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Corpo Forestale dello Stato

BAT FEEDING ACTIVITY IN DIFFERENT HABITATS AT SITE OF COMMUNITY IMPORTANCE IT7110104 "CERRETE DI MONTE PAGANO E FEUDOZZO" (ABRUZZO, ITALY)

In July, August and September 2013 a bat monitoring program was carried out within the Site of Community Importance (SCI) IT7110104 "Cerrete di Monte Pagano e Feudozzo" (Abruzzo, Italy) (surface 9 km^2) managed by the Ufficio Amministrazione Foreste Demaniali Castel di Sangro, in order to draw up a bat checklist and to define management recommendations for the most suitable habitats for bat foraging.

Monitoring was conducted by active (Pettersson D1000X) and passive equipment (SM2Bat and Batlogger) for a total of 139 hours in 61 different sampling sites within SCI.

The site is predominantly characterized by woodland, mostly Turkey oak *Quercus cerris* (43,4%) and to a smaller extent by beech *Fagus sylvatica* and mixed deciduous woodlands. The remaining part is covered by shrubland (23,4%), meadows and pastures (9,2%). Elevation ranges from 900 to 1200 m.

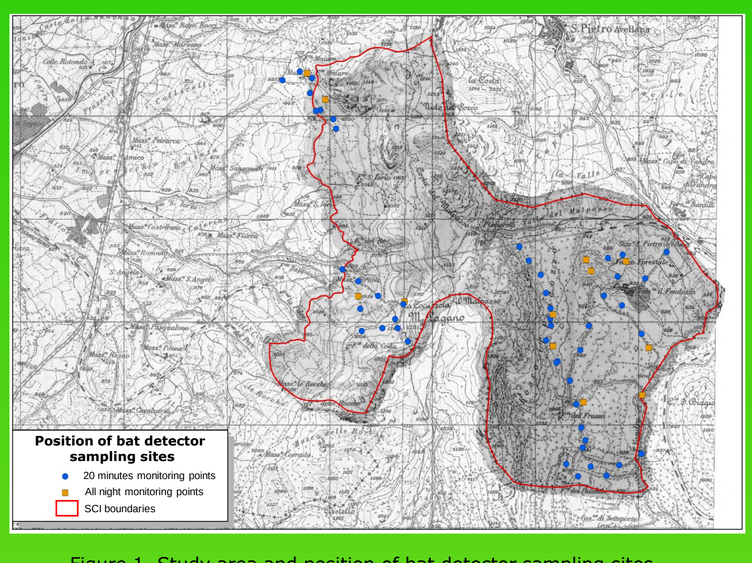

Figure 1. Study area and position of bat detector sampling sites

Figure 2. Example of Turkey oak woodland within SCI

File	Id	Contact	Group	IGp	Species	ISp	Year	Month	Day	Hour	Minute	Date	Time	NbCalls	MedFreq	MedInt	Iqual	Isc	Ibuz
20130717_210024.wav	PippiM	Main	PipMi	8	PippiM	8	2013	7	17	21	0	17/07/2013	21.00	48	49	54	6	0	6
20130717_224620.wav	PipMi	Main	PipMi	8	PippiM	3	2013	7	17	22	46	17/07/2013	22.46	28	52	80	8	1	0
20130717_230955.wav	PipMi	Main	PipMi	10	Minsch	3	2013	7	17	23	9	17/07/2013	23.09	66	52	59	8	0	8
20130717_231558.wav	PippiM	Main	PipMi	10	PippiM	8	2013	7	17	23	15	17/07/2013	23.15	47	50	77	7	0	0
20130717_234151.wav	PippiM	Main	PipMi	10	PippiM	9	2013	7	17	23	41	17/07/2013	23.41	24	50	84	8	0	0
20130718_001155.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	0	11	18/07/2013	0.11	33	48	0	7	0	0
20130718_002419.wav	PippiM	Main	PipMi	10	PippiM	9	2013	7	18	0	24	18/07/2013	0.24	59	50	73	7	0	0
20130718_003026.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	0	30	18/07/2013	0.30	59	49	68	7	0	0
20130718_003307.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	0	33	18/07/2013	0.33	36	48	76	7	0	0
20130718_004935.wav	MyoHF	Main	MyoHF	7	Myocap	1	2013	7	18	0	49	18/07/2013	0.49	61	49	0	5	0	1
20130718_005500.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	0	55	18/07/2013	0.55	45	50	76	7	0	0
20130718_005620.wav	PippiM	Main	PipMi	10	PippiM	9	2013	7	18	0	56	18/07/2013	0.56	25	50	90	8	0	0
20130718_005834.wav	PippiM	Main	PipMi	10	PippiM	8	2013	7	18	0	58	18/07/2013	0.58	29	51	78	6	0	0
20130718_005959.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	0	59	18/07/2013	0.59	30	49	84	7	0	0
20130718_010132.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	1	1	18/07/2013	1.01	24	49	85	7	0	0
20130718_011248.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	1	12	18/07/2013	1.12	12	48	86	6	0	0
20130718_014121.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	1	41	18/07/2013	1.41	39	49	91	7	0	0
20130718_014604.wav	PippiM	Main	PipMi	8	PippiM	8	2013	7	18	1	46	18/07/2013	1.46	60	49	0	8	0	0
20130718_014635.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	1	46	18/07/2013	1.46	29	48	0	7	0	0
20130718_015011.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	1	50	18/07/2013	1.50	14	49	0	7	0	0
20130718_015739.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	1	57	18/07/2013	1.57	27	48	80	7	0	0
20130718_020059.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	0	18/07/2013	2.00	12	49	74	7	0	0
20130718_020723.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	7	18/07/2013	2.07	28	48	87	7	0	0
20130718_020755.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	7	18/07/2013	2.07	26	48	0	7	0	0
20130718_021647.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	16	18/07/2013	2.16	54	50	0	6	0	0
20130718_022801.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	28	18/07/2013	2.28	34	49	82	7	0	0
20130718_023228.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	32	18/07/2013	2.32	42	49	72	7	0	0
20130718_023748.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	37	18/07/2013	2.37	28	48	0	7	0	0
20130718_023754.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	37	18/07/2013	2.37	51	49	74	8	0	0
20130718_024248.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	42	18/07/2013	2.42	28	48	93	7	0	0
20130718_024805.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	48	18/07/2013	2.48	34	48	93	7	0	0
20130718_024943.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	49	18/07/2013	2.49	67	49	78	7	0	0
20130718_025827.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	2	58	18/07/2013	2.58	8	49	96	7	0	0
20130718_030025.wav	PippiM	Main	PipMi	10	PippiM	10	2013	7	18	3	0	18/07/2013	3.00	25	48	80	7	0	0
20130718_041053.wav	ChiroSp	Main	MyoHF	4	Myodau	1	2013	7	18	4	10	18/07/2013	4.10	69	47	75	6	1	0

Figure 3. Example of SonoChiro output: 17 July 2013

Ultrasound identification was performed by Sonochiro® software. Bat calls were considered to be correctly identified at species level only when probability of correct identification was higher than 70%. If lower, identification was performed by specialists. When species identification was not possible, bat calls were attributed to the genus or the group of species proposed by the software, if probability was higher than 70%. All the other bat sequences were classified as "Chiroptera sp".

In order to evaluate habitat suitability for bats, the number of contacts was standardized as an activity index (n. of contacts / sampling hour). A contact was considered as a bat sequence lasting 5 seconds at the most and imputable to an individual.

	Total	Active sampling	Passive sampling
Bat contacts *n*	1196	280	916
Sampling *h*	242	28	214
Sampling sites *n*	107	84	22

Table 1. Summary of bat contacts, monitoring hours and monitoring points

Figure 4. An SM2BAT+ installed for bat detection inside a woodland

A total amount of 1909 contacts was obtained corresponding to 20 bat species, between which many were interesting as to their conservational or biogeographic interest or for updating their distribution knowledge in Italy: *Rhinolophus hipposideros, Rhinolophus ferrumequinum, Myotis oxygnathus, Myotis myotis, Myotis bechsteinii, Myotis emarginatus, Barbastella barbastellus, Miniopterus schreibersii, Pipistrellus pygmaeus*. More than 72% of contacts was from *Pipistrellus pipistrellus*, which is also the most widespread species followed by *Hypsugo savii*, *Pipistrellus kuhlii* (both recorded in over 30% of sampling sites) and *Myotis* sp. group (ca. 20% of sampling sites). The highest activity index was recorded in Turkey oak woodland (21,43 contacts/h) followed by meadows and pastures, bushes and beech woodland and differences between habitat categories were statistically significant (chi-squared = 62.0544, d.f. =7, *p*-value <0,01). All 20 species were recorded inside Turkey oak woodland while other habitats showed a lower richness at species level. Because of *Pipistrellus pipistrellus'* dominance in Turkey oak woodland, equiripartition index was lower compared to shrubland and meadows and pastures. Some species (*Barbastella barbastellus* and all *Myotis* sp. group) appeared to be strictly linked with woodland habitats in general as their activity indexes were higher in this habitat than in the others. *Myotis* species also conspicuously foraged on meadows and pastures probably because of food availability (biomass and species diversity and richness) and because the study area is primarily covered by trees with relatively small patches of open-habitats also suitable for species strictly connected to the ecotones. Data are consistent with an area of significant conservational meaning. Our findings were useful in order to provide management recommendations, especially for woodlands and pastures, which significantly increase environmental diversity that are fundamental for bat diversity and a well-structured bat community.

Taxon	Activity index	Taxon	Activity index
Pipistrellus pipistrellus	11,02	*Myotis oxygnathus*	0,04
Pipistrellus kuhlii	0,46	*Plecotus sp*	0,04
Hypsugo savii	0,42	*Myotis bechsteinii*	0,03
Myotis sp	0,35	*Myotis daubentonii*	0,03
Eptesicus serotinus	0,29	*Myotis myotis*	0,03
Barbastella barbastellus	0,26	*Chiroptera sp*	0,02
P.kuhlii/nathusii	0,20	*Myotis alcathoe*	0,02
Miniopterus schreibersii	0,19	*Pipistrellus pygmaeus*	0,02
Rhinolophus ferrumequinum	0,14	*Myotis mystacinus*	0,01
Pipistrellus nathusii	0,07	*Rhinolophus hipposideros*	0,01
Myotis emarginatus	0,05	*N. leisleri/E. serotinus*	0,01
Nyctalus leisleri	0,04	*R. hipposideros/euryale*	0,01
Myotis cfr nattereri	0,04	***Total***	**13,73**

Table 2. Activity index of each detected taxon

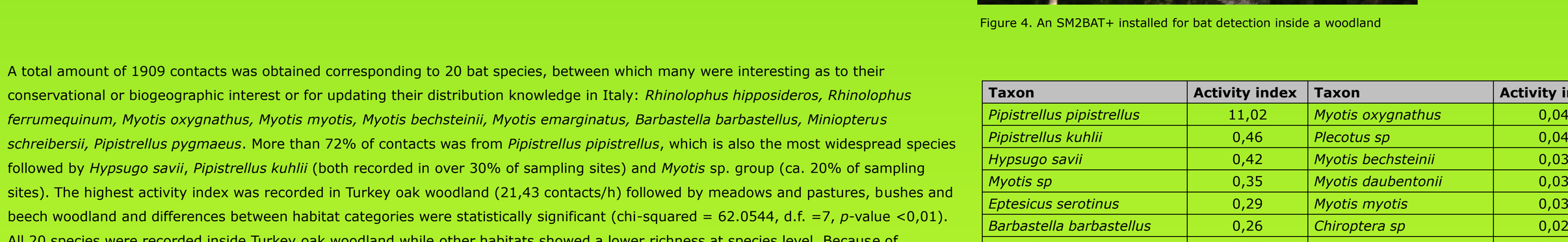

Figure 5. Variability of activity index of each detected taxon

Habitat	N. of points	Activity index	Min n. of species	Shannon Index	J Index
Shrublands	10	17,10	10	1,87	0,75
Mixed decidous woodlands	1	9,00	1	-	-
Turkey oak woodlands	26	21,43	20	0,78	0,24
Water	1	0,44	2	-	-
Beech woodlands	2	16,50	3	-	-
Meadows and pastures	6	19,80	9	1,94	0,78
Hygrophil woods	3	2,38	5	0,74	0,46
Ecotones	14	2,20	8	1,71	0,78

Table 3. Biodiversity and activity index for each habitat

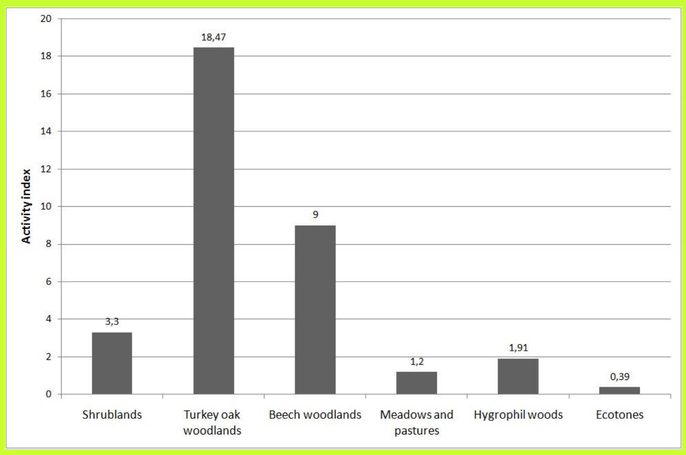

Figure 6. *Pipistrellus pipistrellus'* activity index in different habitats

Management recommendations

- Forestry management (conservation of trees suitable as roosting sites, practices for biodiversity conservation….)
- Buildings management for roosting sites protection and availability
- Pastures management (conservation of open areas for bat foraging, reduction/banning of ivermectin-based drugs for livestock…)

Figure 7. *Pipistrellus pipistrellus* mist netted within SCI