A preliminary inventory of the parti-coloured bat in the Eemshaven – Delfzijl area, Groningen, the Netherlands

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Abstract: The parti-coloured bat (*Vespertilio murinus*) has been considered a rare species in the Netherlands, with only one known nursery colony since 1998. A possible second colony was reported in 2002 in the north-eastern part of the province of Groningen, but it was not rediscovered afterwards. In 2016, a first systematic survey on the occurrence of the parti-coloured bat with hand-held and static bat detectors was conducted in the area of Eemshaven – Delfzijl in northeast Groningen. During the inventory, using a hand-held detector, three roosts belonging to two colonies, were found in the villages of Spijk and Bierum. In 2016, the highest number of departing parti-coloured bats in one night in Spijk was 29 and 12 in Bierum. In 2017 the highest figures were 61 and 12, respectively. Low numbers (1-4 individuals) of serotines (*Eptesicus serotinus*) were detected departing from the same roosts, always before the parti-coloured bats departed. There were indications of a possible third colony, but these could not be confirmed. We report observations showing that reproduction has taken place in the study area and occurred in or very close to the roosts that we observed. Automatic recorders detected much foraging activity in a relatively small area on the western shore of the river Ems, situated 2.5-4.5 km away from the roosts. During peak activity in this foraging area up to 71 recordings of nyctaloid bats (i.e. belonging to the acoustically similar genera of *Nyctalus*, *Eptesicus* or *Vespertilio*) in one 10-minute interval were recorded. In general, only a small proportion could be identified with certainty and we discuss the difficulties experienced with automatic identification of nyctaloid bat calls. In autumn the study area was surveyed for display calls and courting locations of males, especially in urban areas with high buildings. However, no courting male parti-coloured bats were found. Although the parti-coloured bat mostly lives in houses and buildings, the colonies are probably often overlooked and we suggest that the colonies found in this study have existed for decades.

Keywords: parti-coloured bat, nyctaloids, Chiroptera, automatic identification, bat detector, Batcorder, nursery colony, province of Groningen.

Introduction

The parti-coloured bat (*Vespertilio murinus*) is a relatively unknown species in the Netherlands. It is a medium-sized bat, comparable in size to the pond bat (*Myotis dasycneme*). It has a white to creamy-coloured belly, a black face and black ears. One characteristic of this species is the two-tone colour of the dorsal hairs: the hairs at the base are black and become white or silvery at the tips, which gives the species a special look. The ears are short and wide, with a short rounded tragus. Typically

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the female has four nipples, which is unique among bat species in Europe (Baagøe 2001, Safi 2006, 2023). The parti-coloured bat normally gives birth to twins, sometimes to triplets, but rarely to a single young (Dietz et al. 2011, Safi 2023). The maximum recorded age is twelve years, which is low for a bat species, but the number of recaptures is very low (Baagøe 2001, Safi 2023). Therefore it is unknown whether this assumed relatively low life span is related to its specific reproduction biology and/or to its migratory behaviour (Dietz et al. 2011).

In May, females form nursery colonies of 20 to 60 females, in some areas up to several hundreds of females (Baagøe 2001, Safi 2023). The roosts are often situated under roofs and in crevices of buildings and, occasionally, in rock crevices and tree holes (Rydell & Baagøe 1994, Baagøe 2001, Safi 2023). Females and males live separately during spring and early summer. Males of parti-coloured bats show an atypical behaviour in comparison to other bat species: they form large, but flexible social aggregations between May and mid-July when they use a network of several summer roosts (Dietz 2011, Safi 2023). The male roosts are situated separately from the nursery colonies, but it is not known how far away and this may differ between locations (Zöllick et al. 1989, Baagøe 2001, Safi 2006). In the second half of July males adopt a more solitary lifestyle, coinciding with the start of the mating season (Safi 2023). In late summer and autumn (late August - December) males perform a conspicuous courting behaviour with display calls, mostly around high buildings in big cities (Baagøe 2001, Safi 2023). Hibernating individuals are found in high buildings, church towers and in rock crevices (Baagøe 2001, Dietz et al. 2011). Long-distance migration has been recorded from individuals reproducing in Eastern Europe, but in Western Europe these distances seem to be much shorter and populations may even be sedentary (Masing 1989, Rydell & Baagøe 1994, Markovets et al. 2004, Dietz et al. 2011).

The parti-coloured bat has a Eurasian distribution and occurs in a broad zone from the Netherlands and Belgium through Central Europe, southern Scandinavia, the Balkan countries and the Baltic states, Central Asia, Mongolia, northeast China and southern Siberia and as far as northern Japan (Kawai et al. 2015, Jansen 2016, Safi 2023). However, there are many vagrants that have been recorded in northern, western and southern parts of Europe and even on oil platforms at sea (Brabant et al. 2016, Boshamer & Bekker 2008)

The parti-coloured bat is considered to be a rare species in the Netherlands (Jansen 2016). The first observation in the Netherlands was in 1977, but since then the number of observations has been increasing (Lina 1991, Jansen 2016). Most individuals were observed in the western and northern part of the Netherlands. Until 2016, only two roosts had been found in the Netherlands. In 1998, a nursery roost was discovered in Maarssenbroek in the province of Utrecht (Jansen 2002, Jansen et al. 2017), which is still present. In 2002 a second roost with unknown status was found in Spijk in the province of Groningen. This colony, however, was not re-recorded and it is assumed that it has disappeared (Jansen 2016).

Very little is known about parti-coloured bats in the Netherlands. Therefore, it is not surprising that nearly all available information on the biology and ecology of this species comes from studies from abroad. In 2016 an attempt was made to systematically search for this species in the area where the second roost of the Netherlands had been located and where since 1995 observations of single individuals had been regularly reported. Thus, we systematically searched the area in the north-eastern part of the province of Groningen, around Delfzijl and the Eemshaven with bat detectors and series of automatic recorders for the presence of parti-coloured bats in an attempt to determine whether a population of this species was present in this area. We investigated the habitat use of the parti-

Figure 1. Study area in north-east Groningen and its position in the Netherlands (inset). Sources: Bing Aerial Maps, Microsoft; top10nl, PDOK.

coloured bat by locating the roosts and foraging areas and also by trying to find a courting area where males were performing their conspicuous courtship behaviour.

Material and methods

Research area and study period

The study area is located in the north-eastern part of the province of Groningen, the Netherlands, and consists of a 77 square kilometre area situated west of the mouth of the river Ems, including Eemshaven and Delfzijl (Figure 1). The study area can be described as a mostly rural area with large, intensive, agricultural holdings. It includes the villages Roodeschool, Oudeschip, Spijk, Bierum and Holwierde and a few smaller settlements. The study area also contains a large industrial area around the harbour of Eemshaven and one large residential area: the city of Delfzijl. Observations were made in 2016 from the end

of May until November. In 2017 the area was revisited from the end of June to the beginning of August for new counts of the colonies.

Surveys with handheld bat detectors

The research area was surveyed using a Pettersson D240x bat detector (Pettersson Elektronik AB, Uppsala, Sweden) with stereo headphones. In this way the heterodyne signal was heard on the left and the time expansion signal on the right. When possible, a sound recording was made and stored as a wav-file on a recording device (Zoom H1, Zoom Corporation, Tokyo, Japan). Recordings were made of all nyctaloids, the group of bats that includes the noctule (*Nyctalus noctula*), serotine (*Eptesicus serotinus*) and parti-coloured bat. These bats produce similar sounds that can be difficult to identify at species level.

In May, June and July 2016, four evening visits and five morning visits were made to the study area by bicycle (Appendix 1). During the evening visits, the locations where bats were foraging and commuting, were mapped. During the morning visits, particular attention was paid to swarming animals near roosts or nursery colonies. This swarming behaviour, with large groups of bats flying around the roost, usually takes place in a period starting two hours before sunrise. Swarming behaviour of a few individuals around nursery colonies occurs during the whole night as females return to nurse their young.

When roosts with parti-coloured bats were discovered, the individuals departing the roost were counted in the evening of the day of discovery. These counts took place from sunset to 1.5 hours after sunset. Additional counts at roosts with large groups of parti-coloured bats were conducted in July and early August. On 13 August a final simultaneous count was conducted at the major roosts found in that year.

During surveys in September and November we looked for courtship behaviour of parti-coloured bats, which mostly occurs near tall buildings in cities. Display calls could be heard by the naked ear and were detected with a bat detector. On 13 September 2016, the Eemshaven area was surveyed by bicycle, especially the areas around high buildings, such as the two power plants. On 22 September the areas around several apartment buildings in the northwest and in the city centre of Delfzijl were surveyed. The search for courtship behaviour was repeated on 11 November 2016.

Species identification of handheld bat detector surveys

The recorded bat calls from the Pettersson D240x detector were analysed in sonograms with Wavesurfer 1.8.8 (Centre for Speech Technology, KTH, Stockholm, Sweden) and Kaleidoscope 4 (Wildlife Acoustics, Maynard, USA) software. An FFT window of 512 points was used and the analysis window was also 512 points. Particular attention was paid to sonar pulses longer than 15 milliseconds, emitted in a slow rhythm of about 3 (2-4) pulses per second, with a quasi-constant frequency (QCF) and a peak frequency between 22 and 24 kHz. These frequencies are commonly used by the parti-coloured bat in open habitat and were used to distinguish the parti-coloured bat from the noctule and serotine. The serotine mostly uses shorter and higher pulses. In open habitat, it sometimes emits pulses with a maximum energy between 22 and 24 kHz, but then the bandwidth between the start and the end frequency lies above 2.5 kHz, whereas in the parti-coloured bat the bandwidth lies below 2.5 kHz (Barataud 2020). The pulses with a duration over 15 ms from the noctule are almost always lower compared to the parti-coloured bat, with a peak frequency below 22 kHz (Barataud 2020). The noctule also uses shorter and higher pulses with a larger bandwidth, making for the characteristic 'blip-blop' sound. This alternation

between higher and lower pulses is absent in the parti-coloured bat (Zbinden 1989, Russ 2021). Leisler's bat (*Nyctalus leisleri*) also emits alternating sonar pulses, of which the lower ones are 4-6 kHz higher than the noctule. However, at higher transition flight levels the higher and shorter pulses are often omitted, leaving only a slow rhythm of pulses in a frequency range that can be confused with parti-coloured bat. The pulses of Leisler's bat are mostly shorter than those of the parti-coloured bat (<15 ms), but when they last between 15 and 18 ms, which is the maximum for Leisler's bat, it is very difficult to discriminate between the two species and only a recording with alternating sounds can give a conclusive answer. Sonar pulses with a peak frequency of 22-24 kHz, that last over 18 ms, can be attributed to parti-coloured bat (Barataud 2020).

When no recording could be made, QCF sounds with a peak frequency between 22 and 24 kHz and a low bandwidth and without alternation were attributed to the parti-coloured bat. The low bandwidth can easily be recognized by listening through time expansion. In half-open and closed habitats, where the noctule alternates between two types of pulses (Barataud 2020), sonar sounds from the parti-coloured bat are more difficult to distinguish from those of the serotine. The pulses get shorter, higher and more frequent and start with an FM-component, during which the frequency falls from around 40 kHz to around 24 kHz (Russ 2021). These start and end frequencies are usually higher in the serotine with a higher bandwidth between them, but there is some overlap between the two species (Barataud 2020). During the field survey, but also when after sonogram analysis a sound recording could not be attributed to either of these species, such observations were classified as 'parti-coloured bat or serotine'.

On some occasions bats were seen in the twilight, near street lights or by using a torch. In these cases serotine and parti-coloured bats could be distinguished by their size, colour and flight pattern. Parti-coloured bats are smaller, fly faster than serotines and have a white belly.

Continuous monitoring of bat activity with Batcorders

Next to the handheld bat detector, the static detector Batcorder 2.0 (ecoObs GmbH, Germany) was used to continuously record during the night at a fixed location. This device automatically records ultrasonic sounds, especially targeting sounds emitted by bats. It consists of a microphone, a sound card, a processor and a SD card. Ultrasonic sound is continuously recorded and temporarily stored in the memory. If the detection algorithm of the Batcorder classifies a particular sound as a bat sound, this recording will be moved to an external memory for later analysis. If the recording does not resemble a bat sound, it is deleted from the temporary memory. These Batcorders are able to record sounds of parti-coloured bats up to circa 50 metres away.

The Batcorders were mounted on a pole at a height of 2.5-3.5 metre and were placed at 20 locations covering the study area (see Results, Figures 4 and 5). Each Batcorder was installed on a fixed location during a recording session, which comprised of two to three nights at the end of June or the beginning of July 2016 (Appendix 2). The Batcorders were set up to start logging roughly one hour before sunset and to end the session roughly one hour after sunrise. Because of a full memory card, recording sessions stopped prematurely during the second night at two locations: at Oostpolderdijk (PL09) at 03:22 AM and at the gas (compressor) station west (PL11) at 01:48 AM.

In September, this scheme of recording sessions was repeated and each recording session lasted three nights. All sessions ended before the end of September, but the exact dates of each individual recording session were not recorded. Although the original sound files from June, July and September 2016 could not

Table 1. Start and end dates and times of the batcorders used on the buildings in Delfzijl. Each recording session was scheduled at 19:00 until 7:00 the next morning (Naterij and Dijkzicht), until 8:00 (Oldiek and Kadijk) or until 9:00 (De Vennen). At Naterij, Oldiek and Kadijk the battery ran out of power before the end of a session.

Building	Floor	Start date	Start time	End date	End time	# nights
Naterij	7	17-10-2016	19:00	22-10-2016	04:16	5
Dijkzicht	7	17-10-2016	19:00	24-10-2016	07:00	7
Oldiek	7	17-10-2016	19:00	22-10-2016	19:42	6
Kadijk	8	17-10-2016	19:00	23-10-2016	19:15	5
De Vennen	6	17-10-2016	19:00	31-10-2016	09:00	12

be retraced, the results of the automatic identifications of the sound files were not lost.

In the second half of October 2016 Batcorders were attached to high apartment buildings to look for courtship behaviour by recording display calls. These buildings were located in the northern part of the city of Delfzijl along the sea dyke, with regular distances between the buildings from the north-western part of Delfzijl to the north of the city centre. A total of five Batcorders were attached to balconies of apartments situated on the 6th, 7th and 8th floors of five apartment buildings in October. The start and end dates of these recordings are given in Table 1. The Batcorders were installed on 17 October and ran for as long as there was sufficient battery power.

Analysis and visualisation of the Batcorder recordings

All Batcorder recordings were analysed by bcAdmin3 and batIdent1.5 (ecoObs GmbH, Germany) to classify each sound to a certain species or species group. BatIdent calculates a probability for the classification of each call based on comparison with a set of reference calls. We used the default setting for the probability of 60%, above which the call was classified to a species or species group.

Some of the results apply to species that do not live in the research area or are very rare. In the nyctaloid group this includes Leisler's bat and the northern bat (*Eptesicus nilsonii*). Using the 'batch replace' function those results were changed into mid-sized nyctaloids and serotines respectively. The number of recordings recorded by the Batcorders was almost 15,000 and could not all be analyzed manually.

Graphs about the nightly activity of nyctaloid bats were created with the 'night graph' function in bcAdmin4. If the recordings could not be identified to a certain species, the following species groups were created: mid-sized nyctaloid bats, including serotine, parti-coloured bat and Leisler's bat, and all nyctaloids which also includes the noctule and three species that do not normally live in the Netherlands. Total recordings per species on each location were calculated and plotted with geographic software package QGIS 3.36.

Results

Surveys with the bat detector

In total 392 observations of bats were made with a bat detector: 328 in the period May until the end of July and 64 in the period August-September. Each observation consisted of one or more individuals or a group of bats. The vast majority of observations was of common pipistrelles (*Pipistrellus pipistrellus*) and Nathusius' pipistrelles (*Pipistrellus nathusii*). Only 44 sightings were classified as being certainly parti-coloured bats. Another 23 observations of nyctaloid bats were uncertain, but most likely also of parti-coloured bats (Table 2). Other species that were iden-

tified include serotine and Daubenton's bat (*Myotis daubentonii*).

In total 100 time-expanded recordings at 54 observations were made and analysed. Twenty eight of these observations were identified as parti-coloured bat (60 recordings) and five observations (7 recordings) as serotine, and 13 (22 recordings) could not be identified as being either of those two species. Also six observations of Daubenton's bat were identified from twelve time-expanded recordings (Table 3).

In July 2016 three large roosts of parti-coloured bats were found by searching for swarming individuals in the morning: two roosts in Bierum and one in Spijk (Figure 2). The number of parti-coloured bats departing from their roosts were counted during two (Bierum B) or three (Bierum A en Spijk) evenings in July and August. The roost at location A in Bierum consisted of twelve animals at the beginning of July. At the end of July there were no bats present, but twelve animals were counted at location B in Bierum. The roost in Spijk consisted of 29 departing animals at the end of July (Table 4). Two colony counts in Spijk and Bierum led to a relatively high summed value of 100 parti-coloured bats in May-July 2016 (Table 2). After departing their roosts, the bats were seen flying over open fields to their foraging grounds at a height of 20-40 metres.

Serotines were found in all roosts. Table 4 shows that between one and four serotines were observed departing the roosts. They could be distinguished by their larger size and slower flight, and they departed the roost earlier in the evening. By mid-August 2016 the three roosts were deserted, but commuting and foraging parti-coloured bats were still found in Bierum: seven individuals, one of which was spotted leaving the barn behind one of the roosts. In September, no bat detector survey was conducted around the roost areas. In June and July 2017, the colonies were revisited once again. In Bierum twelve parti-coloured bats were counted departing roost B

Figure 2. The roost locations and the maximum number of bats (parti-coloured and serotines) that departed the roosts in 2016. The colony in Bierum moved around mid July from location A to B. Source: Luchtfoto Actueel (Current Aerial Map), PDOK.

and in Spijk 61 individuals departed the roost. At the beginning of August only nine individuals were left in the Spijk roost.

The roosts were all located at the edge of the village in houses consisting of one or two floors and a gable or hip roof. At Bierum A bats flew out of both chimneys, one of which looked like a small ridge turret ('dakruiter' in Dutch). At the other location in Bierum and the location in Spijk, the bats flew out from openings over the full length of the roof between the ridge tiles and the top layer of roof tiles. Some left the roost near the end of the ridge tiles ('eindvorsten'), but most bats departed from other places on the roof.

All three houses that hosted parti-coloured bats colonies had concrete roof tiles ('sneldekkers'). In addition to these roosts, swarming individuals or small groups of the parti-coloured bat were observed around houses in Bierum (five individuals), Spijk (two individuals) and in Holwierde (three individuals). Most of these houses were similar to the houses with the colonies: low-rise houses with a gable or hip roof and two floors or less and

Table 2. Number of observations of different species in May to July (nursery period) and August to September (migration period) and the range (min-max) of the number of individuals per observation. The total number of individuals in those periods are also given.

	Total	May-July			August- September		
Species	Observations	Observations	Range	Sum	Observations	Range	Sum
Common pipistrelle	212	189	1-26	258	23	1-2	27
Nathusius' pipistrelle	83	56	1-3	63	27	1-2	31
Parti-coloured bat	44	39	1-30	100	5	1-2	7
Parti-coloured bat or serotine	23	18	1-3	48	5	1	5
Serotine	19	18	1-3	21	1	1	1
Daubenton's bat	9	6	1-2	7	3	1	3
Myotis (unidentified)	2	2	1	2	-	-	-

Table 3. Number of observations with time expansion recordings, the minimum and maximum number of recordings per observation and the total number of recordings per species.

Species	Observations	Min	Max	Sum
Parti-coloured bat	28	1	10	60
Parti-coloured bat (maybe serotine)	13	1	8	22
Serotine bat	5	1	3	7
Nathusius' pipistrelle	1	3	3	3
Common pipistrelle	1	6	6	6
Daubenton's bat	6	1	6	12

Table 4. Numbers of bats (parti-coloured and serotines) departing the roosts in 2016 and 2017. Vmur = parti-coloured bat, Eser = serotine.

Date	Location	Vmur	Eser	Remarks
09-07-2016	Bierum A	9-12	1-4	
14-07-2016	Bierum A	0	0	Foraging bats were observed at the gas compressor station despite heavy drizzle and a high wind of 5 Beaufort
22-07-2016	Bierum B	12	2	
13-08-2016	Bierum A	0	0	One from the barn behind the roost
13-08-2016	Bierum B	0	0	
22-07-2016	Spijk	23	0?	
23-07-2016	Spijk	29	1	
13-08-2016	Spijk	0	0	
23-06-2017	Bierum A	0	0	
31-07-2017	Bierum B	12	0	
08-07-2017	Spijk	61	2	
02-08-2017	Spijk	9	0	From the ridge of the house

generally located on the edge of the villages.

Foraging parti-coloured bats have mainly been observed at a height of 5 to 30 metres above wide waterways, the sea dyke and the inland dyke, but they were also seen in the villages and along tree avenues (Figure 3). This figure shows the observations of parti-coloured bats and nyctaloids, which were

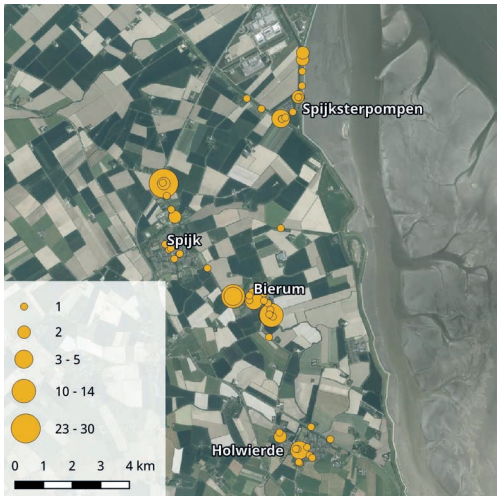


Figure 3. The number of bat detector recordings of parti-coloured bats in the study area. Source: Luchtfoto Actueel (Current Aerial Map), PDOK.

most likely parti-coloured bats. Looking at the characteristics of the foraging habitat, 17 individuals were seen above water, 2 individuals near agricultural area (inland dyke), 2 individuals near tree avenues and 17 individuals in the villages. Away from the colonies and the village of Holwierde, all the foraging activity was observed near the gas compressor station northeast of Spijk, the adjacent pumping station (Spijksterpompen) and Oostpolderdijk, the dyke along the river Ems. These locations are situated at 2.5–4.5 kilometres from the colonies.

Surveying the study area with Batcorders

In June-July, all Batcorders, except one, recorded sounds produced by nyctaloid bats (Table 5). The highest numbers of calls that we classified as parti-coloured bats were recorded by three Batcorders northeast of Spijk: Oostpolderdijk (PL10) and the gas compressor station (PL09, PL11). In addition, the two Batcorders in the villages of Spijk (PL13) and Holwierde (PL15) recorded relatively high numbers of parti-coloured bat (Figure 4). Nine Batcorders recorded only one or two recordings of the parti-coloured bats and six Batcorders did not record a recognisable parti-coloured bat sound.

In September, 11 out of 20 Batcorders recorded sounds of the parti-coloured bat (Figure 5). The numbers are overall a bit lower and recordings were more equally distributed over the study area. There was no concentration of recordings around the gas compressor station and Oostpolderdijk, as was seen in June-July. Interestingly, at Uiteinderweg (PL19), a relatively high number of parti-coloured bat sounds was recorded, whereas there were none there in June and July. In addition, there were more recordings in September than in June-July in the Eemshaven area (PL03-PL06). Only in Bierum (PL14) were individuals observed near a colony site in September. All Batcorders with high numbers were located at different locations than in July, except the Batcorder at the gas compressor station west (PL11).

The temporal distribution of the bat sound recordings

The nocturnal activity of the nyctaloid bats at eight locations is shown in Figure 6. Only a small proportion of the recorded bat calls were identified to a certain species. These recordings included noctule, serotine and parti-coloured bat and they were present in varying proportions at different locations. The majority of calls, however, was designated to the group of mid-sized nyctaloids (Nycmi), to which the parti-coloured bat belongs.

The peak activity differed between the locations. At Borkumkade (PL05) and Marsum (PL17) an early peak occurred around 23:00 hours (Figure 6, H and G). At Oostpolderdijk (PL09) and gas station west (PL11) the numbers were very high with a clear peak between 24:00-01:00 hours and a somewhat smaller peak between 03:00 – 04:00 (Figure 6, A and

Table 5. Number of batcorder recordings made per nyctaloid species in two periods in 2016. Automatic identification by batIdent: Vmur = parti-coloured bat, Nnoc = noctule, Eser = serotine, All nyct. = all recordings with any species of nyctaloid bat, including Vmur, Nnoc, Eser and nyctaloid bats, not identified at species level.

		June-July				September
Code	Location	Vmur	Nnoc	Eser	All nyct.	Vmur
PL01	Oudeschip	0	0	0	1	1
PL02	Roodeschool (Greedeweg)	1	3	0	6	1
PL03	Middenweg	1	5	4	23	5
PL04	Emmapolderdijk	0	2	0	3	1
PL05	Borkumkade	1	40	31	85	0
PL06	RWE-centrale	1	1	2	13	6
PL07	Synergieweg	0	0	0	0	1
PL08	Eemscentrale	2	0	0	4	2
PL09	Oostpolderdijk (Binnenbermsloot)	63	37	27	381	0
PL10	Gas (compressor) station east	8	2	78	228	0
PL11	Gas (compressor) station west	45	117	61	573	6
PL12	Oosteinde (Lage Trijnweg)	0	5	0	12	0
PL13	Spijk	3	6	3	48	0
PL14	Bierum (campsite Kiek op Diek)	1	0	0	14	8
PL15	Holwierde	10	35	22	134	0
PL16	Losdorp	1	18	18	82	1
PL17	Marsum	1	35	17	158	0
PL18	Uitwierde	1	1	5	18	0
PL19	Uiteinderweg	0	1	2	10	9
PL20	Hoogwatum	0	1	0	8	0

Table 6. The total number of recordings per apartment building and the number of recordings of the common pipistrelle (Ppip), Nathusius' pipistrelle (Pnat) and serotine (Eser). For the common pipistrelle the number of recordings with courtship behaviour (mating calls) is also given. For all species the maximum number of individuals per recording is also included.

Building	Recordings		Ppip			Pnat		Eser	
	Total	#/night	Total	Courtship	Indiv.	Total	Indiv.	Total	Indiv.
Naterij	19	0 – 12	17	7	1	2	1		
Dijkzicht	842	11 – 686	816	648	3	19	1	7	1
Oldiek	872	1 – 574	864	805	3	8	2		
Kadijk	91	3 – 57	85	6	3	6	1		
De Vennen	31	0 – 14	29	11	2	2	2		

E) It should be noted that gaps in recordings at Oostpolderdijk and gas station west occurred because the memory cards were already full halfway through the second night. At Holwierde (PL15) and Losdorp (PL16) calls were recorded during the whole night, without steep peaks in the number of calls (Figure 6, D and F). At gas station east (PL10) there was a clear peak between 02:00-03:00 (Figure 6, C). At Spijk (PL13) most calls were recorded between 01:00 – 04:00 hours, without a clear peak (Figure 6, B).

At all other locations there were no or only few calls recorded. Their total number was

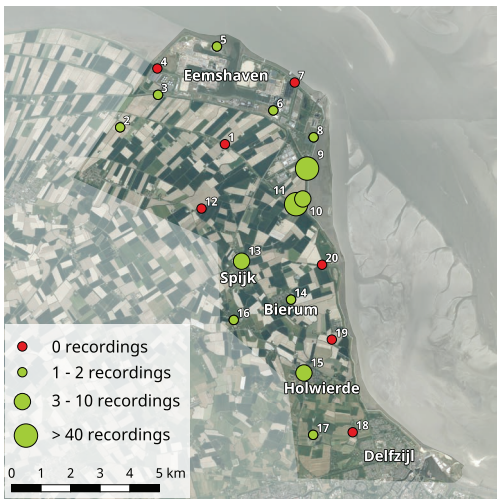


Figure 4. Overview of batcorder locations in July 2016. Green dots show locations with recordings identified as parti-coloured bats. Red dots show locations where no parti-coloured bats were recorded. The numbers on the map correspond with the numbers in the location codes of Table 5 and Appendix 2. Source: Luchtfoto Actueel (Current Aerial Map), PDOK.

Figure 5. Overview of batcorder locations in September 2016. Dots in green show locations with recordings identified as parti-coloured bats. Red dots show locations where no parti-coloured bats were recorded. The numbers on the map correspond with the numbers in the location codes of Table 5 and Appendix 2. Source: Luchtfoto Actueel (Current Aerial Map), PDOK.

always less than 25 recordings, except at Middenweg (PL03) with 28 recordings. Middenweg is situated southwest and in the direct neighbourhood of Borkumkade (PL05). At both Middenweg and Borkumkade a peak occurred around 23:00. Of the locations that are not shown in Figure 5, a high peak number of 15 recordings during one hour was found at Middenweg.

Monitoring courtship behaviour

The five Batcorders attached to high apartment buildings in Delfzijl did not record any parti-coloured bat sounds, and certainly no display calls. Other bat species, however, produced many calls. The vast majority of recordings were of the common pipistrelle and included many social calls (Table 6). Only a few sounds of Nathusius' pipistrelles were recorded and none were social calls. Seven recordings with sonar pulses below 30 kHz were made at an apartment building in Dijkzicht, but they were most likely from serotines. The number of recordings of the common pipistrelle varied greatly per night, and also between the apartment buildings. Most recordings were made on the balconies of the Dijkzicht and Oldiek apartment buildings, where 816 and 864 series of calls were recorded, of which, 648 (79%) and 805 (93%), respectively, contained display calls. On the Naterij, De Vennen and Kadijk building complexes there were 17, 29 and 85 recordings respectively, of which 7 (41%), 11 (38%) and 6 (7%) were display calls.

Discussion

Although there have been various scattered observations of individual parti-coloured bats, this inventory is the first effort to systematically search for this species in north-east Groningen. In 2016 and 2017 we surveyed the

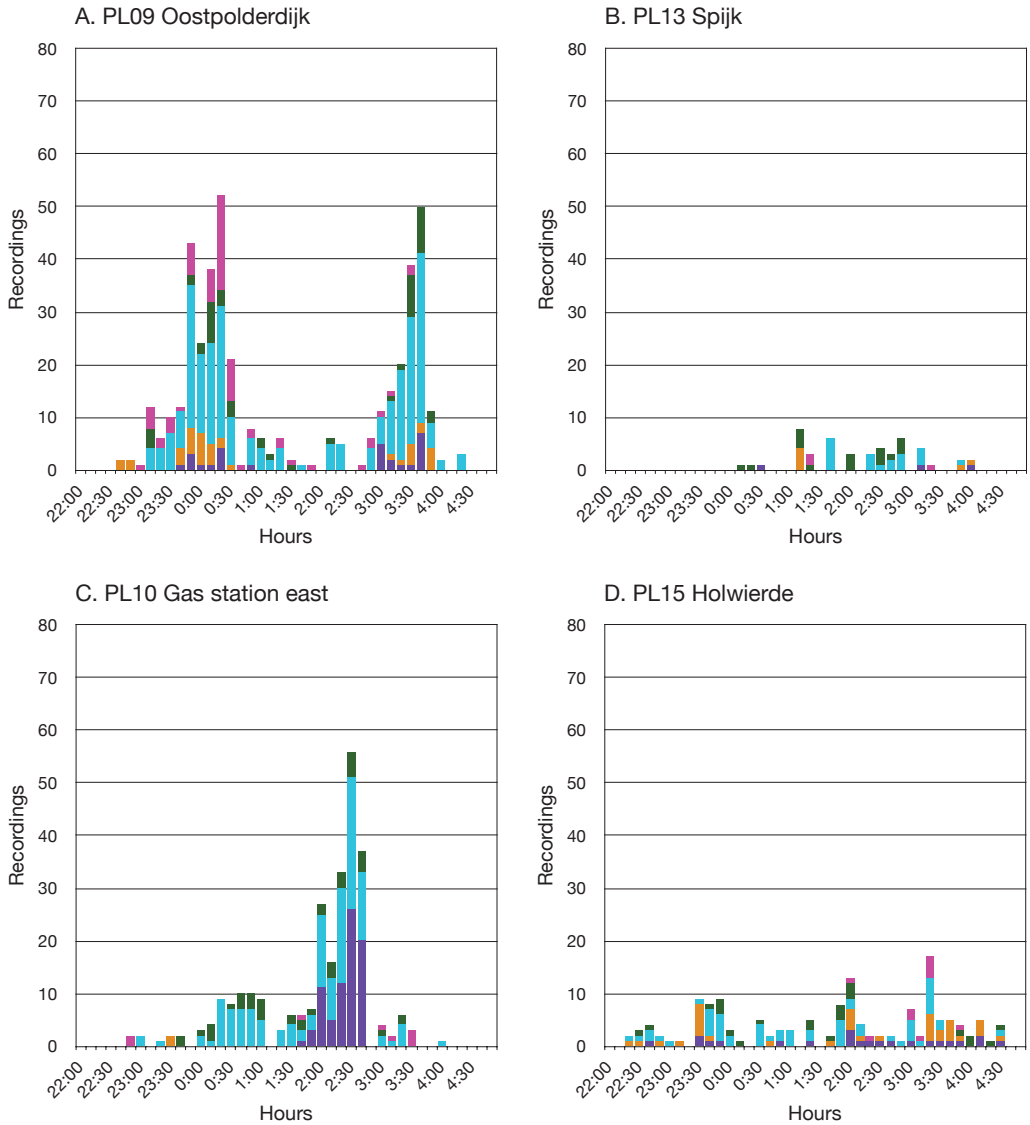
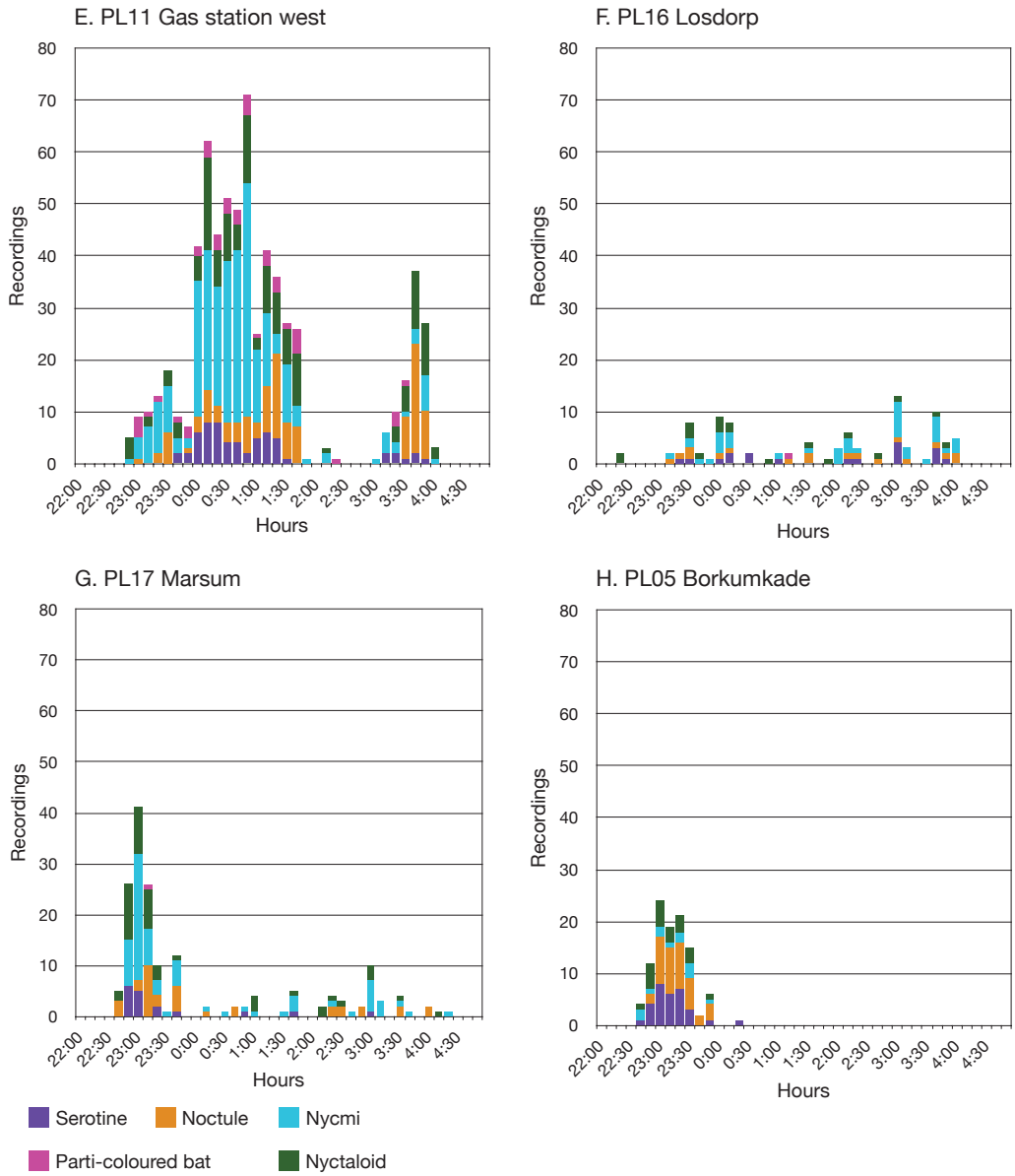


Figure 6. Night activity of nyctaloid bats. For each location recordings were aggregated in 10-min intervals. The recorded bat calls were identified by automatic identification software to different species or species groups: serotine, noctule, parti-coloured bat, Nycmi = mid-sized nyctaloid bat, and Nyctaloid = any nyctaloid bat (see text for further explanation). Locations with very few records are not shown.

study area of Eemshaven-Delfzijl with mobile bat detectors and Batcorders at fixed positions. We found roosts of parti-coloured bats in villages and much foraging activity in one particular area along the coast, but no courting males with their conspicuous display calls were observed in the area.

Roosts of parti-coloured bats in north-east Groningen

Houses in which the roosts have been found are modern single family houses, consisting of one or two storeys with a multi-pitched (gable or hip) roof. The landscape and this type of



houses are quite similar to northeast Zealand (Denmark), where there are many nursery colonies of parti-coloured bats (Baagøe 1986, 2001). Two colonies of parti-coloured bats were found in our study area, one in Spijk and another one in Bierum. After 2002, when a roost with 25 individuals in Spijk was found, no new observations of roosts have been reported until this study. Although no systematic survey of the area has been done before, we think that a summer population of this species may have been present for a long period, but not noticed. The roost found in Spijk in 2016 was situated in a similar house along the same street, roughly 250 metres from the location in 2002. The residents of the new location mentioned that in summer seasons they were having bats under the roof of

both their home and the adjacent garage for 20 to 30 years. They also found many droppings after each breeding season. It is not fully certain which bat species inhabited the space under the roof, but it is most likely that it was a colony of the parti-coloured bat. In 2016 the maximum total of individuals that departed the roost was 30. In 2017 this number was 63.

The locations of the roosts in Bierum were previously unknown. In 2007, two individuals were found in the same part of the village as roost Bierum B (waarneming.nl 2024). The maximum number of parti-coloured bats that departed both roosts in Bierum was twelve. Roost Bierum A appeared abandoned five days after its discovery in the beginning of July. Later that month roost Bierum B was discovered. Towards the end of the nursery period in 2016 the location of the colony apparently switched within Bierum (from Bierum A to Bierum B) over a distance of nearly 750 metres. By the end of July 2017 twelve parti-coloured bats departed from Bierum B. When the young become independent, females and their young often move to other locations (Safi 2023). In Maarssenbroek the main group of the nursery colony stayed in the same building block during the nursery period, but in the course of July, small groups were found in other blocks in the neighbourhood. On three occasions the nursery colony moved to one of the other blocks in the following year. Nursery colonies often change roosts within the same building block during the nursery period (Jansen et al. 2017).

A potential location for a nursery roost is Holwierde. A relatively high number of recordings of parti-coloured bats were made at several locations in this village using a handheld bat detector. In addition the Batcorder on location PL15 in Holwierde recorded more calls of the parti-coloured bat and other nyctaloids, not identified at species level, than the Batcorders in Spijk (PL13) and Bierum (PL14) did. Commuting and foraging individuals were seen, and potential swarming behaviour was observed. However, no colony was confirmed in this village in 2016 or 2017. In 2022 and 2023 a colony with unknown reproduction status was discovered in Holwierde, occupying two roosts that were located close to each other (Jonge Poerink 2024).

Reproduction status of the roosts

The roosts in Bierum and Spijk were not discovered until July 2016. Normally most young parti-coloured bats start to fly in July, which means that there were already flying young present when we started the roost counts. Therefore we were not able to compare these counts with counts of only flying adults in the first half of June. This means that our counts could not be used to establish the reproduction status of the colonies. Due to time constraints we were also not able to do early roost counts in 2017.

We received more information from a bat rehabilitation centre in the province of Groningen that gave us more insight in the reproductive status of the roosts in the study area. On 20 June 2017, a young female, of around two days old, was found in a house across the street from the Bierum A roost. Three days later we looked for a nursery colony there, but did not see any bats flying out at either location. On 30 July 2017, a young male, which was born the same year and already able to fly, was found near the village centre of Spijk. On 31 July 2018, a weakened lactating female from the roost in Spijk was brought to the rehabilitation centre. These findings show that reproduction takes place in the study area and in, or very close to, the roosts that were found in this study.

Foraging

The main hotspot of the nyctaloid bat recordings is the western shore of the river Ems, around the Oostpolderdijk and the gas compressor station. This area is situated only 2.5-

4.5 km away from the roosts in Spijk and Bierum. The importance of the western shore of the river Ems for nyctaloid bats is very clear (Figure 6 A, C and E), especially when taken into account that at two locations in this area the memory cards were already full halfway by the second night. Although these two Batcorders have the highest number of recordings, they were only active for 51% and 57% of the planned recording time, respectively. Figure 6 shows high numbers of nyctaloid bat calls in several peaks over the night. Up to 71 recordings in one 10-minute interval were recorded. The highest peaks in the number of recordings occurred between 00:00 and 04:00 hours. Before 0:00 hours lower numbers were found and after 04:00 hours the recordings ended rather abruptly. It is possible that the early foraging bats were mainly serotines, which were consequently replaced by parti-coloured bats. Hessing & Hinkel (2006) note that serotines leave the foraging area when parti-coloured bats arrive. However, all nyctaloid bats that were seen at Oostpolderdijk and around the gas station, were visually identified as parti-coloured bats due to their comparably small size in combination with their fast foraging flight. At the dyke this species was seen foraging in the evening twilight, shortly after 23:00 hours, at a height of over 20 metres, which is normal for the parti-coloured bat. The serotine is much larger and normally forages at lower heights (Haensel 2007).

Interestingly, there are relatively few recordings from the area around the colonies in Spijk and Bierum. Nearly all calls in the villages were recorded after midnight, and especially after 02:00. Parti-coloured bats are known to fly high and straight to foraging areas (Haensel 2007) and their calls are probably not picked up by the Batcorders, as the detection distance in these situations is only 50 metres. The Batcorders need to be placed straight below a commuting route to be able to record parti-coloured bats.

Parti-coloured did not seem especially attracted to street lamps, as we did not observe higher foraging activity close to street lamps. The rural area outside villages in northeast Groningen is quite dark, and artificial illumination in villages may lure insects from their normal environment. Although this 'vacuum cleaner effect' (Lewanzik & Voigt 2017) in residential areas could be a reason why parti-coloured bats are often observed in the villages, it is more likely that the nearby roosts explained their presence. Most of the bat detector observations occurred near open water (45%) and in the villages (45%). Within the villages the bats were observed at different locations: near canals, buildings or tree lines. Far fewer observations were found in agricultural land (5%) or along tree avenues outside villages (5%).

Rydell (1992) suggested that the street lights may partly have caused the increase of parti-coloured bat population in Sweden. We doubt whether this is the case in northeast Groningen. New research shows that artificial light at night might have little impact on foraging of fast-flying open-space foragers such as the parti-coloured bat (Straka et al. 2019). A stable high density of swarming insects above a large open water body is probably more important for parti-coloured bats, especially when located at a short distance from a nursery colony (Jaberg 2003). In our opinion this is the case in our study area, where the open water of the Ems-Dollard provides good foraging conditions with a high abundance of insects. The agricultural land, which covers a large proportion of the study area barely seems to be used for foraging by the parti-coloured bat.

Identification of nyctaloid bat sounds

Acoustic research of nyctaloid bats is challenging because of the overlap of the ultrasonic sounds produced by the different species. Automatic identification reveals many uncertainties and probably wrong identifications (Straka et al. 2019, Vandendriessche

2020). In our study many recordings could not be classified to certain species, but to species groups such as Nycmi or Nyctaloid, which shows that the automatic identification software of batIdent is not very precise for this group of bat species. Straka et al. (2019) arrived at the same conclusion after using the same Batcorders and identification software for automatic recording of bat calls in Berlin. The authors found also that recognition between nyctaloid species was problematic and therefore created species complexes: calls from *Nyctalus* spp., *Eptesicus* spp. and *Vespertilio murinus* were combined in the group NEV, and all calls from *Myotis* species were combined in one *Myotis* group. In a comparative study of four auto-identification programmes, Brabant et al. (2018) found that most false identifications occurred with nyctaloid species: Leisler's bat, serotine and parti-coloured bat.

One reason for the problematic identification is that batIdent uses individual calls, and therefore misses alternating calls ('blip-blop') which are characteristic of the noctule and Leisler's bat (Barataud 2020, Russ, 2021). An observer with a bat detector and a headphone will almost automatically pick up the alternating calls and interprets these sounds correctly. Unfortunately, as the original Batcorder recordings were lost, we were not able to re-analyse these sounds manually. In the bat detector survey, however, we never heard alternating sounds in the sonar of any nyctaloid bats. Therefore, we assumed that the noctule and Leisler's bat were absent during the nursery period. In August and September 2016, which is the migration period, we did not observe either of these species.

Generally, recordings in open habitat are most suitable for a reliable identification for nyctaloid bats (Russo et al. 2017, Brabant et al. 2018). For example, when parti-coloured bats and serotines are flying low and near clutter they may use very similar echolocation sounds. Although serotines in these circumstances usually emit sonar pulses with a higher peak frequency, the large variation in their pulses still creates some overlap with the parti-coloured bat (Barataud 2020). When flying at higher altitudes and in open habitats both species normally use pulses with different bandwidths and only little overlap occurs (Barataud 2020, Russ 2021).

Interaction with serotines in the study area

Baagøe (1986) suggested an allopatric distribution pattern between serotine and parti-coloured bats in Zealand, Denmark. Interestingly, he mentioned in his study one nursery roost of parti-coloured bat with three to five serotines. In our study in northeast Groningen we observed serotines departing from all the parti-coloured bat roosts, but always in low numbers. This is in accordance with other studies where serotine and parti-coloured bats were found in the same roost (Baagøe 1986, Hermanns et al. 2001, Jonge Poerink 2024). In Mecklenburg-Vorpommern, Germany, Hermanns et al. (2001) found a small group of serotines close to a nursery roost of parti-coloured bats in the same building complex. They also found parti-coloured bats in a serotine nursery roost. In the same study 15 serotines were observed in a large (probable) nursery roost of parti-coloured bats in Białowieża, Eastern Poland. In Holwierde, at a roost located in our study area, Jonge Poerink (2024) observed a few serotines flying out before 31 parti-coloured bats departed.

In contrast to Baagøe (1986), we found both serotines and parti-coloured bats in considerable numbers in our study area. A nursery colony of serotines has been discovered in Holwierde in 2024 (personal observation). In 2016, we saw serotines flying through Spijk, Bierum and Holwierde, mostly in the evening or morning twilight. Other observations in the evening twilight included a small group of serotines commuting along a tree line from Bierum in the direction of the sea dyke of the

Ems and serotines commuting and foraging near Roodeschool, at the western border of our study area. Parti-coloured bats and serotines were never visually observed together during our study, except at the roost locations. Serotines leave the colony and start foraging much earlier than parti-coloured bats (Hessing & Hinkel 2006; personal observation). This means that clear peaks of bat recording early in the night, might indicate the presence of serotines (Hessing & Hinkel 2006; personal observation). This is the case at both the north-western end of the study area (Borkumkade and Middenweg) and south-eastern corner of the study area (Marsum and Uitwierde). Here we also made only a few recordings after midnight.

Courting behaviour of males and hibernating roosts

Despite our systematic search for courtship behaviour of the male parti-coloured bats no display calls were found. Sexes are segregated in summer season, but they meet each other in autumn at display locations where males sing for long periods on mild evenings in the period from October to December. These display calls are typically heard near high buildings, often in larger cities and towns (Baagøe 2001, Dietz 2011, Safi 2023). We found no evidence that apartment buildings in Delfzijl, nor other areas in the study area are used as courting roosts by the parti-coloured bat. There were various other species recorded and one or two buildings seemed to be used as display areas and possibly winter quarters of the common pipistrelle. The number of recordings varied greatly per night, which was probably mainly caused by the large variation in weather conditions in autumn. The only published occurrence of display calls of the parti-coloured bat in the Netherlands is near a light house at the Maasvlakte to the west of the Rotterdam seaport (Mostert & Wondergem 1993). The harbour area around Eemshaven was systematically surveyed, both with hand-held bat detectors and Batcorders, with no signs of singing males. With the exception of the observation by Mostert and Wondergem, no display calls were reported in Belgium and the Netherlands until 2017.

Since the overall numbers of recordings were much lower in the northeast of Groningen in September, we assume that most individuals migrated and left the area. We presume that they flew to courtship areas or hibernating roosts, especially in larger cities, often located hundreds of kilometres away. For example, Groningen, which is a relatively large city with many high buildings, could be a possible courtship and hibernating location. However, bats are actively monitored in this city and no display calls have been recorded there. Further away, larger cities in northwest Germany could harbour mating locations. In Hamburg single males and females have been found in winter, and in Bremen a single pregnant female was found in 1997 (Hessing & Hinkel 2006). It should be noted that it is also unknown where the females of the Maarssenbroek colony go after their nursery period (Jansen et al. 2017).

Conclusions

Our preliminary inventory revealed three roosts of parti-coloured bats, used by two colonies in the study area in 2016 and 2017, where reproduction does occur. We do not know the population size of the parti-coloured bats in this area, or if it is growing or declining. Therefore, regular counts of parti-coloured bats departing their roosts before the nursing period and during the nursing period are recommended to monitor the population status.

We propose that roosts of the parti-coloured bat may have been present for several decades in this area, although remained unnoticed. The species might have been overlooked because of the problematic identification of echolocations sounds of nyctaloid bats,

in particular the parti-coloured bat, serotine, Leisler's bat and noctule. A new generation of acoustic identification has been developed which uses machine learning techniques to increase the accuracy in acoustic species recognition. Hopefully with this software the parti-coloured bat will be better recognized and more roosts discovered in other parts of the Netherlands. Only one main foraging area for the parti-coloured bats was found, which was located at the western shore of the river Ems. Further research is needed to establish whether and which other bat species were using this spot.

There is still much to learn about the males of the parti-coloured bats. We were not able to determine if there were also adult males present in the nursery roosts, and if there are all-male colonies in the study area, which would be typical for this species (Safi 2006). To gather this information, bats have to caught with nets or traps and sexed. Ideally, also some bats could be provided with radio transmitters to be able to follow individuals and get an insight in their nightly behaviour. In late summer when individual males migrate to their courting places, the females will migrate to these display areas not only to mate but often also will hibernate in or nearby these places. In north-western Europe these locations are often situated in high buildings in big cities. We observed declining numbers of parti-coloured bats in the area after August, and no courting display area has been found in this part of the Netherlands.

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Samenvatting

Een eerste onderzoek naar het voorkomen van de tweekleurige vleermuis in het gebied Eemshaven-Delfzijl, Groningen

De tweekleurige vleermuis (*Vespertilio murinus*) wordt in Nederland als een zeldzame soort beschouwd met maar één kraamkolonie, die in 1998 werd ontdekt. Een mogelijke tweede kolonie werd gemeld in Noordoost-Groningen in 2002, maar is daarna niet meer teruggevonden. Deze studie is een eerste systematische inventarisatie naar het voorkomen van de tweekleurige vleermuis in het gebied Eemshaven – Delfzijl, die in 2016 werd uitgevoerd met een mobiele batdetector en automatische recorders op vaste locaties. Met de batdetector werden drie verblijfplaatsen, behorend tot twee kolonies, aangetroffen in de dorpen Spijk en Bierum. In 2016 was het maximale aantal uitvliegende tweekleurige vleermuizen in Spijk 29 en in Bierum 12, terwijl in 2017 de maximale aantallen 61 respectievelijk 12 bedroegen. We zagen ook kleine aantallen, 1 tot 4 individuen, van de laatvlieger (*Eptesicus serotinus*), die eerder dan de tweekleurige vleermuizen uit dezelfde verblijfplaatsen uitvlogen. Er waren aanwijzingen voor een mogelijke derde kolonie, maar deze konden tijdens deze studie niet worden bevestigd. In dit artikel gaan we ook in op observaties van anderen die laten zien dat er voortplanting heeft plaatsgevonden in of heel dichtbij de kolonies die we in het studiegebied hebben gevonden. Met automatische recorders werd veel foerageeractiviteit geregistreerd in een relatief klein gebied aan de westelijke oever van de rivier de Eems. Deze foerageerlocatie was gelegen op 2,5-4,5 km afstand van de kolonies. Hier zijn foeragerende tweekleurige vleermuizen gezien op 5 tot 30 meter hoogte boven water. Tijdens de piek van de foerageeractiviteit werden in intervallen van 10 minuten maximaal 71 opnames gemaakt van de sonar van nyctaloïde vleermuizen (d.w.z. behorend tot de geslachten van *Nyctalus*, *Eptesicus* of *Vespertilio*, die vergelijkbare geluiden produceren). Over het algemeen kon slechts een klein deel met zekerheid op soortniveau worden geïdentificeerd en we bespreken de moeilijkheden die wij ondervonden bij de automatische identificatie van de echolocatiegeluiden van nyctaloïden. In de herfst zochten wij in het studiegebied naar baltsgeluiden en baltslocaties van mannetjes van de tweekleurige vleermuis, die in dat jaargetijde vooral in stedelijke gebieden met hoge gebouwen voorkomen. Er werden echter geen baltsende mannelijke tweekleurige vleermuizen aangetroffen. Hoewel deze soort voornamelijk in huizen en gebouwen en dus in menselijke nabijheid leeft, worden de zomer- en winterverblijven waarschijnlijk vaak over het hoofd gezien. In het geval van tweekleurige vleermuis in Noordoost-Groningen hebben we het vermoeden dat er al tientallen jaren kolonies aanwezig zijn.

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Appendix 1. Visiting dates and times, locations that were visited and the weather conditions during the visits

Date	Time	Temp. (°C)	Wind (Bft)	Locations/remarks
26-05	21:30 - 01:05	15 > 11	2 - 3	Eemshaven, Polen, Oudeschip
27-05	21:30 - 01:05	16 > 13	3 - 4	Spijk, Nieuwstad, Hoogwatum, Spijksterriet, Bierum
28-05	21:30 - 01:05	19 > 14	3	Delfzijl, Hoogwatum, Bierum, Holwierde, Nansum
01-06	21:55 - 00:10	20 > 18	4 - 5	Delfzijl, Farmsum, industrial area
08-07	01:20 - 05:20	15	0 - 1	Eemshaven, Polen, Oudeschip
09-07	01:15 - 05:15	15	3 - 4	Delfzijl, Nansum, Holwierde, Bierum, Spijk
09-07	22:00 - 23:30	18	3 - 4	Roost Bierum A
14-07	22:00 - 23:00	17	5	Roost Bierum A, foraging area gas compressor station Spijk, overcast with sometimes drizzle and rain
21-07	01:15 - 05:15	18	1	Delfzijl, Holwierde, Bierum, Appingedam
22-07	02:00 - 05:00	19	1 - 2	Spijk, Bierum
22-07	21:30 - 23:15	19	2 - 3	Roosts Bierum B and Spijk
23-07	21:30 - 23:00	18	0 - 1	Roost Spijk
25-07	03:00 - 05:00	19	0	Holwierde
13-08	21:10 - 22:20	18	1 - 2	Roosts Bierum A en B, roost Spijk
13-09	20:00 - 22:00	28 > 24	2 - 4	Eemshaven ZO, Spijksterpompen, Polen, Oudeschip
22-09	20:40 - 22:55	15 > 14	1 - 2	Delfzijl
11-11	18:15 - 20:25	2 > -1	2	Eemshaven, Delfzijl

Appendix 2. Locations of batcorders in June and July with the dates and times when the recording started, and the dates and times when the recording ended.

Code	Location	Start date	Start time	End date	End time
PL01	Oudeschip	27-06-2016	21:00	30-06-2016	06:00
PL02	Roodeschool (Greedeweg)	09-07-2016	21:00	12-07-2016	06:00
PL03	Middenweg	27-06-2016	21:00	30-06-2016	06:00
PL04	Emmapolderdijk	27-06-2016	21:00	30-06-2016	06:00
PL05	Borkumkade	06-07-2016	21:00	09-07-2016	06:00
PL06	RWE-centrale	06-07-2016	21:00	09-07-2016	06:00
PL07	Synergieweg	27-06-2016	21:00	30-06-2016	06:00
PL08	Eemscentrale	27-06-2016	21:00	30-06-2016	06:00
PL09	Oostpolderdijk (Binnenbermsloot)	12-07-2016	21:00	14-07-2016	03:22
PL10	Gas (compressor) station east	03-07-2016	21:00	06-07-2016	06:00
PL11	Gas (compressor) station west	09-07-2016	21:00	11-07-2016	01:48
PL12	Oosteinde (Lage Trijnweg)	09-07-2016	21:00	12-07-2016	06:00
PL13	Spijk	03-07-2016	21:00	06-07-2016	06:00
PL14	Bierum (camping Kiek op Diek)	06-07-2016	20:00	09-07-2016	06:00
PL15	Holwierde	12-07-2016	21:00	15-07-2016	06:00
PL16	Losdorp	06-07-2016	21:00	08-07-2016	06:00
PL17	Marsum	12-07-2016	21:00	15-07-2016	06:00
PL18	Uitwierde	03-07-2016	21:00	06-07-2016	06:00
PL19	Uiteinderweg	03-07-2016	21:00	06-07-2016	06:00
PL20	Hoogwatum	03-07-2016	21:00	06-07-2016	06:00