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Oskarshamn site investigation

Investigations on mammals – bats

Investigation of the fauna of mammals in selected places within SKB investigation area

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September 2004

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Keywords: Survey of species, Richness of species, Biotopes, Exploitation, Bat environment, Bats, Inventory, Consequences, Red listed species.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

A pdf version of this document can be downloaded from www.skb.se

Abstract

This report gives an account of the result of investigations of the fauna of bats in selected places within SKB site investigation area at Oskarshamn. In order to produce a basis of knowledge on the fauna of bats within the investigation area Calluna AB has made an inventory of bats at night by means of an ultrasound detector. The sections for investigation have been chosen after interpretation of air photos, inquiry into available knowledge, and field work. An inventory was made of 23 identified sections of which 14, and 4 additional particular objects, were investigated during the summer of 2004.

The inventory resulted in 9 species being identified within the area of investigation. In the two sections most rich of species 5 species were registered and in 6 additional places 4 species were found. Two kinds of environments have been identified as especially valuable to bats within the area of investigation. In the archipelago the most valuable areas are in wind shielded sites in association with water and in the mainland in association with buildings. Two red listed species were found within the area of investigation and a third red listed species cannot be excluded.

So far the result of the investigation hints that two different kinds of environments should be taken into consideration; wind shielded areas, having high production of insects, in the archipelago, and in agricultural environments with active farming. To sum up we suggest deeper studies including increased activity in areas with red listed species, visits in other areas of similar character to the one most rich of individuals in this investigation, and extended studies around the farms in the area.

Sammanfattning

Den här rapporten redovisar resultatet av undersökningar av fladdermusfaunan på utvalda platser inom SKB utredningsområde vid Oskarshamn. För att ta fram ett kunskapsunderlag om fladdermusfaunan inom utredningsområdet har Calluna AB under sommaren 2004 nattetid inventerat fladdermöss med hjälp av ultraljudsdetektor. De delområden som inventerats har valts ut efter flygbildstolkning, genomgång av befintlig kunskap och fältbesök. Under arbetet identifierades 23 delområden varav 14 stycken samt 4 punktojekt inventerats under sommaren 2004.

Undersökningen resulterade i att nio arter observerade inom utredningsområdet. I de två artrikaste delområdena noterades fem arter och på ytterligare sex platser hittades fyra arter. De två artrikaste områdena påträffades i skärgårdsmiljön där också det individrikaste området hittades. Två typer av miljöer har identifierats som speciellt värdefulla för fladdermöss inom utredningsområdet. I skärgårdslandskapet finns de värdefullaste områdena i vindskyddade lägen i anslutning till vatten och på fastlandet i anslutning till gårdsbebyggelser. Två rödlistade arter påträffades i utredningsområdet och en tredje rödlistad art kan inte uteslutas.

Hittills antyder resultatet av undersökningen att hänsyn främst bör tas i två olika typer av miljöer. I vindskyddade miljöer, med hög insektsproduktion, i skärgårdsmiljön, och i jordbruksmiljöer med aktivt jordbruk. Avslutningsvis föreslås förslag till fördjupade aktiviteter. De består av utökad aktivitet i områden med rödlistade arter, besök i flera miljöer med likartad karaktär som den individrikaste i undersökningen och utökade studier kring gårdarna i utredningsområdet.

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1 Introduction

This report accounts for the result of investigations on the fauna of bats in selected places within SKB site investigation area at Oskarshamn. SKB carries out investigations of places in the area of Simpevarp, Oskarshamn, to investigate the adequateness of a location for deep repository for spent fuel. The activity was carried through in the local modell area of SKB. The purpose of the investigation is to form a basis for a future environmental impact assessment (EIA) on final safekeeping and to minimize disturbances in SKB investigations. In Table 1-1 controlling documents for performing this activity are listed. The Activity plan, listed in Table 1-1, is an SKB internal controlling document.

Table 1-1. Controlling documents for the performance of the activity.

Activity plan	Number	Version
Inventory of bats	AP PS 400-04-028	1.0
Method descriptions	Number	Version
Naturvårdsverket /7/		1996-10-29

Bats are a group of mammals strongly influenced by human activities, both in positive and in negative sense. Of the 18 species of bats in the country 6 are on the national red list. Several conventions and agreements also exist in protection of the fauna of bats. EU indirectives within the area of preservation of natural amenities imply that all species “demand close protection” and that the species pond bat and barbastelle bat shall be preserved in the country by “appointing special preservation areas”. The most important document in this matter is the agreement on protection of bats in Europe signed by Sweden and valid from 1994.

Activities that negatively influence the production of insects in the landscape also have a negative effect on bats as well as changes in structures, both on large and small scales, and changes in accessibility of small areas that offer places for hibernation and breed.

Valuable bat environment is signified by propitious structure in tree-bushlayers as well as other natural conditions like custom, access to water, location and plenty of insects.

Pre-work in the field was carried out on the 10th of June 2004. Field visits in order to study the fauna of bats have been made six times at night during the period from June 28th, 2004 till August 2nd, 2004.

In Table 1-2 references for storage of data in the SICADA database, from the performance of the activity, are listed.

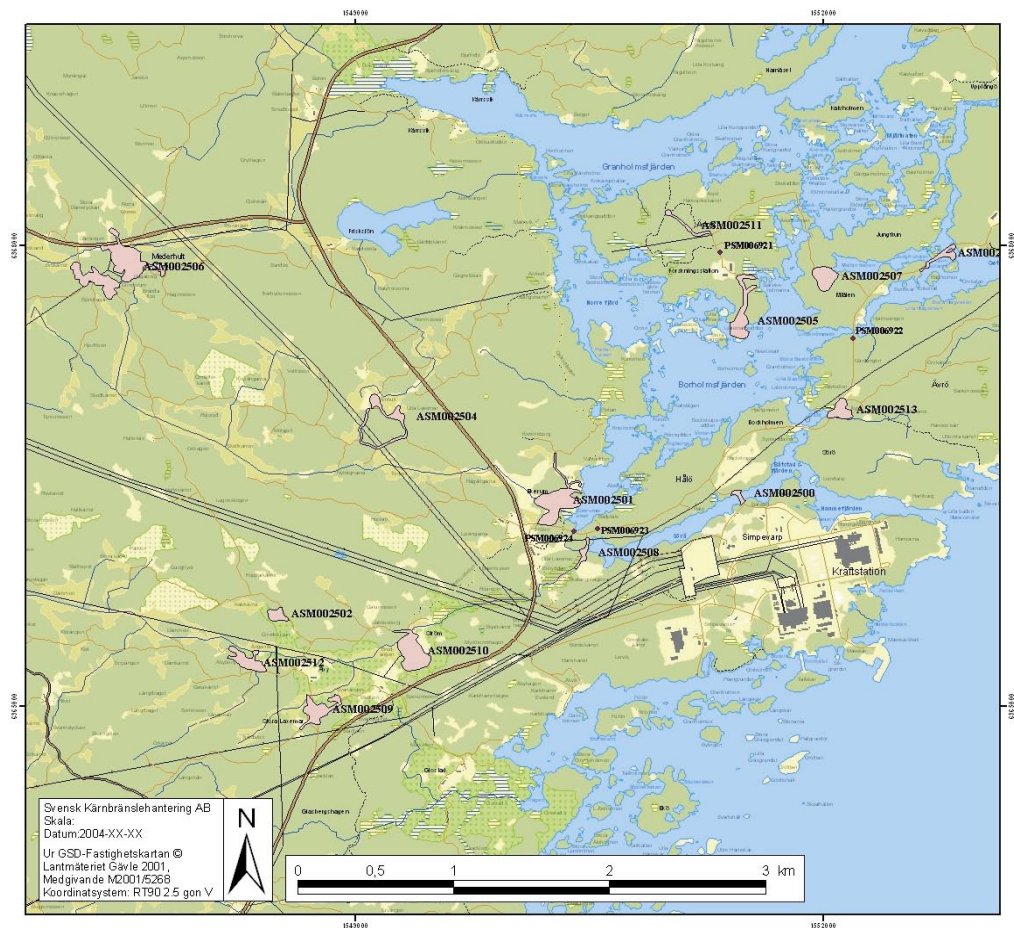


Figure 1-1. Location of the studied areas, chosen due to conditions likely to have a rich presence of bats.

Table 1-2. Data references.

Subactivity	Database	Identity number
ID code Bat observations	SICADA	Field Note Simeparv 508
ID code Bat observation area	SICADA	ASM 002500-002513
ID code Bat observation point	SICADA	PSM 006921-006924

2 Objective and scope

This investigation is a first overall survey to gather information on the fauna of bats within the investigation area. In connection with fieldwork those species hunting at night are looked for, in every section of investigation.

General objectives for the investigations are to generate a basis of information for the forthcoming environmental impact assessment and to generate knowledge of the bat fauna in the site investigation area, in order to minimize the disturbance during activities performed by the SKB.

Sub objectives are to:

- Identify valuable bat biotopes in the area of investigation.
- Investigate the fauna of bats in a number of chosen bat biotopes.
- Search for possible presence of red listed species or EU-listed species.
- Suggest direction of potential continued work in the area of investigation.
- Describe conceivable consequences for the fauna of bats in connection with exploitation.

3 Equipment

3.1 Description of equipment/interpretation tools

To carry out a study on bats at night an ultra sound detector with a possibility for time expansion is required. In the study the model Ultrasound detector D 240x was used which is manufactured by Petterssons elektronik AB.

This instrument transforms high frequency sounds that bats use to “see” in the dark, into hearable sound. At a sound observation of bats in the field the equipment is adjusted to make the sound as clear as possible to make it possible to judge the frequency of the sound. Frequency, rhythm, and the conduct and appearance of the animals, are all parts of the qualification. For a more thorough description of how work is done with an ultra sound detector we refer to publication /1/.

To achieve a good result it is essential the investigator has a good knowledge of the sounds and behaviour of different species. The equipment must also be used with headphones.

In connection with recording rare species and species difficult to qualify, a digital tape recorder is used to tape the sound observations made in the field. The tape recorder must be equipped with two separate channels and the volume for recording must be manually adjustable.

A detailed calibration of the instrument is not necessary since the definite qualification of bats is a synthesis of behaviour, rhythm, pulse, and appearance in the species. An adequate calibration of the instrument is achieved when known species are being recorded.

In relation to field work a handheld GPS modell Garmin eTrex Venture with exactitude of 4–10 metres depending on surrounding conditions, was used.

4 Execution

4.1 General

This work has been carried out in two steps. In step one, identification of sections of areas and reconnoitring in the field in daytime was included. Step two involved the inventory of bats at night using an ultra sound detector.

Methods used broadly follow the method for environmental supervision established by Naturvårdsverket. Bats, the part dealing with mapping of species. The description of the method is available at www.naturvardsverket.se.

4.2 Preparations

The initial work was begun in May by collecting known knowledge about the area from earlier investigations, air photos and map material.

After these preliminaries the area was visited in the daytime in order to identify suitable places where to carry out the investigations at night. At the same time contact was also established with inhabitants in the chosen sections.

An initial meeting with the client also took place before the investigation. This initial meeting and reconnoitring took place in the beginning of May. As a result maps for fieldwork were recognized.

When the map for fieldwork was produced the extent of the assignment was discussed with the client with regard to costs.

Before every inventory at night an inventory in daytime was carried out in order to search for small settings within every section.

4.3 Execution of field work

After the brooding period of the bats the inventorial work was initiated at the end of June. After the birth of the young bats, female bats are more disposed to remain in the surroundings where they have been observed. Every chosen section was visited 1–3 times between 15–45 minutes. 3–4 sections were visited every night. To identify flying bats, every section is ransacked very fast with an ultra sound detector. In addition also occasional inventories were carried out involving short stops along roads in the area. These stops took 5–15 minutes.

Two species were specially treated: whiskered bat and brandt's bat. These have been joined together collectively as whiskered/brandt's (w/b) because it is impossible to separet sonar sounds.

We have also tried to appreciate the number of individuals in the section. We have counted individuals we have seen or heard in the ultra sound detector. Appreciations of number of individuals are always unsure, partly because the limited range of the detector and partly because of the movements of the bats. Therefore we have only counted the number of observations that have been apprehended to be separated in space. This implies that the real number of individuals is likely to be higher. The appreciation is mainly thought to be of help when judging of the relative richness of individuals in the sections.

At every inventory, but not on occasional inventories, air temperature, cloudiness wind direction and wind power were registered. Co-ordinators, with handheld GPS, was taken in every place of inventory.

Weather observations were made according to standard documents issued from SMHI /8/. Weather is something that essentially influences the activity in bats. Standardized methods to carry out weather observations can be of help for evaluation of future repetitive inventories.

Wind power on every occasion is assessed according to SMHI's five-grade scale as follows.

Table 4-1. SMHI's five-grade scale to assess wind power.

Code	Windpower	Description
A	Calm	No wind
B	Soft	Hardly notable – leaves move
C	Moderate	Leaves and weak twigs move continuously – twigs and weak branches move continuously
D	High	Smaller deciduous move – large trees move
W	Strong	Whole trees swing – twigs breaks off from trees

Cloudiness on every occasion is assessed according to SMHI's nine-grade scale as follows. During nighttime, when clouds can't be observed, cloudiness is estimatet by how great extent of the starry sky that is visible. Cloudiness is to be found on the field protocol as a number code.

Table 4-2. SMHI's nine-grade scale to assess cloudiness.

Code	Cloudiness	Description
0	0	Cloudless
1	1/8	Wisp of cloud
2	2/8	
3	3/8	
4	4/8	Cloud-cover of half the sky
5	5/8	
6	6/8	
7	7/8	A bit of blocked out sky can be seen
8	8/8	Cloud-cover of the sky

4.4 Data handling/post processing

To assemble data we used a field protocol adapted for this study. Data were then arranged manually in tables.

In connection with inventories in addition to species also numbers of individuals were recorded as above. The number of individuals should be seen as a rough estimation which probably most often is an underestimation of the real number of individuals. Although the estimation is uncertain it is presented in this context as an absolute number so we can use the information in case of a future follow-up.

4.5 Analyses and interpretations

The analysis of collected data is based the following three criteria for evaluation.

- Richness in species in the investigated habitats.
- Occurrence of rare or red listed species.
- Identify valuable environment for bats within the area of investigation.

As to richness of species we start from the last compilation of the distribution of species and status made in Sweden /2/ and Calluna's earlier experience in the inventory of bats. A inventory of Oskarshamn's and Mönsterås' districts made by county administration are used for a local comparison.

Analysis of red listed and rare species are based on current red list /3/, artfaktablad (facts of species) from Artdatabanken and Calluna's earlier experience in the inventory of bats. Current information about red listed species can be found at www.artdata.slu.se.

When analysing sections investigated we used earlier experience of bat habitats. For easily accessible information about the demand of the bats on their habitats we refer to Jordbruksverket's publication of bats /5/.

4.6 Nonconformities

In the activity plan we state that the period of investigation is 040601–040730. Due to bad weather towards the end of the investigation the last visit was paid on 040802.

On one occasion 040802, an inventory was done although a there was a drizzle in the evening. The inventory was later suspended due to steady downpour.

Otherwise no discrepancies were recorded.

5 Results

- The original results are stored in the primary data bases (SICADA and GIS), and that it is the data in these data bases that will be used for further interpretation (modelling).
- Totally 23 sections have been identified with possible increased values for bats in the area of investigation. 14 of these were visited at night including 4 particular objects.
- Altogether 9 species of bats were found. Of these two are red listed, natterer's bat and nathusius' bat. It cannot be excluded that a third red listed bat, whiskered bat, is in the area.
- In the two habitats richest of species, both in the archipelago, 5 species were reported and in 6 additional places 4 species were recorded. The visits in the other sections resulted in 0–3 species.
- The area richest in individuals was found in the archipelago at Länsmansudde.
- Two sure brooding colonies have been found in the area, and indications of colonies are noticed on two more sites.
- Two types of environments have been identified as especially valuable for bats within the Simpevarp area. In the archipelago the most valuable areas are in wind-shielded habitats near water and in the main land near farms.

5.1 Investigated sections

In the area of investigation 21 sections of different sizes were identified which showed characters favouring bats. During the end of the investigation another 2 sections were found which could be of importance to the fauna of bats. Of these 23, 14 have been visited at night at different intervals. Besides these sections ransacked four particular habitats (particular objects 1–4) were investigated. All sections shown in Table 5-1 are situated within the area marked on the map (Figure 1-1), except for Vändplanen and Pumphuset.

Table 5-1. Site co-ordinates and Id-code for investigated sections.

Sections	Id-code	x-co-ordinat	y-co-ordinat	comments
Båtstad	ASM002500	6366397	1551436	In the area
Ekerum	ASM002501	6366315	1550300	In the area
Grindstugan	ASM002502	6365604	1548498	In the area
Jungfruhålet/ Törn tullarna	ASM002503	6367929	1552732	In the area
Lilla Laxemar/ Ärnhult	ASM002504	6366902	1549283	In the area
Länsmansudden	ASM002505	6367794	1551476	Start
Mederhult	ASM002506	6367863	1547525	In the area
Mjälen	ASM002507	6367799	1551940	
Pumpstation	ASM002508	6366036	1550474	In the area
Stora Laxemar	ASM002509	6364903	1548 49	In the area
Ström	ASM002510	6365350	1549359	In the area
Vändplanen	ASM002511	6368215	1551000	In the area
Åbyberg	ASM002512	6365272	1548316	In the area
Ävrö	ASM002513	6366926	1552051	In the area
Particular objects				
Punktobjekt 1	PSM006921	6367953	1551338	
Punktobjekt 2	PSM006922	6367394	1552189	By bridge
Punktobjekt 3	PSM006923	6366154	1550552	By beach
Punktobjekt 4	PSM006924	6366139	1550402	

5.2 Weather conditions at inventory occasions

The weather conditions during the work were good as a whole. On a few occasions the wind speed in the archipelago was a little too high for an inventory. On these occasions sections in the main land were investigated instead. The worst conditions are a strong wind and low temperature. On one occasion it was raining which constitutes a bad condition. Look further under deviations.

Table 5-2. Date, time and weather conditions for all inventory occasions.

Section	Date	Start time	Stop time	Wind at start	Wind at stop	Direction of wind	Cloudiness at start	Cloudiness at stop	Temp at start °C	Fog/rain-fall
Båtstad	040717	01.20	01.51	B	C	V	0	0	11	No
Båtstad	040802	22.33	22.45	A	A	non	8	8	28	Rain
Ekerum	040628	22.23	23.11	A	B	V	4	4	18	No
Ekerum	040716	23.20	00.08	A	A	non	0	0	14	No
Grindstugan	040631	00.20	00.40	A	A	non	0	0	11,5	No
Jungfruhålet/ Törn tullarna	040714	23.30	23.54	B	B	non	2	2	14	No
LillaLaxemar/ Ärnhult	040714	22.45	23.20	A	A	non	0	2	11	No
Länsmansudde	040628	23.34	24.10	A	B	V	7	7	19	No
Länsmansudde	040715	00.02	00.40	A	B	N	3	3	12	No
Mederhult	040630	23.10	00.15	B-C	B-C	V	0	0	?	No
Mederhult	040716	22.20	23.07	A	A	non	0	0	13	No
Mederhult	040629	01.28	01.53	A	A	non	5	5	13	No
Mjälén	040629	00.28	00.51	C	C	V	8	8	19	No
Pumpstation	040717	00.10	00.47	A	A	non	0	0	11	No
Pumpstation	040802	21.45	22.22	A	A	non	8	8	18	Rain
Stora Laxemar	040802	22.35	00.01	A	A	non	8	8	16	Rain
Stora Laxemar	040630	22.50	23.35	A	A	non	4	0	12	No
Ström	040629	01.38	02.14	B-C	B-C	V	8	8	17	No
Ström	040631	00.44	01.32	A	C	V	0	0	12	No
Vändplanen	040715	00.45	01.07	A	B	N	6	6	13	No
Åbyberg	040629	23.45	00.19	A	A	non	0	0	12	No
Åbyberg	040802	22.35	23.30	A	A	non	8	8	17	Rain
Ävrö	040717	00.55	01.10	C	C	O	0	0	11	No

5.3 Number of species

In total nine species have been discovered. In the three sections most rich of species five species were recorded and in five sections four species. The two habitats most rich in species can be said to be in the archipelago while the others are farms in the main land.

Table 5-3. Species in the investigation area.

Species Latin name	Species English name	Species code	Occurrence in number of sections
<i>Myotis mystacinus/Myotis brandtii</i>	Whiskered/Brandts bat	Myotis w/b	5
<i>Myotis nattereri</i>	Natterer's bat	Myotis nat	1
<i>Myotis daubentonii</i>	Daubenton's bat	Myotis dau	6
<i>Vespertilio murinus</i>	Frosted bat	Vesp mur	1
<i>Eptesicus nilssonii</i>	Northern bat	Epte nil	11
<i>Nyctalus noctula</i>	Noctule	Nyct noc	10
<i>Pipistrellus pygmaeus</i>	Pipistrelle	Pip pyg	14
<i>Pipistrellus nathusii</i>	Nathusius' pipistrelle	Pip nat	1
<i>Plecotus auritus</i>	Brown long-eared bat	Plec aur	5

The most spread species in the study are pipistrelle, northern bat and noctule. Pipistrelle and northern bat are also among the most common species in the investigation of 56 habitats in the districts of Mönsterås and Oskarshamn /6/ made by the county administration. Noctule often moves over wider areas. In this investigation the sections are occasionally close to each other, which might contribute to the fact that it is among the most common species in the investigation. Frosted bat was only recorded in one place in the area. It is a species which often is rare at inventories of the countryside. In spite of this it is not red listed which can be explained by the fact that it can be frequent in towns in the autumn. Brown long-eared bat is held to be one of the most common species in the country. In spite of this it is only recorded in five places. The species has a very faint sonar and is difficult to discover in the field. Daubenton's bat is another species which often is very common in connection with water. All observations have been made near water. All observations of whiskered/brants have been made in sections in the main land near farms.

Table 5-4. Noticed species in all sections. Question mark marks uncertain observations. The number gives estimated numbers of individuals and number within parentheses give the number of observations during visit.

Delområde	Date	Myotis ?	M. w/b	M. nat	M. dau	Vesp mur	Epte nil	Nyct noc	Pip pyg	Pip nat	Plec aur	Spe- cies	Un- certain spe- cies
Båtstad	040717				2(4)		1(1)	1(5)	1(4)	1(1)			
Båtstad	040802				1(1)							5	
Ekerum	040628							1(1)	2(3)				
Ekerum	040716				2(2)			1(1)	1(1)		1(1)	4	
Grindstugan	040631											0	
Jungfruhålet/ Törn tullarna	040714				2(4)		1(1)	2(2)	1(1)			4	
Lilla Laxemar/ Ärnhult	040714		1(1)				1(1)		5(7)		?	3	1
Länsmansudde	040628						6(12)	3(6)	1(2)		?		
Länsmansudde	040715					1(1)	6(12)	2(5)	2(2)		1(1)	5	
Mederhult	040630		2(2)				?		1(?)		3(5)		
Mederhult	0400716						1(1)		1(1)		1(1)		
Mederhult	040630						?				1(1)	4	
Mjälen	040629				1(1)		1(1)		?			2	1
Pumpstation	040717				1(5)			1(4)	2(6)				
Pumpstation	040802				5(16)			1(1)	1(1)	?		3	1
Stora Laxemar	040802							1(1)					
Stora Laxemar	040629		1(2)						2(6)		2(2)	4	
Ström	040629						1(4)	1(5)	1(2)		1(1)		
Ström	040630		2(4)					1(1)	2(2)		2(2)	5	
Vändplanen	040715	1(1)							1(1)			2	
Åbyberg	040630		1(1)				1(5)	1(2)	2(3)				
Åbyberg	040802						1(1)	1(2)	1(1)			4	
Ävrö	040717						1(2)		1(1)			2	
Particular objects													
Punktobjekt 1	040628						1(1)	1(1)	1(1)			3	
Punktobjekt 2 (vid bro)	040629				1(1)		3(3)	1(1)				3	
Punktobjekt 3 (badplats)	040629								1(1)			1	
Punktobjekt 4	040629			1(1)								1	

5.4 Colonies

Within the area of investigation two colonies were discovered with certainty. In the house at Lilla Laxemar there was one colony of pipistrelle and at Mederhult there was one colony of brown long-eared bat in one of the summerhouses. At Länsmansudde there flew several individuals of northern bat and close to Pumpstationen there flew several individuals of daubenton's bat. At both places there were many individuals early at dawn, which would suggest that there is a colony close to the observation site.

5.5 Red listed species and richness of species

Red listed bats are in area of the investigation. Two of the red listed species have been recorded in a rather limited area. Natterer's bat was observed at south end of Ekerumeviken, at the inflow, and the Nathusius pipistrelle at the bridge in the northern end of the "pond" Sörå. This site is within the section named Båtstad, at the northern entrance to Simpevarp. Nathusius' pipistrelle is classed as near threatened (NT) in the Swedish red list and the whiskered bat is classed as vulnerable (VU) in the Swedish red list.

In five places in the area recordings of species have also been made of the complex Whiskered/brandt which is impossible to separate in the field. All observations are made in connection with houses in the main land at Lilla Laxemar, Mederhult, Stora Laxemar, Åbyberg and Ström. It is therefore impossible to exclude whiskered bat, which is classed as vulnerable (VU) on the red list from possibly being in the area. Brandt's bat is not red listed.

Natterer's bat, nathusius pipstrelle and whiskered bat are listed in the habitat directories of the EU, enclosure 4. All European bats are included in the "Bat treaty" EUROBATS, Agreement on the Conservation of Bats in Europe, 1991, which is an agreement under the Bonn Convention.

Both natterer's bat and whiskered bat belong to the hard definable species myotis. To definitely classify these two species they must be caught. Catching bats is a very time demanding task, which often takes knowledge of where the colony is. No colony of the species mentioned was discovered this year. In county administration inventory /6/ including the districts of Oskarshamn and Mönsterås they are relatively common.

The richness of species in the searched areas cannot be said to be high. In Sweden the areas most rich of species have 11–13 species and a habitat in South- and Middle Sweden is regarded especially rich of species if there are 7 or more species /2/. Within the area totally 9 species have been found in this investigation which is half of the species of bats being found in the country. Of the 18 species of bats being found in the country 5 are rare and only recorded a few times i mainly the south of Sweden /2/.

In connection with the inventory in 2003 made by count administration (Länsstyrelsen in Kalmar län) in adjacent habitats Misterhult and Basthult 6 species were found in each habitat. No other species than those found in the area of investigaton are recorded.

5.6 Valuable bat habitats

In the area 14 sections and 4 particular objects were searched. Of the sections most rich in species there are two categories. Partly wind shielded habitats close to the archipelago north of the power plant and partly in farm areas with more or less active farming in the main land.

When it comes to the first mentioned category a good example is Länsmansudden south of the research station. Here 5 species were recorded and here was also the richness in individuals highest. Several reasons contribute to make this area valuable. Bats do not like environments with thick wood and here the wood is sparse. The rocks in the area cause an extension in space among the trees. In connection with the area there are shallow areas with reeds contributing to high production of insects. The point of land in itself contributes to the fact that there are wind-shielded sites disregarding wind speed, which is valuable to insect hunting bats. Five species were also recorded at Båtstad in spite of the fact that the area being searched was relatively limited. Here the richness in individuals was not as high but water including production of insects in wind-shielded surroundings is surely an explanation to the richness of species. Another explanation might be that this area offers an inviting passage to move in. In the area there are several sites with qualities like the above mentioned which have not been searched.

The main land is strongly influenced by woodland with interspersed fields. The landscape is also very dry and is marked by wood cultivation with growing, more or less closed younger pine-forests, mainly pines. The most interesting part of the main land is probably the part framed by the farms Åbyberg, Ström and Stora Laxemar. In this part of the landscape there are for example farms with animals, which cause a landscape with the biggest element of deciduous forest and natural pastures in the area of investigation. Here are also at least three ponds and farms that are positive components in the landscape of bats. Several of the farms in the area sheltered 4 species and one 5 species, which suggests the living farm environmental importance on the fauna of bats in the Simpevarp area.

6 Consequences of exploitation

The study of bats in the area of investigation suggests that attention should be paid to several components in the landscape. If the bat population is to be preserved in connection with a potential future exploitation, wind shielded areas rich in insects in the archipelago and farms with active farming must be considered. Drainage of main land areas must also be obstructed.

In the archipelago in the area at Länsmansudden one habitat has been observed as especially rich in individuals. The area can be compared to the area north of the research station (Vändplanen), where observations were made of two isolated species. The area is characterized as equal to wood structure but it is on a hill and not as protected against wind. In the area also shallow water with rich production of insects is missing.

There might be areas with as good conditions in the area as at Länsmansudden. Sections with the quality can also fill an important function in a larger perspective for the fauna of bats. Early in spring, in April, when the bats wake up from the hibernation and the production of insects in the landscape otherwise has not started there is feed here. Environments of this type are specified in scientific connections as key habitats for bats /4/ and can play a key role for bats in a larger geographical association.

Several of the environments most rich in species in the main land are farms with active farming for example Ström, Mederhult and Åbyberg. All companies in the area which have a negative influence on farming should be considered negative to the fauna of bats. Above all if the possibilities of keeping animals is negatively influenced. Farming creates an open landscape and pasture contributes to creating structures in the landscape and the production of insects. Around the houses there are also often elements of deciduous forrest which is positive to bats.

The deciduous forrest in the main land can be said to be concentrated in a triangle with corners at Ström, Åbyberg and Stora Laxemar. All companies which limit the contribution of deciduous forrests in the area are negative, especially if old sparse placed hardwood trees are being felled. Isolated trees with cavities are also an important component to the fauna of bats.

The main land environment in the area is characterized by not having so much water, of more permanent character, or swamps. All companies which drain the landscape further will influence the production of insects in a negative way and are thus negative to the fauna of bats. Smaller ponds have been spotted close to the houses at Åbyberg and Ström and about 200 metres north to Åby, in the wood, just north of the road to Ström. All of these are in the triangle which is described for the spreading of deciduous forrest above.

If the two red listed species, natterer's bat and nathusius' bat shall go on living in the area also consideration in connection with exploitation is demanded. Than also in the area outside the above mentioned triangle. The area where they have been recorded, and in adjacent areas must be excluded from large scale companies. It is reasonable to suppose that the surroundings of Sörån and the swamp in the southwest extension of the pond ought to be kept untouched. The habitats along the brook which falls into the Ekerumsvik should also be taken into consideration. With today's knowledge it is likely to suggest that intensive clearing, felling, excavation and similar measures might involve local eradication of red listed species of bats.

7 Suggestions for deeper efforts

Below suggestions for increased efforts in connection with the documentation of the fauna of bats are given.

- In a rather limited area both natterer's bat and nathusius bat were recorded. Increased efforts in this area could give information if the observations consisted in isolated observations or if the species are permanently in the area. A more detailed knowledge about what considerations must be taken at a possible exploitation of the area is also a result of an increased effort here.
- In connection with that the propitious conditions at the Länsmansudden were recorded there was an ambition during the latter part of this years investigation to search more places with similar character. Due to bad wind conditions no inventory was carried out at for example the area around the Äspeholmen, Lilla Bastviken and Stora Bastviken. An extended effort could give valuable information about the local value for bats in this type of environments.
- In connection with the work around the farms at Mederhult, Ström and Åbyberg the effort was concentrated to the houses and the closest surroundings. We suggest an extended effort here with the aim of visiting surrounding pastures and deciduous forrests close to the farms. This can contribute more species to the investigation but above all contribute with knowledge about the importance of this part of the landscape for the fauna of bats.

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