

**Alison Fure MSc C.Env MCIEEM
Ecological Consultant**

Furesfen

Tel/fax 020 8974 6670
Mob.0786 750 7086
Email alison@furesfen.co.uk
Website: www.furesfen.co.uk

**BAT SURVEY REPORT,
DUKE OF NORTHUMBERLAND RIVER (DNR)
KNELLER GARDENS TO WHITTON DENE,
L.B'S RICHMOND AND HOUNSLOW.**

To:

FORCE

August, 2015

From:



Simlaw
ECOLOGY



REPORT CONTENTS

(warning: from page 20 there are a number of colour appendices which can be omitted from a print run if preferred).

1. Introduction
2. Methodology
3. Results
4. Evaluation
5. Discussion and Recommendations
6. Underpinning Legislation and Policy
7. References
8. Appendix

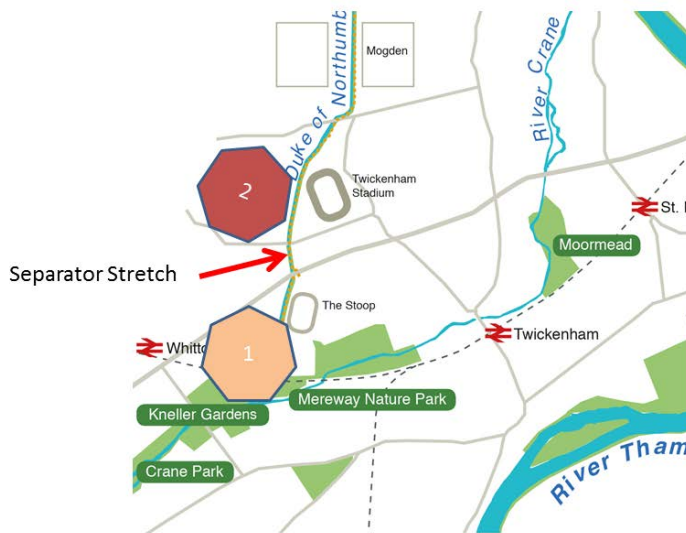
Abbreviations and terminology:

RBAP	Richmond Biodiversity Action Plan
BAP	Biodiversity Action Plan
HAP	Habitat Action Plan
SAP	Species Action Plan
FORCE	Friends of the River Crane Environment
LNR	Local Nature Reserve
SINC	Site of Importance for Nature Conservation
LBG	London Bat Group
DNR	Duke of Northumberland River
Freeboard	The distance from the water level to the top of the channel's sides.
RB or east bank	Right Bank looking downstream
LB or west bank	Left Bank looking downstream
S.S.	Southern stretch From Kneller Gardens to Quinns
Separator Stretch	A316 to B361 Whitton Road
N.S	North stretch From B361 Whitton Road-Whitton Dene

Thanks to Daniel Simmons, Tasha Hunter, Philip Briggs, Niall and Una Blair, Gary Backler, Anna Smyk, Rob Gray, Joe Pecorrelli, Tim Elson, Jane and Phil Satchwell.

SUMMARY

Six possibly seven bat species use the DNR corridor as a foraging area throughout the night. The southern part of the corridor is the most active with a greater diversity of species in greater numbers. In the southern and central area of the study bats were recorded during their emergence period, this means that bats had not travelled far from a roost site. The northern section of the DNR suffers from anthropogenic disturbance of light, noise, dust and smell as well as macrophytes choking the stream. The survey demonstrated the changing use over time by the bat community dependant on the demands of the breeding season and their synergy with insect swarming behaviour. It is just as important therefore to look after and encourage insects by imposing limits on pollutants such as dust, light, fumes and noise.



Team 1 and 2 Positions

Map Courtesy FORCE

1.0 INTRODUCTION

1.1 INTRODUCTION

A bat survey was commissioned by the Friends of the River Crane Environment (FORCE) and Richmond Council Parks Department, to investigate the bat activity along a 1,500m stretch of the Duke of Northumberland River (DNR) between Kneller Gardens (to the south) and Whitton Dene (to the North) centred on a 'separator' stretch at TQ151739. The investigation was necessary in order to determine how bats: were using the area; the species present and if bats might be affected by local habitat changes.

1.2 PARTICIPANTS

The survey was led by A. Fure and D. Simmons holders of protected species licences assisted by volunteers from Force. Team 1 was led by Daniel Simmons of Simlaw Ecology. Daniel holds a Class 2 Bat Survey Licence (Natural England licence number 2015-03434-CLS-CLS). Team 2 was led by Alison Fure Class 2 Survey Licence 2015-10381-CLS-CLS) and has previously worked with FORCE. Both are full members of the Chartered Institute of Ecology and Environmental Management (CIEEM).

1.3 FORCE

FORCE have been engaged in the development and monitoring of a ninety seven hectare park, known as Crane Valley Park, within the London Boroughs of Hounslow and Richmond. They have been monitoring water quality, birds, eels etc. and it is hoped that the current round of surveys will assist with a citizen science approach to future monitoring of the bat species within the Crane Valley to inform habitat management. To this end, a range of monitoring equipment was provided to twelve volunteers, along with some instruction.

1.4 PURPOSE

It has been a joint aspiration of the council and FORCE to widen the footpath along the DNR by moving the fence surrounding the Council Central Depot (Langhorn Drive) eastward. This will entail the removal of some trees, but enable conservation work to strengthen the value of the corridor, in the long term.

1.5 DESIGNATIONS AND CHARACTER

The DNR River is an artificial watercourse built in the 1530's to provide water power for mills and a water supply to Syon Priory and is a Site of Grade 2 Site of Borough Importance. It is a bifurcation of the River Crane, a Site of Metropolitan Importance at Kneller Gardens. Along the east bank, lies Mereway, a Local Nature Reserve (LNR). A railway corridor crosses the river where the rear gardens of residential properties line the west bank and the Council Central Depot (featuring the Pump House Building of Townscape Merit) occupies the east quadrant. Rugby stadia about this quadrant (on the south side of the A316) followed by the entire right bank to the north until Whitton Dene (after a 180m 'separator' stretch between the two main areas of river). In general the southern stretch is more residential in character and the northern stretch is largely occupied by community open space and buildings (schools and stadia).

1.6 EAST SECTION OF THE DNR

This eastern section of the DNR diverts water from the Crane in Kneller Gardens, Whitton, north-eastwards past The Stoop and Twickenham Stadium, through Isleworth, originally to the Mill then onwards to supply the ornamental ponds in the Duke of Northumberland's estate at Syon Park. The River within the study area (Fig.1).



1.7 FEATURES

Mature trees, overhanging and emergent vegetation ensure that the site retains some value for wildlife. Beneath the railway embankment on the northern boundary of Kneller Gardens is a wet flush, indicative of a rising spring. A small water vole colony was recorded during surveys (2009-14). Its value as a wildlife corridor has been affirmed by surveys undertaken along the southern section at: Kneller Gardens (2009-14); Mereway Local Nature Reserve (LNR) [2011]; and the River Crane (2014); which should be read in conjunction with this report. However, further downstream less is known about the DNR corridor.

2.0 METHOD

2.1 DESK STUDY

A desk study was undertaken using author's data and London Bat Group records. This included surveys and bat walks undertaken in recent years particularly:

- Kneller Gardens (2009);
- Mereway Nature Reserve (2005);
- Bat Conservation Trust, Daubenton's Waterway Survey: Mogden Sewage Treatment Works (route centred around TQ154750); and
- River Crane Corridor bat surveys, (Fure, 2014).

2.2 WALKOVER SURVEY

A walkover of the river was undertaken from the bank (5.6.15) in order to ascertain any niches, which might be available to wildlife along the corridor in line with Bat Conservation Trust Guidelines (2012) to establish specific features of bat interest, including any flight lines and any roost opportunities. This included an inspection of a pumping station and house at the Central Council Depot after a site induction (18.6.15). The information from this survey was used to inform monitoring positions using passive bat detection equipment.

2.3 COUNCIL CENTRAL DEPOT, LANGHORN DRIVE

A site inspection to establish features of bat interest included a binocular inspection of the visible tree-holes and buildings (external view from the ground only). Trees can be classified on roosting opportunities for bats, and the general condition of the tree. Potential bat roosting features can include significant cracks, splits, hollows or holes in the trunk or branches, areas of loose bark, and features such as Ivy. This information can be used to classify individual trees as follows.

- High Bat Roost Potential. Trees with good bat roost potential have numerous or cavities, or sections of hollow trunk. They are likely to be used by bats.
- Moderate Bat Roost Potential. Trees with moderate bat roost potential are those with small holes such as woodpecker nest-holes, or cracks. They could be used by individual bats and might be suitable for a maternity roost or other types of roost.

- Limited Bat Roost Potential. Trees with limited bat roost potential are those with cracks and holes or small sections of loose bark and Ivy growth. They might be used as occasional or transient roosts.

2.4 BAT EMERGENCE AND ACTIVITY SURVEYS

Two bat activity surveys were undertaken four weeks apart on the evenings of 29.6.15 and 27.7.15. The surveys were conducted during the optimal survey period for bats and in suitable temperature and weather conditions. Each dusk Transect survey began at least 15 minutes before sunset and continued until at least 1.15 hours after sunset. The survey methods were in accordance with The Bat Conservation Trust's Bat Surveys: Good Practice Guidelines - 2nd Edition (Hundt, 2012), and The Bat Worker's Manual (Mitchell-Jones and McLeish, 2004).

2.5 EQUIPMENT

During each survey, two teams of surveyors were deployed on separate sections of the DNR. Surveyors walked slowly between four or five listening posts and recorded any bat activity observed. On the southern section each surveyor was equipped with an Echo Meter Touch bat detector supported by an Apple iPad Mini 2 interface running IOS 8, on which all bat activity was recorded. Recordings were later analysed using Kaleidoscope Pro software to aid the identification of species according to Russ, 2012. North of the separator stretch surveyor were equipped with a range of hand held bat detection equipment including recordable Bat Box 4 Frequency Division Duet with an Edirol recorder, Bat Box 3, Ciel and Magenta's. Recordings taken from the Duet were played through BatSound and interpreted according to Russ (2012).

2.5 PASSIVE MONITORING

Static bat detection equipment, notably an Anabat, and an Anabat Express were situated as follows:

- An Anabat Static Bat Detector was left at Continental Landscapes compound (facing the Lombardy Poplar trees [earmarked for removal in the Rootcause report] along the DNR within the Central Depot) 19.6.15-22.6.15);
- An Anabat Express was strapped to a tree along the 'separator stretch' (29.6.15);
- An Anabat was chained to a tree on the left bank or west bank of the river abutting Cardinal Vaughn School Playing Fields (29.6.15-2.7.15);

- An Anabat was chained close to railway line on left or west bank of river (14.7.15-17.7.15).

3.0 RESULTS

3.1 DESK STUDY

The desk study showed that nine species of bat are recorded locally five of which are roosting nearby. Roosts of both common pipistrelle bats *Pipistrellus pipistrellus* and soprano pipistrelle *Pipistrellus pygmaeus* are known within 1,000m. Daubenton's bats *Myotis daubentonii* are recorded navigating over the River Crane and there is a known hibernaculum of this species at Cavalry Tunnel near Feltham Marshalling Yards. However there are no records of this species being detected during the Bat Conservation Trust Daubenton's Waterway Survey (P. Briggs *pers comm.*, July 2015). Brown Long-eared bats have been recorded in surveys within the study area.

Table 1: Status of bats recorded in the local catchment.

Species	Frequency in London	Main roost sites
Common pipistrelle	Common	Buildings nearby (LBG) Roosts nearby
Soprano pipistrelle	Common	Buildings and trees especially near water (LBG). Large roosts nearby 2 sites >300 bats Twickenham Early bats were recorded at Heatham Park, 2010
Nathusius's pipistrelle	Rare	Buildings Trees. Has roosted within the catchment but its local status is variable
Daubenton's bat	Becoming less common in the Greater London area (Briggs, et a , 2007)	Trees, structures and underground sites Percy Road, Lincoln Fields, 2010; Hibernation site at Cavalry Tunnel LBG data Bat Conservation Trust Daubenton Waterway Survey transects on the River Crane: Crane Park (route centred on grid ref TQ130728) 1997 Moormead recreation ground passes also. (Briggs, <i>Pers comm.</i> , 2014)
Natterer's bat <i>Myotis nattereri</i>	Infrequent since 2009 at this location	Trees and structures
Noctule bat <i>Nyctalus noctula</i>	Becoming less common in London	Known roosts nearby Recorded: emergence survey Heatham Park, 2010
Leisler's bat <i>Nyctalus leisleri</i>	rare	No known roosts in the area flight records only but early registrations Author's data, 2005
Serotine <i>Eptesicus serotinus</i>	Rare in London	Record from the Lensbury surveys along the River Thames at Teddington 2012.
Brown long-eared bat <i>Plecotus auritus</i>	Becoming rare in London	Roosts nearby, difficult to detect in flight Maternity colony at Normansfield. Flight Records at Twickenham Rough C. Nash

Adapted from Mitchell-Jones (2007)

LBG=London Bat Group records

3.2 HABITAT FEATURES AND GENERAL CHANNEL CHARACTERISTICS

The two stretches are very different in character and are heavily influence by the offsite activities, the channel width and openness, as well as proximity to the diffluence.

- The South Stretch (S.S): the channel is heavily shaded by Lleylandii trees and contains stands of prostrate ivy which is the only plant to tolerate such low light conditions and in turn inhibits the growth of flora; the banks are constrained by garden fences and attempts to claim the bankside for seating etc. Many trees exhibit a high or medium potential for bat use, although this might be transient in nature due to disturbance by squirrels and parakeets. Contains some important lying dead wood, rotten wood in water; the former generates insect swarms, which rise to the tree canopy; and in turn are attractive to foraging bats.
- The North Stretch (N.S.): Heavily influenced by anthropogenic features including light, sound, smell and noise. Some mature trees capable of supporting bats and a walnut tree, which may have resulted from a sewage spill or squirrel planting. During the survey the following habitats were identified: slow running water, dead wood, bramble/scrub, mature trees with high and medium potential for bat interest, stream macrophytes and Japanese knotweed.

3.3 WALKOVER SURVEY SOUTH STRETCH CENTRAL DEPOT 18.6.15



Figs. 2 and 3 Pumping station. Anabat bat detector camouflaged by vegetation.

The pumping station has been recently reroofed. There was no visual indication that it was being used by bats although it was only possible to view the building externally from the ground. A bat detector was left at Continental Landscapes compound chained to the fence and covered in undergrowth over a weekend period (refer to Fig.3).

3.4 BAT SPECIES RECORDED DURING DETECTOR SURVEYS: JUNE SUNSET (21.21)

A total of five bat species were recorded during the combined acoustic and passive bat detector surveys. This included: Common, Soprano and Nathusius' Pipistrelle bat (one registration at sunset +1.21 hours); as well as *Nyctalus* species i.e. a Noctule bat and several registrations of Leisler's bat foraging over the Central Depot. *Nyctalus* species were not recorded at the northern stretch, where only Common and Soprano Pipistrelle bats were detected. At the end of the survey (S.S.) a bat call with the characteristics of a Serotine Bat was indicated although this requires validation. This bat is known along the Thames and its call can appear similar to Leisler's bat. The detailed results are as follows:

3.5 PASSIVE BAT DETECTION 19.6.15- 22.6.15.

The results from the passive bat detector (Anabat) left at Central Depot, revealed foraging activity by Leisler's bats throughout the night. Some registrations were of a lower frequency and were recorded as Noctule bats or *Nyctalus* species, the genus of the two closely related species. Some pipistrelle bat activity was recorded during the third evening. This may be due to weather conditions.

Table 2: Selected Anabat activity (mid-June).

Sunset 21.21p.m. Cloud cover 5/8 .Temperature 14 degrees centigrade at start

Time	Details: Anabat located at the Central Depot 19.6.15 - 22.6.15
Date and times of activity (First and peak).	All activity pertains to Leisler's Bats unless stated
19 th June 22.48-24.00	24 passes x 4 files per minute (intense activity likely to be more than one bat).
20 th June 24.00-03.05	Approximately 120 passes of Leisler's bats
20 th June 21.54-24.00	Earliest registration similar activity until midnight
21 st June 21.57-24.00	Leisler's bat until 03.16 but with some Common Pipistrelle activity between at 22.30 and between 01.30 and 01.52
22 nd June 01.27-02.05	May have rained during the remainder of the early morning.

3.6 BAT EMERGENCE AND ACTIVITY SURVEYS SOUTHERN SECTION: TEAM 1 JUNE.

Team 1 covered the area along the right bank of the Duke of Northumberland's River between the A316 Chertsey Road, in the north and Meadway LNR, in the south. During the bat detector surveys three survey groups using Echometer Touch modules in conjunction with iPads detected the five bat species: Common, Soprano and Nathusius' Pipistrelle bat (sunset +1.21 hours); as well as Noctule bat and several registrations of Leisler's bats foraging over the Depot. The first recordings of Leisler's from the three teams are as follows:

- South Section - 21:51 (31 minutes after sunset);
- Mid Section - 22:17 (57 minutes after sunset); and the
- North Section - 22:10 (50 minutes after sunset).

3.7 ACTIVITY LEVELS

Common and Soprano Pipistrelle bats were recorded foraging over the river throughout the duration of the survey. The first bats recorded were entering the site from the west and others were travelling along the river from the south. In the case of Common Pipistrelle there was no discernible activity pattern but Soprano Pipistrelles arrived consistently at 21.40 (sunset +19 minutes). The first Leisler's bat recording was at 21:55 with first observed Leisler's activity in the south of the S.S. from 22:09; Noctule and Leisler's activity in the area of the Central Depot. The mix of faint and close calls indicated wide foraging loops in this area.

3.8 NORTHERN SECTION BAT EMERGENCE AND ACTIVITY SURVEYS: TEAM 2 JUNE

The surveyor 'beats' covered larger areas than those of Team 1 beginning at the B361 Whitton Road and ending at Whitton Dene. The character changed substantially from open areas to 'woodlot'. Lining the left bank along playing fields north of Chase Bridge were mature trees and the first Common Pipistrelle bat arrived at 21.48 (sunset + 27 minutes) from the north.

3.9 BAT ACTIVITY

Bats did not remain to feed until 21.54 when Soprano Pipistrelle bats arrived (sunset + 33 minutes) and remained foraging along the final stretch just before Whitton Dene. The

bats tended to use the mid-stream area for foraging rather than the bankside vegetation. On one occasion a bat was seen to skim over the water, but recordings confirmed this to be a Soprano Pipistrelle bat and not a Daubenton's bat as had been anticipated. Activity was low.

3.10 SEPERATOR STRETCH: 29.6.15

During the survey an Anabat Express static bat detector was left fixed to a tree along the small stretch of river which separates the north and south sections between the A316 Chertsey Road and Hospital Bridge Road. A Common Pipistrelle bat was recorded at 21.52 (sunset + 31 minutes) and remained foraging for six minutes. The last Common Pipistrelle bat was recorded at 22.11.

3.11 ANABAT 29.6.15-2.7.15.

An Anabat was left chained to a tree on the left bank approximately 400 metres north of Chase Bridge where there were trees which had been identified as capable of supporting bats, during the walkover survey. There was a very low level of pipistrelle bat activity.

3.12 BAT EMERGENCE AND ACTIVITY SURVEYS: BAT SPECIES, JULY

A total of five bat species were recorded during the combined acoustic and passive bat detector surveys. This included: Common and Soprano Pipistrelle bat; as well as Noctule bat and a reduced number of registrations of Leisler's bat foraging over the Depot which arrived much later than before. An additional species, that of Daubenton's bat was recorded on passive bat detection equipment positioned south of the Depot. This detector was intended to gain additional information on the direction of travel of the Leisler's bats. The Daubenton's registrations were brief passes only. The detailed results are as follows:

3.13 BAT EMERGENCE AND ACTIVITY SURVEYS: TEAM 1 JULY (SUNSET 20.56).

A well-used Soprano Pipistrelle foraging route was observed between the River Crane and the DNR bridges. Activity was concentrated beneath the tree canopies at the south of the site when away from the bridges. Later in the survey, intense foraging activity by many bats was noted over the river in Kneller Gardens. Activity trailed off towards 21:50,

with noticeably depreciated activity towards the artificial lighting of the residential road to the south. The southernmost extent of the transect tended to record the first bat arrivals:

- First Soprano Pipistrelle 21:03 (sunset + 7 minutes).
- First Common Pipistrelle 21:17
- First Leisler's bat 21:56

3.14 NORTH SECTION BAT EMERGENCE AND ACTIVITY SURVEYS: TEAM 2 JULY

Two bat species were recorded and arrived later than those at the southern stretch. In the case of pipistrelle bats, the first arrival was not determined to species as there was no recording facility in the detection equipment. This was at 21.14 (sunset + 18 minutes) with Soprano Pipistrelles remaining in small numbers to feed (from sunset + 26 minutes). Constant foraging by Soprano Pipistrelles was observed from sunset + 30 minutes at the northernmost stretch towards Whitton Dene along a ribbon of the best and darkest area of habitat (J.P.). Bats were more regularly encountered from (sunset + 1 hour) along the remaining survey beats. In addition: Roesel's Bush Cricket was recorded on bat detection equipment (sonogram appended) and a Tawny Owl was heard calling on several occasions.

3.15 SEPARATOR STRETCH

During the second survey there was sufficient volunteer numbers to cover the Separator Stretch. This was divided into two seventy five metre 'beats' by the two surveyors who recorded pipistrelle bat species activity from 21.10 (sunset + 14 minutes R.G.) at the southernmost or Chertsey Road section. This was followed by activity by two pipistrelle bats at 21.15-21.20 nearer to the Whitton Road end (A.S). By 22.00 the activity was described as 'extensive' consistently around a tree with sweeps over the water. By the time Team 2 returned these bats were arcing up the side of the bridge on both sides of the road, which is typical of pipistrelle foraging behaviour as they swoop on insect congregations near the warm brickwork. These were later determined to be both Common and Soprano pipistrelles.

3.16 ANABAT: LEFT BANK CLOSE TO RAILWAY CORRIDOR 14.7.15-17.7.15

During the Anabat static bat detector surveys, three bat species were recorded. This included: Soprano and Common Pipistrelle bat as well four Daubenton's bat passes. A limitation of this survey was that the Anabat was directed upward to obtain more

information about the movement of Leisler's bats so this was not a good indication of the activity levels of this species at this point in time. Daubenton's were recorded at the following times:

- 23.23 14.7.15
- 01.24 15.7.15
- 22.42 16.7.15
- 23.07 16.7.15

4.0 EVALUATION

Evaluation criteria for features outside of protected areas are difficult and Ratcliffe's criteria are helpful for Sites of Special Scientific Interest, but not neighbourhood or borough sites. Once a feature has been identified as important, it should be considered further by an assessment, with appropriate mitigation and compensation provided so that there is 'no net loss' of that feature. If the predicted impacts to the ecological features can be balanced by avoidance, mitigation and compensation, then any project can claim to have met the principal of 'no net loss' of biodiversity. This is in accordance with recent changes in planning policy and takes account of the new British Standard for Biodiversity, BS42030 (Edmonds, 2014). The following evaluation also relies on the work of an author on bats Wray (2010).

Table: 3 Evaluation Summary Table.

Site Resources	Importance.	Reasons.
Small river with macrophytes	S.S. is of Borough value	The S.S. is an important foraging area for six possibly seven <i>bat</i> species and a potential roost site for Leisler's bats. This species is rare nationally and come to feed over the area. Important habitat containing structural features of interest to bats. Provide linear features used by commuting birds and bats and provides insect biomass for feeding purposes.
Mature oak/poplar trees	Neighbourhood	This is a valuable local habitat Used by a tawny owl family (N.S.). Trees create a link between neighbouring habitats, provide light shields on the southern section and harbour insect biomass.
Rough grassland	Neighbourhood	Generating invertebrate activity. Grasshoppers and bush crickets such as Roesel's bush cricket <i>Metrioptera roeselii</i> recorded during the July survey N.S are an important food resource.

4.1 VALUE.

Overall the N.S is assessed to be of local value and the S.S of borough value. Fragmentation, light pollution and a lack of open water caused by too much emergent vegetation create problems for the movement and foraging of Daubenton's bats. With improvements to bankside screening and better rationalisation of vegetation across the mid-stream areas, could increase the foraging value.

4.2 SURVEY EVALUATION

- The field survey identified the presence of six/seven species of bat protected by national and international legislation: Common, Soprano and Nathusius' Pipistrelle, Noctule and Leisler's bat and a Daubenton's bat. A Serotine bat may have also been detected on one occasion.
- The field study identified a Soprano Pipistrelle roost nearby due to their early emergence times;
- Surveys identified invasive species such as Japanese knotweed and signal crayfish (found predated on an emergent rock 5.6.15).

4.3 LIMITATIONS

A recorder failed at one station at the south transect during the first survey (29.6.15) so some species records for this period have not been validated. To account for this limitation, identification of bats has been limited to genus level on occasion. The lack of recording facility (until later in the evening) at the Separator Stretch meant that early arriving bats were not confirmed to species. To account for this limitation the Anabat recordings confirmed that only two pipistrellus species were present and there had been no movement of *Nyctalus* species. Surveyors noted environmental limitations such as the pressure washing of the A316 overbridge, lighting, diesel fumes from a generator and strong smells of wood smoke, which is known to affect insects.

5.0 DISCUSSION

5.1 SOUTHERN SECTION: SPECIES

The surveys generated a robust set of data over the summer months during the bat breeding season from the beginning of June to the end of July. Six possibly seven bat species were recorded at the S.S. during the surveys: Common, Soprano and Nathusius' Pipistrelle, Noctule and Leisler's bat, with four Daubenton's bat passes during one evening as well a possible Serotine bat. No bats were recorded emerging from trees but bats had a close association with trees for movement and foraging particularly during windy conditions.

5.2 NORTHERN SECTION

Two pipistrelle bat species were recorded at the N.S. No bats were recorded emerging from structures or trees. This section was perhaps not so interesting for the survey teams covering the open areas, where there were few commuting passes quite late in the evening. However this does not diminish the importance of the data and observations can be made about bat commuting behaviour and the habitat quality.

5.3 SEPARATOR STRETCH

The spread of bat registrations and the early emergence times are suggestive of the presence of a colony of Soprano Pipistrelles close to the Separator Stretch (first bat 21.10 sunset + ten minutes 27.7.15). The activity recorded on the static bat detector, indicated the Central Depot is an important foraging area for *Nyctalus* bat species during their breeding and lactating period. The N.S. was used later in the evening for by pipistrelle bats for foraging purposes, particularly the area close to Whitton Dene.

5.4 BAT ECOLOGY

Bat ecology was expounded within the River Crane Bat Report (2014) so only a few specific comments are made here with reference to:

- Nathusius' pipistrelle;
- Leislars bats; and
- Daubenton's bat.

5.5 NATHUSIUS' PIPISTRELLE ECOLOGY

Nathusius' Pipistrelle is thought to roost primarily in tree holes, crevices and bat boxes, and sometimes in tall modern buildings. It may share a nursery roost with other species, notably other pipistrelles. When commuting, it tends to fly between 4 - 15m above the ground (Russ 1999). This species has a strong association with large waterbodies and waterways but also forages in woodland. It is migratory with a peak in records in the UK during its late summer/autumn passage when it moves from its main breeding range in Eastern Europe to central Western Europe. As with Soprano Pipistrelle, there is a concentration of records following a south westerly direction across London, perhaps partially reflecting the two species' similar habitat preferences. (London Bat Group Atlas, 2014).

5.6 BATS: NYCTALUS BAT ECOLOGY

Leisler's bats are classed as a rare species (Focus on Bats, T. Mitchell Jones). It is thought as Noctules become less common in our urbanising landscapes this closely related species is able to take advantage of the niches vacated by the larger Noctule bat. However this could also be an artefact of the lack of sophistication in bat recording equipment until recently when the peak frequency and repetition rate were not firmly understood due to a lack of reference calls. The presence of a rare bat species spending a large proportion of its evening foraging during the breeding and lactating period is significant.

5.7 DAUBENTON'S BATS

There were only four registrations of Daubenton's bats during the survey and these were late in the evening and would not have been captured during the Team work. Studies indicate that this species cannot feed over emergent vegetation and require open water and dark conditions. It is estimated the average distance at which Daubenton's bats can detect their prey to be only 128 cm. The water surface, therefore, seems to have an important influence on the acoustic environment. For this reason clutter on the water surface, such as plant cover, could exert a negative effect on the hunting behaviour of any trawling bat species (Booman, A., et al 1998).

5.8 BAT MOVEMENT AND FORAGING.

Vegetation, particularly mature trees, is used by bats for a variety of functions:

- roosts: e.g. the Noctule and Leisler's bats;
- commuting routes: in order to avoid open areas;
- cover: especially during the early part of the evening and in areas where light levels are high such as the; as well as
- foraging areas: the trees are both an insect breeding habitat and offer a sheltered microclimate.

Whilst trees abutting the study area offer suitable roosting conditions for both Noctule and Leisler's bats exhibiting many woodpecker holes, it was likely that they would be disturbed by the many parakeets and squirrels noted at this location. Bat boxes provided in mitigation for the loss of trees would be dedicated solely to bat use. Epicormic growth at the base of the Lombardy Poplars indicated stress and that the trees were close to the end of their healthy life and planning for the future would be useful. Lleylandii trees created dense shade which only ivy could tolerate and habitat creation could be dedicated to a healthy river corridor, rather than solely as a screen for the Central Depot.

5.9 BAT RESPONSE TO LIGHT

A light level of 14 lux can be a better indication of pipistrelle emergence in urban areas than minutes after sunset. In areas affected by light pollution, bats can emerge late in the evening. This means that the dusk peak for insects may have passed and our urban bat populations may be feeding at a suboptimal time. The regional reduction in the numbers of Daubenton's bat is thought to pertain to the increase in light pollution (Briggs *et al*, 2007). Light pollution combined with another limiting factor; that of the nutrient enrichment of water, are the likely reasons for the loss of local foraging sites.

5.10 INSECTS AND LIGHT WAVELENGTH

As the wavelength of light decreases, the attractiveness to insects increases. As low pressure sodium light has wave lengths in the region of 555nm, it does not attract insects. High pressure sodium does attract some insects but on average 57% fewer insects than a Mercury vapour light source. This can lead to demographic insect losses and a third of the insects that fly around light will damage themselves or die leaving less prey for foraging bats (Eisenbeis, 2006; Bruce White and Shardlow, 2011).

5.11 BAT TIPPING POINT

Removal of areas of vegetation can lead to an increase in urbanisation. The extent and density of urbanized land-use is increasing, with implications for habitat quality, connectivity and city ecology. Little is known about 'densification' thresholds for urban ecosystem function and the response of nocturnal mammals (Hale *et al*, 2012). In his study, common pipistrelle activity exhibited a relationship with the area of built land-cover which was much reduced beyond the threshold of ~60% built surface, implying the existence of a threshold or tipping point, of which light and light pollution plays a part. This tipping point is illustrated by the results obtained at the northern stretch.

5.12 RIVER CORRIDORS

In its Guidance on 'Preparing for Climate Change for Wildlife' 2011, Defra has highlighted the need to protect corridors used by bats for commuting purposes. Bat behaviour patterns are changing with the changing climate and hibernation times are being reduced; with bats being forced out to feed there is a duty to strengthen and protect wildlife corridors and commuting routes from light pollution and urbanisation.

5.13 EQUIPMENT DETAILS

The idea of Citizen Science is to generate interest and encourage participation of volunteers by demystifying the equipment used by professionals so that they can organise their own monitoring projects without the need for massive investment. Most participants found the Echo Touch Meters empowering and gained confidence in their use. Feedback suggests that the lack of animal registrations at the northern section led to frustration with the acoustic detectors as there were insufficient examples to practise their use. The survey forms were deemed essential in guiding participants to the required commentary.

5.15 ECHO TOUCH METER

The Echo Touch has the advantage of ease of reference for volunteer groups and a citizen science approach. They can make bat detecting more accessible and understandable and could be useful in bat conservation. The bat detectors are available at <http://www.wildcareshop.com/new-echo-meter-touch.html> iPad Mini 2's

available from Ebay at less than £190.00 for a brand new one. None of the acoustic detectorists would have picked up a *Nyctalus* bat and a Daubenton's bat could be confused with a *Pipistrellus* species.

5.16 PEERSONIC <http://personic.co.uk/>.

Personic is a new bat detector and 4GB recorder with an FFT display. This could be purchased by FORCE at a price of £159.99 a unit that records up to 250 files at 384kss/sec. It has auto record and a tripod mount. This does not include a clock module, which would be an additional £23.00. Thus supplying a low cost entry system, but one that will always be cheap enough for the less dedicated, but equally interested. The disadvantage is that it records in direct sampling mode, i.e. it's recording the ultrasound at a high sampling rate without converting to a lower frequency which is why you can't hear anything when you play back. So it's really designed for high quality sonogram analysis but it's the cheapest detector that offers direct sampling. While in the field you can also listen in heterodyne or frequency division mode although as previously stated, these don't get included in the audio recordings.

5.17 SURVEYS

Once equipment has been agreed upon and purchased the National Bat Monitoring Programme surveys administered by the Bat Conservation Trust, which might be of interest. These have been designed so that anybody can take part as a massive Citizen Science project. This includes the Daubenton's Waterway Survey (DWS) and Noctule/Serotine/Pipistrelle Field Survey (NSP) see here: http://www.bats.org.uk/pages/take_part_in_surveys.html Alternatively, time series data can be gathered on similar dates and using a similar methodology every year.

6.0 LEGISLATION AND POLICY

6.1 EUROPEAN AND UK LAW PERTAINING TO BATS

All species of bat are fully protected under the Wildlife and Countryside Act 1981 (as amended) through their inclusion in Schedule 5. All bats are also included in Schedule 2 of the Conservation (Natural Habitats, & c.) Regulations, 2010. The Act and Regulations make it illegal to:

- intentionally or deliberately kill, injure or capture (take) bats;
- deliberately disturb bats (whether in a roost or not);
- damage, destroy or obstruct access to bat roosts;
- possess or transport a bat or any other part of a bat, unless acquired legally; or
- sell, barter or exchange bats or parts of bats.

6.2 AMENDMENTS TO THE CONSERVATION OF HABITATS REGULATIONS (2010)

Moves to strengthen the protection of features of importance that protected species are reliant upon. This applies where there may be ANY disturbance to bats or a disturbance affecting:

- The ability of a group of animals of that species to survive, breed or rear or nurture their young;
- In the case of migratory species, impair their ability to hibernate or migrate or
- The local distribution or abundance of the species

This may preclude fragmentation of corridors caused by **light pollution** and a useful discussion of this is provided by Garland and Markham (2007). If a bat roost is to be affected by development activities, a licence from Natural England will need to be obtained.

6.3 UK HABITATS AND SPECIES OF PRINCIPLE IMPORTANCE NERC 2006 AND THE ROLE OF CONSERVATION UNDER BIODIVERSITY ACTION PLANS (BAPS)

Section 40 (1) of the NERC Act (2006): lists principle habitats and species, which are often included in Local, Regional and National Biodiversity Action Plans (BAP's). For example, the UK Biodiversity Action Plan (BAP) contains a Bat Species Action Plan (SAP). The BAP aims to increase the number of this species within the district by

protecting certain habitats; securing appropriate management for them and by halting the factors leading to their decline such as:

- Loss of maternity roost sites through damage or destruction resulting from a lack or a misunderstanding of the legislation protecting bats ;
- Loss of hibernation and other seasonally used roost sites;
- Lack of insect rich feeding habitats such as wetlands, woodlands and grasslands;
- Losses of linear landscape elements (flight line features) such as tree lines; and
- Excessive lighting, such as in streets and some open spaces.

6.4 ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION (2009)

The Royal Commission on Environmental Pollution, reported on the nuisance caused by badly designed lighting and the effects of artificial light on nature and ecosystems. It concluded that there was an urgent need for government to recognise that artificial light in the wrong place at the wrong time is a pollutant, which can harm the natural environment.

7.0 REFERENCES

Author's data 2001-2012

Archer, J., and Curson, D. (1993) Nature Conservation in Richmond upon Thames
London Ecology Unit Handbook

Bat Conservation Trust (2012) Bat Survey Guidelines available from www.bats.org.uk

Booman, A., et al (1998) Prey detection in trawling insectivorous bats: duckweed affects hunting behaviour in Daubenton's bat.

Briggs, P.A., Bullock, R. J., Tovey, J., (2007) Ten years of bat monitoring at the WWT London Wetland Centre, compared with National Bat Monitoring Programme trends for Greater London, London Naturalist no 86 London Natural History Society

Bruce White, C. and Shardlow, M. 2011. A review of the impact of artificial light on invertebrates. Buglife;

Garland L., & Markham S., (2007) Is important bat foraging and commuting habitat legally protected?

Mitchell –Jones A.J. (2006) 'Focus on Bats' English Nature
Peersonic <http://peersonic.co.uk/>.

Rootcause, June, 2015 Tree Masterplan DNR

Russ, J (2004) The Bats of Britain and Ireland (Echolocation Calls, Sound Analysis and Species Identification

Wray, S., et al/ 2010 Valuing bats in Ecological Impact Assessment, 2010 In Practice 70

8.0 APPENDIX

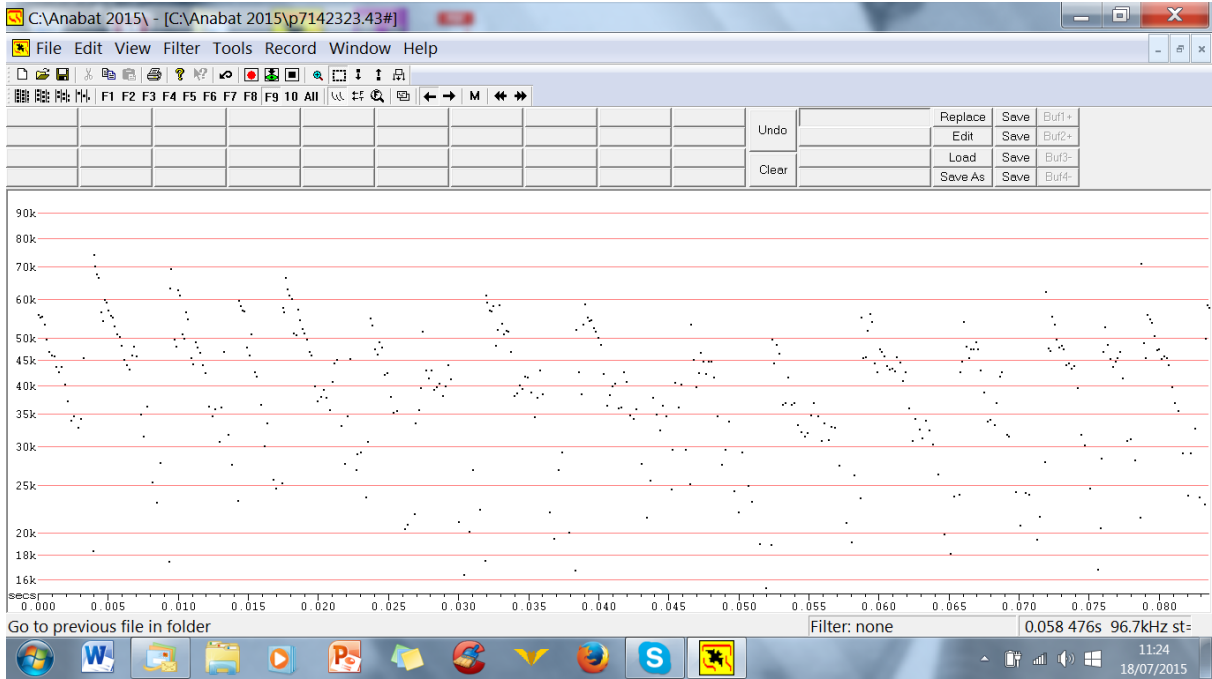


Fig 4 Screenshot of the sonogram of the best Daubenton’s pass (one of only 4). This was late in the evening (23.23, 14.7.15). No Leisler’s bats were recorded.

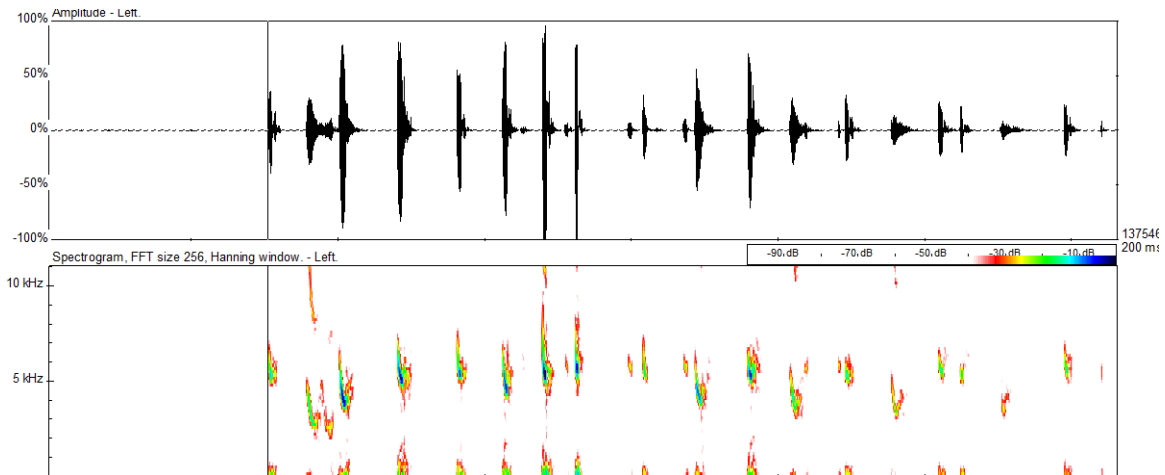


Fig.5 Screenshot of the sonogram of two bat species at the A316 bridge (N.S) there were bats foraging on both sides of the bridge despite the ‘road effect’.

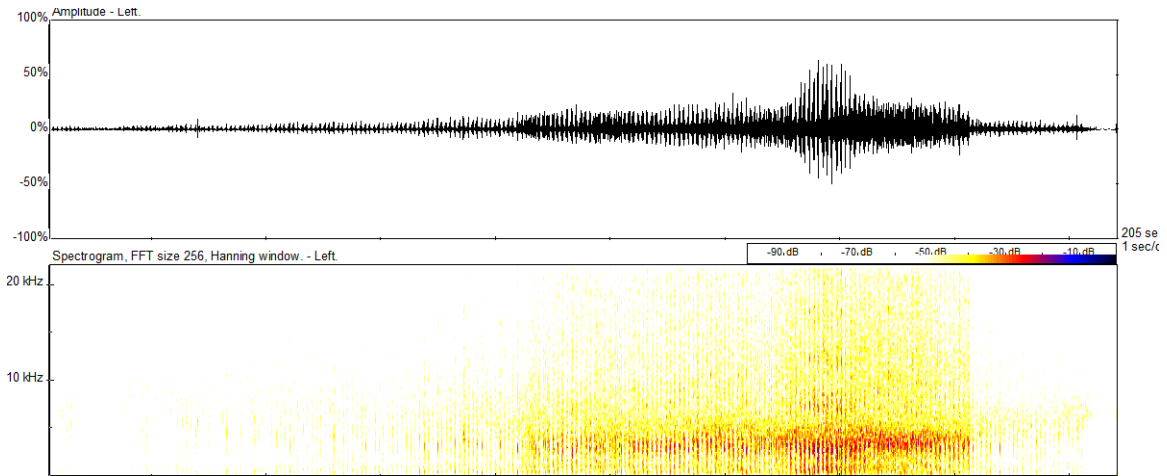


Fig. 6 Roesel's Bush cricket by Chase Bridge N.S.

The following are sonograms recorded by the Echo Touch Meter.

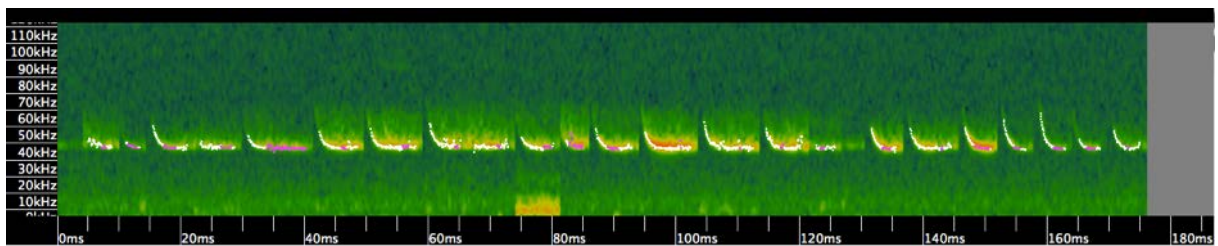


Fig 7 Common pipistrelle *Pipistrellus pipistrellus*

Fig 8 Soprano pipistrelle *P.pygmaeus*

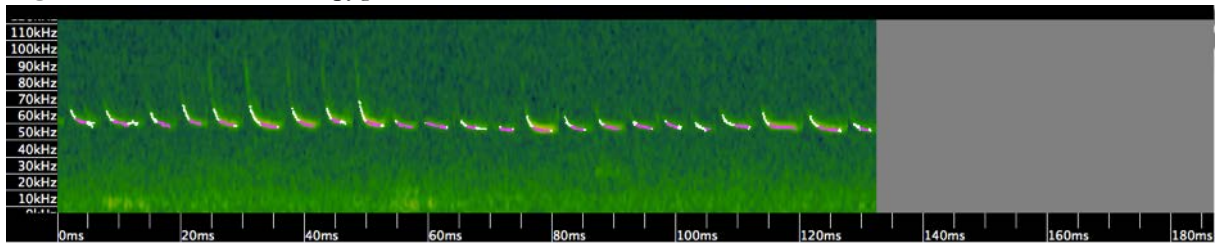


Fig 9 Nathusius' pipistrelle *P.nathusii*

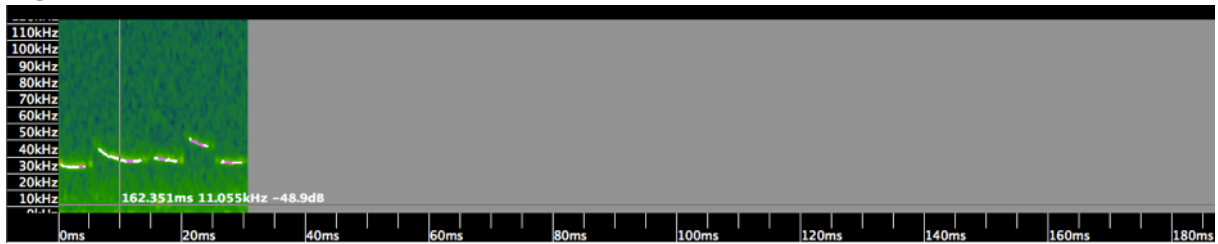


Fig 10 Noctule *Nyctalus noctula*

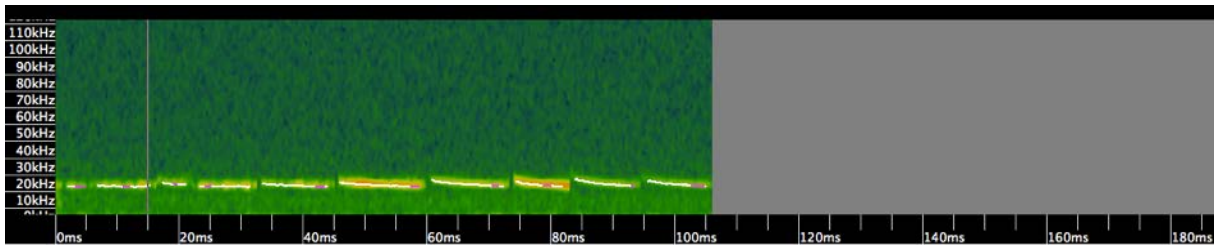


Fig 11 Leisler's *N.leislerii*

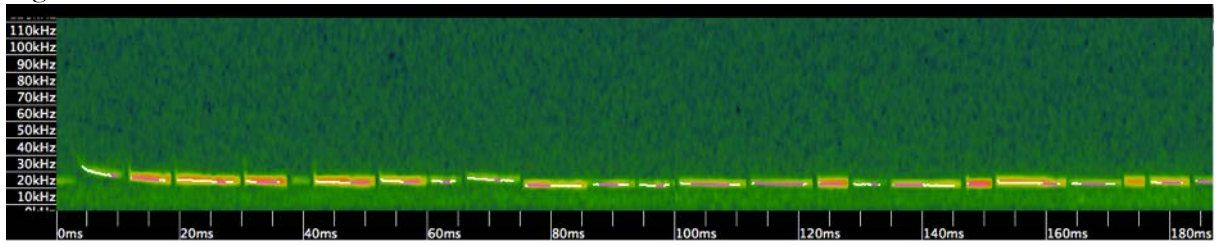


Fig 12 Serotine *Eptesicus serotinus*

