 6). The differences in preferences for different types of water environment should be mentioned. Proportionally, sand pits were used most – 27.5 km out of 52.2 km (52.8% of available space was used); but this type represents only 4.1% of the total potentially settled ecosystems (1266.7 km). Rivers were determined to be the second most occupied aquatic habitat. Out of the total amount (172.2 km out 363.2 km) 47.4% were settled by beavers. In the total

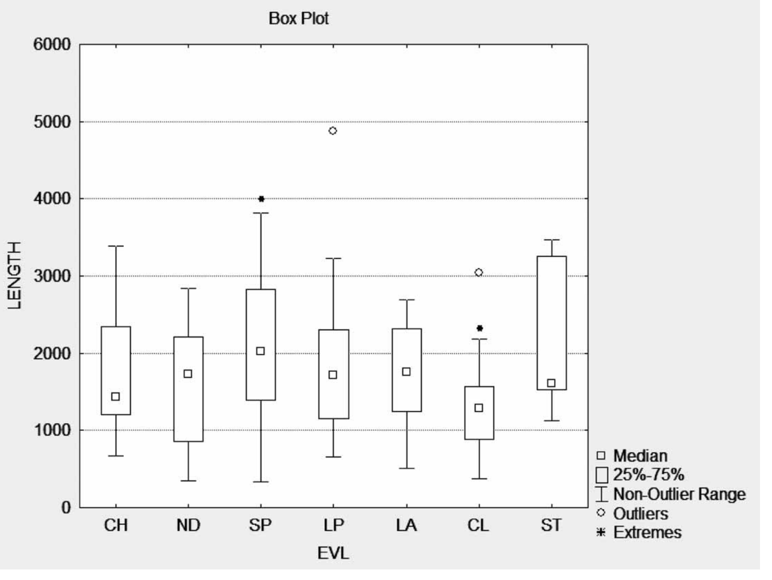

Fig. 2. Box-and-whisker plots represent diverse variances of territory length (in metre) in each surveyed area; for detailed characterisation see Tab. 1. Marked boxes (with stars) are significantly different from the others and to each other, too.

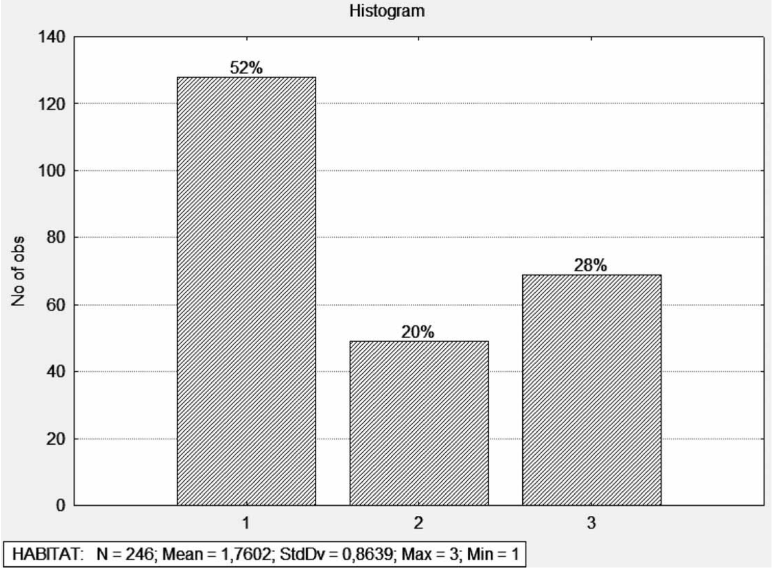

Fig. 3. Ratios of monitored territories standing for the three selected habitats. Whole sample were tested without remands to the each monitored areas. Legend: 1 – floodplain forests; 2 – small water courses; 3 –agricultural landscape.

Tab. 3. Basic territory length characteristics, tested on Figure 4

HABITAT	in total	flood plain forest	agricultural landscape	small water courses
	–	1	2	3
n	246	128	49	69
min	333	333	375	343
mean	1713	1796	1238	1887
max	4878	3815	2250	4878
SE	801	823	438	830

Tab. 4. P-levels of multicomparisons of territory length in the classified habitats. Marked (*) cases are significant.

	HSD multicomparisons	habitat	habitat	habitat
		1	2	3
habitat	1		0.0009*	0,9268
habitat	2	0.0009*		0.0002*
habitat	3	0,9268	0.0002*	

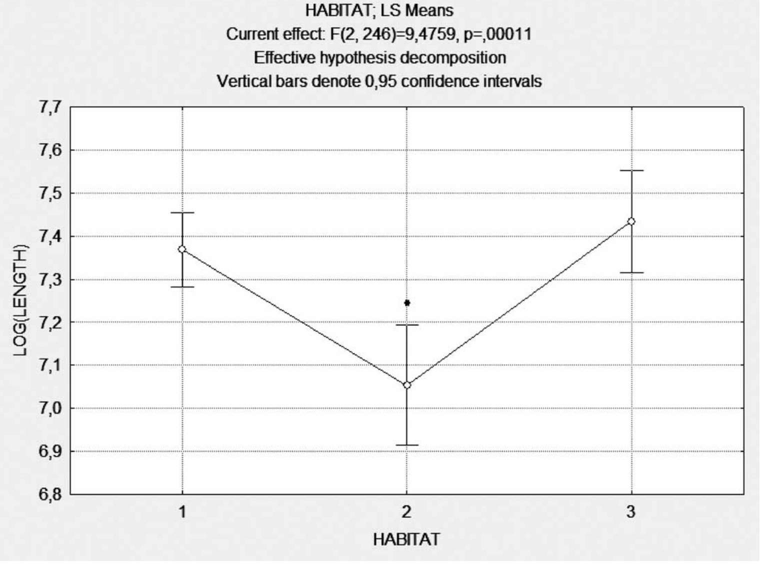

Fig. 4. Analyses of variance of territory length in three habitats (logarithmic transformation had to be used). Marked boxes (with stars) are significantly different from the others. The sample was tested as a whole without regard to the separately monitored areas. Legend: 1 – floodplain forests; 2 – small water courses; 3 – agricultural landscape

Tab. 5. Offer of water habitats in each monitored area

EVL		CL Cesky Les	LA Labske udoli	ST Straznicko	SP Soutok – Podluzi	ND Niva Dyje	CH Chropynsky luh	LP Litovelske Pomoravi	Total
River	*km*	0,00	40,79	19,11	96,55	34,93	63,02	108,81	363,21
Blind stream branch	*km*	0,00	3,02	8,32	17,36	12,56	2,96	6,32	50,52
Channel	*km*	90,29	0,00	26,58	209,11	102,91	43,89	18,08	490,86
Sand pitch	*km*	0,00	0,00	0,00	6,44	3,12	21,58	21,02	52,16
Fish pond	*km*	13,87	0,00	0,00	13,33	21,25	17,38	3,37	69,19
Brook	*km*	171,55	0,00	0,00	0,00	0,00	3,79	30,30	205,64
Marsh	*km*	8,48	0,00	0,00	1,80	5,16	0,00	0,00	15,44
Pool	*km*	0,15	4,31	0,00	8,37	6,57	0,13	0,19	19,71
Total	*km*	284,34	48,12	54,01	352,95	186,50	152,74	188,08	1266,72

amount of water ecosystems, rivers comprised 28.6%. Then followed, in descending order, pools (46.8%), blind stream branches (46.4%), marshes (28.7%), brooks (25.7%), fish ponds (25.2%) and channels (21.1%). All results are shown in Tab. 6 and fig. 5.

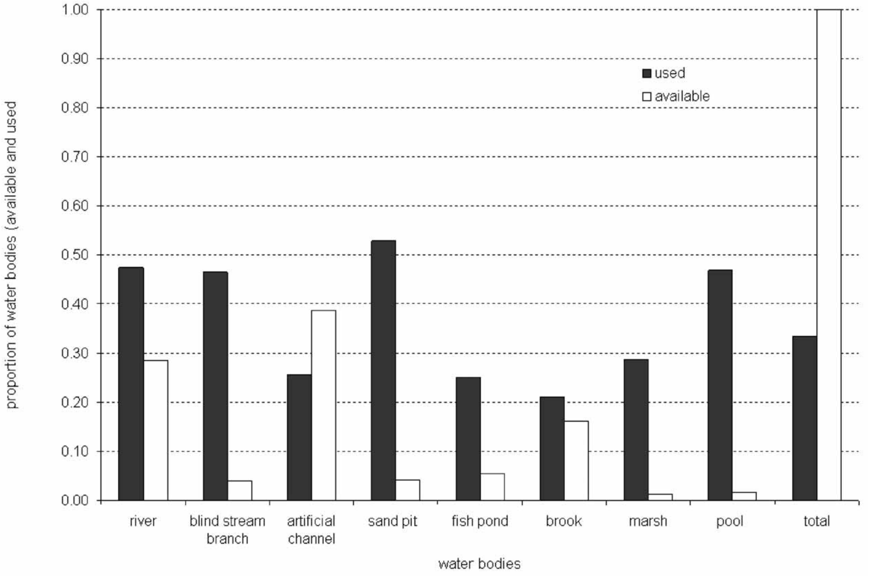

Fig. 5. Relation between the supply of water habitats (Tab. 5) in all surveyed areas (according to Tab. 1) and the ratio of the water bodies used by beavers. Sand pits and rivers were used most even although they were not maximally represented in the total amount of the available water environment.

Tab. 6. Relation between offer of water habitats in each different areas and the ratio of by beavers used parts of the water bodies. See also figure 3.

water habitat	Area		units	river	blind stream branch	artificial channel	sand pit	fish pond	brook	marsh	pool	total
Total	available	a	km	363,2	50,5	490,9	52,2	69,2	205,6	15,4	19,7	1.266,7
Total	used	u	km	172,2	23,4	125,9	27,5	17,4	43,4	4,4	9,2	423,5
	proportion	*p*		***0,474***	***0,464***	***0,257***	***0,528***	***0,252***	***0,211***	***0,287***	***0,468***	***0,334***
CL	Cesky Les	a	km	0,0	0,0	90,3	0,0	13,9	171,6	8,5	0,1	284,3
		u	km	0,0	0,0	6,3	0,0	9,3	39,3	2,5	0,0	57,3
		p		–	–	***0,069***	–	***0,669***	***0,229***	***0,292***	***0,000***	***0,202***
LA	Labske udoli	a	km	40,8	3,0	0,0	0,0	0,0	0,0	0,0	4,3	48,1
		u	km	18,2	2,6	0,0	0,0	0,0	0,0	0,0	3,4	24,3
		p		***0,447***	***0,860***	–	–	–	–	–	***0,800***	***0,504***
ST	Straznicko	a	km	19,1	8,3	26,6	0,0	0,0	0,0	0,0	0,0	54,0
		u	km	12,0	0,3	3,1	0,0	0,0	0,0	0,0	0,0	15,4
		p		***0,629***	***0,040***	***0,116***	–	–	–	–	–	***0,286***
SP	Soutok - Podluzi	a	km	96,5	17,4	209,1	6,4	13,3	0,0	1,8	8,4	352,9
		u	km	46,1	10,9	76,1	4,8	2,5	0,0	0,4	2,1	142,7
		p		***0,477***	***0,627***	***0,364***	***0,739***	***0,187***	–	***0,197***	***0,253***	***0,404***
ND	Niva Dyje	a	km	34,9	12,6	102,9	3,1	21,3	0,0	5,2	6,6	186,5
		u	km	18,9	8,1	32,9	2,2	5,7	0,0	1,6	3,7	73,2
		p		***0,542***	***0,649***	***0,320***	***0,720***	***0,266***	–	***0,311***	***0,557***	***0,392***
CH	Chropynsky luh	a	km	63,0	3,0	43,9	21,6	17,4	3,8	0,0	0,1	152,7
		u	km	23,6	0,1	5,5	7,3	0,0	0,0	0,0	0,0	36,5
		p		***0,375***	***0,028***	***0,124***	***0,336***	***0,000***	***0,013***	–	***0,000***	***0,239***
LP	Litovelske Pomoravi	a	km	108,8	6,3	18,1	21,0	3,4	30,3	0,0	0,2	188,1
		u	km	53,4	1,4	2,1	13,3	0,0	4,0	0,0	0,0	74,1
		p		***0,490***	***0,220***	***0,117***	***0,631***	***0,000***	***0,132***	–	***0,000***	***0,394***

When we compared the different populations monitored there were moderate differences in the supply of water habitats as well as (Wilcoxon matched pair test $Z=2.80$; $p < 0.01$) in the use of the available water habitats. We observed different preferences in water habitats in different areas. This was not closely correlated with supply of water bodies. The hypothesis that standing water ecosystems (e.g. sand pits, fish ponds, blind stream branches or pools) are widely used in comparison to water flow ecosystems (rivers, brooks or channels), was not assigned significant differences (Pearson Chi^2 = 0.66, d.f. = 1, p = 0.4156).

The population density varied from 0.13 territories per stream km in Straznicko, to 0.29 territories per stream km in Labske udoli. Common (total) population density for all monitored areas was 0.19 territories per kilometer. Results of population density were fitted with time when the first settlement occurred in the area monitored – no relation between age of the population and density was detected [nonlinear regression R2 = 0.12, F-statistic: 0.2727, p-value = 0.7744] (Fig. 6).

The abundance estimation of beaver population in all the surveyed areas combined is approximately 1230 individuals. More detailed characteristics of each surveyed area are given in Tab. 1. The largest population was of 355 animals while on the other hand the smallest had no more than 35 individuals (see Tab. 2).

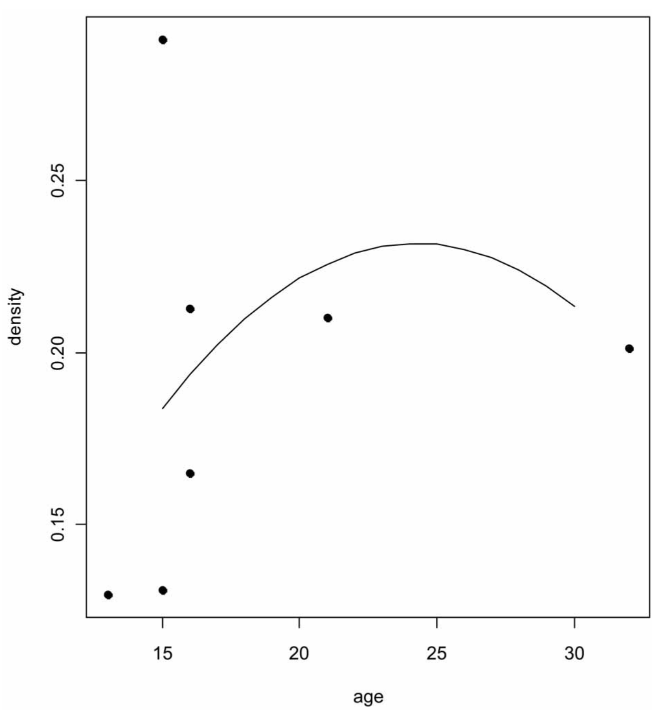

Fig. 6. Nonlinear regression (R2 = 0.12, F-statistic: 0.2727, p-value = 0.7744) between age and population density of the population. Nor linear or polynomial effects were de-

DISCUSSION

There is no uniform definition for using and distinguishing the terms home range and territory in most papers concerning beavers, for example NOLET & ROSELL (1994), HEIDECKE (1986) in FUSTEC *et al*. (2001). The area where the individual or the group gets food, breeds and carry offspring and so on is considered as a home range. Within the home range, which can coincide with that of others, there is a territory, an own area, which the animal strictly defends (*sensu* BEGON *et al.*, 2006). By using the method of kernel density estimate, with use of Animal movement extension under GIS software ArcView 3.2 (HOOGE & EICHENLAUB, 1997) we were able to set the core areas (centre of activities) from the home ranges that can be considered territories. Thanks to the facts noted above, the variability of the territory lengths in different studies is large. The average size of territory in our paper was 1.7 km. HEIDECKE (1986) in FUSTEC *et al.* (2001) mentioned the size of the home range in the interval from 3.1 to 6.5 km. NOLET & ROSELL (1994) in the Netherlands determined, using radio-tracking, the average size of the home range as 7.9 km, but as they examined beavers just reintroduced, the acquired home range length was much more larger. Because these migrating individuals were searching for an appropriate place for a settlement, so it can be said, that these authors acquired data about dispersion rather than the home range size. SEMYONOFF (1951) in NOVAK (1987) stated that 0.5–0.7 km of a stream is occupied by one beaver family in the former Soviet Union. In conclusion the variability of home range size or territory is dependent on many factors – the type of the water habitat, size and composition of the beaver family, duration of the settlement, intraspecific relations and above all on the food resources of the environment (BAKER & HILL, 2003). Naturally, it also depends on methods used for determining the defendable area of the animals.

Significant differences between the lengths of territories were recorded in two regions. According to the general presumption, the size of territory descends with the increasing quality of the habitat (NOLET & ROSELL, 1994; CAMPBELL *et al.*, 2005). Soutok-Podluzi provides beavers a better environment with respect to habitat and diet higher qualities than Cesky les, so we expected smaller territories in Soutok--Podluzi than in Cesky les. Contrary to our expectations and to those of other authors (NOLET & ROSELL, 1994; CAMPBELL *et al.*, 2005), an entirely opposite trend was found.

Generally, habitat quality (availability and richness of deciduous trees) is higher in Soutok-Podluzi than in the Cesky les. But the heterogeneity of available resources within territories was not tested in our paper. Therefore we can only guess that thanks to the higher population density in Soutok-Podluzi the ability of beavers to find and to defend territory with homogeneous food resources could be more difficult. This behavior might be partially density dependent. The observed effect should be important for the higher variation of territory length of the Soutok-Podluzi area in comparison to territory length in the Cesky les area. Beavers in a low density population might find sufficient food sources along shorter parts of water bodies. And vice versa, strong competition in populations with higher density does not always allow for settling the sufficient and homogenous resources within the shorter territories.

In addition, significant differences in territory length between types of habitat were found. The smallest territories were located along small streams. But territories in flood plain forest and agriculture landscape were larger, although they had both quite similar sizes. We are not able to explain satisfactorily those facts, at the present. According to some authors (BUSHER & LYONS, 1999; MCTAGGART & NELSON, 2003) the territory length can also relate to other factors – the size and structure of Eurasian beaver social units. In the populations that were determined as high and where the habitat was saturated, delayed dispersal movement was displayed (BUSHER & LYONS, 1999), or the time of released sub-adults was prolonged and they stayed with the breeding pair in the role of additional adults. This leads to the establishment of families with a higher number of individuals, which is why claims on larger territory length a have risen (MCTAGGART & NELSON, 2003). One possible way to generalize our partly surprising results consists of deep and extended habitat analyses. Particularly, the determination of the detailed feed supply in the particular parts of the Czech Republic and a comparison with the age of the settlement and parameters of territories as well as the evidence of the structure and average size of families must remain subjects for further research.

The majority of territories 128 (52%) were located in the habitat of more or less proved flood-plain forests in the alluvial plains of medium-sized or big rivers. BROSCHART *et al.* (1989) mentioned similar habitat conditions – shallow marsh, seasonally flooded meadows, ponds and wet deciduous shrubs, although their study was conducted in a boreal landscape. FUSTEC et al. (2003) feature the importance of tall trees and bushes at beaver sites.

Proportionally pools were the most settled (52% out of the supply), then blind stream branches (49% out of the supply), although the hypothesis that standing water ecosystems are used more than running water ecosystems was not significantly borne out. BAKER & HILL (2003) stated that the habitats used by beavers are very variable and beavers can inhabit streams with at least intermittent flow and lakes or ponds with standing water as well as bogs that lack open water. Beavers in eastern Lithuania most often inhabited dammed swamps, rivulets and ditches, less lakes, and the peat-bog habitat was least occupied, but the rates were quite balanced with the period of the settlement (BLUZMA, 2003).

The population density varied from 0.13 families per stream km in Straznicko, to 0.29 families per steam km in the Labe region. Common (total) population density for all monitored areas was 0.19 territories per kilometer. Beaver population density is very variable, MÜLLLER-SCHWARZE & SCHULTE (1999) mentioned that the density of the American beaver (*Castor canadensis*) in Allegany State Park in western New York ranged from 0.24 to 1.14 colonies per stream kilometer. The population density in Voyageurs National Park in Kabetogama Peninsula increased from 0.13 colonies/km of the surveyed route in 1940 to 1.83 colonies/km in 1986 (BROSCHART *et al.*, 1989). The numbers show that the population density in the Czech Republic is not at the present so high, but populations in some regions do show signs of saturation. The highest population density was reached in Labske udoli, because the space for potential beaver settlement is there limited by a large weir, which works as a barrier for dispersion. The second highest density, in Niva Dyje, is 0.21 territories per stream km and corresponds to the long period of the beaver settlement in this area – 22 years. The lowest densities were reached in Straznicko and Chropynsky luh, where many artificial channels occur; nevertheless they are not very favorable for the establishment of beaver settlements.

The estimated abundance 1230 individuals is similar to that in countries with a similar history of beaver reintroduction – Halley & Rosell (2003) adduced 1300 individuals in Austria and about 500 in Slovenia and Slovakia, where reintroduction took place in 1995.

We were not able to estimate Eurasian beaver status in the whole area of the Czech Republic. There are many small subpopulations where rough estimates only can be carried out. An intensive and detailed monitoring system, along the lines of this paper, was able to be carried out only in a few model areas.

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