

tussen Duin & Dijk



Connection and defragmentation

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Bats and ecological

Bats, like birds, migrate between summer and winter habitats. When it comes to the specific details of bat migration, we know precious little. How high do bats fly on average, how often do they rest, do they fly mostly at night or also during the day, and under which weather conditions? This article describes the current state of knowledge on and specific bottlenecks of bat migration.

In the Netherlands, we have some idea of the structures that form important migration routes for bats, but to date, this has not led to any concrete protection measures. And even though bats and their habitats are protected under national and international legislation, spatial development projects rarely take migrating bats into account. These kinds of omissions could have negative consequences for the population conservation objectives in the long run.

The life cycle of bats

In most bat species, the males and females live in separate habitats during the summer. This happens for a variety of reasons, the most important of which is food competition (Angell *et al.*, 2013). As the females assume full care of the young bats (they can nurse their young, after all) they need to have

plenty to eat.

Mating takes place in autumn, which is when the sexes meet each other. They have all kinds of relevant places where they meet, like at strategic points along a migration route, or in and near their winter habitat.

These winter habitats are where bats spend the period of roughly 1 August to 15 May. More or less between 15 October and 15 April they hibernate. As the winter habitat are also where mating occurs, we tend to call the places that bats use during these months ‘mating and wintering sites’ or roosts. They are often underground structures such as forts, bunkers and marl caves, but some bats actually prefer structures above ground such as expansion joints (which are meant to absorb any expansion or contraction of construction materials) in tall structures such as apartment or

office buildings, but also monumental old buildings such as churches or castles. Bats go into hibernation to survive the winter without food (insects, especially mosquitoes) for a long period of time. Thanks to their slow breathing, heart rate and digestion, bats can survive these six months on fat reserves that are equivalent to about a quarter of their body weight. Finding a winter destination with the right conditions for their physiology (among other things the right temperature and humidity, tranquillity, darkness) is so important that bats fly long distances to get there. So, unlike birds, bats do not necessarily migrate from north to south, but can set off in any direction. In some places, migrating bats can even be seen going in opposite directions, when one group is intending to hibernate somewhere else than where the other group is going.

corridors



Migration

As regards migration, Dutch bats can be split into two groups: long and short-distance migrants (table 1). The distances that the long-distance migrants cover are between 300 and 3,000 kilometres and are still modest compared to those that birds travel (Hutterer *et al.*, 2005), but they are still significant and often take them across borders. Short-distance migrants on average travel between 10 and 80 kilometres, depending on the location of their summer habitat in relation to their winter habitat.

Despite the fact we know little about the details of bat migration, we can, on the basis of individual observations and characteristics such as the morphology and echolocation, discern a number of possible patterns. Factors include the wing morphology, flight altitude when hunting, preference for open



- Bats like to travel along the coastline of Holland when migrating. They come across urban areas, such as The Hague. While large cities are a nuisance for some species of bats (pond bats and Daubenton's bats, among others) because a city coastline is brightly illuminated, for other species such as Nathusius's pipistrelle and the parti-coloured bat it is a bonus, because they can serve as a stopover location during the migration.

or enclosed habitats and the type of echolocation the animals use during commuting and hunting. Because bats are often adapted to hunting in a particular habitat, these characteristics are almost necessarily interrelated (table 1). On the basis of these characteristics, we can conclude that the pond bat (*Myotis dasycneme*) and serotine bat (*Eptesicus serotinus*) probably have a greater need for a nationwide network of ecological connections, and Daubenton's bat (*M. daubentonii*) and the brown long-eared bat

(*Plecotus auritus*) have a greater need for a local network of ecological connections between summer and winter habitats.

Do we already have concrete examples of migration routes? In Noord-Holland, there are two known elements that are essential in migration routes: They are the Afsluitdijk and the Dutch North Sea coast. On the basis of these two examples I will explain how bat migration may work. From mid-July, the first young bats are weaned ▶



● Figure 1. Well-known bat migration routes along waterways in North and South Holland. The bottlenecks (red asterisks) where motorways and migration routes cross.

and their mothers start leaving their maternity roost. The mothers first fly to a kind of stopover location at the start of the migration route. Well-known examples are Stompwijk and Amsterdam (Haarsma & Blokker, 2014). These in-between roosts should be seen as a mating and meeting place. The first animals to migrate will arrive here one

by one. These migrants are only distinguishable from resident bats by their reproductive characteristics, or if they are marked with a ring (so not discernible using a bat detector). The very gradual migration movements continues until all the young have become independent, which is around mid-August. From mid-August until the end of

October, migration really sets off and becomes noticeable, with higher densities of migrating animals being sighted while travelling from the stopover location to the final destination (the wintering site). It may be that this final leg of the migratorion route is only possible after a period in which bats fatten up and gather enough energy to fly larger distances. Because bats seem to avoid large bodies of open water, in some places they are forced to resort to narrow-front migration, especially after a period of less than ideal conditions for migration (such as strong headwinds and rain). At moments like these, bats will stay at a stopover site, sometimes for longer periods of time. Despite the conditions for migration not being optimal, there is a good chance the animals will hunt locally at night whilst at these sites. A well-known place where this occurs is the Afsluitdijk, which is used by 20,000 to 40,000 bats annually on their migration route (Janssen *et al.*, 2016). Popular stopovers for Nathusius's pipistrelles (*Pipistrellus nathusii*), pond bats and common noctules (*Nyctalus noctula*) are the Makkumerwaard to the east and the Robbenoordbos and Dijkgatbos to the west of the Afsluitdijk

● Table 1. Overview of the factors that may determine whether bats would have an interest in specific ecological connections. Echolocation type (sounds with a full sound: 'full', sounds with a dry sound: 'dry').

	Common pipistrelle (<i>Pipistrellus pipistrellus</i>)	Nathusius's pipistrelle (<i>Pipistrellus nathusii</i>)	Serotine bat (<i>Eptesicus serotinus</i>)	Pond bat (<i>Myotis dasycneme</i>)	Common noctule (<i>Nyctalus noctula</i>)	Parti-coloured bat (<i>Vespertilio murinus</i>)	Daubenton's bat (<i>Myotis daubentonii</i>)	Brown long-eared bat (<i>Plecotus auritus</i>)
Min. en max. flight during hunt (m)	1-30	3-50	0-50	0,3-?	5-100	5-100	0,3-?	0-10
Preference for open or enclosed habitat	open	open	open	open	open	open	open	enclosed
Linkage withline elements	high	high	interm.	high	interm.	interm.	high	high
Average migration distance	long	long	?	long	long	long	short	short
Use of echolocation during hunt	full	full	full	full	full	full	dry	dry
Morphology of wings	narrow	narrow	narrow	narrow	narrow	narrow	interm.	broad
Importance of ecological connection	interm.	interm.	great, national	great, national	interm.	interm.	great, local	great, local



(Boshamer & Lina, 1999). Additionally, several bat species migrate along the coastline. The best known example is the common noctule, which sometimes migrates by day and are reported by birdwatchers at times. The parti-coloured bat (*Vespertilio murinus*) and Nathusius's pipistrelle actually look to the high buildings of coastal cities for their stopover, which takes them to places like Scheveningen, the Maasvlakte, Rotterdam and IJmuiden. Here, resting individuals are regularly sighted during the day. Pond bats and Daubenton's bats use the bunkers along the coastline, such as the clusters in the Natura 2000 areas of Noordhollands Duinreservaat, Kennemerland-Zuid and Meijndel & Berkheide.

Protection of routes should be improved

At present, the protection of migration routes and associated stopover sites by bats have been insufficiently laid down in national nature conservation policy. Even for places where, demonstrably, extremely high numbers of bats are passing by and/or resting, no protection focused on migration is currently in place. Therefore it is still possible to place wind turbines in areas which are important stopovers for bats, despite the fact that it has been proven that migrating bats run a serious risk of being hit. Because rotating wind turbines attract insects (Cryan *et al.*, 2014; Rydell *et al.*, 2016), bats foraging for food in a stopover area will also venture outside on windy nights

(not migration) and run a greater risk of being hit.

A second factor that makes the protection of migration routes less than optimal, is the recognisability (or actually the lack of it) of migrating animals themselves. If an ecologist involved in spatial plans sees a bat flying by, he or she must ascertain the function of the landscape element the bats just visited. That may be: foraging area, commuting route (a route between summer and feeding habitat) or migration route (a route between summer and winter habitat). Unfortunately, there is still no proper method for identifying between these functions. Whenever an ecologist scores a function as uncertain, this is often legally interpreted as 'there is no function'. The consequence is that this function is not protected.

The lack of protection becomes painfully clear when we realise that in the Netherlands ecoducts are being constructed for many animal species, while bats are often not considered during planning phase – though the distances between summer and winter habitat are often more than a hundred kilometres, meaning these animals regularly have to cross motorways (see figure 1). Natuur Netwerk Nederland (NNN) has been developed to aid connectivity across landscapes. This is still hardly taking into account the needs of bats. On the basis of the external effect of the Natura 2000 areas, we have an obligation to prevent the disruption of migration routes. After all, if animals are no longer able to

- For bats, a bunker always has two functions: hibernating and mating. The mating season roughly lasts from 1 August to 15 October and from 15 April to 15 May. Bats are often awake during the mating season, also during the day. The males tend to fight amongst themselves about territory borders.

migrate, they can no longer make it to their winter habitat. For all species, but especially for Natura 2000 target species like the pond bat, Geoffroy's bat (*Myotis emarginatus*) and greater mouse-eared bat (*M. myotis*), it would be desirable to resolve bottlenecks on migration routes. Often these are places where a major motorway and a waterway meet or cross. I would therefore recommend taking protective measures for bats proactively at these kinds of places.

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