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Bats and wind power –investigations required for risk assessment in Denmark and Sweden

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Background

Field investigations of the bat fauna were initiated with the use of ultrasound technique in 1978.

Today we have an almost complete overview of bat distribution and species richness in Sweden and Denmark. Data were published as atlases, distribution maps, and facts on status for each species.

Bats killed by wind turbines were discovered the first time in September 1999 on Gotland. Studies on behaviour of bats at turbines started in 2001 and were performed with the use of detectors, heat image cameras, acoustic playback experiments, and automatic registration.

The research was funded by the Swedish Energy Agency, the Swedish Environmental Protection Agency (Vindval programme), the Swedish University of Agricultural Sciences, the Natural History Museum of Denmark, and the University of Copenhagen. The project on wind power at sea involved cooperation between scientists in Denmark, Germany and Sweden.

Need for guidelines and recommendations

We experienced an urgent need among authorities and consultancies to get clear guidelines for planning and field investigations at suggested wind parks. Certain minimum conditions must be fulfilled concerning evaluation of the project area, timing of investigations etc. to provide data necessary for a meaningful risk assessment. Therefore we are preparing guidelines with our recommendations for investigations and procedures for handling problems with bats and wind power installations.

Planning process

Planning, evaluation and decisions on bats and wind power problems are handled by a number of authorities. In Sweden it is mainly County administrations and Municipalities, and in Denmark the Municipalities. Some cases are also handled by the Swedish Environmental Protection Agency and the Danish Nature Agency. A few cases are also decided at the Land and Environment Court, and the Land and Environment Court of Appeal in Sweden and Environmental Board of Appeal in Denmark.

Field investigations of bat species occurrence at planned wind power installations are usually carried out by biologists (who are only sometimes bat specialists) from consultancies. Results and conclusions about effects on bats are then referred to in an Environmental Impact Assessment (EIA) that follows the official application.

We have made it possible for bat specialists to get any difficult or remarkable observations confirmed by a “Rarities committee” common for Denmark and Sweden. Observations recommended for checking are defined by criteria revised every year. These are based on best expertise and our experience of difficulties and frequent mistakes.

Examples of procedures that need improvements

In both Sweden and Denmark there have been a number of cases where the procedures in planning, examination, and field investigations have not been conducted in a professional and thorough way. Improvements and guidelines are needed. Some cases were quite unacceptable and call for a change of procedures as soon as possible. A few examples of such cases follow.

- Some wind power companies hide investigation reports and do not mention them in the EIA.
- In some EIA statements and conclusions differ from the specialists and are sometimes contrary to well known facts.
- Some authorities require investigations from the migration period only based on a widespread misunderstanding that investigations during breeding time are not needed.
- A large wind farm project was approved with reference to a specialist statement that habitats are of no value for bats. The authority refused to give the specialist's name and no documents were registered, neither any notes from phone calls.
- Investigations are kept secret by a number of companies even if referred to in EIA.
- Specialists with insufficient competence have been engaged.
- Detectors with heterodyne system only, have been used by some consulting specialists.

Timing and area for pre-construction surveys

Field investigations require studies on activity and species composition in a project area also including suitable colony habitats and hunting sites within a radius of at least 2 km in the surroundings. Remember that some small bat species regularly fly 4 - 5 kilometers from their colony or roost and larger species even more. Methods include automatic registration, detector listening etc. to ensure data on species presence, number of observations and facts on activity and status.

Investigations are obligatory for the following periods:

- A) At least two separate surveys in the breeding season (late June - early August),
- B) Two surveys in mid-August to mid-September when bats migrate or disperse.
- C) If certain "key habitats" are suspected with mass occurrence of insects in spring, two additional surveys are required in late April-May. Examples are river mouths, lakes, coastal meadows.

Two separate surveys (separate in time) is an absolute minimum for the breeding season. It means that each survey can take more than one night depending on area size (including surroundings) and habitat diversity.

Observations of bat behaviour and activity at turbines should be carried out in weather favourable for bat hunting in open air. Nights with strong winds, heavy rain, fog, and cold temperature should be avoided. Exact limits may vary with geographical location and must be based on experience from the area.

Technique and methods for pre-construction surveys

The methods and techniques should follow the "Species Richness Method" (presented in EUROBAT publication 5, 2010), and "Artkartering" (Naturvårdsverkets handledning för miljöövervakning, 2012) in Sweden and in Denmark "Teknisk anvisning: Overvågning af flagermus *Chiroptera sp*" (Nationalt Center for Miljø og Energi, 2012) or "Flagermus og større veje, registrering af flagermus og vurdering af afvaergeforanstaltninger".

It is important to use direct detector listening supplied with autoboxes for automatic registration. In many cases it would be sufficient to use at least 6-10/night to cover an area. Large areas may need more than one night rather than handling too many boxes/night. Only high quality recordings will allow identification of most species. Supplementary netting is sometimes necessary to confirm observations. Some species that are rare or difficult to identify require confirmation or identification aid by the "Rarities committee" (common for Denmark and Sweden, see "Artkartering" appendix 2).

Post construction surveys

We suggest post-construction surveys in all cases where wind turbines are established but where there is still an uncertainty about the risks. Searching for bats on the ground should be carried out throughout the periods when hunting bats are likely to be found in the area, most often from late July

to early September. If available, specially trained dogs can be very efficient to find bat carcasses. Bat activity around turbines can be monitored by automatic registration.

Important for bat studies at sea

Recent investigations at sea around the coasts of southern Scandinavia gave new knowledge on bat movements and behaviour. Both resident and migratory species use the rich access to flying and drifting insects and also take crustaceans in the surface. Bats commute between mainland and certain areas several kilometers off the shores. This goes on from summer to early autumn. Therefore they are probably not only dependent on good food supply on land, before departure for migration to the continent, but can also forage on this rich food resource during migration over the sea. Detailed mapping of these insect rich offshore areas is far from complete but is needed to secure that wind power installations are avoided in these areas.

When using automatic registrations from sea-marks, small islands, lighthouses or on boats in traffic etc. data on bat activity can be secured. However without data on flight directions it is often impossible to separate migrating bats (south, southwest, along the coast etc.) from bats commuting (between the coast and foraging area at sea). This is accomplished by visual observations with spotlights or heat image cameras if the automatic registration cannot register the changing sound directions from the source.

Other ecological effects on bats

Establishing wind power parks may affect bats by changed ecological conditions. One example is broadening of old forest roads and removal of leaf vaults that has been an important foraging habitat, especially in periods of bad weather. This can be negative for the survival of local populations of *Barbastella barbastellus*, *Plecotus auritus*, and *Myotis nattereri*. The location of a wind park in a larger forest area can also lead to maintained clear-cut areas and invasion of some dominant bat species with deteriorating conditions for some *Myotis*-species depending on continuous and dense forest habitats e.g. *Myotis nattereri*.

Conclusions and risk assessment

We warn that it is difficult to predict bat activity at wind turbines before they are built. At certain weather conditions turbines may attract huge masses of insects and bats are able to discover such new food resources even if they occur far out in “non-bat areas”. This also occurs in the breeding season.

The number of bats found killed at wind power installations in Europe do not only represent the vulnerability of each species but to a high degree also the abundance of them hunting or passing the turbines. The rare species are not likely to be found in high numbers. Some of them have not been sufficiently studied to predict their vulnerability.

We stress the fact that even bats that normally fly low sometimes go higher up for hunting insects. For example *Plecotus auritus* can scan turbines all the way up to the top. Out at sea *Nyctalus noctula* usually migrates and forages at low altitudes. However noctules will readily inspect the top portion of turbines for insects, and there are repeated observations of them hunting insects up to 1200 m above ground and shoreline in southern Sweden. Thus increased height of modern turbines may not minimize the risk for bats. On the contrary some studies show the opposite effect.

Need for high competence and independent status

This kind of bat work is difficult and requires engagement of bat specialists with high competence and several years of experience. They must have the skill to identify most bat species by detector listening, make high quality recordings and do most of the subsequent species identification. They should also have the knowledge of the different behaviour patterns of all species present in the area and know how to search for their favorite hunting sites. The situation for a bat specialist would be

better when she/he can be regarded as independent to economic and political interests and can report the results and conclusions with open access. The influence of site location on the fauna is of common interest for everybody. Therefore this part of the process is worth a status much like archaeological investigations e.g. before new roads are built.

A classification to speed up the planning and reduce the need of investigations

It should be possible to build up an increasing knowledge of how topography, habitats, coastlines, river valleys etc. in the landscape influence on the risk for bats. Already now it could be possible to simplify the planning and investigation procedures by starting with a classification of the planned sites into three categories for location in the landscape. 1) High risk sites, 2) Uncertain, and 3) Low risk sites.

With increasing knowledge this can save time and money by a concentration on studies of category 2 sites. Category 1 could be stopped at once, while category 3 gradually need less resources as soon as the type of site is safely assessed.

To build up sufficient knowledge for this planning model, almost every single case is dependent on a general survey of many wind parks all over our countries. Just now it is especially important to study bats at the new type of locations in forest areas. However all efforts to raise money for such a planned network of independent specialists have failed. Today there are some surveys carried out by wind companies, but the results are too often kept secret and are not accessible for scientific analyses.

What is an acceptable risk?

Criteria that ask for impact on species populations are at present unrealistic. We do not have enough data on population size and composition. Some calculations are presented by Rydell et al (2012) in the "Vindvals Syntesrapport". Examples of comparisons with other mortality e.g. road kills, tower wires is not quite relevant since collisions with turbines can be avoided by careful location of the turbines in the landscape. An ethical standpoint could therefore rather be to choose category 3 category sites and thereby avoiding risk for regular calamities of any species, common or rare.

All species deserve attention and some species deserve special attention

A total of 19 bat species is known to occur in Denmark and Sweden. Some of them are common and widespread and are not regarded as vulnerable at population level even with some casualties at turbines. But local populations of such more common species will still be vulnerable to repeated killings of higher numbers of individuals. Therefore the erection of wind turbines should be avoided in or near areas with a large and regular activity (colonies in the area) of more than 4 of those more common species, such as forests, forest edges, hedgerows, water courses, lakes etc. Even more seriously there are rare and probably vulnerable species with small populations in Denmark and Sweden that could be severely affected even with a limited number killed by turbines. These are all or some of the following, *Barbastella barbastellus*, *Myotis alcathoe*, *Myotis bechsteinii*, *Myotis brandtii* (in Denmark, except Bornholm), *Myotis dasycneme*, *Myotis myotis*, *Myotis mystacinus*, *Myotis nattereri*, *Nyctalus leisleri*, *Eptesicus nilsonii* (in Denmark), and *Pipistrellus pipistrellus* (in Sweden).

A buffer zone of 2 km to the nearest turbines is a standard recommendation for important colony habitats of *Barbastella barbastellus* and for very species rich localities. This is based on several studies on regularly used areas and the most frequently used parts. Special attention to *Barbastella barbastellus* in Sweden is due to request from EU to improve the survival status according to Appendix 2 in the Habitats directive. Until further research has been made and accepting the precautionary principle, we propose that a buffer zone of 2 km is applied for all the above mentioned vulnerable species.

List of references will be attached to a later version of this summary and in the Danish and Swedish guidelines.