NAT. CROAT. | VOL. 6 | No 2 | 233–241 | ZAGREB | June 30, 1997

ISSN 1330-0520
UDK 598.323.2+59.08(443.83)

THE GARDEN DORMOUSE (*ELIOMYS QUERCINUS* L.) IN THE PETITE CAMARGUE ALSACIENNE (NATURE RESERVE, ALSACE, FRANCE). AN ECOLOGICAL STUDY BY TRAPPING AND RADIO TRACKING.

CHRISTIAN VATERLAUS-SCHLEGEL

Institut für Pathologie, Abteilung Medizinische Biologie, Schönbeinstrasse 40, CH-4003 Basel, Switzerland

Vaterlaus-Schlegel, C.: The garden dormouse (*Eliomys quercinus* L.) in the Petite Camargue Alsacienne (nature reserve, Alsace, France). An ecological study by trapping and radio tracking, Nat. Croat., Vol. 6, No 2., 233–241, 1997, Zagreb

Garden dormice (*Eliomys quercinus* L.) were investigated in 1993 and from 1995 to 1997 by trapping and radio tracking in a nature reserve (Petite Camargue Alsacienne, Alsace) in France. The number of captured animals was 463, 118 were trapped for the first time, 345 were recaptured. Normal seasonal activity of the population was from April to October in 1993. New born amimals entered the population in 1993, 1995 and 1996 only in July. Radio tracking results showed a correlation of activity and sun rhythm, a behaviour which is already described for edible dormouse and hazel dormouse.

Key words: *Eliomys quercinus*, radio tracking, France

Vaterlaus-Schlegel, C.: Vrtni puh (*Eliomys quercinus* L.) u Petite Camargue Alsacienne (prirodni rezervat, Alsace, France). Ekološka studija uz lovljenje i radio-praćenje, Nat. Croat., Vol. 6, No 2., 233–241, 1997, Zagreb

Istraživani su vrtni puhovi (*Eliomys quercinus* L.) 1993. i 1995.–1997. lovljenjem i radio-praćenjem u prirodnom rezervatu (Petite Camargue Alsacienne, Alsace) u Francuskoj. Broj ulovljenih životinja bio je 463, od toga je 118 ulovljeno po prvi put, a 345 je ponovno ulovljeno. Normalna sezonska aktivnost populacije bila je od travnja do listopada 1993. godine. Mlade životinje ulazile su u populaciju 1993., 1995. i 1996. samo u srpnju. Rezultati radio-praćenja pokazali su korelaciju između aktivnosti i sunčevog ciklusa, a takvo je ponašanje već zabilježeno za sivog puha i puha orašara.

Ključne riječi: *Eliomys quercinus*, radio-praćenje, Francuska

INTRODUCTION

The garden dormouse (*Eliomys quercinus* L.) in the Petite Camargue Alsacienne was known only by occasional trappings and observations before this study. Serious scientific data were lacking. To complete the limited ecological data (e.g. BAUDOIN, 1976; BAUDOIN et al., 1986; LOUARN & SPITZ, 1971; MANN, 1976), the author began this ecological research in 1993 (VATERLAUS,1994).

Two main methods were used: The capture-mark-recapture-method with traps and radio tracking. The results elucidate the population structure, daily and seasonal activity, and home range size.

The data in this paper are, with few exceptions, from 1993. This study was resumed in 1995 and will continue until 1997, so further results can be expected.

MATERIALS AND METHODS

A) Study area

The Petite Camargue Alsacienne (238–242 m.a.s.) is an Alsatian nature reserve (France), located 7 kilometres from Basel (Switzerland). This area is part of a former alluvial forest, which was periodically inundated by the river Rhine until 1838 (Rhine correction). This nature reserve (2.5 $km^{2)}$ has an especially high diversity of plants and animals. Mean annual temperature in 1993 was 10.4 C°.

The dominant species of trees are oaks (*Quercus sp.*), alders (*Alnus glutinosa, A. viridis*), ash (*Fraxinus excelsior*) and robinia (*Robinia pseudoacacia*). A great part of the area is covered by reed (*Phragmites communis*). In the center of the nature reserve there are some occupied houses.

B) Capture-Mark-Recapture

This method is very common in the wildlife biology of small mammals (e.g. BURT, 1940; HAYNE, 1949 a,b; STICKEL, 1954; BROWN, 1966).

One hundred and forty traps were set in a grid system in the field (LUNA mouse trap, 280x62x75mm, Deutsche Fallenfabrik, Germany), covering an area of about 3.5 ha. The captures took place during two nights every 12 days. The traps were baited with peanut butter, rolled oats and raisins. During summertime the author added some fruit (apple, pear) as water supply. Trapping was done in 1993 from March to November, from 1995 on during the whole year.

The animals were marked by ear tattooing with numbers and letters. This method is very suitable for garden dormice, because it is cheap, quick and it does not harm the animals. Animals were weighed, measured and the sex and age were determined. Estimation of population was calculated by the Lincoln Index.

C) Radio tracking

The radio tracking was carried out with small transmitters fixed to a collar (SS-2 in 1993, TW-4 in 1996, 3.5 g, Biotrack, UK) and the animals were observed during the whole night or during half of the night.

Certain parameters (e.g. time, location, meetings with other animals, food intake, behaviour, weather) were noted every 10 minutes (see MUELLER-STIESS & VATERLAUS, 1995). Home range size was determined by the grid method (HAYNE 1949a; AMLANER & MACDONALD, 1980; MUEHLENBERG, 1989), where every observation has a X- and a Y- co-ordinate. The mean of the X- and Y- co-ordinate is the »centre of activity«. From this point every observation is connected by a line and the area of the grid touched by this line is summarized (grid 12,5 m x 12,5 m) and by the Convex-Polygon-Method (= CPM, = minimum home range method), which is described in MOHR (1947) and AMLANER & MACDONALD (1980) and where most exterior observations are connected by a line (polygon).

RESULTS

In 1993, 463 animals were trapped, 118 (67 males, 51 females) were caught for the first time, 345 (124 males, 221 females) were recaptured (Table 1). In both age groups (adults and juveniles) the number of males first captured was larger than the number of females. With recaptures the reverse was true: females were more frequent in the traps than males.

The first animals entered the traps in 1993 on 6th April (1 male) and the last garden dormice were in the traps on 20th October (5 juvenile males; 1 adult male; 3 juvenile females, 3 adult females). In 1995 and 1996 trapping was done during the whole year and in November 1995 the author trapped 5 animals (2 adult females; 2 juvenile females; 1 juvenile male), in December 1 animal (1 adult male), in January 1996 2 animals (1adult male; 1 adult female), in February 2 animals (1 adult male; 1 adult female) and in March 1 animal (1 adult male). The adult male from December, January and February was always the same animal, whereas the females were different individuals.

The first appearance of juvenile animals in the traps during the season 1993 was on 14th July (1 male). The following years confirmed this observation, in 1995, the

Table 1. Number of captures in 1993 by sex and age groups

	adult males	adult females	juvenile males	juvenile females	TOTAL
First Captures	37	31	30	20	118
Recaptures	71	186	53	35	345
TOTAL					463

Table 2. Home range sizes calculated by two methods. Results are based on radio tracking results of 1993.

	Grid		CPM	
	males	females	males	females
Home range size (average)	2.5 ha	1.04 ha	4.19 ha	1.42 ha
Standard deviation	1.42	0.54	2.19	0.81
Minimum	0.61 ha	0.52 ha	1.09 ha	0.63 ha
Maximum	4.66 ha	1.91 ha	7.95 ha	2.74 ha
Spread	4.05 ha	1.39 ha	6.86 ha	2.11 ha

first evidence of new born animals was on 25th July (1 female) and in 1996 the author captured two juveniles (1 male, 1 female) on 16th July. July seemed to be the month when the young animals of the year leave the nest and enter the population.

Estimation of the population (Lincoln-Index) indicated a value of 12.6 animals/ha (average of the whole season 1993).

Weights of garden dormice changed during the season, differing from 66.7 g/56.6 g (average weights males/females, April 1993) to 91.6 g/89.6 g (average weights males/females, October 1993). The heaviest animal captured in 1993 was a male weighing 112 g, the heaviest female was 104 g.

Results of the radio tracking study indicated home range sizes (Table 2) between 0,52–4,66 ha (Grid-method) and 0,63–7,95 ha (Convex-Polygon-method). Male home range size was significantly larger (Convex-Polygon-Method, $t = 4.18$, $p = 1\ \%$).

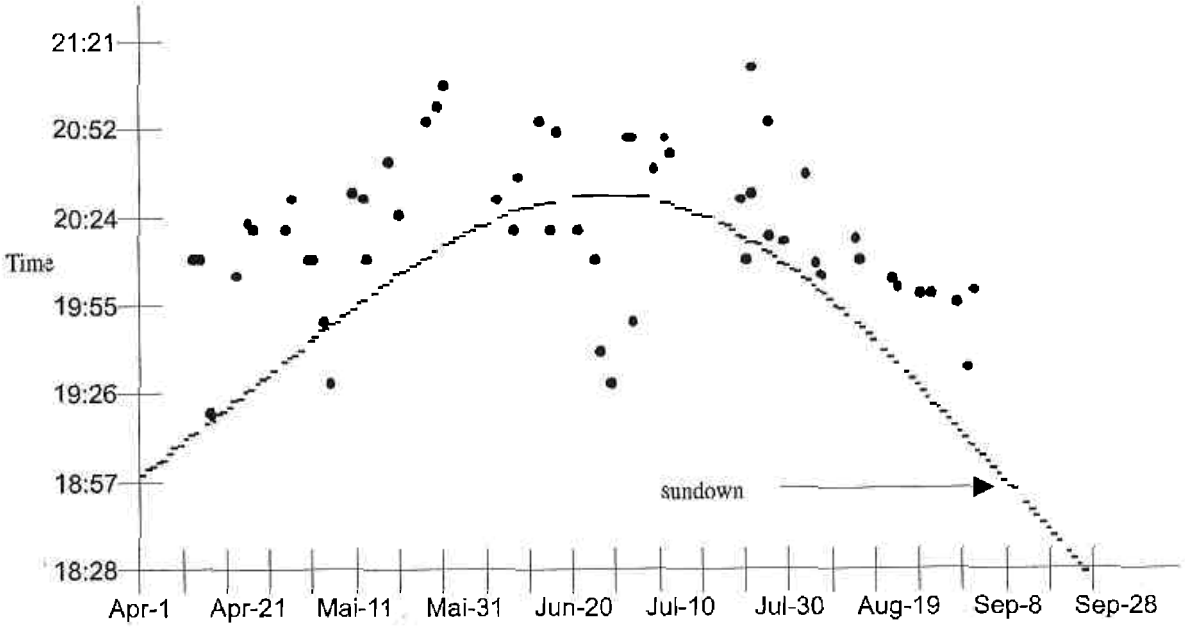

Fig. 1. Start of activity (•) and sundown (---) 1993

Garden dormice are active during the night and so it was of interest to look for the start and end of activity. Start of activity and sundown correlated positively (r = 0,487; t = 3,96, p = 5 %), as did end of activity and sunrise (r = 0,416; t = 2,375, p = 5 %). Figures 1 and 2 show the observations of the start and end of activity. In 8 out of 9 cases the same female was responsible for starting before sundown. She was nursing her litter during this time (June). It was also the same female who was responsible for these two endings of activity after sunrise.

Further results of radio tracking showed (Figure 3) that in 33.9 % of the locations garden dormice were active directly on the ground, in 22.7 % between 0–2 metres and in 24.9 % between 2–4 metres above the ground. Excursions higher than 40 metres above ground were very rare.

DISCUSSION

The reasons for the sexes having a different recapture rate is at the moment not clear, but there are some hypothesis. Food attractivity for a resident nursing female is higher than for the male. Males may be more afraid of entering traps. BATEMAN (1984) and BAUDOIN (1979) discussed another aspect. After hibernating males form groups with hierarchical structures and the weakest animals have to leave the area (»disperse«). For this reason a lot of first captured males were no longer in the study area. KAHMANNN & STAUDENMAYER (1970) suppose too, that males migrate from the female area.

As confirmed by other authors (e.g. KAHMANN, 1970) the start of the seasonal activity of central European garden dormice is in April, the end is in October. But

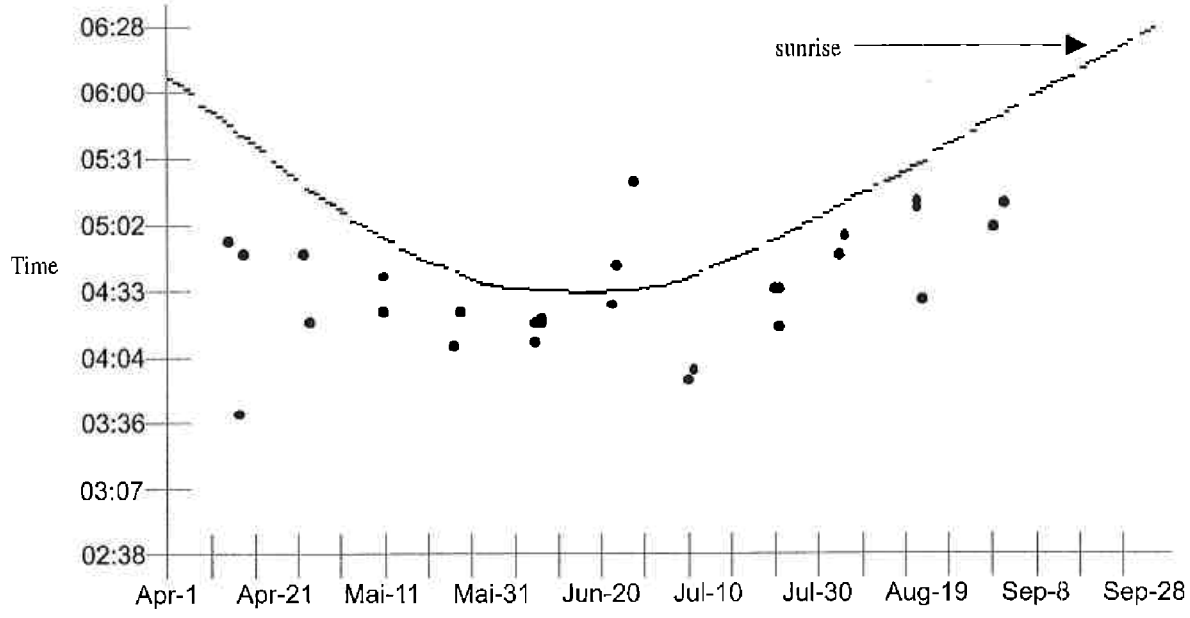

Fig. 2. End of activity (•) and sunrise (---) 1993

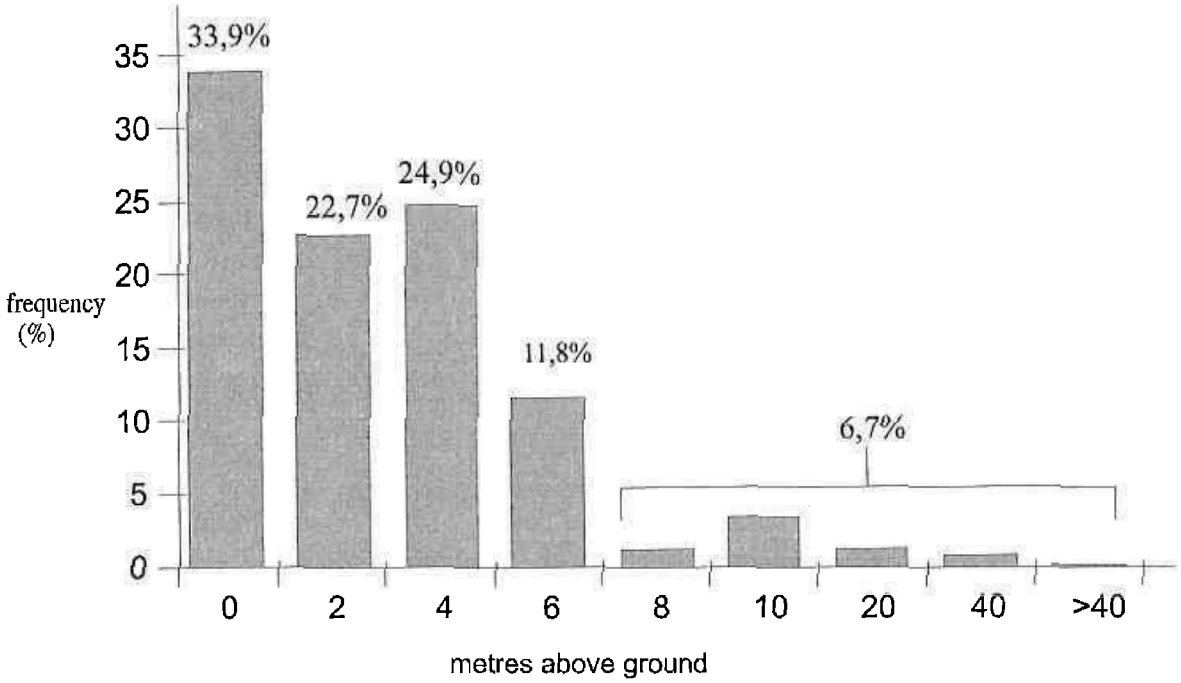

Fig. 3. Frequency (%) of the locations by altitude during radio tracking locations 1993.

it must be said that the date of the seasonal activity start is dependent on local climatic situations and on the altitude. In the Swiss Alps for instance, the time of activity of garden dormice is much shorter because of the early snow fall. The few captures during winter 1995/1996 are not explicable at the moment, because weather data are lacking (they will be available soon). It is an open question too, why it was always the same male that was active in January, February and March. Perhaps there are individual temperature levels or he was often disturbed in his nest.

Different calculating methods of home range sizes lead to different values. Every method has its advantages and disadvantages. The true value is probably between grid-method-size and CPM-size, because grid values are rather too small, whereas CPM values tend to be large.

The home range size of males was bigger than the home ranges of females. It should be considered that most the males were radio tracked 1993 during reproductive period, so it is possible that home range size of males is bigger during sexual activity than in the non reproduction phase. It will be interesting to compare the data from 1993 with the data from 1996, which are unfortunately not prepared yet.

Sun rhythm is one of the most important influences on dormouse activity (STORCH 1978). Calculations of correlations between sundown/sunrise and start/end of activity have been calculated for edible dormouse (*Myoxus glis*) (MUELLER-STIESS, 1988; HOENEL, 1991) and for the hazel dormouse (*Muscardinus avellanarius*) (BANGURA; 1988). In both species, there was a significant dependence of sun rhythm and

activity. The radio tracking results for garden dormice also showed a correlation between these two factors, too.

Lactating females have at least to double their energy intake. This may explain the prolonged activity period.

All dormice are good climbers, the hands and feet being specially well adapted. In contrast to the edible dormouse and the hazel dormouse, who live in rather higher vegetation structures (SURY 1985; MUELLER-STIESS 1988; HOENEL 1991), the garden dormouse is very frequently active directly on the ground (cf. KAHMANN 1951; FEUSTEL 1984). One reason for this behaviour is certainly food. Garden dormice are more carnivorous than the other dormice species, so they search for food on the ground.

ACKNOWLEDGEMENTS

I am grateful to H. Durrer, A. Ochsenbein and K. Vaterlaus-Schlegel, who helped me in different ways to realize my work.

Received November 15, 1996

REFERENCES

AMLANER, C. J. & MACDONALD, D. W., 1980: A handbook on Biotelemetry and radio tracking. Oxford: Pergamon Press.

BANGURA, B., 1988: Telemetrische Untersuchungen zur Biologie der Haselmaus (*Muscardinus avellanarius*). Dissertation, Rheinische Friedrich- Wilchelms-Universität, Bonn.

BATEMAN, G.,1984: The Encyclopaedia of mammals, Vol.II, 678–680. Oxford. Equinox.

BAUDOIN, C., 1976: La structure sociale chez le lrot. Proc. XIV. Int. Ethological Conf. Parma.

BAUDOIN, C., 1979: Behavioural mechanisms of population regulation in a hibernating mammal = *Eliomys quercinus* L. Rodentia-Gliridae). Proc. XVI. Int. Ethological Conference Univ. of British Columbia

BAUDOIN, C., MANN, C. & TAILLARD, CH., 1986: Comparaison de la structure sociale et de l'organisation spatiale du lérot, dans les alpes et dans le jura. Coll. Nat. CNRS »Biologie des Populations«.

BROWN, L. E., 1966: Home range and movement of small mammals. Symp. zool. Soc. Lond. **18**, 111–142.

BURT, W. H., 1940: Territorial behaviour and populations of some small mammals in southern Michigan. Misc. publ. Mus. Zool. Univers. Michigan **45**, 1–58.

FEUSTEL, H., 1984: Zur Verbreitung der Schälfer (Gliridae) im Odenwald. Bericht Naturw. Ver. Darmstadt N.F.8. Hessische Faunistische Briefe **4** (1), 7–17.

HAYNE, D. W., 1949a: Calculation of size of home range. J. Mammalogy **30** (1), 1–18.

HAYNE, D. W., 1949b: Two methods for estimating population from trapping records. J. Mammalogy **30** (4), 399–411.

HOENEL, B., 1991: Raumnutzung und Sozialstruktur freilebender Siebenschläfer. Dissertation, Universität Karlsruhe.

KAHMANN, H. (1951). Die deutschen Schlafmäuse. Kosmos, **47**, 491–496.

KAHMANN, H., 1970: Der Gartenschläfer *Eliomys quercinus ophiusae* Thomas, 1925 von der Pytuseninsel Formentera. Verff. Zool. Staatssamml. Mnchen **14**, 75–90.

KAHMANN, H. & STAUDENMAYER, T., 1970: Ueber das Fortpflanzungsgeschehen bei dem Gartenschläfer *Eliomys quercinus* (Linnaeus, 1766). Säugetierkundl. Mitt. 18, 97–114.

LOUARN LE, H. & SPITZ, F. 1971: Biologie et écologie du lérot *Eliomys quercinus* L. dans les Hautes-Alpes. Terre et la vie, Paris **28**, 544–563.

MANN, C. S., 1976: Etude du cycle annuel, de la Demographie, de l'Ecologie et du Comportement vis-á-vis de l'espace du lérot (*Eliomys quercinus*) dans le Brianconnais. Ph.D. thesis, University Pierre et Marie Curie, Paris.

MOHR, C. O., 1947: Table of equivalent populations of north American small mammals. Americ. Midl. Naturalist **37**, 223–249.

MUEHLENBERG, M., 1989: Freilandökologie. Heidelberg und Wiesbaden. Quelle und Meyer.

MUELLER-STIESS, H., 1988: Untersuchungen zum Raum-Zeit-System freilebender Siebenschläfer (*Glis glis* L.) im südlichen Saarland. Diplomarbeit Uni. Saarlandes.

MUELLER-STIESS, H. & VATERLAUS, C., 1995: Telemetrie von Bilchen (*Myoxidae*). Methoden feldökologischer Säugetierforschung, Wissenschaftliche Beiträge Universität Halle-Wittenberg, Band **1**, 335–344.

SURY, F., 1985: Biologische Bedeutung der Nestumgebung und des Nestes bei Haselmäusen. Dissertation, Universität Bern.

STICKEL, L. F., 1954: A comparison of certain methods of measuring ranges of small mammals. J. Mammalogy **35** (1), 1–15.

STORCH, G., 1978: Handbuch der Säugetiere Europas, Bd. I, Nagetiere 1. Wiesbaden. Akademische Verlagsgesellschaft.

VATERLAUS, C., 1994: Zur Oekologie des Gartenschlfers in der Petite Camargue Alsacienne. Diplomarbeit Universität Basel.

SUMMARY

The garden dormouse (*Eliomys quercinus* L.) in the Petite Camargue Alsacienne (nature reserve, Alsace, France). An ecological study by trapping and radio tracking

C. Vaterlaus-Schlegel

Garden dormice (*Eliomys quercinus* L.) were investigated in 1993 and from 1995 to 1997 by trapping and radio tracking in a nature reserve (Petite Camargue Alsacienne, Alsace) in France. This area is a former alluvial forest with a high diversity of animals and plants.

The number of captured animals was; 463, 118 (67 males, 51 females) were trapped for the first time, and 345 animals (124 males, 221 females) were recaptured. Even in the winter months there were some single animals captured (from November to March). The reasons why they were active is not answered yet because meteorological data are still lacking, but it seems to be related to temperature.

Correlation between temperature and activity will be done later. Normal seasonal activity of the population was from April to October in 1993.

New born animals entered the population in 1993, 1995 and 1996 only in July.

Radio tracking results showed a correlation of activity and sun rhythm, behaviour which has already described for the edible dormouse and the hazel dormouse. With few exceptions (nursing female), the animals start activity after sundown and end it before sunrise. The male home range size was bigger than the female home range size, calculated by two methods (grid-method and Convex-Polygon-method).

The data collection for this study will continue until 1997, so further results will be presented later.

SAŽETAK

Vrtni puh (*Eliomys quercinus* L.) u Petite Camargue Alsacienne (prirodni rezervat, Alsace, France). Ekološka studija uz lovljenje i radio-praćenje

C. Vaterlaus – Schlegel

Istraživani su vrtni puhovi (*Eliomys quercinus* L.) 1993. i 1995.–1997. lovljenjem i radio-praćenjem u prirodnom rezervatu (Petite Camargue Alsacienne, Alsace) u Francuskoj. To područje je nekadašnja aluvijalna šuma s vrlo raznolikim biljnim i životinjskim svijetom. Broj ulovljenih životinja bio je 463, od toga je 118 (67 mužjaka, 51 ženka) ulovljeno po prvi put, a 345 (124 mužjaka, 221 ženka) je ponovno ulovljeno. Pojedinačno su životinje lovljene i u zimskim mjesecima (od studenog do ožujka). Razlozi zbog kojih su bile aktivne još su nepoznati jer nedostaju meteorološki podaci, ali čini se da su u vezi s temperaturom. Korelacija između temperature i aktivnosti izračunat će se naknadno. Normalna sezonska aktivnost populacije bila je od travnja do listopada 1993. godine. Mlade životinje ulazile su u populaciju 1993., 1995. i 1996. samo u srpnju. Rezultati radio-praćenja pokazali su korelaciju između aktivnosti i sunčevog ciklusa, a takvo ponašanje već je zabilježeno za sivog puha i puha orašara. Uz nekoliko iznimaka (ženke s mladima), životinje su započinjale s aktivnošću poslije zalaska sunca i završavale prije izlaska sunca. Životni prostor mužjaka bio je veći od onog ženke, izračunato pomoću dvije metode (metoda mreže i Convex-Polygon-metoda). Sakupljanje podataka za ovu studiju nastavit će se i u 1997. godini, pa će daljnji rezultati biti objavljeni naknadno.