Myotis	Vol. 38	41 - 46	Bonn, December 2000

Survey of the bats of the Athens metropolitan area

Anastasios Legakis, Constantinos Papadimitriou, Martinos Gaethlich & Dimitrios Lazaris

Abstract. The bats of urban areas in Greece have never been studied. No data exist on species present, on the status of populations and on the effects of urbanisation on these animals. In order to study the bats of Athens metropolitan area which is the largest urban conglomerate in Greece, concentrating more than 1/3 of the total human population of Greece, 64 sites were chosen according to several criteria. The sites were surveyed using an ultrasonic bat detector and roosts, number of foraging bats, vegetation, level of human disturbance and other factors were noted. Although not in large numbers, bats are found everywhere in Athens. The biggest concentrations were observed in the foothills of the mountains around Athens. Five species were recorded: *Pipistrellus pipistrellus, Pipistrellus kuhlii, Myotis blythii, Myotis emarginatus* and *Eptesicus serotinus*. The analysis of the relation between environmental parameters and bat activity showed that the most suitable sites for foraging are those with abundant vegetation and a diversity of habitats that lie near the edge of the city limits in sparsely built areas. Suitable foraging sites with high traffic and noise are avoided. An intermediate artificial light intensity seems to favour bat activity. The numerous caves in the surrounding mountains may be important for hibernation. Pine trees which have been planted extensively in the last 40 years in and around Athens, do not seem to be suitable for bats.

Key words. Bat survey, metropolitan area, Athens, Greece.

Introduction

The bats of urban areas in Greece have never been studied. No data exist on species present, on the status of populations and on the effects of urbanisation on these animals (Legakis 1996). In order to study the bats of the Athens metropolitan area which is the largest urban conglomerate in Greece, concentrating more than 1/3 of the total human population of Greece, it was decided to instigate a project for the survey of the species present in this area, the identification of roosting and foraging areas, the identification of potential threats and the formulation of proposals for their conservation. The greater Athens area has more than 3 million inhabitants. Although it has been built up extensively and without any plan, it still preserves significant wildlife and it is considered as one of the most interesting cities in Europe from this point of view, as its Mediterranean-type climate favours a high diversity of plants and animals. It was therefore expected that bat populations would still be present and active in this area.

Materials and methods

The project began in August 1992 and ended in September 1995. The selection of the 64 representative sites in Athens was based on the presence of areas suitable for the feeding and living of bats. An attempt was made to cover as much as possible of the study area. Every site was covered at least once and a number of activities was recorded: the time of the beginning and ending of bat activity, the general description of the site, the human activities, an estimation of bat population, the direction and altitude of flight, and for the roosting sites, the description, the number of individuals, probable traces etc.

Several neighbouring sites were visited on the same date and therefore, the results were lumped together in 33 areas.

Recording was carried out visually whenever possible and with the help of a bat detector device (Ultra Sound Advice S-25 using an SM-2 microphone). Bat calls were also recorded in a cassette recorder (AIWA HS-F160) modified to remove the modulating effect of the microphone auto-level input control.

The number of calls/km was used as indicator for the foraging activity and the general population density at every site. The average time spent in each transect was 39 min/km. When many bats were heard simultaneously but could not be seen, the estimation of the number of calls was based on previous experience with simultaneous visual and acoustic observations. From experience, it was decided that separate calls heard within a distance of 50 m were considered as coming from the same animal and were counted as one call.

The results were correlated with environmental parameters such as type of roost and human activities. The intensity of the environmental parameters was scored using a scale of 1 to 3.

The methodology was chosen for being fast and effective, yet at the same time not disturbing bats, as it happened in the past in Greece.

The recorded signals were analysed in a computer using the Pettersson LP-900 Signal Analyzer. This analysis provided species identification as the calls were compared with those included in the I. Ahlen, Identification of bats on flight, cassette (Ahlen 1990).

Results

The results of the bat detector surveys are presented in Table 1 and Figure 1.

These data were correlated with the environmental data (ten parameters) using a non-parametric analysis of variance. The effects of the environmental parameters are presented in Table 2.

Using the ultrasound analysis, five species were identified: *Pipistrellus pipistrellus (45 kHz sonic type)*, *Pipistrellus kuhlii*, *Myotis blythii*, *Myotis emarginatus* and *Eptesicus serotinus*. Of these, *Pipistrellus pipistrellus* and *Pipistrellus kuhlii* were the most abundant. Table 2 lists the frequency of observation of these species. From one site (Skopeftirio Kaisarianis, Alsos Pangratiou & Ardittos) four species were recorded while from another (Akti Kountourioti, Profitis Ilias & Stadio Eirinis & Filias) we recorded three. From all the rest, only one or two species were recorded.

Table 1. Bat activity in the study sites expressed as bat calls per km. Species:1: *Pipistrellus pipistrellus* (45 kHz), 2: *Pipistrllus kuhlii*, 3: *Myotis blythii*, 4: *Myotis emarginatus*, 5: *Eptesicus serotinus*, 6: *Plecotus auritus* (in sites where no species are mentioned, the signals were not strong enough for analysis to species level).

SITE	Distance(m)	No. of bat calls	Density	Species recorded
Plaka, Akropoli, Filopappou	7454	56	7.5	1,2
Nea Filadelfeia, Prompona	4352	39	8.96	1,2,6
Pyrgos Vasilissis, Skamandros, Mykoniatika	5139	30	5.84	1
Rema Chalandriou	4399	19	4.32	1
Lofos Strefi, Polytechneio, Mouseio, Pedio Areos	5093	22	4.32	
Lofos Dexamenis (Nikaia)	3565	14	3.93	
Alsos Papagou, Agia Paraskevi, Cholargos	8010	31	3.87	1,2
Skopeftirio Kaisarianis, Alsos Pangratiou, Ardittos	7084	27	3.81	1,2,3,5
Kifisia	5047	18	3.57	1
Filothei, Psychiko	5602	19	3.39	
Polemiko Mouseio, Zappeio, Evangelismos	4630	15	3.24	1,5
Panepistimioupolis, Alsos Syngrou	7343	20	2.72	1
Lykavittos	6112	16	2.61	1
Parko Scholis Chorofilakis	4028	6	1.49	1,2
Kipos Diomidi	3426	41	11.96	
Palaia Penteli, Asteroskopeio	4630	44	9.5	1,2
Thrakomakedones	2150	25	11.62	1,2
Ethnikos Kipos, A' Nekrotafeio,	6204	44	7.09	1,2,3
Ekali	4352	39	8.96	2
Glyfada	7037	32	4.55	2
Nekrotafeio Anastaseos (Keratsini)	2778	3	1.07	1,2
Alsos, Nekrotafeio Peristeriou	3518	17	4.83	1,2
Alsos Aigaleo	5741	13	2.26	1,2
Elaionas, TEI Peiraia	5463	7	1.28	
C' Nekrotafeio, Nekrotafeio Nikaias	5556	3	0.53	
Kareas, Alsos Alexandrou Ari (Vyronas, Ymittos)	6482	14	2.16	1,2
Asyrmatos, Nekrotafeio Neas Smyrnis, Palaiou Falirou & Kallitheas	2778	6	2.15	
Ktima Syngrou (Marousi), Parko Katsimbali (Pefki)	9260	29	3.13	1,2
Melissia, Profitis Ilias (Nea Penteli)	5463	4	0.73	
Akti Kountourioti, Profitis Ilias, Stadio Eirinis & Filias	6528	9	1.38	1,2,4
Kerameikos, Votanikos, Lofos Ippeiou Kolonou & Lofos Skouze	6296	10	1.59	1
Tourkovounia	4167	35	8.40	1,2
Varibobi, Tatoi	1050	34	30.91	1,2

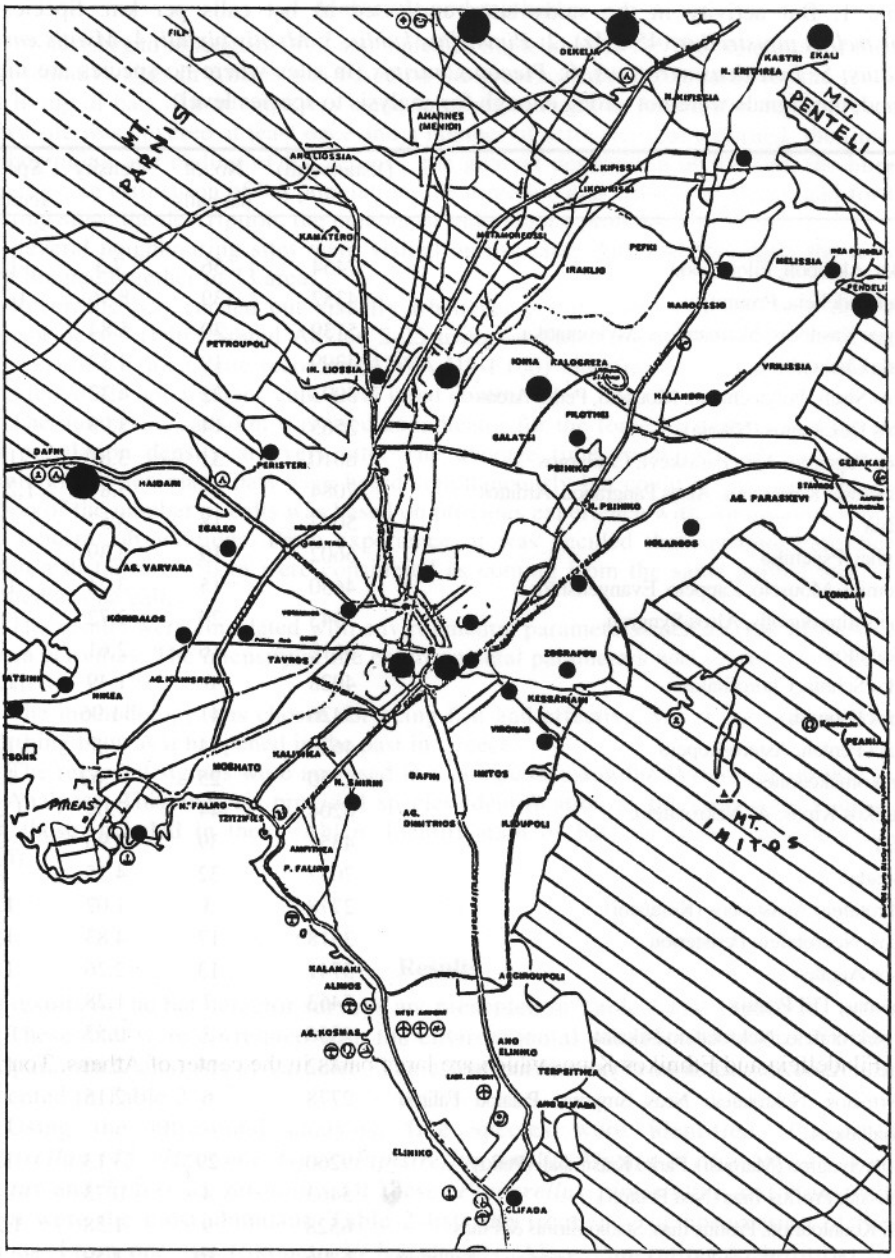

Fig. 1. Map of Athens showing survey sites. The radius of the black dots denotes the density of bat calls per km. Small dots: less than 6 calls/km, medium dots: 7-10 calls/km, large dots: more than 10 calls/km.

Table 2. Effect of environmental parameters on bat call density.

Environmental parameters	Effect on bat call density	Significance level
Abundance of vegetation	+	0.0003
Pollution	-	0.003
Diversity of habitats	+	0.005
Density of buildings	-	0.007
Presence of water	+	0.04
Nearness to edge of city	+	0.004
Light intensity	Non significant	0.28
Noise	-	0.01
Presence of abandoned bldgs.	Non significant	0.1
Human presence	-	0.0008

Table 3. Relative frequency of observation of the five species identified in the studied sites.

Species	Rel. frequency (%)
Pipistrellus pipistrellus	90
Pipistrellus kuhlii	65
Myotis blythii	10
Myotis emarginatus	5
Eptesicus serotinus	10

Discussion

Although in small numbers, bats are always found everywhere in Athens. The largest concentrations have been found in Varibobi which lies at the edge of the urban area near the foot of Mt. Parnis. Large concentrations have also been found in a few more sites such as Kipos Diomidi which is a large park near Mt. Aigaleo, Thrakomakedones which is a suburb near Mt. Parnis, Palaia Penteli and Ekali which are suburbs near Mt. Penteli, Nea Filadelfeia and Ethnikos Kipos which are large parks in the center of Athens, Tourkovounia which is a rocky hill with small caves in the centre of Athens and Plaka with the Acropolis which have many old houses and ruins.

All of the species recorded are generally considered as typical inhabitants of towns, at least in central Europe (Redel 1995).

The analysis of the environmental parameters showed that the most suitable sites for foraging are those with abundant vegetation and a diversity of habitats that lie near the edge of the city limits in sparsely built areas. Sites with increased traffic and air pollution, with much noise and frequented by many people seem to be avoided. Artificial light also plays a significant role. Bats do not seem to be interested in very low lit areas and avoid much lighted sites. An intermediate artificial light intensity seems to favour bat activity

as light attracts many insects, a fact observed in other places (Rydell 1991). However, the much lighted areas also have a lot of noise.

Athens and especially the adjacent areas have been planted during the last 40 years with pine trees. In these areas bat activity seems to be reduced. There are also very few urban parks in Athens and most of them do not have significant low vegetation, they have trees of the same age, poor insect fauna and in general they have reduced diversity.

From the analysis of the direction of flight of bats it was clear that some sites such as streams and parks serve as passages or corridors both between roosting sites and foraging grounds and between foraging grounds. Therefore, it seems that bats are using a large number of suitable sites such as all the small or large islets of greenery in the centre of the city, in order to search for food in and around the Athens area with the help of natural corridors. There are also indications that bats use different sites in the mountains around Athens, and especially caves which abound, both as roosting sites and as hibernation sites.

In general, populations were medium in size. In several sites that seemed suitable for bats, the observations were very few because of the nearby very frequented and noisy streets. Another possible reason for these locally small populations is the use of pesticides in gardens and parks.

The results of this study revealed the diversity of Athens in spite of all its problems like pollution, dense urbanisation, noise, lack of parks etc.

Acknowledgments

The authors would like to thank the Fauna and Flora Preservation Society (now Fauna and Flora International) for their financial support throughout the project. They would also like to thank the following persons that participated in the project: Ch. Alivizatos, A. Harrisson, P. Kasapidis & P. Robolis. The project was also supported by the Hellenic Zoological Society and the Hellenic Bat Society which participated in its activities after its formation in 1992.

References

Ahlen, J. (1990): The identification of bats in flight. - Swedish Society for the Conservation of Nature & The Swedish Youth Association for Environmental Studies and Conservation, 50 pp.

Legakis, A. (1996): Study and conservation of bats in urban areas of Greece. - Final report of a project financed by the Fauna and Flora Preservation Society. Hellenic Zoological Society, Athens, 32 pp.

Redel, T. (1995): Zur Ökologie von Fledermäusen in mitteleuropäischen Städten. - Examensarbeit am Fachbereich für Biologie der Freien Universität Berlin.

Rydell, J. (1991): Seasonal use of illuminated areas by foraging northern bats *Eptesicus nilssoni*. - Holarct. Ecol. 14: 203-207.

Anastasios Legakis & Dimitrios Lazaris, Zoological Museum, Dept. of Biology, Univ. of Athens, 157 84 Athens, Greece; Constantinos Papadimitriou, Hellenic Zoological Society, P.O. Box 3249, 102 10 Athens, Greece; Martinos Gaethlich, Hellenic Bat Society, P.O. Box 3277, 102 10 Athens, Greece.