A review of the results obtained during the Field Study Group summer camps of the Dutch Mammal Society, 1986-2014

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Abstract: The 28 summer camps of the Field Study Group of the Dutch Mammal Society organised between 1986 and 2014 are reviewed here. Over time the Field Study Group gradually spread out its activities throughout Europe, including former Eastern Bloc countries. Camp locations were found through contacts in host countries, who also assist in the preparation of camp activities. Out of a total of 160 participants from the Netherlands and Belgium, 80 attended a summer camp once and 80 joined more than once; 116 participants from local origin were active during these camps. For the 128 mammal species found, the observation techniques used are described. Overall, 7,662 small mammals were caught with live-traps and 990 bats were caught in mist nets. Among the trapped mammals, 421 casualties were counted, predominantly common and pygmy shrews in northern European countries. In pellets, predominantly from barn owls, 21,620 small mammals were found. With detectors, 3,908 bats could be identified. Caves and (old) buildings were explored for bats, and the results of these surveys made up a large part of the total number of bats found. Sightings (> 1,740) and tracks & signs (> 1,194) revealed most of all the presence of carnivora and even-toed ungulates (Artiodactyla). Since 2007, infrared camera traps were used to detect medium-sized and larger mammals; 77 individuals were detected with this relatively new technique. During seven camps, parasites were taken from 23 bat species: most of these were mites (80%) and louse flies (Diptera: Hippoboscidae) (15%). The locations where mammal species were found were compared to the existing knowledge (expressed as presence in 50x50 km UTM grid squares) on the distribution of mammal species in Europe, as presented in *The Atlas of European mammals* by Mitchell-Jones et al. (1999). The presence of mammal species was confirmed in 1,268 squares; 35 squares reaffirmed their presence after 1970, and in 218 new squares an extension of the distribution was demonstrated for a number of mammal species. The highest proportion of new squares appeared to be for Chiroptera, mostly due to the use of mist nets and the introduction of bat detectors as a new technique. Besides positive mammal observations, attention has also been paid to species that, against all odds, were not observed in specific areas. The application of newly introduced, tested, techniques during the study period are part of this review.

Keywords: fieldwork, inventory, survey, sighting, bat detector, tracks and signs, live-trap, mist netting, camera trap, mammals.

Introduction

In 1975, the board of the Society for the Study and Protection of Mammals (since 2009 named the 'Dutch Mammal Society') decided to give more attention to fieldwork and listed eight goals for the Field Study Group, established at the time, ranging from mapping the distribution of species to finding ecological

key factors that could explain the species' distribution (Anonymous 1975). At that time, the Society was in a transition from a purely academic circle of mammal specialists towards an organisation that put more emphasis on basic ecological field studies (more precisely: collecting factual information about the distribution of wild mammals in the Netherlands) and on nature conservation. Three members of the new Field Study Group compiled a manual for terrestrial mammal surveys in the Benelux (Hoekstra et al. 1977).

The first surveys of the Field Study Group were organised during the autumn in the Benelux, starting in 1981 with the Oostvaardersplassen (Canters 1982), followed by Swalmdal (Bosman & Margry 1983), Kampina (Margry & Minkenberg 1984), Hollenfels (Minkenberg et al. sine anno), Dyleland (Allaerts et al. 1986), Staphorsterveld (Canters 1987) and Nijmegen (Thissen & Pelzers 1992). These early camps were aimed to teach participants some basic knowledge and skills required for mammal research. These skills turned out to be very useful for the summer camps that followed. The results were mostly published as reports (above), but some were published as regular published papers as well (e.g. Canters et al. 1983, Bosman & Margry 1984, Margry & Minkenberg 1985).

After several years of autumn camps, the first summer camp was organised in 1986 in Belgium, in the Gaume area, a favourable location for catching and observing species such as yellow-necked mouse (*Apodemus flavicollis*) and edible dormouse (*Glis glis*). From 1988 on these summer camps became a yearly event. The list of destinations (see the caption of figure 1) illustrates that the Field Study Group over time gradually spread its activities to the far corners of Europe. The geopolitical changes that took place in 1989 favoured opportunities for mammal research in former Eastern Bloc countries (e.g. Yugoslavia; photo 1).

Small mammal surveys were still performed within the Netherlands during autumn and spring focusing on small mammal live-trapping, bat detector surveys, mist netting and other activities. All of these domestic camps were good opportunities for training new participants and for trying out new techniques.

Photo 1. Biogradska Gora, Montenegro, the location of the 2014 summer camp. *Photo: K. Mostert.*

There is no user guide for preparing and organising a Field Study Group camp. Camp locations are found through contacts in host countries. The local knowledge of species and locations of these people is essential, and, as a rule, they play an important role in the preparation of a camp. Camps are usually loosely organised and participants are free to follow their interests and take initiatives. Activities requiring a group effort, such as trapping small mammals, are coordinated by the camp staff.

Some data and analysis of materials collected during the camps have been published separately (e.g. van der Kooij et al. 1997, Woutersen & Bafaluy 2001, van der Kooij 2006) or used as a reference (e.g. Twisk sine anno). In recent years, on a more or less regular basis, some highlights were described in the magazine of the Dutch Mammal Society, "Zoogdier" (e.g. Mostert et al. 2008, Mostert et al. 2009, Mostert 2012, Mostert 2015). Only occasionally, specific results were published separately, e.g. the record of a high altitude mist net capture of a serotine (*Eptesicus serotinus*) (Boshamer & Bekker 2006). The results and experiences of so many Field Study Group camps deserve a broader audi-

ence and certainly merit a review. The information collected during the camps were also important for the realisation of the (Western) European mammal field guides of Lange et al. (1994) and Twisk et al. (2010). The reports of Field Study Group camps contain many interesting details on techniques which will be summarised in a special report (Bekker et al. in prep.).

The general, repetitive objectives for the camps can be summarised as: 1. inventories of mammals in the area as an attribution to the knowledge of the existing mammals; 2. exchange of experiences and knowledge with regional and national mammal study groups; 3. gathering experience with species that are not present or rare in the Netherlands. Most of the camps also have, regionally determined, subgoals, such as observing specific species or unfamiliar ecosystems with their specific mammals. This paper aims to assess the contribution of the Field Study Group to new knowledge about the distribution of mammals in Europe; furthermore to discuss the effectiveness and results of different techniques used to establish species and /or species groups during the camps; and, finally, report on the exchange of experiences between local counterparts and Field Study Group participants.

Summer camps

Records and taxonomy

In this paper we review the 28 reports of the Field Study Group reports of the Dutch Mammal Society over the period 1986-2014. An overview of these reports is listed in section B of the References. We added information from our personal notebooks and experiences, together covering 26 of the 28 camps. A further search of the Field Study Group data, compiled by Jeroen Willemsen, was conducted through the Zoogdiervereniging website (*http://www.zoogdiervereniging.nl*).

The survey methods are specific for the three major groups of terrestrial mammals and are therefore described separately underneath. Often the various methods complement each other: sightings, tracks & signs, camera traps for larger mammals; live-traps, remains in pellets & excrements for small mammals; and bat detectors, mist nets, and exploring caves & abandoned buildings for bats.

In this review we follow the sequence of species used in *The Atlas of European mammals* (Mitchell-Jones et al. 1999). However, since its publication, the nomenclature of several species has changed. Therefore, for scientific names, except *Arvicola terrestris*, we follow the more up-to-date nomenclature by Wilson & Reeder (2005), in which *Erinaceus concolor* is replaced by *Erinaceus roumanicus*, *Lepus capensis* by *Lepus europaeus*, *Microtus pyrenaicus* by *Microtus gerbei*, *Ovis musimon* by *Ovis ammon* and *Clethrionomys* by *Myodes*. *Pipistrellus savii*, *Microtus nivalis* and *Mustela vison* have been assigned to new genera according to Wilson & Reeder (l.c.) and are now *Hypsugo savii*, *Chionomys nivalis* and *Neovison vison*.

On several locations we also traced some newly described species that were split off since 2004; in the species accounts, these recent splits directly follow the species from which they 'originated'. Recently, two new species in the *Myotis mystacinus* group were generally accepted: *Myotis alcathoe*, which was split off based on molecular-genetic characteristics (Von Helversen 2004) and *Myotis aurascens*, which was described based on morphological and morphometric characteristics (Benda 2004). The '*Myotis nattereri* complex' nowadays comprises four (sub)species: *Myotis nattereri* in most of central Europe, *Myotis escalerai* on the Iberic peninsula, *Myotis* SpA, in northern Spain and the Pyrenees, southern France and the north of Italy, while *Myotis* SpB is thought to restricted to Morocco (Salicini et al. 2013). In the 1990s, a new (sub) species was identified within the species *Pipistrellus pipistrellus* and originally described

as the '55 kHz phonic type' next to the '45 kHz phonic type' (Barlow & Jones 1999). Based on the sympatric distribution of both phonic types, but different wing morphology and differences in the cytochrome sequence of the mitochondrial DNA, *Pipistrellus pygmaeus* explains the up to recently hidden identity of this species next to *Pipistrellus pipistrellus*. The genus *Plecotus* too has produced two new species relevant for the European continent and worthwhile to mention here: *Plecotus kolombatovici* and *Plecotus macrobullaris*. The characteristics of both species have been described by Kiefer & Von Helversen (2004a, 2004b).

The fossorial form of the water vole *Arvicola terrestris* has recently been split off and is here named *Arvicola scherman*, the montane water vole.

The two species described until 2005 as *Mus musculus* and *Mus domesticus* were afterwards lumped together and named as *Mus musculus*.

Locations and participants

In general the choice of a particular destination within Europe of a Field Study Group summer camp has largely been the result of three criteria: 1. the availability of one or more local contact persons with relations in national nature conservation organisations; one of these organisations is preferably located in a nature reserve and should have specific ecological, mammal-related questions regarding this area; 2. the availability of basic accommodation to suit a group of 20-25 persons in or near the research area for ca. ten days; 3. a high biodiversity of mammal species, preferably including several rare or endemic species. With some exceptions, this selection process resulted in regions in Europe, where (extensive) mammal inventories had not yet been performed.

The positions of the camp locations varied from 40° (Serra da Estrela) to 63° North (Patvinsuo) and from 7° West (Alvão N.P.) to 30° East (Patvinsuo). Figure 1 specifies the locations of the 28 camps between 1984 and 2014 and shows the increasing distances of the locations over the course of the years. The camps in 1989 and 1996 included two loca-

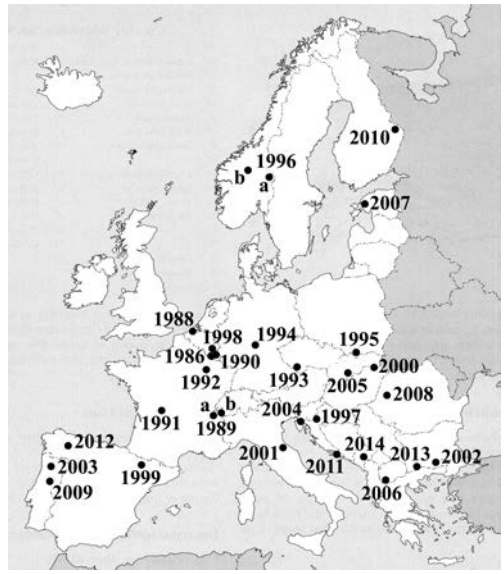

Figure 1. Map of Europe with locations of the Field Study Group summer camps held between 1986 and 2014, including the following camps (year-country (region): 1986-Belgium I (Gaume), 1988-the Netherlands (Western Zeeuws-Vlaanderen), 1989-France I (a: Culoz; b: Samoëns), 1990-Luxembourg (Wiltz), 1991-France II (Limousin), 1992-France III (Argonne), 1993-Czech Republic* (Šumava), 1994-Germany (Thüringen), 1995-Poland (Pieniny), 1996-Norway (a: Trysil; b: Dovre), 1997-Slovenia I (Podstene), 1998-Belgium II (Prelle), 1999-Spain I (Siera de Guara), 2000-Hungary (Zemplen), 2001-Italy (Onferno), 2002-Bulgaria I (Eastern-Rhodopes), 2003-Portugal I (Alvão N.P.), 2004-Slovenia II (Rakitovec), 2005-Slovakia (Poľana), 2006-Republic of Macedonia** (Galicica N.P.), 2007-Estonia (Matsalu), 2008-Romania (Rosia), 2009-Portugal II (Serra da Estrela), 2010-Finland (Patvinsuo), 2011-Croatia (Biokovo N.P.), 2012-Spain II (Galicia), 2013-Bulgaria II (Western-Rhodopes), 2014-Montenegro (Biogradska Gora); *: hereafter abbreviated as 'Czech R.'; **: hereafter abbreviated as 'Macedonia'.

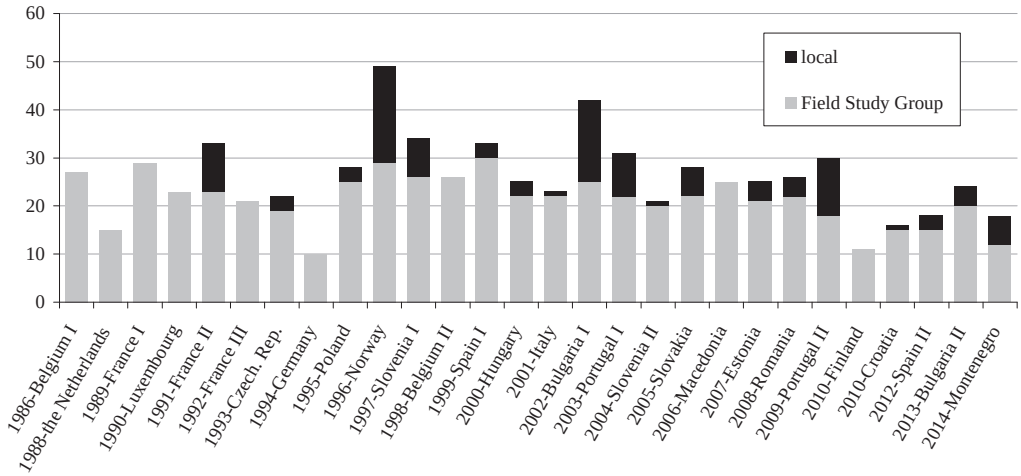

Figure 2. Number of participants in Field Study Group summer camps.
Source: Field Study Group summer camp reports, listed in Section B of References.
Local: participants of local origin.

tions (figure 1). The camp in 1989 was located in Culoz and every other day several participants moved to Samoëns, 80 km to the east and returned afterwards. The setup in Norway 1996 was different: 49 participants from Norway and the Netherlands were mixed and divided over the two camp locations in Trysil and Dovre, 190 km apart. On the fourth day the participants switched between the two sites.

From figure 1 it can be derived that there is a tendency of summer camp locations to be positioned near the borders of countries; 21 camps were located less than 50 km from the nearest border, 14 of these even less than 10 kMyotis Six camps were located between 50 till 100 km to the next nearest border, while the remaining three camps were more or less centrally located at more than 100 km off the respectively country borders (1989-France I and 1996-Norway both counted twice). An explanation for this phenomenon is the fact that interesting nature parks are often located in mountainous regions or regions with a low human population density which often coincide with country borders.

The first Field Study Group camp in 1986 began in the second half of August, while later on most camps started around (the weekends of) the 1st of August. Four camps were organised earlier in the summer, e.g. well before the onset of the migration of bats in Eastern European countries. The duration of the Field Study Group camps increased with the distance of the camp locations from the Netherlands.

The number of participants from the Netherlands and Belgium - although the Dutch Mammal Society was originally of Benelux-origin, no participant from Luxembourg ever attended - varied from 10 (1994-Germany) to 30 (1999-Spain I) (figure 2). In the first four years no local participants attended the camps, but from 1990 on local participants were present at each camp, up to 17 in 2002 (Bulgaria I). The high number of 20 local participants in Norway was due to the combined organisation by the Norwegian Zoological Society and the Field Study Group of the Dutch Mammal Society.

The presence of local mammal researchers at the camps is considered important by the Field Study Group of the Dutch Mammal Society. The board of the Field Study Group has always aimed to exchange knowledge, experiences and observation techniques

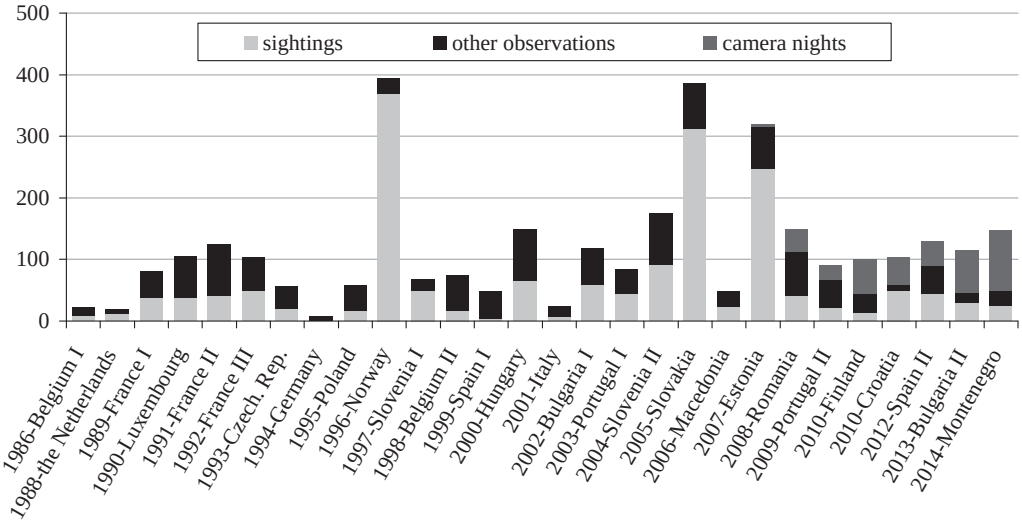

Figure 3. Sightings, tracks & signs and camera nights (predominantly of medium-sized and large mammals) in Field Study Group summer camps.

Source: Field Study Group summer camp reports, listed in Section B of References.

(including those from previous camps), both mutual and with the local participants, during the camps. Besides, locals are familiar with regional habits and peculiarities, which makes solving communication problems that may arise with local inhabitants easier.

Between 1986 and 2014, a total of 116 local participants attended the Field Study Group camps, one of whom attended a camp twice, and one three times.. For Dutch and Belgian participants the frequency of attendance is quite different: of a total of 160 participants, 80 attended once and 80 joined more than once. Seventeen persons participated ten times or more and three even more than 20 times.

Survey methods

Sightings

Direct observations, mostly sightings (visual observations), with or without the aid of binoculars, have always been a major source of information for Field Study Group camps. To a lesser extent, mammal sounds too provide information (e.g. howling wolves, barking foxes, etc.). Acoustical observations through bat detectors, however, are treated separately in this paper. In two cases acoustical and olfactorial observations (of greater white toothed shrew) are listed as 'sightings'. Since the very start of the camps, visual observations were done during night excursions with the use of searchlights (later on car-based), casting over fields or along forest trails. Figure 3 gives the number of sightings for each camp; the total number of sightings was > 1,740. For two camps, 1986-Belgium I and 1994-Germany, the number of sightings was not specified. Observations of roosting bats inside buildings and caves show a large variation and numbers are often too high (up to several thousands) to include in figure 3. These numbers are given in the species accounts.

Tracks and signs

Tracks and signs include footprints, tracks, gnawing or scratching marks and (remains of) nests or dens and droppings; these also include dead mammals or parts of mammals (e.g. skulls, antlers, hairs); for all camps

Photo 2. Preparation and baiting of the live-traps (Finland, 2010). *Photo: K. Mostert.*

> 1,652. The remains from pellets are dealt with separately. In many camp reports the number of tracks and signs are not clearly counted and separated from other observations; therefore the totals per species (figure 3) should be considered as minimum numbers. In camp reports the descriptions of tracks and signs were not always determined to species level, e.g. excrements of beech marten (*Martes foina*) or pine marten (*Martes martes*). These cases were excluded from the analyses.

Camera traps

During 2007-Estonia, the Field Study Group for the first time used an infrared camera trap for two nights, comprising a video camera (Sony®, Sony Corporation, Tokyo, Japan) in a weather proof cylinder, a separate sensor block and a battery block, all cable connected. Strong odorous lures such as peanut butter and valerian tincture, were used to attract mammals to a spot in front of the camera. The next year (2008-Romania), six camera traps (Moultrie®, EBSCO Industries, Inc., Birmingham, AL, USA), sized 27x17x10 cm, were set over 36 camera nights. From 2010 to 2014 smaller camera traps (Bolyguard®, Boly Media Communications Co, Ltd, Santa Clara, CA, USA) and Reconyx®, Holmen, WI, USA), measuring ca. 13x8x5 cm were used. The number of photographs taken each time a camera is triggered, and the reaction time after the trigger moment, can be selected and was therefore very variable. Consequently, the number of camera nights are presented to demonstrate the quantitative efforts with this method (figure 3). Since the introduction of camera traps 77 individuals were detected with this relatively new technique.

Live-traps

Since the first Field Study Group camps were held, the live-traps used were predominantly Longworth traps (photo 2). The annual use of these live-traps differed between camps, depending on the ecological questions, the landscape type, climatic circumstances and the number of camp participants with specific

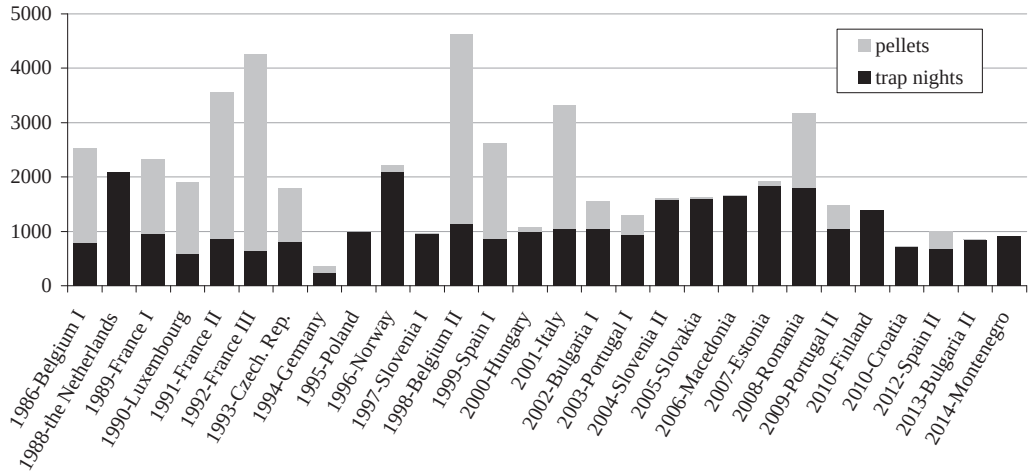

Figure 4. The number of trap nights and prey items (predominantly of small mammals) from owl pellets and excrements found at Field Study Group summer camps between 1986 and 2014.
Source: Field Study Group summer camp reports, listed in Section B of References.

Photo 3. Placing the live-traps in the verge of a dirt road (Romania, 2008). *Photo: K. Mostert.*

knowledge about small mammals and trapping techniques. Figure 4 shows the number of trap nights during the Field Study Group camps between 1986 and 2014 (a trap night being the product of the number of traps and the number of nights during which they are set).

Since the start of camp surveys in 1986, a wide range of live-traps have been used: besides the oblong aluminium Longworth® (Longworth Scientific Instruments, Abingdon, UK) and Sherman® (Tallahassee, FL, USA) traps (see e.g. Hoekstra et al. 1977), specially manufactured Czech wooden traps and metal wired Ugglan® (Grahnab AB, Hillerstorp, Sweden) traps (three different types) (Gundersen et al. 1999) have been used incidentally (photo 3). In addition, various pack-

ing materials have been modified to pitfalls e.g. yoghurt cups and PET bottles. Slovenian dormice hunters used big snap-traps fixed on a three meter long stick, suspended on a tree-branch (Anonymous 2001); a modified method which, adapted for Sherman traps, has been used since 2004 for dormice (Bekker & Bekker 2006). From 2013 on, the Heslinga® trap (Zilvermeer, Groningen, the Netherlands) came into use too. This trap has the general design of a Longworth® trap, but the treadle-mechanism is slightly altered.

Bigger traps have been employed as well for special purposes: commercially available ground squirrel traps and home made treadle traps for the common hamster (*Cricetus cricetus*) (Bekker 2001) and fyke nets for the Pyrenean desman (*Galemys pyrenaicus*) (Bekker & Hunia 2004).

Traps were usually checked three times a day: once in the morning (7 a.m.), once in the afternoon (4 p.m.) and once at night (11 p.m.), yielding an optimal compromise between control effort and the survival rate of the small mammals captured. A limited number of 256 specimens could not be determined down to species level, concerning mostly animals from the genus *Apodemus* (*Apodemus flavicollis* or *Apodemus sylvaticus*). During all camps together, 7,662 small mammals were caught with live-traps in a total of 31,097 trap nights (three hand captures included). The high trapping result of almost 25% is partly due to the usual three checks of the traps per day. Trap-happy individuals belonging to *Apodemus flavicollis* and *Apodemus sylvaticus* strongly contribute to this result, with almost 38% of the catches belonging to these species.

Remains in pellets and excrements

One of the usual questions to address to the camp hosts beforehand is whether (barn)owls are present in the area and if (barn)owl pellets are already available. Camp staff always prioritises and stimulates the search for pellets in the surroundings. During all camps together, the total of all mammalian prey items in pellets amount to 21,403 (including the not at species level determined specimens: 22,766). Numbers of mammalian prey items strongly vary between camps (figure 4). They sometimes exceed 2000 items, while on some occasions analysable material was scarce or even absent. By far the highest numbers of mammalian prey items were found in barn owls pellets (*Tyto alba*) (*n*=21,620; 95%). Other owl species contributed considerably less: tawny owl (*Strix aluco*): *n*=615 (3%); little owl (*Athene noctua*): *n*=154; long-eared owl (*Asio otus*): *n*=137; Tengmalm's owl (*Aegolius funereus*): *n*=108; eagle owl (*Bubo bubo*): *n*=26; and Ural owl (*Strix uralensis*): *n*=9. Other pellet-producing predators contributed only marginally: lesser spotted eagle (*Aquila pomarina*): *n*=46; common kestrel (*Falco tinnunculus*): *n*=17; Montagu's harrier (*Circus pygargus*): *n*=5; and common buzzard (*Buteo buteo*): *n*=7. Besides, one prey item of raven (*Corvus corax*) and one of a shrike (*Lanius* sp.) was found. Apart from the avian predators, carnivores too often have prey remains in their excrements, especially red fox (*Vulpes vulpes*): *n*=13. Mammal remains were furthermore found in low numbers in droppings of beech marten (*Martes foina*) (*n*=4), genet (*Genetta genetta*) (*n*=2) and pine marten (*Martes martes*) (*n*=1).

Bat detectors

Ever since bat detectors became available to field workers in the 1980s, they rapidly evolved into advanced, reliable and easy-to-handle devices, which are indispensible in today's bat research. Parallel to this development, sound analysis equipment and software was introduced at the Field Study Group camps, thereby greatly improving the reliability of bat identifications.

Detectors have been used during all camps, from 1986 onwards, although the level of effort differs greatly between camps. Primarily, hand-held bat detectors were used in promising locations where many hunting bats could be expected, such as ponds, lakes and

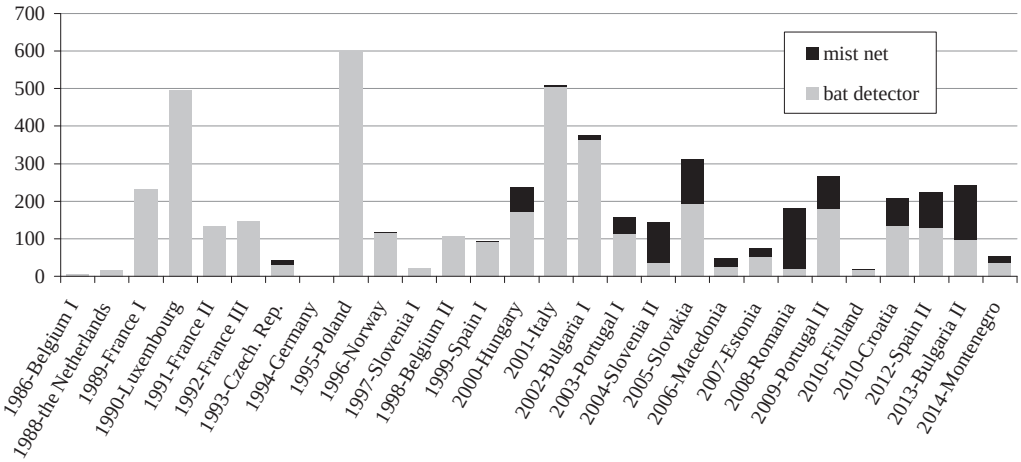

Figure 5. Bat detector observations and mist net captures of bats at Field Study Group summer camps.
1986-Belgium I and 1988-the Netherlands: exact number of bat detector observations unknown; missing numbers in 1994-Germany.
Source: Fieldwork Study Group summer camp reports, listed in Section B of References.

forests with an open structure. In addition, in recent years, detectors mounted on slow-moving cars were used on quiet roads. These car transect surveys sometimes covered considerable distances and have increased the numbers of bats identified. During all camps together, a total of 3,908 bats were identified with bat detectors, including sound analysis equipment; 165 bats could not be identified to species level. The emerging and commuting bats found during 1995-Poland (*Rhinolophus hipposideros*: 80 resp. 93 individuals) and 2001-Italy (*Miniopterus schreibersii*: ca. 5,500 individuals) are not included in these numbers.

During most camps, a considerable number of bat species were identified with the use of bat detectors (figure 5). Especially Daubenton's bat (*Myotis daubentonii*), soprano pipistrelle (*Pipistrellus pygmaeus*), noctule (*Nyctalus noctula*), Leisler's bat (*Nyctalus leisleri*), greater noctule (*Nyctalus lasiopterus*), serotine (*Eptesicus serotinus*) and free-tailed bat (*Tadarida teniotis*) were relatively easily identified with detectors (while the latter species can often be heard with the naked ear as well). Some of these species fly relatively high and fast, and are often overlooked with other survey methods. For others, especially *Myotis* and *Plecotus* species, the bat detector clearly has its limitations, as these species are virtually impossible to differentiate by sound. In recent years, however, identification of *Myotis* and *Plecotus* species could be more reliably done by computer analysis of sounds recorded with bat detectors.

Searches for colonies and other roosts during the early morning in villages and cities with the help of detectors has been a commonly used method during many camps. During twelve camps, one or more roosts or maternity colonies have been found using this method. Searching roosts was especially successful during the camps of 1989-France I, 1998-Belgium II, 2001-Italy, 2003-Portugal I and 2007-Estonia. Detectors were also used in the early morning (and sometimes in the evening) to search for swarming bats near colonies and other hides in old trees and in villages and towns. When a colony was found, the total number of bats leaving the roost on the subsequent evening was counted by stationary observers. On some occasions bat detectors were also used by observers on foot or bicycle to survey commuting or hunting

Photo 4. Putting up a mist net in front of a cave entrance (Romania, 2008). *Photo: K. Mostert.*

bats. The discovery of colonies in concrete lamp posts during 2001-Italy and 2002-Bulgaria I deserves special mention here.

Surveys with the specific aim to find maternity colonies in trees were carried out only a few times during the camps. Besides the fact that the most favourable period to do this had usually already passed, many forests in the countries visited were found to have lower accessibility (compared to the Netherlands) or seemed to be unsuitable for harbouring colonies of bats, like in many Mediterranean and north-European camp locations. Tree colonies, predominantly in old oak and beech, were found during the 2000-Hungary, 2005-Slovakia and 2007-Estonia camps.

Mist nets

In the early years of the Field Study Group camps, the use of mist nets to capture bats, was not practised regularly. The first attempts were made in 1990-Luxembourg, without success. During 1993-Czech R. and 1996-Norway a modest beginning was made with the capture of five bats and one bat respectively, but then it took four more years before a good number of captures was achieved (2000-Hungary). Later on, apart from the low numbers that were caught during the 2001-Italy, 2002-Bulgaria I and 2010-Finland camps, all other camps counted more than 30 mist netted bats, four camps even over 100 specimens. Mist netting was not part of the program during the 1995-Poland camp, because shortly before this camp, extensive mist netting had already been carried out in Pieninsky Park Narodowny, with many captures of bats. During 1998-Belgium II permission to capture bats was not granted. During 2007-Estonia and 2010-Finland bats were caught using harp traps instead of standard mist nets (one and three specimens respectively; also included in figure 5).

Ever since mist netting became an integrated part of the camps' programme, surveying bats along streams, preferably near bridges, above ponds and on trails in forests has become feasible. Besides, mist nets were frequently set up near entrances to caves and caverns, as these are regularly inspected by bats of many species (photo 4). Undoubtedly, the increased number of mist nets (or the increased total length of mist nets) that took place over the years contributed to the increased numbers of bats captured. Even so,

Photo 5. Abandoned house used by bats as a day roost (Spain, 2012). *Photo: K. Mostert.*

the increased experience of some of the regular camp participants with selecting good locations for setting up the nets undoubtedly added to the mist netting success. During all camps together, 990 bats were caught with mist nets.

Exploring caves and abandoned buildings

Caves and mines (here regarded as artificial caves), can be interesting places to check for bats. In some cases, bats had already been counted by local researchers, both inside the caves while roosting and outside while emerging. Many other caves and mines were already known to bat researchers, leaving little room to contribute new information. In addition, caves are often fenced off or inaccessible without climbing equipment.

At 14 camps, caves and mines were surveyed for bats. During 2000-Italy, 2002-Bulgaria I, 2006-Macedonia, 2008-Romania, 2009-Portugal II and 2013-Bulgaria II, this method contributed considerably to the survey. Many of these bat populations were already known.

Daytime inspection of abandoned houses and other buildings furthermore proved to be an indispensable source of information for the bat surveys, as did the investigation of bridges, tunnels, canastro's (characteristic small sheds to dry and store crops) and wine cellars (photo 5).

In depopulated agricultural areas many abandoned houses, buildings and factories are found. This is a particularly common phenomenon in parts of France, Spain and Portugal and in parts of Eastern Europe (Romania, Bulgaria, Slovenia, Poland). In the Benelux countries and in Fennoscandia it is much more difficult to find this kind of places; the few abandoned buildings that were found in these countries, however, were not inhabited by bats.

Churches were also inspected, especially church attics and sometimes bell towers. Church buildings were only surveyed in areas where churches that looked promising in terms of offering spaces potentially suitable for roosting bats. Extensive surveys of churches were restricted to areas with many, potentially suitable, churches and where surveys had not recently been carried out.

During ten camps in different regions of France, Belgium, Luxembourg and Eastern Europe (1995-Poland, 2000-Hungary, 2002-Bulgaria, 2008-Romania) and particularly at the 2004-Slovenia and 2005-Slovakia camps, churches were surveyed. During 2005-Slovakia, a remarkably high proportion (14 out of 25) of churches was found to be used by bats, while, during 2004-Slovenia, 24 churches were accessible and in eight of the church attics bats were found. During all camps together, 23,943 bats were identified while exploring caves and abandoned buildings. Groups of bats that were not identified to species level (8,515) are not included in this number.

Collecting and preserving

Casualties

In the Appendix the number of casualties of various species are presented. Most of these animals died after capture. Their death might have been related to starvation, stress, cannibalism and predation (especially shrews eating each other and eating other species), (sometimes unexpectedly) high daytime temperatures and excessive rainfall. Among the 8,652 small mammals captured, 421 casualties

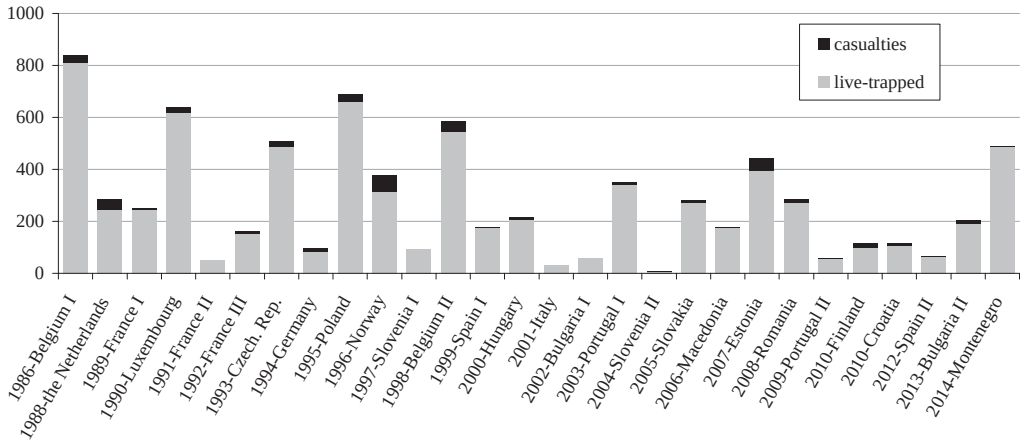

Figure 6. Small mammals caught in traps, with the number of casualties indicated in black.
Source: Field Study Group summer camp reports, listed in Section B of References.

(4.9%), were counted, mostly common shrews (*Sorex araneus*) and pygmy shrews (*Sorex minutus*). Comparing the number of casualties with the number of trapped animals, the pygmy shrew is clearly the most sensitive of all shrews, followed by the common shrew. Obviously, red-toothed shrew species (*Sorex* and *Neomys* spp.) are more sensitive than white-toothed shrew species (*Crocidura* spp.).

Casualty proportions were relatively high in northern countries (figure 6): 1996-Norway (17.2%), 1994-Germany (14.6%), 2010-Finland (14.5%), 1988-the Netherlands (13.9%) and 2007-Estonia (11.2%). These high proportions can be explained by the frequent captures in northern countries of common and pygmy shrews; these species, both of which are relatively sensitive, made up 93% of the casualties in these countries. In the past, several measures were implemented to minimise casualty rates, e.g. by placing traps at locations that are not exposed to direct sunlight, setting traps 'safe' on very hot days (e.g. during a heatwave at 1990-Luxembourg) and by the addition of mealworms (*Tenebrio molitor* larvae) to the regular bait of a peanut butter/oats-mix and apple and carrots; these were standard procedures as of 2007 (Bekker & Bekker 2008).

Preserved specimens

Casualties in traps and animals found dead were measured and labelled before they were preserved. Small mammals were preserved in alcohol or dissected to preserve the dried, flat skin and or the cleaned skull. In consultation with the local researchers the specimens were added to the collection of the Zoological Museum of Oslo (1996-Norway) or transferred to Naturalis, Leiden, the Netherlands. In all other cases specimens were added to the private collections of camp participants (details are given in the respective reports).

DNA sampling

Since 2006, biopsy tissues of bat wing-membranes and occasionally buccal smears of other small mammals were collected by the Field Study Group for DNA analysis. For collecting DNA samples, standard procedures were used, intended to avoid contact with other DNA sources (Anonymous 2012). During 2006-Macedonia a captured Alpine long-eared bat (*Plecotus macrobullaris*) was identified through DNA analysis (Bekker & Boshamer 2007) and subsequently during 2009-Portugal II a *Myotis* species was identified as *Myotis escalerai*.

Table 1. Locations of Field Study Group summer camps with the number of (partially) surveyed UTM-squares (50 x 50 km²). The large number of UTM squares in Norway is explained by the request of the camp staff in 1996 to the participants to take different routes as they changed between camp locations in order to improve their chances to observe mammals. * Second camp location.

Year	Country	Area	UTM sq.	Year	Country	Area	UTM sq.
1986	Belgium I	Gaume	1	2000	Hungary	Zemplen	2
1988	The Netherlands	W.-Zeeuws-Vl.	1	2001	Italy	Onferno N.P.	2
1989	France I	Culoz	2	2002	Bulgaria	E.-Rhodopes	4
1989	France I	Samoëns	*	2003	Portugal I	Alvao N.P.	2
1990	Luxembourg	Wiltz	2	2004	Slovenia II	Rakitovec	2
1991	France I	Limousin	6	2005	Slovakia	Pol'ana	4
1992	France II	Argonne	3	2006	Macedonia	Galicica N.P.	4
1993	Czech. R.	Šumava	3	2007	Estland	Matsalu N.P.	3
1994	Germany	Thüringen	1	2008	Roumenia	Rosia	4
1995	Poland	Pieniny	2	2009	Portugal II	Serra da Estrela	2
1996	Norway	Dovre	22	2010	Finland	Patvinsuo	2
1996	Norway	Trysil	*	2011	Croatia	Biokovo N.P.	2
1997	Slovenia I	Podstene	4	2012	Spain II	Galicia	2
1998	Belgium II	Prelle	2	2013	Bulgaria	W.-Rhodopes	1
1999	Spain I	Siera de Guara	6	2014	Montenegro	Biogradska Gora	3

Bat parasites

Since 2004-Slovenia, ecto-parasites of captured bats were collected and identified (Boshamer 2005). Bats are known to carry large numbers of parasites with them. Although the occurrence of certain types of parasites is often genus- or even species-specific, the general knowledge of the parasite-host relationship shows many gaps. In recent years the interest in ecto-parasites on bats has greatly increased. In prehistoric times the most common bat species in Europe lived in and undoubtedly shared caves with humans for shelter and became synanthrope, in the meantime sharing each other's parasites too. This synanthropy nowadays evokes interest as to what extent these parasites carry pathogens (zoonosis) that pose a risk for people (Mühldorfer 2013).

Mist netted or otherwise captured bats were handled in a fixed sequence. The wing membrane, ears, face and coat were meticulously checked for ecto-parasites, which were removed with tweezers. The parasites collected were identified by dr Jan Kristofik and Peter Mašán of the Institute of Zoology in Bratislava, Slovakia.

Data in UTM-grid

We compared contributions by the Field Study Group to knowledge of the distribution of mammal species in Europe to known and previously known distribution patterns in *The Atlas of European mammals* (Mitchell-Jones et al. 1999). These maps are based on 2,464 terrestrial and coastal 50x50 km² square units in UTM projection; each square represents one of the next three categories. Bold dot: species is present, based on data since 1 January 1970. Small dot: species previously present, presumed presence based on data before 1970, but without evidence the species has become extinct locally. No dot: species absent or not observed (see: Mitchell-Jones et al. 1999 for detailed explanation). In this paper recorded mammal species in squares with a bold dot are regarded as 'confirmed', those with a small dot as 'reaffirmed' and those without a dot as 'new' (table 1).

Species accounts

The total number of mammals observed during all camps between 1986 and 2014 was well over 70,000. The different survey methods used are not evenly distributed over the mammalian orders (figure 7). For instance, for Insectivora and Rodentia, 76% and 69%, respectively, of the observations were done by owl pellet analysis, and 17% and 27%, respectively, of the observations come from live-traps. Lagomorpha and Artiodactyla, on the other hand, were predominantly observed visually (over 79% and 68%, respectively), while 14% and 30% respectively of the observations were signs and tracks. For bats, sightings in caves and abandoned buildings make up more than 83% of the records, and bat detector observations 14%. Most of the observations of Carnivora consist of signs and tracks (57%), and just over 36% of sightings. Obviously, certain observation methods are of minor quantitative importance to some orders, e.g. traps (< 0.5%) and pellets (< 0.5%) to Carnivora and pellets to Chiroptera (< 0.05%).

Of the mammalian orders Insectivora, Chiroptera, Leporidae, Rodentia, Carnivora and Artiodactyla, all species observed during the Field Study Group camps will be briefly described here. The numbers of records per species and per method are given in the Appendix. Records of former species that were split up, are assigned to the newly described species where possible (e.g. *Sorex araneus/coronatus* to common shrew *Sorex araneus* or Millet's shrew *Sorex coronatus*).

Insectivora

The presence of the Western hedgehog (*Erinaceus europaeus*) could be confirmed during 14 camps (table 2). The number of sightings exceeds the number of dead specimens (mainly found on the road). This also applies to the Eastern hedgehog (*Erinaceus rouman-*

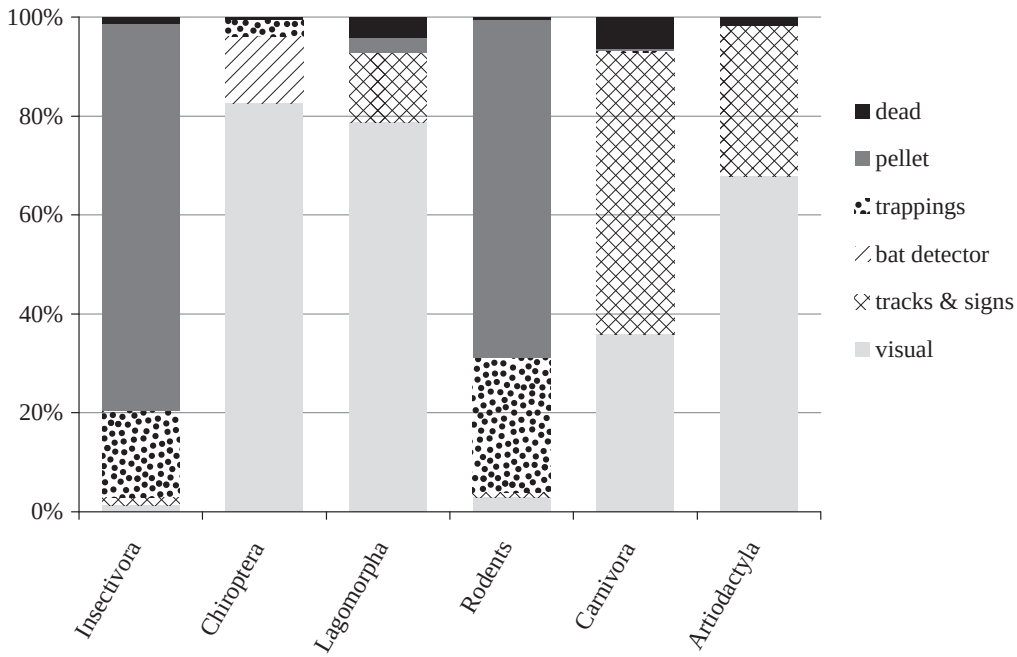

Figure 7. Relative importance of various survey methods per mammalian order. Observations of bats in caves and abandoned buildings in this figure are rendered under 'sightings' and for mist netting under 'trappings'. The observations by camera trapping (Rodents: 17, Carnivora: 34 and Artiodactyla: 7) are not included in this figure.

Table 2. The presence (black dots) of Insectivora established at the summer camps between 1986 and 2014 (all methods included).

	Species	1986-Belgium I	1988-the Netherlands	1989-France I	1990-Luxembourg	1991-France II	1992-France III	1993-Czech. Rep.	1994-Germany	1995-Poland	1996-Norway	1997-Slovenia I	1998-Belgium II	1999-Spain I	2000-Hungary	2001-Italy	2002-Bulgaria I	2003-Portugal I	2004-Slovenia II	2005-Slovakia	2006-Macedonia	2007-Estonia	2008-Romania	2009-Portugal II	2010-Finland	2011-Croatia	2012-Spain II	2013-Bulgaria II	2014-Montenegro
1	*Erinaceus europaeus*	●	●	●	●	●	●	●	●		●		●			●					●			●				
2	*Erinaceus roumanicus*									●		●			●		●		●	●	●		●			●		●	●
3	*Sorex alpinus*			●				●		●		●								●									
4	*Sorex araneus*	●	●	●	●		●	●	●	●	●	●	●		●					●		●	●		●			●	●
5	*Sorex caecutiens*										●																		
6	*Sorex coronatus*	●	●	●	●	●	●						●	●															
7	*Sorex granarius*																	●						●			●		
8	*Sorex isodon*										●																		
9	*Sorex minutus*	●	●	●	●	●	●	●	●		●	●	●		●	●	●			●	●	●	●		●		●		●
10	*Sorex samniticus*															●													
11	*Neomys anomalus*					●		●		●			●		●		●	●		●			●	●					●
12	*Neomys fodiens*	●		●	●	●	●	●	●	●	●		●		●	●				●		●							
13	*Crocidura leucodon*	●	●				●								●	●	●		●	●			●						
14	*Crocidura russula*	●	●	●	●	●	●		●				●	●				●						●			●		
15	*Crocidura suaveolens*							●				●			●	●	●		●	●	●		●	●		●	●	●	●
16	*Suncus etruscus*													●		●													
17	*Galemys pyrenaicus*																	●						●			●		
18	*Talpa caeca*																												●
19	*Talpa europaea*	●		●	●	●	●	●	●	●		●	●	●	●	●	●		●	●		●	●		●		●	●
20	*Talpa occidentalis*																	●						●			●		

icus), which was found at eleven camps.

The Alpine shrew (*Sorex alpinus*) was caught during four camps (1989-France I (Samoëns) (one animal), 1993-Czech R. (one animal), and 1995-Poland (two animals) and 1997-Slovenia (one animal)). Five animals were found dead during two camps, i.e. 1997-Slovenia I (two animals) and 2005-Slovakia (three animals). The most frequently caught shrews were the common shrew (*Sorex araneus*) and Millet's shrew (*Sorex coronatus*). The distinction between trapped *Sorex araneus* and *Sorex coronatus* was not always made during camps; in remains, however, this was possible. These two species were found at 18 and eight camps, respectively. The masked shrew (*Sorex caecutiens*) was caught in Dovre during the 1996-Norway camp, but was not recognised at that time. The identification of one dead individual, which was originally identified as a pygmy shrew, was revised at the Museum of Natural History in Oslo ten years later (van der Kooij 2006; see also van der Kooij et al. (2015), in this issue). During the two camps in Portugal the Spanish shrew (*Sorex granarius*) was caught in live-traps (photo 6) and was also found in owl pellets. The taiga shrew (*Sorex isodon*) was recovered once from Tengmalm's owl pellets, collected at Trysil during the 1996-Norway camp. The occurrence of the pygmy shrew was confirmed with traps during 21 camps. The impressive number of

Photo 6. Live trapped Spanish shrew (*Sorex granarius*) (Portugal, 2009). *Photo: K. Mostert.*

42 specimens found in Estonia may largely be ascribed to the large number of pitfalls used. During most camps, pygmy shrew was captured in modest numbers (1-5 animals). The presence of the Appenine shrew (*Sorex samniticus*), was restricted to 2001-Italy and was only confirmed from owl pellets.

Miller's water shrew (*Neomys anomalus*) was caught in live-traps during nine camps, while the water shrew (*Neomys fodiens*) was caught during 14 camps; both species were also recovered from owl pellets, during respectively eight and nine camps.

The bi-coloured white-toothed shrew (*Crocidura leucodon*) was only caught once outside the Netherlands, during 2008-Romania (one specimen). Three other specimens were caught during 1988-the Netherlands. The greater white-toothed shrew (*Crocidura russula)*, which has a southwest-European distribution, was captured during seven camps; with the owl pellet finds added, it was found during twelve camps. The related lesser white-toothed shrew (*Crocidura suaveolens*) was established at 14 camps and caught at five camps with a total of 28 captures. The pygmy white-toothed shrew (*Suncus etruscus*) was never caught in live-traps, despite several attempts in Mediterranean countries. This species was, however, repeatedly recovered from pellets.

During 2003-Portugal I, a Pyrenean desman (*Galemys pyrenaicus*) was caught with fyke nets set half above and half below the water surface. With the same technique, but with more traps, three specimens were caught and one entangled specimen was found dead during 2012-Spain II. Tracks and signs were only recorded at streams where the presence of the species had previously been confirmed. During 2014-Montenegro, the presence of blind mole (*Talpa caeca*) was established once only by the find of a dead specimen in the highlands. In contrast to the latter, the presence of common mole (*Talpa europaea*) was established frequently by signs and tracks and also in owl pellets, while occasionally a dead specimen was found. During three of the four Iberian Field Study Group camps (2003-Portugal I, 2009-Portugal II and 2012-Spain II) the presence of Iberian mole (*Talpa occidentalis*) was established using three observation methods, i.e. by their characteristic, relatively small, molehills, from remains in pellets and from dead animals.

Chiroptera

During the 1992-France II and 2006-Macedonia camps, several Mediterranean horseshoe bat (*Rhinolophus euryale*) colonies were visited at already known locations with estimated numbers of respectively 60 and 500 individuals (table 3). In addition, during 2004-Slovenia, II this species was found in an abandoned building. the Mediterranean horseshoe bat appeared to be present during nine summer camps (bat detector recordings included). In the Mediterranean part of Europe the lesser horseshoe bat (*Rhinolophus hipposideros*) is most commonly found in abandoned buildings, church attics and caves, which often house maternity roosts. By surveying suitable locations, at least 1072 specimens were found, mostly in small groups of up to several tens of animals. During 2014-Montenegro the largest group found inhabited an empty building where 175 animals were counted. The

Table 3. The presence (black dots) of Chiroptera established at summer camps between 1986 and 2014 (all methods included).

Species	1986-Belgium I	1988-the Netherlands	1989-France I	1990-Luxembourg	1991-France II	1992-France III	1993-Czech. Rep.	1994-Germany	1995-Poland	1996-Norway	1997-Slovenia I	1998-Belgium II	1999-Spain I	2000-Hungary	2001-Italy	2002-Bulgaria I	2003-Portugal I	2004-Slovenia II	2005-Slovakia	2006-Macedonia	2007-Estonia	2008-Romania	2009-Portugal II	2010-Finland	2011-Croatia	2012-Spain II	2013-Bulgaria II	2014-Montenegro
21 *Rhinolophus euryale*					●						●		●		●	●		●		●			●				●	
22 *Rhinolophus ferrumequinum*	●		●		●	●					●		●		●	●	●	●		●		●	●		●		●	
23 *Rhinolophus hipposideros*			●		●		●		●		●		●	●	●	●	●	●	●	●		●	●		●	●	●	●
24 *Rhinolophus mehelyi*																●												
25 *Myotis bechsteinii*			●										●	●				●	●			●	●				●	
26 *Myotis brandtii*										●				●					●					●				
27 *Myotis capaccinii*																●		●										
28 *Myotis dasycneme*		●												●							●	●						
29 *Myotis daubentonii*	●	●	●		●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●	●
30 *Myotis emarginatus*			●								●	●	●	●	●	●	●	●		●		●	●		●	●	●	
31 *Myotis myotis*			●	●	●	●	●	●	●		●		●	●		●		●	●	●		●	●		●		●	
32 *Myotis mystacinus*	●									●	●			●			●	●	●					●			●	
33 *Myotis alcathoe*																										●		
34 *Myotis aurascens*																●				●					●			
35 *Myotis nattereri*			●	●					●				●	●		●	●	●	●			●	●		●			●
36 *Myotis escalerai*																							●			●		
37 *Myotis oxygnathus*					●									●				●	●	●		●	●					
38 *Pipistrellus kuhlii*			●		●						●		●		●	●	●	●		●			●					●
39 *Pipistrellus nathusii*		●	●	●				●	●												●							
40 *Pipistrellus pipistrellus*	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●
41 *Pipistrellus pygmaeus*														●		●			●			●	●		●		●	
42 *Hypsugo savii*													●		●	●	●	●	●				●		●	●	●	●
43 *Nyctalus lasiopterus*														●	●	●			●						●			
44 *Nyctalus leisleri*			●	●			●						●	●	●	●	●	●	●			●	●			●	●	●
45 *Nyctalus noctula*		●		●	●	●	●		●		●	●		●	●	●	●	●	●		●	●			●		●	●
46 *Eptesicus nilssonii*							●		●	●									●		●			●				
47 *Eptesicus serotinus*	●	●	●	●	●	●			●		●	●	●	●	●	●	●	●	●			●	●		●	●		
48 *Vespertilio murinus*									●	●								●				●					●	●
49 *Barbastellus barbastellus*			●								●		●	●			●	●	●			●	●		●	●	●	●
50 *Plecotus auritus*			●				●	●	●	●		●	●	●			●	●	●	●	●	●	●		●	●	●	
51 *Plecotus austriacus*			●										●	●		●	●		●			●	●		●	●		
52 *Plecotus kolombatovici*																									●			
53 *Plecotus macrobullaris*																				●								
54 *Miniopterus schreibersii*																●				●		●			●	●		
55 *Tadarida teniotis*													●			●	●			●			●		●	●	●	●

discovery of 125 animals during 2011-Croatia in an old olive oil mill is also worth mentioning. During 2003-Portugal I, a total of 15 lesser horseshoe bats were found in canastro's (see above) on three occasions, while during 2000-Hungary, 30 lesser horseshoe bats were found in wine cellars. During 1995-Poland, the use of hedgerows as commuting routes was studied (Kapteijn & van Winden 1998). Dozens of greater horseshoe bat (*Rhinolophus ferrumequinum*) roosts were found in abandoned buildings and in churches in the southern part of Europe as well, but their numbers were considerably lower than those of the lesser horseshoe bat (over 251 animals). A mixed colony of greater horseshoe bats and Geoffroy's bats (*Myotis emarginatus*) was found by inspecting a tunnel in a dam in Riglos, which was also inhabited by Natterer's bats (1999-Spain I). During 2000-Hungary a colony with ten greater horseshoe bats was discovered in a wine cellar. Using bat detectors, at eleven camps, at least 45 foraging individuals were traced, predominantly in deciduous forest. Mehely's horseshoe bat (*Rhinolophus mehelyi*) was observed and photographed only once, during 2002-Bulgaria I. At this summer camp, the species was also found to be present in five caves, together with Blasius' horseshoe bat (*Rhinolophus blasii*), in mixed colonies of the two medium-sized Rhinolophid species; both species, however, remained indiscernible (Kapteyn 2003). Several highly suggestive recordings during 2008-Romania I for the presence of Mehely's and Blasius' horseshoe bat species are mentioned by Achterkamp (2009). Because of the remaining uncertainties in identifying bats in these mixed colonies, and of the bat detector recordings made, observations of both species are not included in table 3 and in the Appendix.

A maternity colony of Bechstein's bat (*Myotis bechsteinii*) was found in an old pear tree in Haute Savoie (1989-France I) with eleven animals leaving the roost in the evening. Furthermore, Bechstein's bat was occasionally found in abandoned houses, and in nest boxes for birds in a forest. One dead animal was found on a forest path (2000-Hungary). Bechstein's bat was captured in mist nets at six camps.

During 1996-Norway and 2010-Finland Brandt's bat (*Myotis brandtii*) maternity colonies were found in wooden buildings, one at each camp. Apart from these observations, the species was captured in mist nets during 2000-Hungary and 2005-Slovakia.

In a cave near Visoka Poljana, a roost of approximately 1,000 long-fingered bats (*Myotis capaccinii*) was surveyed (2002-Bulgaria I). In addition, the species was captured in mist nets during three summer camps.

The presence of pond bats (*Myotis dasycneme*) was only established during 1988-the Netherlands and 2000-Hungary (with bat detectors) and during 2007-Estonia and 2008-Romania (with mist nets). On one occasion, a pond bat colony, housed in a farm at Hanila (2007-Estonia), was surveyed; 41 individuals were counted, in the company of three resident Northern bats (*Eptesicus nilssonii*).

The presence of Daubenton's bat (*Myotis daubentonii*) was usually established with bat detectors and, especially in recent years, with mist nets set over streams. An extraordinary discovery of Daubenton's bat was made during 2014-Montenegro, where the species had been previously unknown. During 2007-Estonia, two colonies in trees were found and surveyed (with respectively 10 and 13 animals). At other camps, roosts of Daubenton's bat with 1-10 bats each were found under stone bridges where the animals were hiding in crevices and holes between the stones. Incidentally, Daubenton's bat was observed in an attic of an abandoned house (2005-Slovakia). During 1996-Norway (Dovre) observations of Daubenton's bat were made at the extreme northern border of its range.

Geoffroy's bat (*Myotis emarginatus*) was regularly found during the day in abandoned buildings in the Mediterranean part of Europe. During 1989-France I and 2000-Hungary several colonies were found in caves and

church buildings, some of which were already known. In the aforementioned inspection tunnel at Riglos (1999-Spain I), a large colony of ca. 350 Geoffroy's bats was found, together with Natterer's bats and horseshoe bats. During 1998-Belgian II in the Ardennes a dead specimen was found entangled in barbed wire, a cause of death mentioned earlier for noctules, serotines and Daubenton's bats (Voûte 1992).

Whiskered bats (*Myotis mystacinus*) were found with bat detectors during the earlier camps and more recently by mist netting. During 2003-Portugal I two colonies of respectively 46 and 11 animals were found under bridges. Whiskered bat was also found in abandoned buildings, churches and under bridges, usually in small numbers. Three specimens of a colony of 200 bats, caught in a loft in a former administration building in Malki Voden (2002-Bulgaria I), could be distinguished as *Myotis mystacinus/brandtii*, but had a back fur with clearly visible 'golden coloured' hair tips, and therefore referred to steppe whiskered bat (c.f. *Myotis aurascens*). During 2006-Macedonia and 2011-Croatia the species was also captured in mist nets. During 2012-Spain II the alcathoe whiskered bat (*Myotis alcathoe*) was caught in mist nets and recordered with bat detectors in Spain.

Greater mouse-eared bat (*Myotis myotis*) was established during 17 summer camps. In temperate Europe, (church) attics are a favourite place for nursery-colonies, while in the warmer parts of Europe caves are more commonly used (Dietz et al. 2007). The largest colony surveyed was in a church building in Očová (2005-Slovakia) with 1250 animals emerging from the roost. In other colonies in church buildings surveyed during this camp, respectively 150, 75 and 55 animals were counted. Almost 150 dead animals were found in these church attics. In some locations, such as in a church in Kovácsvágás (2000-Hungary), the roost was shared with lesser mouse-eared bats (*Myotis oxygnathus*), a sibling species. Less frequently, greater mouse-eared bats were observed in abandoned houses, whereas one specimen was discovered under a bridge. Greater mouse-eared bats were furthermore captured frequently in mist nets, as well as it was found with bat detectors. The presence of the lesser mouse-eared bat was established during nine camps, not only in church attics, but also with mist nets (five cases) and at day roosts (three cases).

Twelve camps produced Natterer's bat (*Myotis nattereri*), through bat detector observations and also through mist netting. A roost of four Natterer's bats was found in the aforementioned tunnel at Riglos (1999-Spain I), which was shared with Geoffroy's bat and horseshoe bats. A specimen caught during 2009-Portugal II was afterwards identified as Escalera's bat *Myotis escalerai*, based on a DNA sample; twelve other bats were determined as *Myotis nattereri* sensu lato. Later, during 2012-Spain II, two *nattereri*-like bats were caught; one was determined as *Myotis escalerai* , the other one was later, after DNA analysis, found to belong to a closely related species, provisionally indicated as '*Myotis* SpA' (Salicini et al. 2013).

Kuhl's pipistrelle (*Pipistrellus kuhlii*) was recorded at eleven summer camps, mostly with the use of bat detectors, but in four cases by mist nets captures. Colonies of Kuhl's pipistrelle were found several times. The most notable of these was a colony, found during 2001-Italy, in a concrete electricity pole; an evening count of this colony resulted in 31 emerging animals. In addition, during 2004-Slovenia II, Kuhl's pipistrelle colonies were found in four churches, while during 1999-Spain I a single bat was found under a bridge. The presence of Nathusius' pipistrelle (*Pipistrellus nathusii*) was established during six summer camps, with bat detectors (five camps) and, during 2007-Estonia only, through mist net captures. Also in Estonia, a large colony of Nathusius' pipistrelle was discovered near Matsalu National Park and subsequently in the evening 165 emerging bats were counted. Colonies and roosts of common pipistrelle (*Pipistrellus*

pipistrellus) were found 26 times, primarily by using bat detectors around in built-up areas. By this method many of dozens of maternity colonies were found and counted throughout Europe. One roost of 34 common pipistrelles was found in a concrete electricity pole in the village of Madzharovo (2002-Bulgaria). The species was found at all summer camps except those in Norway and Finland, the locations of which were north of the species' distribution area. In church buildings only dead animals and faeces of this species were found. The Soprano's pipistrelle (*Pipistrellus pygmaeus*) was observed during eight summer camps: seven times by bat detectors and twice (2009-Portugal II and 2014-Montenegro) by mist net captures. So far, roosts of this species were not discovered during summer camps. Savi's pipistrelle (*Hypsugo savii*) was found frequently during summer camps: in eight cases through bat detector observations and in seven through mist netting. Only one roost of Savi's pipistrelle was found, during 2001-Italy, near the village of Gemmano. Hunting animals were discovered in an abandoned potato storage building (2013-Bulgaria II). During 2011-Croatia, Savi's pipstrelle was surprisingly abundant in the coastal region.

The presence of greater noctule (*Nyctalus lasiopterus*) was established during six camps: four times with bat detectors and three times by mist netting (photo 7). During 2000-Hungary, a flight path of this species was discovered over the village of Vágáshuta; frequently passing greater noctules were taken here as an indication of a colony in the area. The roost, however, was not found. The capture of a greater noctule during 2005-Slovakia was the third capture of the species in Slovakia and was published in a local newspaper. The presence of Leisler's bat (*Nyctalus leisleri*) was demonstrated during 16 camps, with bat detectors (at twelve camps) and with mist nets (at eight camps). Only once, during 2000-Hungary, a Leisler's bat roost was discovered, in an old beech, inhabited by 50 animals. A few Leisler's bats were found in bird's nest boxes in the area as well. During 2005-Slovakia, three roosts of this species were found in an old deciduous forest. Noctules (*Nyctalus noctula*) were found during 17 camps, in most cases with bat detectors, but during six camps also with mist nets. A tree roost of this species with 27 emerging individuals was found in the village of Kloostri (2007-Estonia) and during 1991-France II and 1992-France III the flight paths of noctules commuting in a forest were tracked.

The serotine (*Eptesicus serotinus*) was found during 22 camps, mostly by bat detectors. The species was also captured in mist nets several times. Only a few day roosts of serotine were found, with 19 animals all together: four colonies were found during 1992-France III in houses; two other colonies found were located in church attics (2000-Hungary); one animal was found in the attic of a house (2003-Portugal I). The northern bat (*Eptesicus nilssonii*) was observed during six camps: five times by the use of bat detectors and three times by mist net captures, while at two camps a total of four day roosts were found in buildings (1993-Czech R. and 2007-Estonia). The parti-coloured bat (*Vespertilio murinus*) was found during six camps, with bat detectors (three camps) and mist nets (four camps). Before 1995-Poland known day roost in a building near the Polish village of Sromowce Niżne was surveyed, with ca. 25 animals emerging (presumably all males, as previously established by local bat workers). During this camp three (probable) parti-coloured bats were found, emerging from the same roost. During 2008-Romania, the species was discovered in a church attic in the village of Uileacu de Beiuș.

During 1997-Slovenia I, a maternity colony of eleven barbastelles (*Barbastellus barbastellus*) was found in a wooden building in a forest area (photo 8). During 1999-Spain I, an animal was found in an old tunnel, and another specimen in a cave. Eleven other barbastelle records at various camps were mist net captures and bat detector observations. During

Photo 7. Mist netted greater noctule (*Nyctalus lasiopterus*) (Slovakia, 2013). *Photo: K. Mostert.*

2014-Montenegro, the occurrence of barbastelle was established by means of sound analysis; this was the second record for this country.

Brown long-eared bats (*Plecotus auritus*) were found during 17 camps; only three times records were based on bat detector calls and seven times brown long-eared bats were captured by mist nets. Many dozens of colonies and roosts of both brown and grey long-eared bat (*Plecotus austriacus*) were found in church buildings and, to a lesser extent, in abandoned buildings. In the southern Pyrenees, both species were found frequently in old tunnels (1999-Spain I). The largest group of grey long-eared bats was located during 2005-Slovakia, in a church attic; 86 animals and one brown long-eared bat were counted. During 2000-Hungary a total of 29 grey long-eared bats were found in five church attics. During 2006-Macedonia one Alpine long-eared bat (*Plecotus macrobullaris*) was captured in a mist net, while the Balkan long-eared bat (*Plecotus kolombatovici*) was only found in Podgora (2011-Croatia), where eight animals were caught in mist nets.

Schreibers' bat (*Miniopterus schreibersii*) was found at seven camps. Three times records were based on bat detector calls and three times the species was captured in mist nets. Large colonies of this species were found during several camps in southern Europe, mostly in caves in mountainous areas. On one occasion a (previously known) colony in a column of a railway bridge was visited (1991-France II). In Onferno (2001-Italy I), 5000 Schreibers' bats emerging from a cave were counted and subsequently followed on their commuting routes by point counting passing bats in the vicinity. The outcome revealed that the vast majority of the Schreibers' bats used linear landscape elements to commute between the cave and foraging

Photo 8. Barbastelle (*Barbastella barbastellus*) colony (Slovenia, 1997). *Photo: K. Spoelstra.*

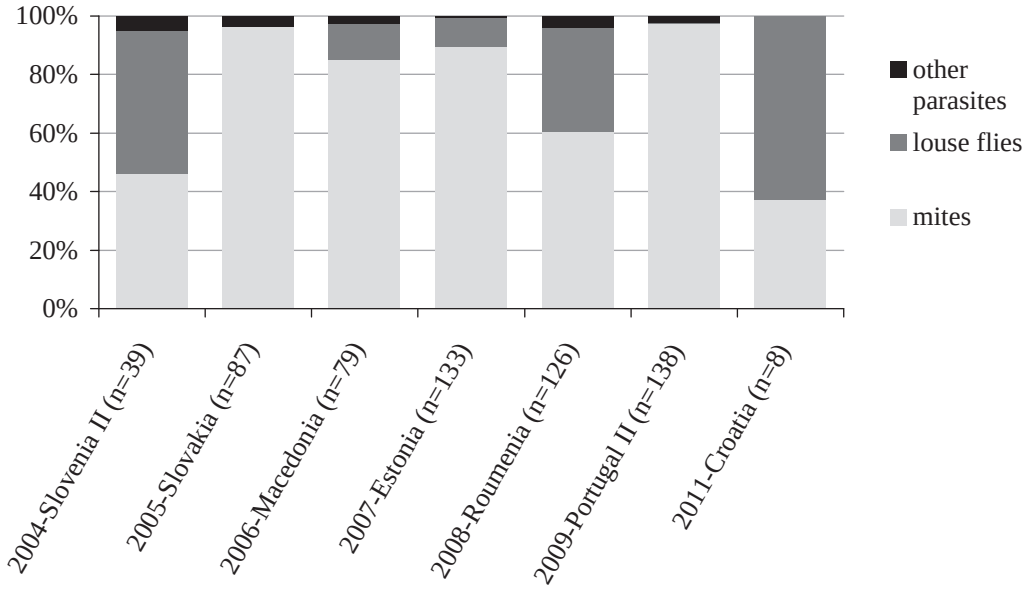

Figure 8. Proportions of different bat parasites collected during seven summer camps.
Sources: Field Study Group summer camp reports, listed in Section B of References and Jan Kristofik (personal communication).

sites (Buys 2002). During 2002-Bulgaria I this species was found roosting in an attic as well.

The European free-tailed bat (*Tadarida teniotis*) was observed during ten camps, with bat detectors and with the naked ear. In addition, a day roost was found at both 2002-Bulgaria I and 2003-Portugal I; for Bulgaria, this was the first known record.

Bat Parasites

During eight camps, 2003-Portugal I, 2004-Slovenia II, 2005-Slovakia, 2006-Macedonia, 2007-Estonia, 2008-Romania, 2009-Portugal II and 2011-Croatia, one or more parasites were collected from a total of 248 bats of 23 species. The single bat parasite taken during 2003-Portugal was not reported as identified (Kosten 2004). A total of 606 parasites were collected, consisting for more than 80% of mites of 18 different species. Louse flies (Diptera: Hippoboscidae) (eleven species) made up 15% of the parasites. Fleas (Siphonaptera) (four species), ticks (Ixodidae) (two species) and bugs (Hemiptera) (two species) were found much less frequently (figure 8). The only parasite free bats were three bats captured during the camp in Finland.

It appears that cave dwelling bats in southern Europe carry a greater number of parasites than (partly) arboreal species. Young animals too seem to be more frequently infested with parasites than older animals, probably because they cling to each other in large groups and only later in life start grooming, thereby removing parasites. Mites were found on all bats at all locations, except Finland. In addition considerable numbers of louse flies were found in southern-European countries.

Particularly, bat species belonging to the genus *Myotis* were found to be infested with large numbers of mites and louse flies. The most commonly observed mites were *Spinturnix andegavinus* and *Spinturnix myoti*, which, like all *Spinturnix* species, are bat-restricted. The, sometimes numerous, occurrence of these mites appears to be the result of a high degree of adaptation to their hosts. *Spinturnix andegavinus*, for instance, is

Table 4. The presence (black dots) of Lagomorpha established at the summer camps between 1986 and 2014 (all methods included).

Species	1986-Belgium I	1988-the Netherlands	1989-France I	1990-Luxembourg	1991-France II	1992-France III	1993-Czech. Rep.	1994-Germany	1995-Poland	1996-Norway	1997-Slovenia I	1998-Belgium II	1999-Spain I	2000-Hungary	2001-Italy	2002-Bulgaria I	2003-Portugal I	2004-Slovenia II	2005-Slovakia	2006-Macedonia	2007-Estonia	2008-Romania	2009-Portugal II	2010-Finland	2011-Croatia	2012-Spain II	2013-Bulgaria II	2014-Montenegro
56 *Lepus castroviejoi*																										●		
57 *Lepus europaeus*	●	●	●	●	●	●	●		●		●	●		●	●	●		●	●	●	●				●		●	●
58 *Lepus timidus*										●														●				
59 *Oryctolagus cuniculus*	●	●	●	●	●							●	●	●	●	●	●			●			●					

known to parasitise specifically on Daubenton's bat (Lučan 2006). The exact taxonomic status of this mite species is still unclear; it is sometimes regarded as a subspecies of *Spinturnix myoti* (Haitlinger & Piksa 2012). The latter is found on several *Myotis* species, such as greater mouse-eared bat and lesser mouse-eared bat and species comprising the *Myotis nattereri /escalerai* /SpA/SpB complex (Baker & Craven 2003). Other host-specific mites are *Spinturnix dasycneme* which is restricted to pond bats and *Spinturnix plecotinus* which is found on both brown long-eared and grey long-eared bats. Yet another mite, *Spinturnix kolenatii,* is found to parasitise on multiple European bat species, including serotine, Northern bat, noctule and lesser mouse-eared bat (Haitlinger & Walter 1997).

Leporidae

During 2012-Spain II the broom hare (*Lepus castroviejoi*) was only observed in the Galician highlands (table 4). The brown hare (*Lepus europaeus*) was found during 21 camps, mostly through sightings, but traffic victims were also found frequently and it was also recorded by camera traps. The mountain hare (*Lepus timidus*) was only recorded in Fennoscandia (1996-Norway and 2010-Finland). The rabbit (*Oryctolagus cuniculus*) was observed during 13 camps, least often in the southeast European countries.

Rodentia

The red squirrel (*Sciurus vulgaris*), which occurs almost everywhere in Europe, was found at 24 camp locations (table 5). Its presence is usually evidenced by sightings, less often by its characteristic feeding signs too. At seven camp locations dead animals were found, mostly traffic victims. The alpine marmot (*Marmota marmota*) was only seen in the Alpine region (1989-France I), where (burrow) signs of its presence were recorded as well. Another ground squirrel, the European souslik (*Spermophilus citellus*) was encountered during three camps (2000-Hungary, 2002-Bulgaria, 2005-Slovakia). In Hungary, the typical burrows with sand in front of the entrance and perpendicular escape burrows, were also found. In Slovakia, 118 individuals were counted in a combined survey effort. During 2010-Finland, characteristic signs of beavers were found. Since only the Canadian or American beaver (*Castor canadensis*) was known from the camp location, and since the nearest European beaver (*Castor fiber*) population was ca. 350 km, these signs were linked to the Canadian beaver. This supposition is corroborated by the fact that, at sites

Table 5. The presence (black dots) of Rodentia established at the summer camps between 1986 and 2014 (all methods included).

	Species	1986-Belgium I	1988-the Netherlands	1989-France I	1990-Luxembourg	1991-France II	1992-France III	1993-Czech. Rep.	1994-Germany	1995-Poland	1996-Norway	1997-Slovenia I	1998-Belgium II	1999-Spain I	2000-Hungary	2001-Italy	2002-Bulgaria I	2003-Portugal I	2004-Slovenia II	2005-Slovakia	2006-Macedonia	2007-Estonia	2008-Romania	2009-Portugal II	2010-Finland	2011-Croatia	2012-Spain II	2013-Bulgaria II	2014-Montenegro
60	*Sciurus vulgaris*	●		●	●	●		●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●
61	*Marmota marmota*			●																									
62	*Spermophilus citellus*																●			●									
63	*Castor canadiensis*																								●				
64	*Castor fiber*			●							●											●							
65	*Cricetus cricetus*														●														
66	*Myopus schisticolor*										●														●				
67	*Lemmus lemmus*										●																		
68	*Myodes glareolus*	●	●	●	●	●	●	●		●	●	●	●	●	●	●				●		●	●	●	●	●	●	●
69	*Myodes rufocanus*										●																		
70	*Dinaromys bogdanovi*																									●			
71	*Arvicola sapidus*					●								●				●						●		●			
72	*Arvicola scherman*																			●			●						
73	*Arvicola terrestris*	●	●	●	●	●	●	●	●	●			●		●	●						●							
74	*Ondatra zibethicus*		●		●	●				●														●					
75	*Microtus agrestis*	●	●	●	●	●	●	●	●	●	●		●	●				●		●		●	●	●		●			
76	*Microtus arvalis*	●	●	●	●	●	●	●	●	●		●	●		●				●	●		●	●					●	
77	*Microtus cabrerae*													●															
78	*Microtus duodecimcostatus*													●															
79	*Microtus gerbei*					●																							
80	*Microtus levis*																●												
81	*Microtus lusitanicus*																	●						●		●			
82	*Microtus multiplex*																		●										
83	*Microtus oeconomus*										●																		
84	*Microtus savii*															●													
85	*Microtus subterraneus*	●	●		●	●	●	●		●		●	●		●		●			●	●		●						●
86	*Chionomys nivalis*			●																	●						●		
87	*Nannospalax leucodon*																				●								●
88	*Micromys minutus*	●	●	●		●	●	●	●													●	●						
89	*Apodemus agrarius*									●					●				●			●	●						
90	*Apodemus flavicollis*	●		●	●	●	●	●	●	●		●	●	●	●	●	●		●	●	●	●	●			●			●
91	*Apodemus sylvaticus*	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●	●		●
92	*Rattus norvegicus*	●	●	●	●	●		●	●	●		●	●	●	●	●	●		●	●		●				●	●		●
93	*Rattus rattus*						●						●	●	●	●	●												
94	*Mus musculus*	●	●	●	●	●	●	●	●	●			●		●	●	●			●		●	●						
95	*Mus spicilegus*														●														
96	*Mus spretus*													●			●	●						●					
97	*Glis glis*	●		●		●	●			●		●			●	●	●		●	●	●		●			●	●		
98	*Muscardinus avellanarius*	●		●		●	●	●		●		●			●	●			●	●	●		●				●		
99	*Eliomys quercinus*			●	●	●	●	●						●				●								●	●		
100	*Dryomus nitedula*																●			●								●	●
101	*Sicista betulina*																					●							
102	*Hystrix cristata*															●													
103	*Myocastor coypus*															●													

in Finland where both species were released, the Canadian beaver apparently displaced the European beaver (Tattersall 1999). During 1989-France I, 1996-Norway and 2007-Estonia the European beaver was observed visually, while numerous signs of its presence were found as well.

The lesser mole rat (*Nannospalax leucodon*) was caught by hand in the highlands near Ohrid (2006-Macedonia). The characteristic signs of its presence were found during the same camp, and also during the camp in the highlands of Montenegro (2014).

The common hamster (*Cricetus cricetus*) has only been encountered in live-traps and in pellets of lesser spotted eagle (2000-Hungary). During 1996-Norway, the wood lemming (*Myopus schisticolor*) was found in pellets of Tengmalm's owl, while during 2010-Finland one specimen was observed and signs of its presence were found (photo 9). Only during 1996-Norway, two specimens of the mountain lemming (*Lemmus lemmus*) were found in prey remains of red fox (*Vulpes vulpes*) and raven (*Corvus corax*), while signs of mountain lemming (not further specified in the concerning report) were found at least five times.

The bank vole (*Myodes glareolus*) was encountered during 21 camps. With 19% of the total number of small mammals, the bank vole is the second most trapped small mammal, but it was only rarely found in pellets (2%). By contrast, the grey-sided vole (*Myodes rufocanus*), which, within Europe, is restricted to Fennoscandia, was only found in pellets of Tengmalm's owl (1996-Norway).

The presence of the Balkan snow vole (*Dinaromys bogdanovi*) could only be demonstrated during 2011-Croatia, where it was trapped in the fringe of stones around a doline and found in eagle owl pellets (photo 10).

The southern water vole *Arvicola sapidus* has been noticed during 1991-France II and the Iberian camps by skull remains in pellets. Also, during 2003-Portugal I and 2009-Portugal II, both were found by direct observation and signs. The water vole *Arvicola terrestris* was recorded 14 times during camps, in most cases through pellet analysis, a few times by direct observation or signs, twice with traps (1986-Belgium I, 1998-Belgium II) and also twice with a camera trap (2013-Bulgaria II). Occurrence of the montane water vole (*Arvicola scherman*), which has recently been split off from *Arvicola terrestris*, was only demonstrated through signs (2005-Slovakia) and skull remains in pellets (1991-France II, 2008-Romania).

Photo 9. Runways of wood lemming (*Myopus schisticolor*) between tufts of lichen (Finland, 2010). *Photo: K. Mostert.*

Muskrats (*Ondatra zibethicus*) were found during five camps by their characteristic droppings, by tracks and by the subaquatic entrances of burrows; during two camps animals were also seen (1990-Luxembourg, 2010-Finland).

The field vole (*Microtus agrestis*) was found during 19 camps: 15 times in owl pellets and 13 times in traps. The common vole (*Microtus arvalis*), here considered together with sibling vole (*Microtus levis*), represented 25% of all prey remains in owl pellets, but no more than 10% of the small mammals trapped.

Photo 10. Balkan snow vole (*Dinaromys bogdanovi*), with its characteristic long whiskers (Croatia, 2011). *Photo: K. Mostert.*

Given its large range the species appears to be significantly under-represented in traps (see: Seasonal effects). The common vole was found during 17 camps, while the sibling vole was only caught during the two camps in Bulgaria. Cabrera's vole (*Microtus cabrerae*), which has a strictly Iberian distribution, was recorded only once, during 1999-Spain I, when three specimens were recovered from owl pellets from the southern Pyrenees. During the same camp, Mediterranean pine vole (*Microtus duodecimcostatus*) was found in large numbers in owl pellets. Not a single specimen was captured, however. Even so, the Pyrenean pine vole (*Microtus gerbei*) was only found in prolific numbers in owl pellets in the Limousin (1991-France II). During three Iberian summer camps (2003-Portugal I, 2009-Portugal II, 2012-Spain), the Lusitanian pine vole (*Microtus lusitanicus*) was frequently found in owl pellets; in addition it was trapped four times during 2003-Portugal I. One specimen of the Alpine vole (*Microtus multiplex*) was found in owl pellets (2004-Slovenia II). Root vole (*Microtus oeconomus*) was only found during 1996-Norway, with several captures and a single specimen in owl pellets. Savi's pine vole (*Microtus savii*) was never trapped during camps but its presence was confirmed during the Italian camp by a great number of remains in owl pellets. Pine vole (*Microtus subterraneus*) was found during 16 camps; it was captured in traps during twelve camps and recovered from owl pellets during six camps. Snow vole (*Chionomys nivalis*) was trapped during two camps (2006-Macedonia, 2012-Spain), and found in an owl pellet once (1989-France I).

Harvest mouse (*Micromys minutus*) was trapped once (1988-the Netherlands) and hand-captured once more (2007-Estonia). However, in owl pellets the species was found to be present at seven other summer camp locations in considerable numbers. During five summer camps the striped field mouse (*Apodemus agrarius*) was found: at four camps in traps and also at four in owl pellets, with 104 and 61 specimens, respectively. During 23 summer camps the yellow-necked mouse (*Apodemus flavicollis*) was found, at 22 camps in traps (544 specimens) and at 15 camps in owl pellets (1558 specimens). Wood mouse (*Apodemus sylvaticus)* was present during 24 summer camps, and was caught 22 times in traps (2571 specimens) and recovered 18 times from owl pellets (1319 specimens), underlining its broad ecological amplitude and trap happiness. The presence of brown rat (*Rattus norvegicus*) was demonstrated once by live-trapping during 1986-Belgium I. During eight camps (including Belgium I) the species was found in pellets; the remaining findings, mostly road kills, were from 16 camps. Black rat (*Rattus rattus*) too was trapped only once (1998-Belgium II). The species was also found in owl pellets from seven other, southern and eastern European countries. During 2002-Bulgaria I 'several' *Mus* specimens found in owl pellets probably had to be ascribed to Balkan short-tailed mice (*Mus macedonicus*). A definitive identification could, however, not be made (Mostert 2003). Even so, the live-trapped *Mus* specimens could not be identified at species level (Bekker 2003). House mouse (*Mus musculus*) was found during 16 summer camps: nine times in traps and 13 times in owl pellets.

Photo 11. Forest dormouse (*Dryomys nitedula*) (Bulgaria, 2013). *Photo: L. Soerink.*

Apart from signs, proof of the occurrence of the steppe mouse (*Mus spicilegus*) was found only once in pellets of a buzzard (2000-Hungary). During the four Iberian summer camps the Algerian mouse (*Mus spretus*) was found through trapping (three times) and pellet analysis (four times).

Edible dormouse (*Glis glis*) was found at 17 camp locations. The species was found during six camps in pellets; the predator was predominantly a tawny owl (32 specimens) and less frequently Ural owl (8) and barn owl (4); in twelve cases the predator was unknown. During twelve camps the characteristic nests of common dormouse (*Muscardinus avellanarius*) were found; its presence was also established through trapping and pellet analysis. The totals from pellets per predator species are: barn owl (26), tawny owl (5), Ural owl (1), unknown predator (1). Garden dormouse (*Eliomys quercinus*) was caught in Longworth traps and once, during 1990-Luxembourg, in a fairly large number (30 specimens) in traps placed on the ground. During other camps this species was caught as well, often in trees and also repeatedly indoors. Garden dormouse was found in pellets of barn owl, tawny owl and Ural owl and pellets of an unknown predator, with one specimen each. Forest dormouse (*Dryomys nitedula*) was found during four camps, mostly by trapping in trees (photo 11). However, one animal was trapped on the ground (2014-Montenegro). Forest dormouse was found in owl pellets during 2002-Bulgaria I only: 15 times these pellets came from tawny owl and once from barn owl. During 2005-Slovakia a nest of this species was discovered in a specially prepared nest box.

The only representative of the Dipodidae family, the birch mouse (*Sicista betulina*), was found in pitfalls as well as in owl pellets (2007-Estonia).

During 2001-Italy, a crested porcupine (*Hystrix cristata*) was briefly observed. Its presence at this location was furthermore confirmed by the large burrow entrances and quills found occasionally. During the same camp, tracks of a coypu (*Myocastor coypus*) could be established. These were the only signs of this exotic species.

Carnivora

Wolf (*Canis lupus*) could be established during four camps (table 6). During 2012-Spain II, two young animals were spotted twice, two provoked calls were heard and one camera trap recording proved the presence of wolf. In other camps only signs could be found. Red fox (*Vulpes vulpes*) was proved to be present during 25 camps; in 19 camps by signs (droppings), 17 by sightings, 10 by traffic victims and during four camps (2011-Croatia, 2012-Spain II, 2013-Bulgaria II, and 2014-Montenegro) via camera traps. Raccoon dog (*Nyctereutes procyonoides*) was observed only during 2007-Estonia, using four different observation methods. Brown bear (*Ursus arctos*) was

Table 6. The presence (black dots) of Carnivora established at the summer camps between 1986 and 2014 (all methods included).

Species	1986-Belgium I	1988-the Netherlands	1989-France I	1990-Luxembourg	1991-France II	1992-France III	1993-Czech. Rep.	1994-Germany	1995-Poland	1996-Norway	1997-Slovenia I	1998-Belgium II	1999-Spain I	2000-Hungary	2001-Italy	2002-Bulgaria I	2003-Portugal I	2004-Slovenia II	2005-Slovakia	2006-Macedonia	2007-Estonia	2008-Romania	2009-Portugal II	2010-Finland	2011-Croatia	2012-Spain II	2013-Bulgaria II	2014-Montenegro
104 *Canis lupus*																●	●		●									
105 *Vulpes vulpes*	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●
106 *Nyctereutes procyonoides*																					●							
107 *Ursus arctos*										●	●								●					●				
108 *Procyon lotor*				●																								
109 *Mustela erminea*	●		●	●	●					●	●	●							●									
110 *Mustela nivalis*	●	●	●	●	●	●	●			●		●	●	●	●		●			●		●						
111 *Mustela putorius*		●		●	●				●		●	●				●		●	●			●						
112 *Neovison vison*										●		●						●	●		●							
113 *Martes foina*	●		●	●	●	●		●			●	●	●	●	●			●	●	●		●	●				●	●
114 *Martes martes*			●	●	●	●	●		●	●	●	●	●	●					●		●			●		●	●	●
115 *Gulo gulo*																								●				
116 *Meles meles*	●		●	●	●	●	●			●	●	●	●	●	●			●	●	●		●			●	●		●
117 *Lutra lutra*					●		●			●				●	●	●		●	●	●	●	●	●	●		●	●	
118 *Genetta genetta*					●								●										●			●		
119 *Felis silvestris*						●										●		●							●		●	
120 *Lynx lynx*							●												●									

found during four camps, by sightings (two camps) and by various signs, including an abandoned den during 1996-Norway (Trysil). Only once signs of the raccoon (*Procyon lotor*) were found (1990-Luxembourg).

The occurrence of stoat (*Mustela erminea*) was proven with three different methods: sightings, as traffic victims and in pellets and excrements, altogether at eight summer camps. Weasel (*Mustela nivalis*) was observed during 16 camps, with the same methods. Furthermore, weasel is the only predator that was caught in traps. Western polecat (*Mustela putorius*) was found during ten camps (by sightings, signs and dead animals) while American minks (*Neovison vison*) were found by sightings and tracks during three camps (1996-Norway, 1998-Belgium II, 2007-Estonia). Beech marten (*Martes foina*) was found during 19 camps, in most cases by its signs (droppings) and also quite frequently by sightings. The presence of pine marten (*Martes martes*) was established at 17 camps, most frequently by signs (droppings) and three times by sightings and camera trapping. Wolverine (*Gulo gulo*) was observed only once; this concerned a bait-lured animal during 2010-Finland. At other locations tracks of this species were found as well. Badger (*Meles meles*) was found during 20 camps, through signs, sightings and dead animals. It was also recorded with a camera trap on one occasion. Otter (*Lutra lutra*) was seen during two camps only, while during twelve other camps signs, almost always spraints, were frequently found. On one occasion, a camera trap photograph confirmed the presence of otter (2013-Bulgaria II).

The common genet (*Genetta genetta*) was

Photo 12. Wild cat (*Felis silvestris*) recorded by a camera trap (Croatia, 2011). *Photo: camera trap.*

Photo 13. Wild boar (*Sus scrofa*), killed by traffic and already discovered by scavengers (Spain, 2012). *Photo: K. Mostert.*

Photo 14. Alpine chamois (*Rupicapra rupicapra*) spotted at the bottom of a doline (Croatia, 2011). *Photo: K. Mostert.*

found during four summer camps in southwestern Europe, mostly by its characteristic droppings, and once through a sighting (1999-Spain I). On three locations, during 2009-Portugal II, pictures with a camera trap were made. The presence of wild cats (*Felis silvestris*) was confirmed during five summer camps, four times by sightings, once by a camera trap and three times by tracks (photo 12). During 2005-Slovakia, a female lynx (*Lynx lynx*) and her two cubs were spotted, while at one other summer camp tracks were discovered (1993-Czech R.).

Artiodactyla

Wild boars (*Sus scrofa*) were found during 20 camps (table 7); in all cases tracks and signs were found, while animals were sighted four times. Wild boar was furthermore confirmed by one traffic victim (photo 13), and by a camera trap recording. Moose (*Alces alces*) was found at the three northernmost camp locations, i.e. 1996-Norway, 2007-Estonia, 2010-Finland, both through sightings and signs (droppings). Red deer (*Cervus elaphus*) were found to be present during 14 camps, based in all cases on signs and in few cases also on sightings. With observations during 21 camps, the roe deer (*Capreolus capreolus*) turned out to be the most often found even-toed ungulate.

Directly after the camp in Norway (1996), one of the participants reported the sighting of reindeer (*Rangifer tarandus*) from the Dovre area; this was the only record of this species during the camps. Alpine chamois (*Rupicapra rupicapra*) was only seen in the Alps (1989-France I), the Tatra mountains (1995-Poland) and the Dinaric highlands (2011-Croatia) (photo 14). During 1996-Norway (Dovre) a small group of musk ox (*Ovibus moschatus*) was observed, the only musk oxes ever encountered during the camps. A skull of a mouflon (*Ovis ammon*) was collected during 1990-Luxembourg.

Table 7. The presence (black dots) of Artiodactyla established at the summer camps between 1986 and 2014 (all methods included).

Species	1986-Belgium I	1988-the Netherlands	1989-France I	1990-Luxembourg	1991-France II	1992-France III	1993-Czech. Rep.	1994-Germany	1995-Poland	1996-Norway	1997-Slovenia I	1998-Belgium II	1999-Spain I	2000-Hungary	2001-Italy	2002-Bulgaria I	2003-Portugal I	2004-Slovenia II	2005-Slovakia	2006-Macedonia	2007-Estonia	2008-Romania	2009-Portugal II	2010-Finland	2011-Croatia	2012-Spain II	2013-Bulgaria II	2014-Montenegro
121 *Sus scrofa*			●	●		●	●	●				●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	
122 *Cervus elaphus*				●	●	●	●		●	●	●	●		●	●	●		●	●									●
123 *Alces alces*										●											●			●				
124 *Rangifer tarandus*										●																		
125 *Capreolus capreolus*	●		●	●	●	●	●	●	●	●	●	●		●	●	●		●	●	●	●	●				●	●	
126 *Rupicapra rupicapra*			●						●																●			
127 *Ovibus moschatus*										●																		
128 *Ovis ammon*				●																								

General remarks

Contribution to the knowledge of species distribution

The mammal that was most often reported during Field Study Group camps was the common pipistrelle (26 camps), closely followed by the red fox (at 25 camps) and red squirrel and wood mouse (both 24 camps). Other relatively widespread and abundant species were pygmy shrew, common mole, roe deer and hare, all of which were observed during 21 camps.

The 28 Field Study Group camps held between 1986 and 2014 have considerably contributed to the present knowledge of the distribution of mammals in Europe. The results of the camp surveys confirmed the previously known presence of a number of mammal species in 1,268 50x50 km UTM grid squares, reaffirmed their presence after 1970 in 35 squares and proved their previously unknown presence in 218 new squares (figure 9). The highest proportion of new squares was established for Chiroptera (65%), followed by Rodentia (15%), Insectivora (11%), Carnivora (7%) and Leporidae (2%). No new squares were recorded for Artiodactyla.

An explanation for the expanding knowledge of the distribution of bats seems to be the development of new equipment: bat detectors, including sound analysis tools, and mist nets. The much smaller contribution to the distribution of Leporidae, the larger Rodentia, Carnivora, and Artiodactyla is probably due to the basic knowledge and interest that already exists within the local human population and the fact that encounters with these more conspicuous, medium-sized and large mammals are relatively common.

The relatively high yield for Chiroptera is even an underestimation considering the fact that all recently described species (*Myotis alcathoe*, *Myotis aurascens*, *Myotis escalerai*, *Pipistrellus pygmaeus*, *Plecotus macrobullaris*, and *Plecotus kolombatovici*) were not included in *The Atlas of European Mammals* (Mitchell-Jones et al. 1999) and were therefore not taken into account in figure 9.

Only a handful of the mammal observations made before 1999, the year of publication of the European Atlas, were actually inserted in the atlas. Obviously, these observations were excluded from the categories 'new' or 'reaffirmation after 1970', e.g. in the case of the taiga shrew (1996-Norway, Trysil). In general, four

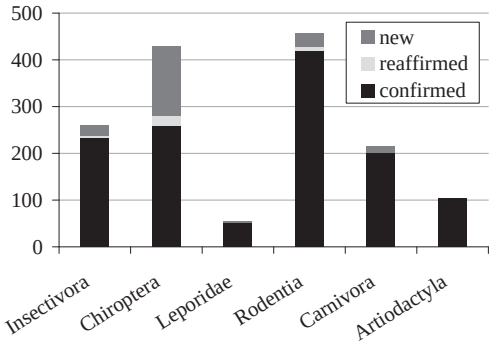

Figure 9. Confirmed, reaffirmed and new UTM grid squares (50x50 km) for each of the European mammal orders, established by the Field Study Group of the Dutch Mammal Society between 1986 and 2014.

different categories can be discerned among squares with new records of mammal species: 1. Squares filling in gaps in a more or less continuous distribution (e.g. greater noctule in 2013-Bulgaria II). 2. Squares at the edge of the known distribution of species (e.g. common mole in 1999-Spain I, 2007-Estonia, 2010-Finland). 3. Squares extending the known distribution of species (e.g. red squirrel in 2003-Portugal I, 2009-Portugal II). 4. Addition of new squares for relatively unknown species in less investigated areas or countries (e.g. small mammals in Romania).

Rare or underestimated?

In spite of the general opinion that some mammal species are extremely rare, several of those species have been trapped or otherwise observed during multiple camps. The following examples nicely illustrate this phenomenon. As mentioned earlier, Miller's water shrew was caught during nine of the 28 camps, while water shrew was caught during 14 camps. Experiences from the summer camps do support the supposition that water shrews, although usually present in low densities, are not difficult to catch (Twisk et al. 2010). The presence of Leisler's bat was demonstrated during many camps (16), in most cases with bat detectors (12) and in eight cases with mist nets. To a lesser extent this applies too barbastelle and Bechstein's bat, which were recorded during ten respectively eight camps. These observations contradict the descriptions of Leisler's bat as 'considered to be vulnerable' (Shiel 1999), of barbastelle as 'one of the rarest bats in western Europe' (Urbańczyk 1999), and of Bechstein's bat as 'considered rare nearly everywhere' (Schlapp 1999).

Missing mammal species

Some mammal species were not recorded during any of the camps, despite their known presence in the areas visited (Mitchell-Jones et al. 1999). Two of these are explicitly mentioned here. The western broad-toothed field mouse (*Apodemus epimelas*) was never trapped or otherwise observed during 2004-Slovenia II, 2006-Macedonia, 2011-Croatia and 2014-Montenegro. During the same camps, golden jackal (*Canis aureus)* was not observed either. The odds of finding a species directly depends on the survey efforts in the field (as for the golden jackal), the general success of trapping or the availability of owl pellets (as for the western broad-toothed field mouse). Although the total amounts of small mammals in owl pellets during the camps in these regions were low (62), the other survey methods used seemed to be rather promising, but clearly insufficient to meet the odds for solid observations of the golden jackal and the western broad toothed field mouse.

Effects of season

As the name 'summer camp' implies, trapping and observation during these camps are restricted to the summer months, i.e. the period around the end of July till early August. During this period, the numbers of Soricidae (shrews) and Cricetidae (voles etc.) in traps were considerably lower at camps

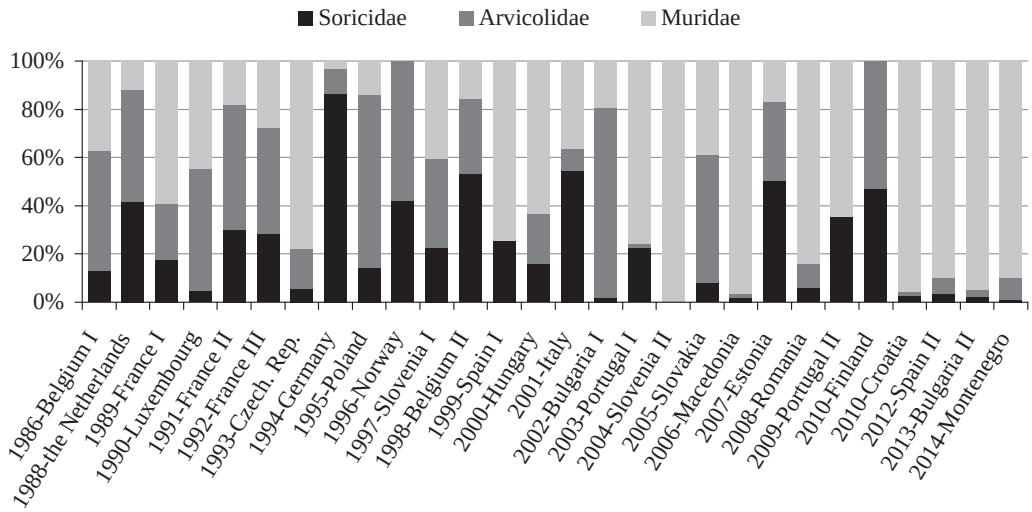

Figure 10. Proportions of Soricidae (shrews), Cricetidae (voles etc.) and Muridae (rats and mice) in live-traps. Source: Field Study Group summer camp reports, listed in Section B of References.

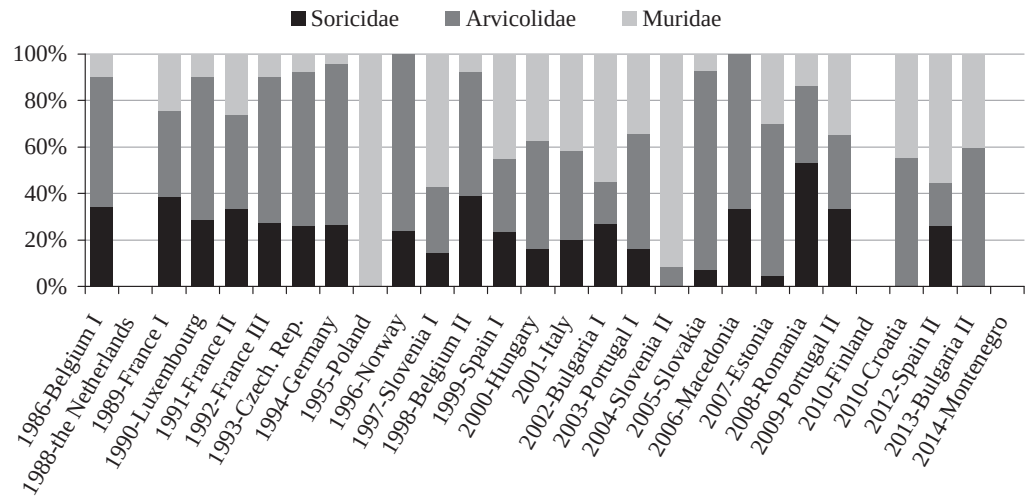

Figure 11. Proportions of Soricidae (shrews), Cricetidae (voles etc.) and Muridae (rats and mice) in pellets. Source: Field Study Group summer camp reports, listed in Section B of References.

held in Mediterranean countries (Spain I and II, Italy and Portugal I and II) than at those held in central and northern Europe (figure 10). There is no indication that these families are actually rare or absent in these regions, as shown by owl pellet analyses (figure 11). An explanation for this discrepancy for Soricidae and Cricetidae could be a possible confinement in summer of the home ranges of these rodents, which then adopt a more subsoil or even subterranean life style when food is plenty available as arthropods or juicy roots.

For the harvest mouse, there may be another explanation for the seasonal variation in capture success. This species, in spite of it having been found during nine camps, was frequently recorded in owl pellets and through signs of its presence (mainly nests),

but it was captured in a live-trap only once (1988-the Netherlands) and hand-captured only once (2007-Estonia). However, harvest mouse was commonly found in live-traps during other Field Study Group camps held in autumn, (e.g. Bosman & Margry 1983, Lange et al. 1992, Bekker & van der Linden 2003). This striking difference in trapping success may be caused by the species' habit of using 'the third dimension', i.e. long leaves or stems of grasses, in summer - for 'safe' nesting and foraging on fresh seeds -, i.e. outside the reach of live-traps at ground level, as described by Paliocha & Dieterlen (2005).

Alternative inventory methods

During some of the camps, alternative methods were applied, sometimes with useful results, but often the results posed new problems. These experimental methods are nevertheless worthwhile to describe briefly as perhaps the set-up can be applied in an altered version.

In 1992 (France II), cut-open tennis balls baited with a number of sunflower seeds and fixed on bamboo poles in high vegetation were used in an attempt to attract harvest mice, in the hope of the mice eating the bait or settle in the ball, after an idea of Warner & Batt (1976). This experiment only resulted in gnawing marks of unspecified small mammals, probably due to the holes being too big and therefore accessible to wood mice. In 1996 a survey covering 13 sites throughout the UK with grids of 50 tennis balls resulted in only one of the tennis balls being occupied by a harvest mouse, despite nests being found in natural vegetation in the same area (Sibbald et al. 2006).

A method to obtain tracks of semi-aquatic small mammal was tested during the 1998 camp in Belgium II. A construction with a submersed funnel connected to a floating, tracking platform with an ink-bed was set out in the water. After passing the ink-bed, the small mammal would pass over a piece of paper and leave the contraption. Tracks of water shrew were indeed found (Bekker & Oostveen 2001), however it seems more easier to set out several small live-traps rather than this fairly large construction.

In the highlands near Ohrid (2006-Macedonia), initial attempts to positively link 'mole-hills' to lesser mole rats, by digging a jar underneath a tunnel, proved unsuccessful. Vogelaers (2006) then demonstrated how to catch lesser mole rat using a slightly adapted method described earlier by Hill et al. (1957). This method is based on the impulse of (lesser) mole rats to close any opened tunnels. The mole rat catcher opens a tunnel and waits for an animal to appear in front of the entrance. When the animal appears, the catcher drives down a hoe, directly behind the animal which can be dug out then.

During the camp in Matsalu (2007-Estonia), Spoelstra (2008) used a new, simple but effective method to identify hunting bats in the field as an extra verification of detector results. The basic principle is a digital camera with a torch perfectly aligned with the camera lens (torch beam in centre of viewfinder) and two flashes with short flash durations (e.g. 10.000 sec^{-1}). When the bat is in close range the torch is switched on by the observer and a picture is taken. The aim is to get a clear view on the tail membrane to distinguish species such as Daubenton's bat, Natterer's bat or long-fingered bat. Modern powerful and more lightweight LED lensed torches could improve the results, which are now directly visible on the display of the camera.

Closing remarks

The results presented here show that much can be achieved within the limited time frame of a summer camp aiming at the study of mammals in different European countries by using a variety of methods and techniques. A major objective of the camps were the inventories of

mammals in the areas visited and their attribution to the knowledge of the extant mammals; the results of these inventories are summarised in tables 2-7. On several occasions, new mammals species were confirmed for a region or a country. During 28 Field Study Group camps a total of 128 different mammal species were found (see Appendix). The new (216), reaffirmed (38) and confirmed (1268) squares in which mammal species were recorded (as compared to the status in *The Atlas of European mammals*), is a substantial contribution to the knowledge of the distribution of mammals in Europe. Quantifying the increase of knowledge and exchange of experiences between the participants from different countries is difficult; however, there are plenty of examples showing that much has been learned by collaborating with regional or national mammal study groups. Using mist nets is one example of how Field Study Group participants learned from local counterparts. Other examples are the use of live traps on top of long sticks placed in trees to capture dormice and to place fyke nets in small Iberian streams to capture Pyrenean desman. As for getting acquainted with 'southern small mammals', the curiosity of regular attendees of the camps has been well satisfied. Not only were members of this group of mammals regularly observed, but also were mammals in Mediterranean and eastern Europe, such as the spectacular greater noctule, observed several times. For other species, in other parts of Europe, several camps were sometimes needed to established them. For instance, for the Northern birch mouse, capture attempts were already done during the 1993-Czech R. camp, but it took another camp (2007-Estonia) before the species could eventually be trapped. Even more attempts (2004-Slovenia II, 2006-Macedonia) were needed before the stenotopic Balkan snow vole could successfully be captured during 2011-Croatia.

The analyses of (owl) pellets is the most efficient method for surveying small mammals, however, sufficient numbers of pellets are not available at each location. As mentioned before, live trapping in the summer months was not very effective for shrews and voles in Mediterranean countries and for the harvest mouse. Both techniques appear to be complementary, and should be used both to maximise the results for these species. For medium-sized and larger mammals surveying the field visually (sightings) and looking for tracks and signs are still effective (standard) methods. In recent years the use of camera traps during the Field Study Group camps has proved to be a valuable addition (e.g. for common genet and wild cat).

Searching for bat roosts in places which are less frequented by humans, e.g. caves, abandoned buildings and church attics, was a standard method in bat research and during camps for a while. Bat detectors have been used since the first camps and yielded valuable information from the start. Later, sound analysis added much to the applicability and reliability of bat detector observations. Since 2000, mist netting was practised during each camp as a standard method and contributed much for the genera *Myotis* and *Plecotus*.

Tissue biopsies have proved to be valuable in validating or correcting field identifications afterwards. Therefore, DNA sampling has to be a one of the basic methods in future mammal research, including Field Study Group camps. Lastly, collecting parasites from mist netted bats during camps provided a good opportunity to increase the knowledge of these organisms.

In the oncoming years, the variety of destinations of the Field Study Group camps to choose from in Europe seems to be inexhaustible. And indeed, several countries have not yet been visited, e.g. Austria, Latvia and Sweden. Moreover, big islands such as the United Kingdom, Ireland and Iceland in the north and all the Mediterranean islands, including the Greek ones, could also be a target for a future camp. The odds are that the location will again be near a country border and indeed the 2015 summer camp location

in Albania fully met this criterion (see Mostert (2015) for a first impression). Promising future destinations could also be those lacking mammal inventories, or those inhabited by rare and interesting endemic species.

Another option for future camps would be to change the time frame of 'summer' into 'autumn' to be able to study southern European shrews and voles in larger quantities and variations as well.

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Samenvatting

Een overzicht van de resultaten verkregen tijdens de zomerkampen van de Veldwerkgroep van de Zoogdiervereniging, 1986-2014

Sinds de oprichting in 1975 van de Veldwerkgroep van de Zoogdiervereniging werden er door deze werkgroep onder meer 28 zogenoemde zomerkampen georganiseerd, van 1986 tot en met 2014. Van de daarbij verkregen resultaten wordt hier een overzicht gepresenteerd.

De eerste kampen hadden België en Frankrijk als bestemming, maar in de loop der jaren heeft de Veldwerkgroep geleidelijk haar activiteiten uitgebreid naar verder weg gelegen locaties in Europa. De bestemming van een zomerkamp wordt bepaald in overleg met een internationale contactpersoon met relaties in nationale natuurbeschermingsorganisaties en daarnaast is de beschikbaarheid van een accommodatie in de omgeving van een natuurgebied, die voorziet in de basisbehoeften van een groep personen. Het aantal deelnemers tijdens de zomerkampen uit Nederland en België, varieerde tussen de tien en dertig. Van de 160 deelnemers uit Nederland en België, nam de helft eenmaal deel aan een kamp; de overige meer dan eens. In totaal waren er 116 deelnemers van lokale herkomst.

De observatietechnieken van alle 128 vastgestelde zoogdiersoorten staan vermeld. Gedurende alle kampen werden met inloopvallen 7.662 kleine zoogdieren gevangen en met mistnetten nog eens 990 vleermuizen (totaal 8.652 dieren). Deze aantallen omvatten onder meer 421 (4,9%) doodvangsten – in de noordelijke landen voornamelijk bestaande uit spitsmuizen (91%). Braakballen en andere excretieproducten van uilen, roofvogels en grotere zoogdieren bevatten 22.766 kleine zoogdieren, veruit de meeste in braakballen van kerkuilen: 21.237 (93%). Met batdetectors werden 3.908 vleermuizen waargenomen. Verder werden grotten, kerkzolders en onbe-

woonde huizen geïnspecteerd op de aanwezigheid van vleermuizen; ook oude bruggen of tunnels bleken in dit verband vaak interessante plekken te zijn, samen bijna 24 duizend exemplaren. Van de directe zichtwaarnemingen, 1.740 in totaal, zijn ook gerekend die met verrekijker of schijnwerper. De aanwezigheid van roofdieren werd voor het merendeel vastgesteld aan de hand van prenten en andere sporen, de aanwezigheid van hoefdieren vooral door zichtwaarnemingen. Ook dode dieren of delen daarvan (schedel, gewei, haren, uitwerpselen en ander zoogdier specifiek materiaal) droegen bij aan deze waarnemingen van de over het algemeen grotere zoogdieren (in totaal meer dan 1.652 waarnemingen). Sinds 2007 zijn infraroodcamera's gebruikt om vooral grotere zoogdieren te detecteren, aangetrokken met een sterk geurend kunstaas (valeriaan of pindakaas); in totaal zijn op deze wijze 77 zoogdieren geregistreerd.

De bijdrage van de Veldwerkgroep aan de kennis over de verspreiding van zoogdieren in Europa is vergeleken met de aanwezigheid van stippen op de kaarten in de atlas van de Europese zoogdieren, hetgeen resulteert in de volgende bevindingen: 1. De aanwezigheid van zoogdieren is bevestigd voor 1268 UTM-kwadranten. 2. Voor 35 kwadranten is de aanwezigheid na 1970 bevestigd. 3. Voor 218 kwadranten is de aanwezigheid voor het eerst aangetoond. Bezien we deze 'nieuwe' kwadranten op orde-niveau dan blijken Chiroptera verantwoordelijk voor het grootste aandeel (65%). Dit hoge aandeel vindt zijn oorzaak in de inzet van mistnetten en nieuwe analysetechnieken. Veel minder nieuwe kwadranten voegden Rodentia (15%), Insectivora (11%), Carnivora (7%), en Leporidae (2%) toe en de Artiodactyla voegden zelfs geen enkel nieuw kwadrant toe.

Sinds 2004 werden ecto-parasieten van vleermuizen verzameld: van 248 vleermuizen (23 soorten) werden in totaal een of meer parasieten genomen. Het totale aantal verzamelde parasieten bedroeg 606 en bestond voor meer dan 80% uit mijten (18 soorten), luisvliegen (elf soorten) vormden 15% van de parasieten.

In de Middellandse Zeegebieden is het relatieve aantal in vallen gevangen Microtidae veel lager dan in de Centraal-Europese of Noord-Europese zomerkampen, terwijl uit braakbal analyses blijkt dat Microtidae zeker niet zeldzaam of afwezig zijn in deze regio's. Dit verschil hangt mogelijk samen met de meer extreme (micro)klimaatsomstandigheden gedurende de zomermaanden, op het hoogtepunt waarvan precies de zomerkampen worden georganiseerd: deze families hebben dan mogelijk een meer teruggetrokken leefwijze in ondergrondse gebufferde (micro)milieus.

Tenslotte wordt kort ingegaan op de plussen en minnen van nieuwe onderzoekstechnieken waarmee door de jaren heen is geëxperimenteerd.

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Appendix

Total numbers of all mammals by observed methods, casualties and presence in UTM squares (confirmed, reaffirmed, new).

* recently described species not included in *The Atlas of European Mammals* (Mitchell-Jones et al. 1999).

	Species	sightings	tracks & signs	camera traps	caves & buildings	bat detector	mist net	live-trap	found dead	pellets and excrements	casualties	confirmed squares	reaffirmed squares	new squares
1	*Erinaceus europaeus*	53	13						29	1		20		
2	*Erinaceus roumanicus*	48	8						32	2		14	3	
3	*Sorex alpinus*							5	5	0		6		
4	*Sorex araneus*							849	13	922	225	31		3
5	*Sorex caecutiens*							1			1			1
6	*Sorex coronatus*							199		1998	25	11		
7	*Sorex granarius*							5		25	1	2		2
8	*Sorex isodon*									1				1
9	*Sorex minutus*							127	6	417	31	30		4
10	*Sorex samniticus*									104		2		
11	*Neomys anomalus*	1						49	1	108	8	11		3
12	*Neomys fodiens*							79	2	118	10	19		
13	*Crocidura leucodon*							4	3	443		11	1	2
14	*Crocidura russula*	2						137	3	1822	7	21		
15	*Crocidura suaveolens*							28	5	533	2	14		3
16	*Suncus etruscus*									82		5		
17	*Galemys pyrenaicus*		5					4	1		1	4		
18	*Talpa caeca*								1				1	
19	*Talpa europaea*	2	100					1	14	37		27		3
20	*Talpa occidentalis*	1	10						2	6		5		
21	*Rhinolophus euryale*				566	14	1					5	1	4
22	*Rhinolophus ferrumequinum*				251	45	11			3		17	3	5
23	*Rhinolophus hipposideros*				1169	40	15					21	2	5
24	*Rhinolophus mehelyi*				1									1
25	*Myotis bechsteinii*				39	2	16		1			4		4
26	*Myotis brandtii*				20	14	6					2		2
27	*Myotis capaccinii*				3000	35	66							4
28	*Myotis dasycneme*				41	2	6					3	1	
29	*Myotis daubentonii*				77	910	156					24		10
30	*Myotis emarginatus*				411	15	33		5			5	1	10
31	*Myotis myotis*				4959	66	79		144	1		20	1	4
32	*Myotis mystacinus*				273	5	26		1			9		5
33	*Myotis alcathoe*					5	3					*	*	1*
34	*Myotis aurascens*				200		8					*	*	3*
35	*Myotis nattereri*				9	91	20		1	2		8	1	6
36	*Myotis escalerai*						2					*	*	2*

	Species	sightings	tracks & signs	camera traps	caves & buildings	bat detector	mist net	live-trap	found dead	pellets and excrements	casualties	confirmed squares	reaffirmed squares	new squares
37	*Myotis oxygnathus*				52		41				1	7		3
38	*Pipistrellus kuhlii*				148	424	13					7		6
39	*Pipistrellus nathusii*				165	8	1					4		2
40	*Pipistrellus pipistrellus*				827	1019	40		2	2		19	4	9
41	*Pipistrellus pygmaeus*					26	2					*	*	10*
42	*Hypsugo savii*				21	206	110					8		5
43	*Nyctalus lasiopterus*					15	5					1		5
44	*Nyctalus leisleri*				50	198	43					6	1	11
45	*Nyctalus noctula*				100	173	19					9	1	9
46	*Eptesicus nilssonii*				26	102	16					18		
47	*Eptesicus serotinus*				127	295	86		1	2		20	1	7
48	*Vespertilio murinus*				4	33	21					7		3
49	*Barbastella barbastellus*				13	10	34			1		5	1	6
50	*Plecotus auritus*				137	10	24					14	2	5
51	*Plecotus austriacus*				81	31	22					5		6
52	*Plecotus kolombatovici*						8				1	*	*	2*
53	*Plecotus macrobullaris*						1					*	*	1*
54	*Miniopterus schreibersii*				10956	20	46			1		6	1	3
55	*Tadarida teniotis*				220	94						5		8
56	*Lepus castroviejoi*	6										1		
57	*Lepus europaeus*	143	20						7	1		25		2
58	*Lepus timidus*	60	1						3	1		13		
59	*Oryctolagus cuniculus*	32	22						3	7		12		2
60	*Sciurus vulgaris*	115	52						15	1		39		3
61	*Marmota marmota*	2	1									1		
62	*Spermophilus citellus*	247	3									3		
63	*Castor canadiensis*		10									2		
64	*Castor fiber*	61	26									13		1
65	*Cricetus cricetus*		10					2		18		1		
66	*Myopus schisticolor*	1	1							35		3		
67	*Lemmus lemmus*									2		4		
68	*Myodes glareolus*	5						1437	7	560	18	30	1	
69	*Myodes rufocanus*									3		1		
70	*Dinaromys bogdanovi*							2	1	5		2		
71	*Arvicola sapidus*	3	2							21		6		
72	*Arvicola scherman*		2							33		*	*	3*
73	*Arvicola terrestris*	4	4	2				4	6	544		17		
74	*Ondatra zibethicus*	8	7						2			5		
75	*Microtus agrestis*	1	2					245	2	1789	3	30		2
76	*Microtus arvalis*	1	3					750	5	5644	21	24	1	1

	Species	sightings	tracks & signs	camera traps	caves & buildings	bat detector	mist net	live-trap	found dead	pellets and excrements	casualties	confirmed squares	reaffirmed squares	new squares
77	*Microtus cabrerae*									3		1		
78	*Microtus duodecimcostatus*									505		5		
79	*Microtus gerbei*									26		1		
80	*Microtus levis*							45	2	81		1		2
81	*Microtus lusitanicus*	1	1					4	1	286		5		
82	*Microtus multiplex*									1		1		
83	*Microtus oeconomus*							15		2	3	4		
84	*Microtus savii*		1							842		2		
85	*Microtus subterraneus*							53	1	113	2	18		3
86	*Chionomys nivalis*							5		1		3		
87	*Nannospalax leucodon*		6					1		1		2		
88	*Micromys minutus*		6					2		127		11	2	
89	*Apodemus agrarius*							104	2	61	5	5		2
90	*Apodemus flavicollis*	3		4				1567	9	546	25	33	1	3
91	*Apodemus sylvaticus*	3	1	5				1319	6	2571	19	36	1	1
92	*Rattus norvegicus*	7	15	1				8	13	31		20	1	
93	*Rattus rattus*	9						1	3	18		8		2
94	*Mus musculus*							77	2	190	3	23		
95	*Mus spicilegus*		1							1		1		
96	*Mus spretus*		1					130	1	583	2	8		
97	*Glis glis*	134	15	5				59	5	58		19		7
98	*Muscardinus avellanarius*	14	40					24	4	33		17		
99	*Eliomys quercinus*	3	4					39	2	4		8	1	1
100	*Dryomys nitedula*	4	1					5		16		3	1	1
101	*Sicista betulina*							2		4		1		1
102	*Hystrix cristata*	1	2									1		
103	*Myocastor coypus*	1	0									1		
104	*Canis lupus*	8	31	2								5		
105	*Vulpes vulpes*	178	154	11					18			44		2
106	*Nyctereutes procyonoides*	22	4	2					3			2		
107	*Ursus arctos*	4	13									5		
108	*Procyon lotor*		1									1		
109	*Mustela erminea*	7	3						4	1		12		
110	*Mustela nivalis*	10	1					4	2	3	1	14		2
111	*Mustela putorius*	13	7						3			9		1
112	*Neovison vison*	7	5									7		
113	*Martes foina*	15	66	6					8			23		4
114	*Martes martes*	7	35	2					4			22		
115	*Gulo gulo*	3	1									2		
116	*Meles meles*	28	62	2					12			29		1

Species	sightings	tracks & signs	camera traps	caves & buildings	bat detector	mist net	live-trap	found dead	pellets and excrements	casualties	confirmed squares	reaffirmed squares	new squares
117 *Lutra lutra*	2	94	1					1			15		4
118 *Genetta genetta*	1	14	7								5		
119 *Felis silvestris*	5	1	1								5		
120 *Lynx lynx*	3	3									2		
121 *Sus scrofa*	7	68	1					1			21		
122 *Cervus elaphus*	15	41						1			19		
123 *Alces alces*	93	17									15		
124 *Rangifer tarandus*	1	6									2		
125 *Capreolus capreolus*	280	59	6					8			42		
126 *Rupicapra rupicapra*	25										3		
127 *Ovibus moschatus*	5										1		
128 *Ovis ammon*								1			1		
Not identified to species level	25	112	19	8515	165	10	270	18	1363	6			
Total	1740	1194	77	32458	4073	990	7662	458	22766	421	1268	35	218+ 22*