Adon McFarlane- AMcF

Dr Adon McFarlane is a senior freshwater ecologist, specialising in protected species. He is an experienced field scientist, with extensive skills in the fields of freshwater habitat assessment; freshwater pearl mussel survey; white-clawed crayfish survey, macroinvertebrate survey, fish habitat assessment and electrofishing survey. He has built up skills in the collection of data both in the field and laboratory, analysis of data using statistical software programs such as R, BORIS, RAVEN and Minitab, creation of distribution maps using GIS. Adon has very strong technical skills in both freshwater and marine laboratory and fieldwork instrumentation and equipment usage. Adon has worked on a number of ecological reports, including Appropriate Assessments, Ecological Impact Assessments (EcIA), Preliminary Ecological Appraisal Reports (PEAR) and Invasive Species Reports.

Amy Adwan- AA

Amy Adwan BSc- Senior Terrestrial ecologist with 8 years' experience in the ecological sector in Ireland. She holds a BSc in Environmental Science from the University of Limerick. Amy is a qualified ecologist experienced in a wide range of ecological survey techniques and methodology including bats, mammals, freshwater and habitats. Amy also has a licence to handle bats and is a licensed bat surveyor, with a Certificate in Bat Acoustics Analysis she is also proficient in using analysis software Kaleidoscope and Anabat Insight.

She has an extensive knowledge of environmental laws with reference to Ireland as well as the EU and the Habitats Directive. Her experience has involved regularly undertaking Appropriate Assessment reporting, including Screening for Appropriate Assessment and Natura Impact Statements, as well as legal reviews of same, in relation to relevant CJEU rulings and European Commission Guidance. She also undertakes Ecological Impact Assessments (EcIA), Environmental Impact Assessment (EIAR) and Preliminary Ecological Appraisal (PEA) reporting.

Ajay Cheruthon- AC

Ajay Cheruthon, an Electrical Engineer with an MSc in Environmental Leadership from NUI Galway, has been serving as the Ecology Support and Data Manager at the Woodrow-APEM Group since March 2022. Previously involved in project coordination with the Government of India, Ajay's interest in nature prompted him to shift his career toward the environmental sector. In his current role, he manages a team of ornithological surveyors and oversees data handling and interim bird reporting for wind energy projects. Ajay is responsible for day-to-day fieldwork coordination, applying his project management skills and geospatial analysis expertise. He contributes to the Woodrow-APEM Group's efforts in managing ornithology surveys across Ireland, as well as windfarm project work and finance. Outside of work he likes hiking, cycling and guitaring

Aoife Hughes- AH

Aoife Hughes was an Ecologist with Woodrow Sustainable Solutions. She has worked on a wide range of projects, including NIS, EcIAs, a successful EU Life Funding Application and various community projects. She has carried out various habitat and mammal surveys, with a specialist focus on botany. She completed a BSc (Hons) in Environmental Science at National University of Ireland, Galway. She was awarded the title of University Scholar for years one-three of her Environmental Science undergraduate course and graduated top of her class with a first-class honours degree. She completed a Masters by Research in University College Cork on how single-use plastics can be eliminated from the UCC campus.

Bridget Keehan- BK

Bridget Keehan is Senior Ecologist and Botany Lead at Woodrow Sustainable Solutions Ltd. She is an accomplished field botanist with over 30 years of experience in plant identification, including bryophytes, and fifteen years of experience working as a professional ecologist. With Woodrow, Bridget has worked on habitat surveys, monitoring and reporting for a wide range of developments including numerous wind farm and quarry sites. She has excellent habitat classification skills at Phase 1, Fossitt and NVC levels and regularly undertakes specialist surveys for Annex I habitats as well as protected plant, mammal and bird surveys. She is proficient in the analysis and interpretation of data, developing strategies and producing detailed reports. Bridget maintains a thorough knowledge of both European and national environmental legislation, and has experience producing a wide range of reports as required by planning legislation, including Ecological Impact Assessments, Natura Impact Statements, Habitat Management Plans and Compliance Reports. Bridget is also experienced in preparing digital habitat maps using ArcGIS.

Brittany Arendse- BA

Brittnay joined the Woodrow team in January 2024 as an Ecologist within the Botany team. She hails from South Africa where she completed her tertiary education at the University of Cape Town and obtained her MSc in Pollination biology, focusing on Ericaceae (heath family). She went on to work for the South African National Biodiversity Institute (SANBI) surveying for and monitoring endangered wildflowers in South Africa. She then spent a further eight years working for a conservation NPO on the southern coast of South Africa. Here she honed her skills in a myriad of different biomes and landscape types including, endemic fynbos, forests, dune systems, rivers and estuaries as well as in the social and human-animal conflict spaces. In her spare time, Brittany enjoys hiking and has an array of creative outlets. She also does website design and dabbles in illustrations, both traditional and digital.

Bruno Mels- BM

Bruno joined the Woodrow team in September 2022. He obtained a MSc in Conservation Biology at the University of Antwerp and worked for several conservation organisations in South-Africa and Seychelles after his studies. His main duties there were to monitor the breeding success of shorebirds and the ensure the protection of endangered species such as the green turtle and the Aldabra giant tortoise. Besides being a biologist, Bruno is also a self-taught digital illustrator. He is capable of creating infographics and animations and, among others, has designed several information boards for UNESCO world heritages sites in the Seychelles.

Emma Horgan- EH

Emma Horgan was an Assistant Project Manager within Woodrow Sustainable Solutions (APEM Group). During her time at Woodrow, she first joined as a scientist, and soon progressed to the project management team after proving exceptional competence in the area. She has amassed experience in different field survey methods and scientific analysis as well as strongly developed skills in project management. She has completed a BSc. in Marine science from University College Galway (previously National University of Ireland, Galway) and a MSc. in Applied Environmental Geoscience from University College Cork. For her final dissertation as part of her masters degree, she partnered with INFOMAR, Ireland's marine mapping programme. She used statistical means in GIS software to classify offshore seabed by sediment classification Folk 7. This was a comprehensive reclassification of the Porcupine Seabight and first ever classification of the Rockall Trough. The data she produced was donated to the EU to become part of EMODnet, the European Union's online data viewer. Since coming to Woodrow, Emma has been trained in bat survey, botany survey and mammal survey skills. She has honed her GIS skills and used them to create a new standardised template for Woodrow projects in GIS. After developing skills in project management and financial tracking software, she advanced to take on the role of assistant project manager, where she now liaises with the 13 technical leads across Woodrow to deliver projects.

Emmeline Cosnett- EC

Emmeline is a field ecologist and part of the botany and habitat team with Woodrow Sustainable Solutions Ltd who has worked in a variety of terrestrial and aquatic environments. She has carried out published research on independent botany/pollination ecology as well as two academic internships with Dr Dara Stanley's Ecology lab NUIG, with a focus on agri-environmental schemes and botanical habitat surveys across Ireland. Emmeline has worked as part of the Eva Crane Project creating a pollen library of the Burren and is currently completing an accredited CIEEM MSc on Wildlife Biology and Conservation with Edinburgh Napier University. She has an BSc (Hons) in Environmental Science from NUI Galway (2018) with a focus on Botany and Entomology. Emmeline has excellent habitat classification skills at Phase 1, Fossitt and NVC levels as well as experience with mammal surveys, bird and bat surveys and with reporting requirements for clients.

Frederico Hintz

Frederico Hintze is an Ecologist at Woodrow and has quality assured this report. He holds a B.Sc. in Biology-Geology and an M.Sc. in Ecology from the University of Minho (Portugal), as well as a PhD in Animal Biology from the Federal University of Pernambuco (Brazil). FH's passion for bat research and monitoring began during his undergraduate thesis in 2009. For his master's thesis, he focused on assessing the impact of agricultural dams on bat populations in North-eastern Portugal. During his PhD, FH utilized bioacoustics and species distribution modelling to enhance our understanding of the distribution of Neotropical bat species. Subsequently, FH's post-doctoral work led him to the world's largest iron ore mine in Carajás, Pará, Brazil. Here, he aimed to characterize the vocalizations of Amazonian bats and assess the impacts of mining on bat populations. Throughout his career, FH has actively participated in more than 10 Environmental Impact Assessment (EIA) projects in Portugal, covering various topics such as dams, wind farms, roads, and transmission lines. He also served as the coordinator of the Bioacoustics Committee at the Brazilian Bat Research Society. In addition to his academic contributions, FH has authored over 15 scientific publications and sampling event datasets, showcasing his expertise in the field. As an ecologist with Woodrow, FH's work focuses on bat data analysis, including bat call identification, bat roost/habitat suitability surveys, and report writing and review. He possesses a high level of proficiency and experience with various analysis software used to assess bat calls and activity.

Guilia Mazzotti- GM

Giulia Mazzotti was a Graduate Ecologist and Data Co-Ordinator with Woodrow Sustainable Solutions Ltd. She has completed a B.Sc. in Biological Sciences at University of Bologna and obtained full marks with honours (110/110 Cum Laude) in Ecology and Nature Conservation M.Sc. from University of Parma. During her studies she learnt to use R for data analysis and became proficient in the use of ArcGIS and QGIS for mapping. Since joining Woodrow Giulia developed experience undertaking ecological surveys including habitat mapping using Fossitt (2000) in ROI and Phase 1 classifications in NI, mammal, bat, and invertebrate surveys. She also assists senior members of staff with GIS mapping activity and reporting for Ornithology Report, Ecological Impact Assessment (EcIA) and Biodiversity Chapters for Environmental Impact Assessment Reports (EIAR). Furthermore, Giulia took the lead of the H&S of the company, producing risk assessments and RAMS, keeping track of all the new hazards, near misses and incidents related to fieldwork. She is a qualifying member of CIEEM.

James O’Connor- JOC

James O’Connor is a senior ecologist with Woodrow, who has a PhD in aquatic sciences and a primary technical specialism in freshwater ecology. James has prior experience in monitoring wild bird populations with Birdwatch Ireland and is heavily involved in ornithological work as part of his role with Woodrow. Here, he regularly carries out mammal surveys and also performs a supporting role as Ecological Clerk of Works (ECoW). James is first author on several peer-reviewed academic research papers and has helped draft reports to disseminate key research findings to state agencies such as the Irish Environmental Protection Agency (EPA) as well as Irish county councils.

Jason Guile- JG

Principal Ecologist at Woodrow Sustainable Solutions Ltd trading as APEM Ireland, part of the APEM Group. He has over 12 years’ relevant industry experience in ecological assessment and has worked in both Ireland and the UK. Jason has a B.Sc. in Marine Biology and Oceanography at University of Wales, Bangor. Jason holds a lead role on numerous projects undertaken by APEM Ireland and provides technical expertise and experience for other significant projects.

Since moving to Ireland Jason’s work has involved coordinating, surveying, analysing data, and writing technical reports for several species and numerous projects including renewables, infrastructure, landfill remediation works, urban planning applications and commercial regeneration sites. Jason is currently lead author of the chapters for several Environmental Impact Assessments (EIA) and AA.

Julie Kohlstruck- JK

Juliane Kohlstruck is senior ecologist at Woodrow. Juliane holds a MSc and BSc in landscape ecology. During a semester at NUI Galway she was able to expand her knowledge on European environmental legislation and its implementation in Irish law. She has carried out extensive vegetation and habitat surveys for research projects in Northern Germany, Central America, and South America, and with Woodrow she regularly undertakes JNCC Phase 1, Fossitt, and National Vegetation Classification (NVC) surveys. She has worked on many upland sites, undertaking pre-development site assessments as well and post-construction compliance monitoring. Her faunistic survey skills include mammals, bats, amphibia, and invertebrates. Her abiotic skills include chemical analysis of soil and water as well as pedological/ geological mapping of soils. Juliane is proficient in mapping, spatial analysis, and data analysis using ArcGIS, QGIS, Excel, R, and SPSSis, QGIS, Excel, R, and SPSS.

Louise Gannon- LG

Louise Gannon is an ecologist with Woodrow. Louise has completed a B.Sc. in Environmental Science. Her main experience lies in carrying out protected species surveys for bats (preliminary roost assessments, emergence/re-entry survey and activity transect surveys) as well as the deployment of static bat detectors and reporting on the same. She also carries out bat call analysis using Kaleidoscope and BatExplorer, the analysis software used to assess bat calls and activity. She also has experience in carrying out otter, badger and red squirrel surveys. She has volunteered in various surveys such as the BCI All Ireland Daubenton's bat survey, the Countryside bird survey and is a seal rescue volunteer. Louise is a licenced bat surveyor (DER/BAT 2024-27) and a Qualifying member of CIEEM.

Meadhbh Costigan- MC

Meadhbh Costigan is an Ecologist with Woodrow. Since joining the Woodrow APEM Group, Meadhbh has conducted fieldwork in the Republic of Ireland and Northern Ireland – gaining experience in habitat identification (according to Fossitt 2000, Phase 1 JNCC, NVC, and the National Survey of Upland Habitats), botanical identification, the biodiversity-metric, and specialised marsh Fritillary surveys. She has been lead author on Appropriate Assessment's, Habitat Regulation Assessment's, Ecological Impact Assessments', Habitat Management Plans, and Local Biodiversity Action Plan's. She is a qualifying member of CIEEM and is an elected member of the CIEEM Irish Section Committee.

Mike Trewby- MT

Mike is an Assistant Director with APEM Group Woodrow and is the Division's lead ornithologist and field work manager. Mike worked for Birdwatch Ireland from 2003 to 2010 conducting research on red-billed chough, red grouse and breeding seabirds. Prior to joining Woodrow in 2016, Mike worked as an independent ornithological consultant, and he has over 20 years fieldwork and research experience in the field of ecology. Mike regularly undertakes impact assessments for large scale developments and is a full member of CIEEM (MCIEEM).

QUALIFICATIONS

B.Sc.- Zoology & Botany, University of Namibia, 1997.

PGDip- Environmental Studies, University of Strathclyde, 2002.

Oisín O'Sullivan- OOS

Oisín O'Sullivan is an Ecologist with Woodrow. Oisín has completed a B.Sc. in Ecology and Environmental Biology at University College Cork. His final year thesis involved bat surveys of urban habitats in Cork City. His work as a graduate ecologist with Woodrow was focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Oisín has developed a high level of proficiency with Kaleidoscope, Ecobat and BatExplorer, all of which are analysis software used to assess bat calls and activity Since joining Woodrow, Oisín current work involves coordinating, surveying, analysing data, and writing summary bat activity reports for all onshore wind developments that Woodrow has worked on in the 2021 and 2022 survey seasons. This also involves the use of R to provide data on bat activity relative to weather conditions with the goal of informing curtailment as a mitigation measure. During 2022 Woodrow began undertaking offshore bat surveys including Oisín as a technical lead on these projects. These surveys involve the long-term recording of activity on islands and headlands to record migration events. Oisín is a Qualifying member of CIEEM and holds a license to survey bat roosts from the Department of Culture Heritage and the Gaeltacht.

Patrick Power- PP

Patrick Power is an ecologist with Woodrow. Patrick has completed a BSc in Forestry, BSc (Hons) in land management in Forestry with Waterford Institute of Technology and a PGCert in Wildlife Biology and Conservation.

His work with Woodrow is focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Patrick has developed a high level of proficiency with Kaleidoscope and BatExplorer, the analysis software used to assess bat calls and activity. Patrick also possess Reptile, mammal and woodland habitat surveying skills. Patrick is a student member of CIEEM and currently has a training licence to survey bat roosts from the Department of Culture Heritage and the Gaeltacht.

Patrick Quinn- PQ

Patrick Quinn has over 7 years' experience in a wide array of construction projects, including large scale wind farm construction, 110kV overhead transmission lines, roads/bridges and other infrastructure projects, including works within sensitive and designated areas (including Natura 2000 sites).

He has a significant level of experience in aquatic ecology and monitoring include water treatment plants and water scheme infrastructure projects that require ecological supervision throughout Ireland

Róisín O'Connell- ROC

Róisín O'Connell an assistant ecologist at Woodrow APEM Group. Róisín obtained a B.Sc. (Hons) in Environmental Science at Atlantic Technological University in Sligo, Ireland. Her final year thesis involved carrying out aquatic macrophyte surveys of lough Doon in County Leitrim. Róisín possesses marine and freshwater habitat survey skills from her time studying at ATU. Róisín has authored multiple bat activity reports, and contributed to sections in EcIA, HRA and NIS reports. Since joining Woodrow, she has developed excellent field survey skills and regularly conducts a broad range of protected species surveying including bats, badger, otter, and amphibians. Róisín is also trained in habitat assessment and has knowledge and experience of JNCC Phase 1 and Fossitt 2020. Róisín is a qualifying member of the Chartered Institute of Ecology and Environmental Management and holds a license to survey bat roosts from the Department of Culture Housing. Local Government and Heritage.

Appendix 6B

BAT SURVEY REPORT

Ørsted

Brittas Wind Farm

Results report for the active bat season (2022) and monitoring bat activity at height (2023)

Louise Gannon, Patrick Power, Fred Hintze, Bruno Mels, and, Mike Trewby

Woodrow Ref: P00008667

Date: November 2024

COMMERCIAL IN CONFIDENCE

Client: Ørsted

Address: City Quarter, Lapp's Quay, Cork, T12 KCW0

Project reference: P00008667

Date of issue: 17/07/2024

Project Director: Will Woodrow

Project Manager: Oisín O'Sullivan

Authors: Louise Gannon, Patrick Power, Fred Hintze, Bruno Mels and Mike Trewby.

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This is a draft document and should not be cited prior to client review.

STATEMENT OF AUTHORITY

Bat surveys conducted at Brittas Wind Farm in 2022 were undertaken by appropriately experienced staff from Woodrow APEM Group (Woodrow), including: Patrick Power, Oisín O'Sullivan, Róisín O'Connell, Mike Trewby, Adrian Walsh, Ajay Cheruthon, and Bruno Mels. This report was compiled by Patrick Power, Bruno Mels and Louise Gannon. This report was reviewed and approved by Frederico Hintze and Mike Trewby.

Oisín O'Sullivan is an Ecologist with Woodrow. Oisín has completed a B.Sc. in Ecology and Environmental Biology at University College Cork. His final year thesis involved bat surveys of urban habitats in Cork City. His work as a graduate ecologist with Woodrow was focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Oisín has developed a high level of proficiency with Kaleidoscope, Ecobat and BatExplorer, all of which are analysis software used to assess bat calls and activity Since joining Woodrow, Oisín current work involves coordinating, surveying, analysing data, and writing summary bat activity reports for all onshore wind developments that Woodrow has worked on in the 2021 and 2022 survey seasons. This also involves the use of R to provide data on bat activity relative to weather conditions with the goal of informing curtailment as a mitigation measure. During 2022 Woodrow began undertaking offshore bat surveys including Oisín as a technical lead on these projects. These surveys involve the long-term recording of activity on islands and headlands to record migration events. Oisín is a Qualifying member of CIEEM and holds a license to survey bat roosts from the Department of Culture Heritage and the Gaeltacht Licence number (DER/BAT- 2022-70).

Patrick Power is a graduate ecologist with Woodrow. Patrick has completed a BSc in Forestry, BSc (Hons) in land management in Forestry with Waterford Institute of Technology. He is currently doing an MSc in Wildlife Biology and Conservation with Edinburgh Napier University. His work as a graduate ecologist with Woodrow is focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Patrick has developed a high level of proficiency with Kaleidoscope and BatExplorer, the analysis software used to assess bat calls and activity. Patrick also possess Reptile, mammal and habitat surveying skills. Patrick is a student member of CIEEM and currently has a training licence to survey bat roosts from the Department of Culture Heritage and the Gaeltacht (DER/BAT – 2022-171).

Róisín O'Connell is an assistant ecologist with Woodrow. Róisín has completed a B.Sc. in Environmental Science at Atlantic Technological University in Sligo. Her final year thesis involved carrying out aquatic macrophyte surveys of lough Doon in County Leitrim. Her work as a graduate ecologist with Woodrow is focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Róisín has developed a high level of proficiency with Kaleidoscope and BatExplorer, the analysis software used to assess bat calls and activity. Róisín also possesses marine and freshwater habitat survey skills from her time studying at ATU. Since joining Woodrow, Róisín has authored multiple bat activity reports and coordinated the bat surveys conducted at Woodrow in 2022. Róisín is a Qualifying member of CIEEM and holds a license to survey bat roosts from the Department of Culture Housing. Local Government and Heritage (DER/BAT – 2022-171)

Louise Gannon is an assistant ecologist with Woodrow. Louise has completed a B.Sc. in Environmental Science. Her main experience lies in carrying out protected species surveys for bats (preliminary roost assessments, emergence/re-entry survey and activity transect surveys) as well as the deployment of static bat detectors and reporting on the same. She also carries out bat call analysis using Kaleidoscope and BatExplorer, the analysis software used to assess bat calls and activity. She also has experience in carrying out otter, badger and red squirrel surveys. Louise holds a license to survey bat roosts from the Department of Culture, Heritage and the Gaeltacht (DER/BAT – 2023 – 25) licenced bat surveyor and a Qualifying member of CIEEM.

Bruno Mels joined the Woodrow team in September 2022. He obtained a MSc in Conservation Biology at the University of Antwerp and worked for several conservation organisations in South-Africa and Seychelles after his studies. His main duties there were to monitor the breeding success of shorebirds and the ensure the protection of endangered species such as the green turtle and the Aldabra giant tortoise.

Frederico Hintze is an Ecologist at Woodrow and has quality assured this report. He holds a B.Sc. in Biology-Geology and an M.Sc. in Ecology from the University of Minho (Portugal), as well as a PhD in Animal Biology from the Federal University of Pernambuco (Brazil). FH's passion for bat research and monitoring began during his undergraduate thesis in 2009. For his master's thesis, he focused on assessing the impact of agricultural dams on bat populations in North-eastern Portugal. During his PhD, FH utilized bioacoustics and species distribution modelling to enhance our understanding of the distribution of Neotropical bat species. Subsequently, FH's post-doctoral work led him to the world's largest iron ore mine in Carajás, Pará, Brazil. Here, he aimed to characterize the vocalizations of Amazonian bats and assess the impacts of mining on bat populations. Throughout his career, FH has actively participated in more than 10 Environmental Impact Assessment (EIA) projects in Portugal, covering various topics such as dams, wind farms, roads, and transmission lines. He also served as the coordinator of the Bioacoustics Committee at the Brazilian Bat Research Society. In addition to his academic contributions, FH has authored over 15 scientific publications and sampling event datasets, showcasing his expertise in the field. As an ecologist with Woodrow, FH's work focuses on bat data analysis, including bat call identification, bat roost/habitat suitability surveys, and report writing and review. He possesses a high level of proficiency and experience with various analysis software used to assess bat calls and activity.

Adrian Walsh is an Assistant Ecologist with Woodrow Sustainable Solutions. He obtained First Class Honours in Zoology from National University of Ireland, Galway and later earned his Master’s from University College Dublin with a focus on Wildlife Conservation & Management. These challenging and varied courses allowed Adrian to obtain valuable experience in habitat surveying techniques and knowledge of ecological assessment methods and the flora and fauna of protected species in Ireland. Since joining Woodrow, he has been involved in a variety of surveying, including terrestrial mammals, bats and extensive ornithology monitoring. Additionally, he has provided input into a several ecological reports including EcIA & AA reports.

Ajay Cheruthon joined the Woodrow team in March 2022 to divert his career to the environmental sector. He is an electrical engineer who worked in project coordination with the Government of India. He developed a love for nature through his travels and adventures and decided to pursue a masters in Environmental Leadership from NUI Galway. Ajay primarily works on the impact of wind energy projects on birds, assisting in data management, field work coordination and geospatial analysis. He manages a team of sub-contracted ornithologists in order to meet the required bird survey needs of the clients.

Mike Trewby is an Associate Director of Woodrow. He is a highly experienced ecologist with over 20 year’s fieldwork & research experience. While specialising in avian studies, he has expanded his field skills to cover a range of survey methodologies. He is also experienced at undertaking invertebrate surveys and amphibian surveys. Mike is regarded as one of the leading authorities on chough ecology in Ireland having produced reports detailing the ecology of several regional chough populations and assisting in the designation of Special Protection Areas (SPAs) for choughs. He has studied some of the country's iconic bird species including red grouse and important seabird colonies adorning the Irish coastline.

CONTENTS

1 INTRODUCTION

1.1 Study area for bats

For bat studies targeted at assess baseline bat activity at proposed wind farm developments the viable area for turbine development determines the core study and for the purposes of this report will be referred to as the wind farm site. Assessment for any associated infrastructure, such grid connection and turbine delivery route (TDR) that stretch beyond the wind farm site are referred to separately. Figure 1 provides an overview of the full application site.

As shown in Figure 2, the viable area for the proposed Brittas Wind Farm site is located between 2.7 and 5.5 km north of Thurles town centre (Liberty Square) in Co. Tipperary and falls within the townlands of Brittas, Rossestown and Brownstown. A precautionary 300 m buffer has been applied to the viable area and indicates the potential zone of influence assessed for bat features in relation to the maximum potential wind turbine layout. The proposed substation is located in the northeastern area, outside the viable area boundary, and it is *c*. 5.3 km north-northeast from Thurles town.

The River Suir flows north to south through the proposed wind farm site. The flood plain is low lying at approximately 100 m AMSL and is subject to flooding in several locations, which are associated with a range of wet grassland, hedges, swampy areas, marshes, and fens. The land rises gently away from the river reaching a maximum elevation of approximately 110 m AMSL. Intensive pastural agriculture dominates land use throughout the wind farm site, with improved agricultural grassland featuring prominently. In the southern part of the wind farm site, compartments of improved grassland occur between forestry plantations, with both broadleaf planting and conifer plantations occurring. The most recent introduction of broadleaves (*c*. 2005[1]) involved underplanting the remnants of a thinned, older woodland and some of the sparsely distributed veteran tree specimens are likely to date back to the original woodland associated with the Brittas Castle. This network of woodland also holds a large pond that has been in existence since the early 1800s, based on the first edition 6 Inch mapping (1829-41)[2]. Aside from the northwestern part of the wind farm site, which has notably large field management compartments, scrub, woodland, hedgerows and treelines provide connectivity between the River Suir and the wider area, including the ruins of Brittas Castle, which is considered to have high roost potential for bats.

1.2 Protected status of bats in Ireland

Bats are protected by law in the Republic of Ireland under the Wildlife Act 1976 and subsequent amendments (2000, 2010, 2012 and 2023). For the purpose of this report, the Wildlife Act 1976 and subsequent amendments will be referenced as "Wildlife Acts". Under the Wildlife Acts, it is an offence to intentionally disturb, injure or kill a bat or disturb its resting place.

[1] Based on ortho-imagery from Google Earth Pro and the Geohive Map Viewer available at: https://webapps.geohive.ie/mapviewer/index.html - both sources accessed Dec-2023
[2] Geohive Map Viewer available at: https://webapps.geohive.ie/mapviewer/index.html - accessed Dec-2023

NPWS (2021a and 2021b) guidelines outline the further legal protection afforded to species listed on Annex IV of the of the Habitats Directive (92/43/EEC), as required by Articles 12, 13 and 16. The Habitats Directive is transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations, 2011-2021 (Habitats Regulations) and this legislates for requirements in relation to Strict Protection of animals listed on Annex IV of the Habitats Directive, which are set out in Regulation 51, with Regulation 54 pertaining to derogation licences, including Regulation 54 A when the Minister is applying for a derogation.

All species of bat are listed on Annex IV of the EU Habitats Directive (1992). The system of Strict Protection is applied across the entire natural range of Annex IV species, even outside of protected sites. As set out in Regulation 51, carrying out of any work with the potential to capture or kill any specimen of a Strictly Protected species, or to disturb these species, and for which a derogation licence has not been granted, may constitute an offence under Regulation 51 of the Habitats Regulations. Furthermore, any action resulting in damage to, or destruction of a breeding or resting place of an animal may constitute an offence unless a derogation licence has been granted. This action does not need to be deliberate, and this places onus on demonstrating due diligence. Breeding and resting places are protected even when the animals are not using them, once there is a high probability that they will return. Planning authorities may refuse planning permission solely on grounds of the predicted impact on protected species like bats.

The lesser horseshoe bat (*Rhinolophus hipposideros*), which occurs only in Counties Cork, Kerry, Limerick, Clare, Mayo and Galway in the Republic of Ireland (NPWS, 2019), is listed on Annex II of the EU Habitats Directive 1992. The level of protection offered to the lesser horseshoe bat effectively means that areas important for this species are designated as Special Areas of Conservation (SACs). Among Ireland’s obligations under the Habitats Directive, is a requirement to “*maintain favourable conservation status*” of this Annex II-listed species.

Ireland has also ratified the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983). This convention was instigated to protect migrant species across all European boundaries, which covers all European bat species including the nine main species found in Ireland: Daubenton’s bat, whiskered bat, Natterer’s bat, Leisler’s bat, lesser horseshoe bat, brown long-eared bat, common pipistrelle, soprano pipistrelle, and Nathusius’ pipistrelle bat.

1.3 Outline of the scope of works

In order to comply with the requirements of the EU Habitats Directive 1992 and the EC Habitats Regulations 2011, wind farm applications in Ireland need to be assessed as to their potential impact on bat populations. To inform the impact assessment at the proposed wind farm site a range of bat surveys were undertaken including a desk-based study and field surveys. The appropriate methodological approach for assessing bat population on proposed wind farm sites is *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*. Hereafter these guidelines will be referenced as NatureScot *et al*. (2021).

This report was written to serve as a technical report to be include as an appendix of an Environmental Impact Assessment Report (EIAR) for the proposed Brittas Wind Farm development. It provides details of methodologies and survey effort for the suite of bat surveys conducted for the proposed development, including tabulated results, maps and charts, as well as reports from roost suitability surveys, bat activity surveys and seasonal static bat detector surveys. These surveys allow for the baseline bat populations and habitat suitability of the wind farm site to be described and to facilitate and inform a robust impact assessment.

In summary, bat surveys undertaken are in compliance with NatureScot *et al*. (2021) guidelines. Automated static bat recording equipment was deployed three times over the 2022 active bat season at locations representative of the proposed turbine layout. The three deployments each lasting a minimum of 10 nights and covered the spring (May), summer (June – July) and autumn (September - October) and were undertaken in conjunction with continuous monitoring of climatic conditions on the wind farm site to ensure recording windows were inline within compliant weather parameters. There were also static at height surveys carried out during 2023 to determine the activity of species which may be of higher risk, particularly the Leisler's bat, who is known for their distinctively high flight behaviour.

In addition, informed by an assessment of potential bat roost features within the proposed wind farm site, manual roost emergence/re-entry surveys and bat activity transects were undertaken. These surveys followed the guidance from Collins (2016) "*Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition*". The observations recorded during roost emergence/re-entry survey and bat activity surveys contextualise how bats utilise the proposed wind farm site.

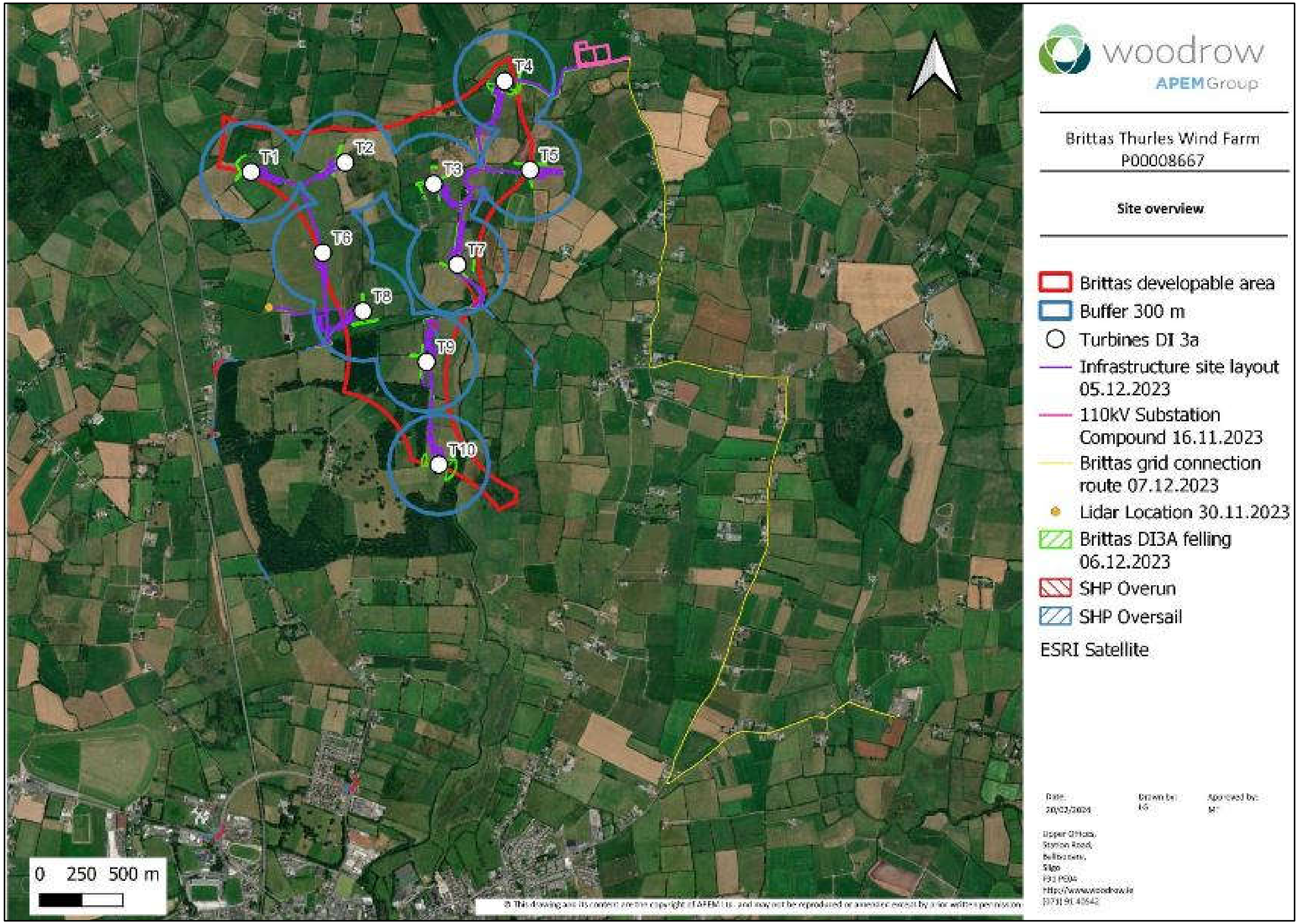

Figure 1: Full Application Site boundary for Brittas Wind Farm.

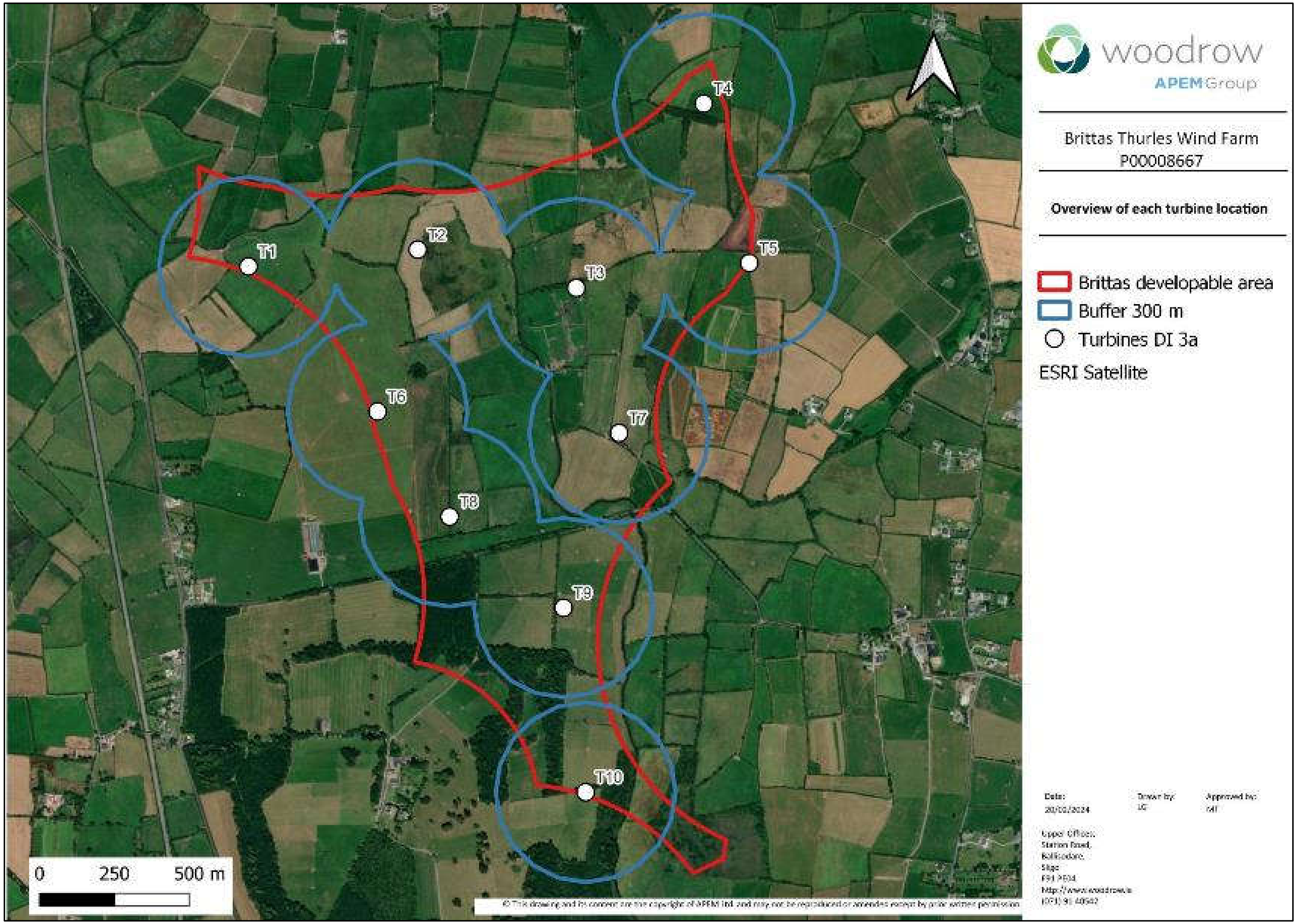

Figure 2: Wind farm site showing viable area with 300 m buffer and proposed turbine layout.

2 METHODOLOGY AND SURVEY EFFORT

Baseline surveys for bats at the proposed wind farm site aim to identify the species occurring within the proposed development area, and to provide an understanding of how local bat populations utilise the area in terms of density of use for foraging, roosting (maternity and hibernation) social interactions and commuting. As detailed in the following sections the following surveys were undertaken:

- Desk-study – site scoping;
- Habitat suitability assessments for bats;
- Roost emergence/re-entry surveys;
- Winter roost inspections;
- Bat activity transects;
- Seasonal static bat detector surveys, including monitoring at height;
- Monitoring of climatic conditions.

Bat surveys were conducted by Woodrow-APEM Group at the Brittas wind farm site over the 2022 active bat seasons to ensure compliance with the most recently published guidelines pertaining to bat surveying, impact assessment and mitigation for bats at onshore wind farms (NatureScot *et al*., 2021). Additional surveys including monitoring at height and further roost assessments of veteran trees were undertaken in 2023.

The NatureScot *et al*. (2021) guidance supersedes some aspects of the previous guidelines (Collins, 2016 , now 2023, updating Hundt, 2012 and BCI, 2012) and requires a site-by-site approach to survey design, with the only prescriptive element being the positioning, number, and duration of static bat detector deployments, as well as the strongly recommended continual monitoring of site-specific weather data on rainfall, temperature and wind speeds. As a minimum, the NatureScot *et al*. (2021) guidelines require three deployments of static detectors covering spring (April to May), summer (June to mid-August) and autumn (mid-August to October), each with a minimum deployment period of 10 nights (within compliant weather parameters). Seasonal deployments of static detectors are set out at all potential turbine locations for proposals comprising ten or less turbines, with a third of any additional locations also covered up to a maximum of 40 detectors. Compliant weather conditions are defined as: temperatures at ≥ 8°C at dusk, maximum ground level wind speed of 5 m/s and no, or only very light, periodic rainfall.

Additional requirements of the NatureScot *et al*. (2021) guidelines include potential roosting feature surveys to identify and classify any potential roosts in trees and structures, as per Collins (2016). As of October 2023, the 4th edition of Bat surveys for professional ecologist has been updated (Collins, 2023). Due to the late release (after the active seasons) of this 4th edition, all bat surveys carried out were carried out with regards to the Collins (2016) guidance. Classification is based on key features which could support maternity roosts and significant hibernation and/or swarming sites, as well as to determine habitat suitability for foraging and commuting to and from roosts. Swarming surveys, and winter roost inspections are also to be conducted if potential hibernation roosts are identified. Transect and/or vantage point surveys are seen as methods used to complement the static detector surveys, with applicability being discretionary, based on professional judgement, and on a case-by-case site-specific basis. From June to September 2023 monitoring at height was conducted, which involved deploying an ultrasonic microphone on a meteorological mast at approximately 50 m. This facilitates analysis of bat activity within the collision risk zone in relation to weather parameters, in particular wind speed and temperature.

Further surveys are due to commence in 2024. These surveys will focus on areas which will be impacted by the gird connection route and the turbine delivery route. Further surveys will also be carried out at new proposed turbine locations, to ensure appropriate mitigation measures can be put in place.

2.1 Desk study

A desk-based review of habitat suitability in the environs of the wind farm site and any available bat distribution data was used to inform the scope of the bat surveys required. As recommended by both NatureScot *et al*. (2021) and BCI (2012) the area covered by the desk-based review was extended to 10 km surrounding the wind farm site. The desk-based study included:

- Reviewing distances from closest Natura 2000 sites designated for bats (the only bat SACs in Ireland are for lesser horseshoe bat *Rhinolophus hipposideros*).
- Examining aerial imagery and 6-inch maps to identify potential bat foraging and roosting habitats, including old buildings and caves.
- Reviewing Lundy *et al*. (2011), as display on Biodiversity Maps[3], which provides a high-level assessment of potential habitat suitability for Irish bat species.
- Review of data received from BCI within 10 km of the wind farm site and the results of Biodiversity Maps report for the 10-km squares covering the wind farm site [S16], including species recorded and known roosting sites.

2.2 Habitat suitability assessments for bats

The most recent guidelines (NatureScot *et al*., 2021) recommend that:

"*…. features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200 m plus rotor radius of the boundary of the proposed development should be subject to further investigation*".

Turbine specification, as well as locations are regularly altered during the design phase of projects, and as a precaution Woodrow-APEM Group conduct roost assessment surveys within 300 m of the potential build area. Features along the access tracks between turbines out to 30 m were also assessed for roost features. Roost and foraging habitat assessment of the wind farm site were undertaken during March 2022, as part of a scoping exercise with additional tree assessments completed in 2023. Bat habitat suitability assessment along route options for the grid connection and turbine deliver route will be undertaken in 2024.

Surveyors utilised the assessment criteria described in Collins (2016), which provides guidelines for assessing potential suitability of habitat features as bat roosts and for foraging bats. At the end of the core study period these criteria were modified slightly by an update to the guidelines – see Collins (2023). The results of habitat suitability assessment have not been brought into line with the 2023 guidelines, as the criteria used for assessment was based on Collins, 2016, due to PRF surveys being completed in 2021.

[3] National Biodiversity Data Centre (NBDC) – Biodiversity Maps. Accessed 11.11.2023 from https://maps.biodiversityireland.ie/Map

Table 1: Guidelines for assessing the potential suitability of proposed development sites for bats, based on the presence of habitat features within the landscape, to be applied using professional judgement.
Source: Collins (2016).

Suitability	Description Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on the site likely to be used by roosting bats	Negligible habitat features on site likely to be used by commuting or foraging bats
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions[A] and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation[B]). a tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential[C].	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by ither habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats die to their size, shelter, protection, conditions[A] and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed.	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, conditions[A] and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, treelined watercourses and grazed parklands. Site is close to and connected to known roosts.

[A] For example, in terms of temperature, humidity, height above ground level, light levels or levels or disturbance.

[B] Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a diverse range of building types in urban environments (Korsten et al., 2015). This phenomenon requires some research in the UK but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in large buildings in highly urbanised environments.

[C] This system of categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI,2015).

Based on the features present and the location of the trees or other structures, the potential use of the feature can also be considered, and classified (as in Hundt, 2012):

- Maternity (breeding roost);
- Summer/transitional (to include transitional, occasional, satellite, night and day roosts); and,

- Hibernation roost.

Surveyors initially employed non-invasive external and internal inspection techniques for any building encountered, and trees were assessed from the ground.

If deemed appropriate, full building/tree inspections can be undertaken under licence from NPWS and would include inspecting any potential hibernation roosts. Based on the findings of PRF surveys, roost inspections were required at some trees classed as moderate and high due to the likelihood of impacts from the proposed development, and also at stone bridge and pump house building.

Based on the findings of the roost assessment surveys features classed as having moderate to high suitability for bats and/or demonstrating likely occupancy, (e.g., dropping found) were targeted for further bat activity surveys, including dusk emergence/dawn re-entry surveys.

2.3 Roost emergence/re-entry surveys

Dusk emergence/dawn re-entry surveys were completed in 2022 to ascertain if PRFs identified on the wind farm site were in use by roosting bats. Due to the vast majority of trees being suitable for roost potential resulting in the whole woodland being a roost resource, only some trees classed between low to high PRF classifications were surveyed, along with an abandoned pump house and Rossestown Bridge.

Surveys commenced 15 minutes before sunset and up to 1.5 hours before sunrise and were typically undertaken prior to or after undertaking transect surveys of the wind farm site. Dusk emergence/dawn re-entry surveys were undertaken using Elekon Batlogger M bat detectors to collect geo-referenced records of bat activity, which were then analysed using BatExplorer to identify species. Survey dates, times and conditions are provided in Table 2, along with the roost ID numbers that can be cross referenced with the locations of emergence/re-entry surveys shown in Figure 7. **Appendix 1: Potential Roost** Features and Roost Emergence/Re-entry Survey location contains images of the features surveyed.

Table 2: Summary of roost emergence/re-entry survey effort.

Date Roost ID	Start time	End time	Sunset/Sunrise time	Location	Survey type – feature details	Weather conditions
12/05/2022 F.147 & F.12	04:30	05:58	05:39	52.71110 -7.82198	Re-entry survey – F.147: lime tree with multiple features and moderate foraging. Also F.12: a ring of ash and alder trees of low roosting potential and an ash tree with a split compression fork, stress shear feature of moderate PRF status	Wind: 1 m/s, SW Temp: 7°C, Precipitation: Dry
26/05/2022 F.24	21:31	22:56	21:37	52.72528 -7.80005	Emergence survey – Pine tree with cavity/fissure 1 m up stem. Active beehive later found in cavity	Wind: 1 m/s, SSW Temp: 10°C, Precipitation: Dry
27/05/2022 F.148	03:47	05:33	05:18	52.71353 -7.80267	Emergence survey – multiple poplar trees with features, cavities, tear aways. Adjacent to river in an area with high foraging and commuting potential	Wind: 0 m/s, NEE Temp: 6°C, Precipitation: Dry
12/07/2022 F.120	21:36	23:21	21:51	52.70941 -7.80742	Emergence survey -Lightning struck oak, highly complex cavity *c.* 25 m with ivy cover higher	Wind: 4 m/s, W Temp: 17°C Precipitation: Dry
13/07/2022 F.135	03:10	05:28	05:23	52.70909 -7.80955	Emergence survey - Beech tree *c.* 25 m, excellent surrounding foraging, multiple deadwood branches, leafy ivy low but uncovered knot hole, high potential for unseen features	Wind: 1 m/s, W Temp: 10°C Precipitation: Dry
31/08/2022 F.53	20:09	21:54	20:21	52.70338 -7.80336	Emergence survey - Multiple poplar trees with features, cavities, tear aways. Adjacent to river in an area with high foraging and commuting potential	Wind: 2 m/s, E Temp: 17°C Precipitation: Dry
24/10/2022 F.149	18:05	19:10	18:16	52.71535 -7.80248	Emergence survey – Pump house with corrugate roof adjacent to river	Wind: 0 m/s, NE Temp: 14°C, Precipitation: Dry

2.4 Winter roost inspections

NatureScot *et al.*, (2021) recommend that winter roost surveys should also be carried out for any potential hibernation roost within 200 m plus rotor radius of developable area. The survey was conducted on the 15 February 2022, within the timeframe in which bats would still be utilising the hibernation roosts. Surveys involved searching for and collecting bat faecal samples to be sent for DNA analysis, closer examination of roost potential, the primary use of an endoscope and a thermal imaging camera, as a secondary device, to detect the heat signatures of hibernating bats due to bats being in a state of torpor.

Structures assessed as PRFs of low to moderate roost potential and which were judged to have potential for occupation as a winter roost were examined. See further details of these features in Appendix 1: Potential Roost Features and Roost Emergence/Re-entry Survey location, which can be cross referenced with locations shown in Figure 5 and Figure 6**.**

2.5 Bat activity transect surveys

The NatureScot *et al.* (2021) guidance considers the application of transect surveys to be discretionary, with survey requirements designed on a site-by-site basis. Transects are complementary to data collected from static bat detectors; and are important for identifying flight lines and for gaining understanding of bat abundance within the survey area. Driven transects can provide useful information on the wider landscape in the vicinity of the wind farm site. If driven transects are undertaken, it is important that appropriate microphones are used and are directed above the vehicle. It is also important to remain at a constant low speed (< 10 km/h). Point counts (of a fixed duration) can be incorporated into transects to survey specific features to provide information on comparative density of use.

Five transects were completed in 2022, which mainly covered the southern section, including the forestry. Survey dates and weather conditions for transects conducted in 2022 are provided in Table 3, with the transect routes shown in Figure 3.

Field records were made of bat species encountered, number of bat passes, activity (when observed: e.g., foraging, commuting, advertising), travelling direction and approximate height (when observed). Temperature and wind speed were measured at intervals throughout the survey, with Batloggers recording temperature throughout the surveys.

Table 3: Survey effort for bat activity transects.

Date	Start time	End time	Transect route	Weather conditions
11/05/2022	21:15	22:35	Figure 3	Wind: 2 m/s, NE Temp: 8°-10°C, Precipitation: Dry
26/05/2022	23:05	00:15		Wind: 0 m/s, NE Temp: 9°-10°C, Precipitation: Dry
12/07/2022	23:21	00:00		Wind: 5 m/s, E Temp: 15°C, Precipitation: Dry
31/08/2022	21:51	22:46		Wind: 2 m/s, W Temp: 16°C, Precipitation: Dry
24/10/2022	19:49	21:15		Wind: 0 m/s, NE Temp: 13°C, Precipitation: Light drizzle

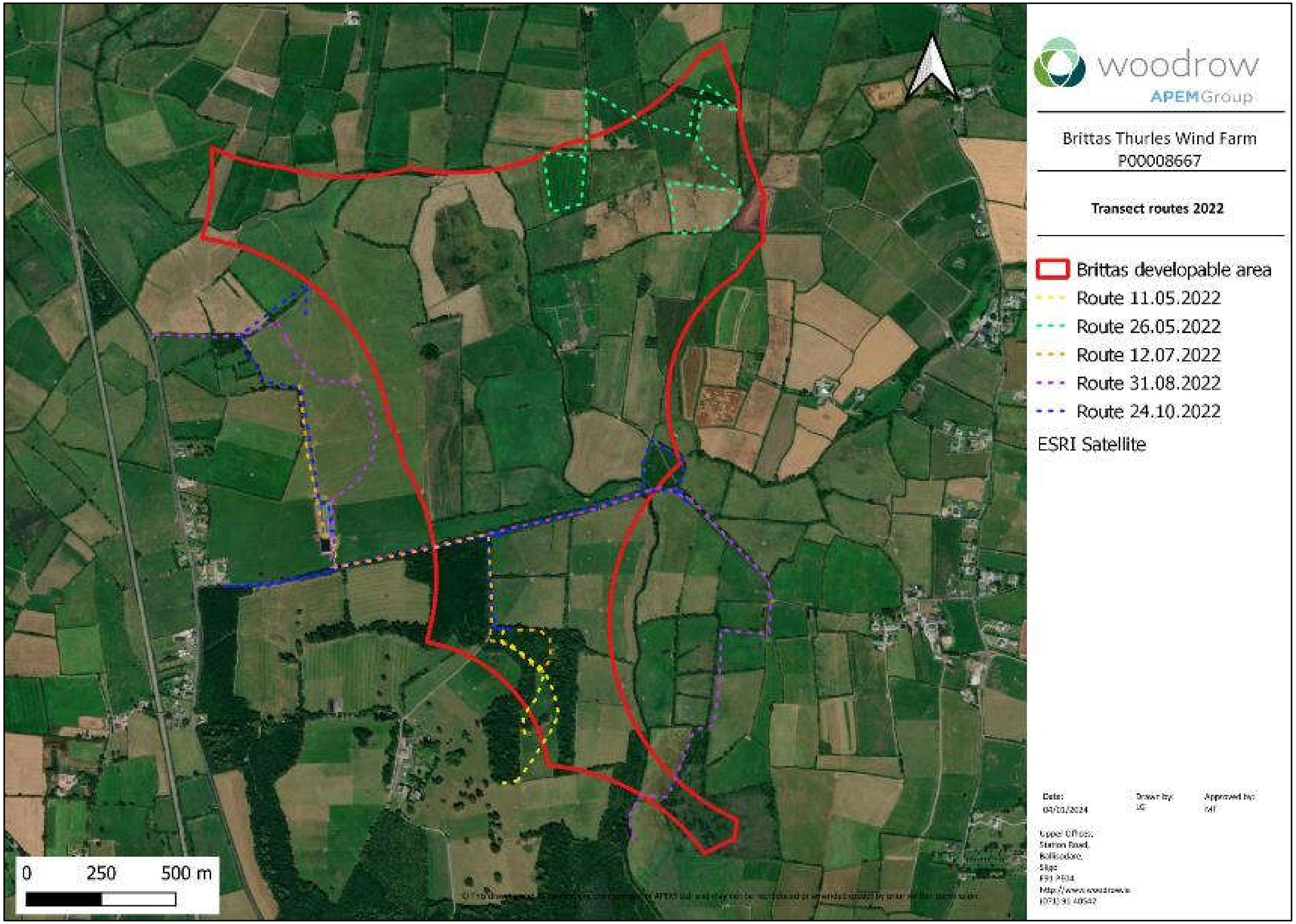

Figure 3: Transect routes covered in 2022.

2.6 Static bat detector surveys

2.6.1 Static bat detector surveys 2022

Static detector surveys were undertaken using two models of Wildlife Acoustics Song Meters detectors, Song Meter 4 Bat Full Spectrum (SM4BAT-FS) and Song Meter Minis (SM Mini), on three occasions covering spring, summer, and autumn in 2022. A 384 kHz sampling rate was set for all detectors, and recording was scheduled to be continuous from 30 minutes before sunset until 30 minutes after sunrise, for at least 10 weather-compliant nights (see section 2.7 "Monitoring climatic of conditions" for details on weather compliance). Static bat detectors were deployed to record the types of bat species present and to provide an overview of how bat activity is broadly distributed over the wind farm site at given habitat features and specifically at selected turbine locations. This provides context to bat activity within the wind farm site to supplement and provide a comparison for the turbine locations, for example comparing bat activity along habitat features vs bat activity in open areas removed from features, emulating post-construction conditions around turbines.

The seasonal deployment periods, along with deployment locations, dates and recording duration of each static deployed provided are shown in Table 4. The location of all static detectors for each deployment in 2022 is shown in Figure 4. **Appendix 2: Weather data for static deployment period** shows the weather conditions during the three deployments.

Table 4: Static detector survey efforts 2022

Map ID	Latitude	Longitude	Dist. to closest turbine(s)	Associated feature	Spring Deployment 11 May - 26 May 2022		Summer Deployment 22 June – 12 July 2022		Autumn Deployment 29 September – 1 November 2022	
					Unit	Run time	Unit	Run time	Unit	Run time
D.01	52.720503	-7.822264	*c.* 60 m (T.1)	Open - improved grassland, most NW detector	WSS033	15 Nights 8,512 mins	WSS054	18 Nights 7,184 mins	WSS034	25 Nights 21,983 mins
D.02	52.719264	-7.81903	*c.* 250 m (T.1)	Open - improved grassland	WSS053	15 Nights 8,512 mins	WSS034	20 Nights 10,144 mins	WSS052	25 Nights 21,983 mins
D.03	52.715437	-7.815054	*c.* 130 m (T.6)	Open - improved grassland	WSS048	Failed	WSS063	20 Nights 10,144 mins	WSS029	31 Nights 27,448 mins
D.04	52.710848	-7.811259	*c.* 315 m (T.9)	Feature - plantation/stream ride, on oak tree along stream/drain in conifer plantation	WSS052	15 Nights 8,512 mins	WSS040	20 Nights 10,144 mins	WSS032	25 Nights 21,983 mins
D.05	52.707715	-7.808328	*c.* 330 m (T. 10)	Feature – along edge of broadleaf plantation and improved grassland	WSS045	16 Nights 9,071 mins	WSS059	20 Nights 10,144 mins	WSS038	Failed
D.06	52.702880	-7.800016	*c.* 410 m (T.10)	Feature - along edge of wetland with scattered scrub and improved grassland, most southern detector	WSS037	15 Nights 8,512 mins	WSS056	20 Nights 10,144 mins	WSS063	Failed
D.07	52.706499	-7.799993	*c.* 340 m (T.10)	Feature - in drain along edge of an area of wet scrub and improved grassland	WSS038	14 Nights 7,956 mins	WSS026	20 Nights 10,144 mins	WSS033	25 Nights 21,983 mins
D.08	52.712741	-7.803397	*c.* 300 m (T.9)	Open – improved grassland 50 m from River Suir and 80 m from the Rossestown Bridge	WSS030	15 Nights 8,512 mins	WSS058	20 Nights 10,144 mins	WSS037	25 Nights 21,983 mins
D.09	52.716349	-7.804327	*c.* 60 m (T.7)	Open - improved grassland	WSS035	15 Nights 8,512 mins	WSS064	20 Nights 10,144 mins	WSS056	31 Nights 27,448 mins
D.10	52.720239	-7.797319	*c.* 100 m (T.5)	Open - improved grassland, most NE detector	WSS047	15 Nights 8,512 mins	WSS024	20 Nights 10,144 mins	WSS059	33 Nights 29,300 mins

2.6.2 Automated static surveys at height 2023

A static detector at height survey was undertaken using Wildlife Acoustics Song Meters Song Meter 2 Bat Plus (SM2BAT+) with one microphone recording at height (50 m), consistently from June to October during 2023. A stereo 192 kHz sampling rate was set for the detector, and recording was scheduled to be continuous from 30 minutes before sunset until 30 minutes after sunrise Static bat detectors were deployed to record the types of bat species present, and to see if there are any high-risk species present, which could be impacted by the proposed development, particularly Nathusius' pipistrelles and Leisler's bats who are known for their distinctive higher flight levels. Table 5: Static detector at height survey effort 2023 shows the survey efforts for the at height detectors.

Table 5: Static detector at height survey effort 2023

Map ID	Lat	Long	Deployment			
			Unit	Height	Deployment Date	Collection Date*
H.01	52.716405	-7.81748	WSS016	50 m	15/06/2023	19/07/2023
	52.716405	-7.81748	WSS016	50 m	21/07/2023	31/08/2023
	52.716405	-7.81748	WSS016	50 m	06/09/2023	12/10/2023

*the first two collection dates (19/07/2023 and 31/08/223) refer to the collection of SD cards and a change of a batteries for the detector to prevent a loss of data occurring.

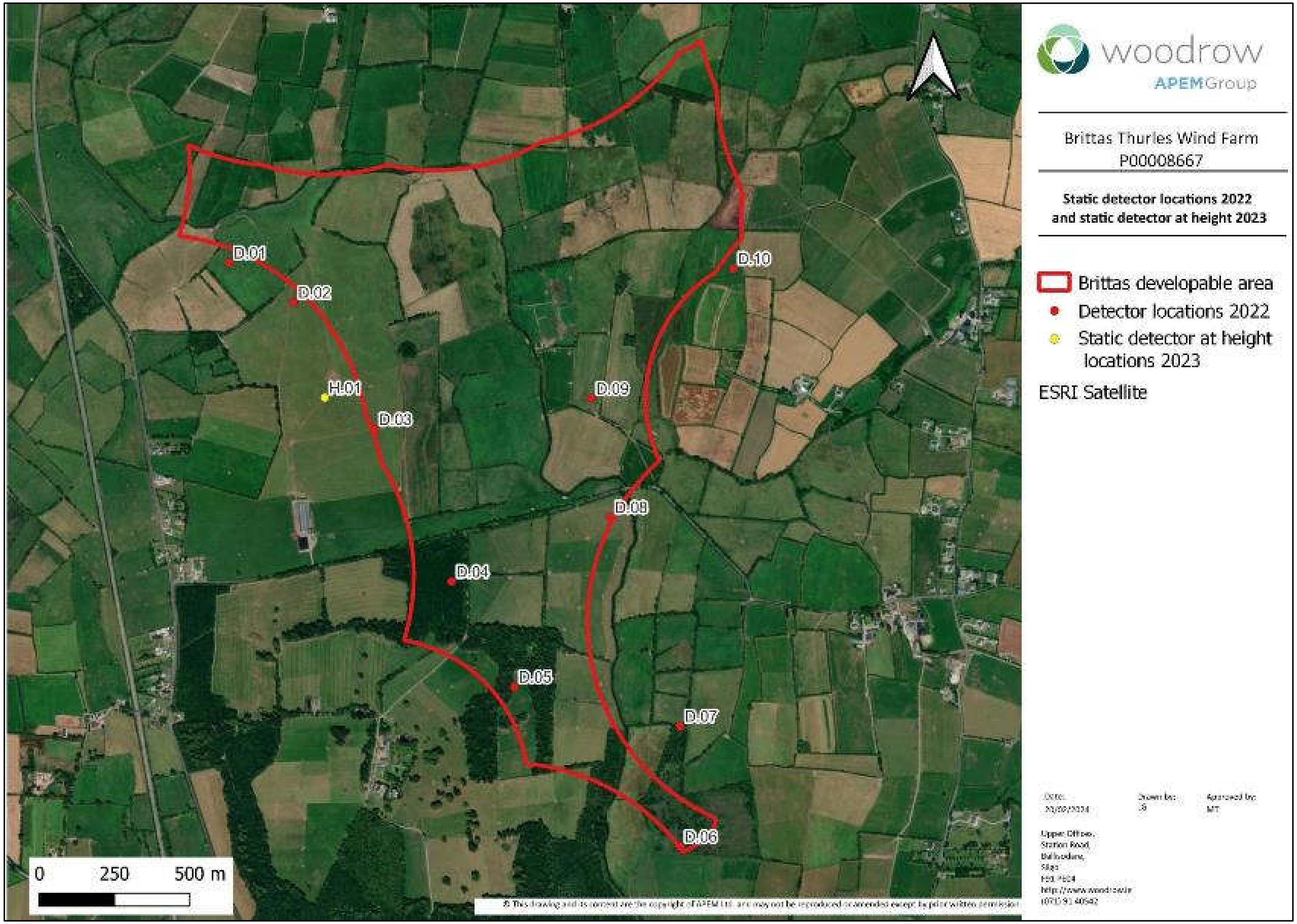

Figure 4: Location of static detectors in 2022 and deployment at height in 2023.

2.7 Monitoring climatic of conditions

Monitoring climatic of conditions was undertaken through the deployment of an on-site fully automated weather station with 3G connectivity. The weather station was deployed on the 11 May 2022 at 52.712773, -7.803407. This weather station was not re-collected due to it being stolen before the autumn static detector deployment. However, it should be noted that all data prior to the weather station being removed was logged and was available to be used for spring and summer data analysis. Another weather station was deployed for the autumn season.

The Davis Vantage Vue wireless integrated sensor suite weather station deployed, provided data on a real-time basis. This allows weather station functionality to be checked on a daily basis during the survey season and for action to be taken if a station fails or there are concerns regarding the data. This obviates the need for a second (backup) weather station. The weather station collected the full range of weather data, including temperature, wind speed and rainfall, which allows surveyors to determine whether deployments nights were compliant with the prescribed weather parameters (≥ 8°C at dusk, max. ground level wind speed of 5 m/s and minimal rainfall) as per the NatureScot *et al.* (2021) guidance on weather data.

Deployment periods can then be adjusted to ensure 10 nights of compliant data are captured. In addition, site specific weather data can be useful for investigating the recorded patterns of site usage by bats, for instance exposed, open sites can receive an influx of foraging bats during nights that are warm and relatively still, especially towards the end of the summer and into the autumn, as bats disperse from maternity roosts (Woodrow per. obs.).

Weather data for the three deployment periods has been extracted and shown graphically in **Appendix 2: Weather data for static deployment period** for spring, summer, and autumn deployments respectively.

2.8 Calibration and testing of recording equipment.

Calibration and testing of recording equipment is required by the NatureScot *et al*. (2021) guidelines, and as a standard operating procedure Woodrow have a stringent schedule of testing all bat recording equipment prior to and during deployment in the field. Checks are logged in excel, providing an audit trail to ensure that all data can be relied on and form a robust and defendable data set. Unique numbering of static detectors, SD cards and microphones allows for reverse checking, if any issues arise, e.g., following a microphone failure. Checks undertaken include pre-deployment device setting and battery checks, and post- and pre- deployment microphone sensitivity checks.

2.9 Analysis

For data collected using Wildlife Acoustics' detectors (SM4BAT-FS, SMMinis, and SM2BAT+) analysis of sound recordings was undertaken using Kaleidoscope software to confirm species (or genus for *Myotis* species) and exact number of bat passes for each transect survey or deployment. For data collected using the Batloggers, analysis of sound recordings was undertaken using BatExplorer software.

This analysis aimed to confirm species (or genus for Myotis species) and bat activity, exact number of bat passes for each deployment and transect survey. All sounds files were run through auto-identification and then manual verification was undertaken by Woodrow operatives. Russ (2012) and Middleton *et al*. (2022) were used to aid in identification of bat calls during data analysis. Common and soprano pipistrelles which Kaleidoscope determined to be a match ratio of 100% (every pulse recorded matched the species call parameters) were considered to be accurate to a level not requiring manual verification. Nevertheless, all other automatically identified bat species were subjected to manual check. Recordings identified as noise were determined to fall outside of the recording parameters for the survey and were manually classified as noise.

Bat passes are commonly used as a metric for bat activity and determine species presence (Kerbiriou *et al.*, 2019). Therefore, we defined a bat pass as the detection of one or more bat calls from a single species within a 15 second sound file. Recordings in which multiple species (or individuals) were recorded were split into separate bat passes. Therefore, bat activity was measured by the number of bat passes recorded per hour. Average bat passes per hour were calculated and visualized using R, a software used for statistical analysis and data visualization and were represented as boxplots.

Activity levels were assessed using an adaptation of the criteria applied by Matthews *et al*. 2016 in a study that examined the risk of European bats to wind energy developments in the UK. Activity levels are classified as prescribed by the study from Matthews *et al.* (2016). Our bat activity level scale (Table 6) has been adapted to average bat passes per hour. This adaption uses an average value of 10 hours per night across the active bat season to determine the cut-off of 'high' activity**.** Table 6 shows the adapted activity categories.

Table 6: Activity level classification as per Matthews *et al*. (2016) adapted to hourly activity levels

Classification	Bat passes per hour
Low	< 2
Moderate	2.00 ≤ 4.99
High	≥5.00

2.10 Survey Limitations

In the case of bat surveys, survey limitations often relate to weather conditions at the time of the surveying and equipment failing in the field, for example microphones can be damaged by livestock or can lose sensitivity when exposed to prolonged episodes of heavy rainfall. The following sections provide details for any potential limitations to bat surveys conducted in 2022. Overall, it considered that the combined survey approach and coverage over the 2022 survey season.

2.10.1 Survey coverage

It is considered that static bat detector coverage of the wind farm site for bat activity in 2022 was not fully in line with the NatureScot *et al.* (2021) guidelines due to turbine movements. Detectors were set up based on older turbine locations, and so, robust data is lacking in some areas, particularly T.2, T.3 and T.4. Due to reasons relating to access and habitat structure, bat equipment could not always be setup at exact proposed turbine locations, e.g., when proposed turbine locations are in dense conifer plantations. While this was not considered to limit the robustness of the data set, it is important to acknowledge the deployment locations in relation to the turbines, as this has implications for interpretation of bat activity. For instance, deploying units away from proposed turbine locations within plantations and along the edge of habitat features is likely lead to more bats being registered, which may not be a true reflection of activity a given turbine location.

Overall, the combined survey approach and coverage over the 2022 survey seasons, provides robust data giving a full insight into the use of the wind farm site by bats. The survey methodologies employed are in line with the recommended guidelines set out within *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (NatureScot *et al*., 2021), and as such, this information can be appropriately used to assess the potential impacts of the proposed wind farm development on the local bat population.

2.10.2 Livestock

Livestock at the Brittas wind farm site had been a constraint for the 2022 survey season, due to livestock tampering with equipment, resulting in the movement of detectors D.03 and D.08. These adjustments were minor, and so, did not affect the coverage range from the detectors. Fortunately, the data was still compliant from these detectors. There was also the theft of the weather station from D.08, in which a new one had to be deployed in a safer location at D.03.

2.10.3 Equipment

Equipment failures/technical issues was limited to the following detectors over the course of the survey:

- Spring deployment D03 – failed to record any data.
- Autumn deployment D.06 - failed to record any data.
- Also on the autumn deployment, the static detector at D.05 only recorded for one night (789 mins)

Despite these technical issues it is considered that that the data collected during this survey remains robust and compliant with NatureScot *et al.* (2021).

2.10.4 Weather

The weather data for the spring deployment period (11 May 2022 – 26 May 2022) was fully compliant with NatureScot *et al*. (2021) guidance for weather conditions.

The weather data for the summer deployment period (22 June 2022 – 12 July 2022) was fully compliant with NatureScot *et al*. (2021) guidance for weather conditions.

The weather data for the autumn* deployment period (29 September 2022 – 24 October 2022) had some compliance with NatureScot *et al.* (2021) guidance for weather conditions. However, due to poor weather conditions at the end of September into October the deployment period was extended out until the end of October.

*Due to the weather station being stolen, the autumn data used was from the Met Éireann Gurteen, Co. Tipperary station, which is *c.* 45 km north of the Brittas site. Due to the local flooding which occurred, it's safe to assume there would've been some non-compliant nights for rainfall during the autumn deployment. We are not confident in an accurate report discussion between bat activity and weather comparisons for specifically the autumn deployment.

3 SURVEY RESULTS

This section provides the detailed results for bat surveys conducted during the 2022 survey period.

3.1 Desk based study

Examining the National Biodiversity Data Centre (NBDC) bat habitat suitability maps the 5x5 km grid square [S16] containing the wind farm site is of moderate habitat suitability (Lundy *et al.,* 2011). Table 7 shows the suitability of the area for bats overall, and also for each bat species. The suitability index refers to areas geographically, as well as suitable roosting habitat. These patterns combined can provide a broad scale geographical area ("habitat suitability") for all Irish bats combined and individual Irish species of bats. The suitability index ranged from 0 – 100 with 0 being least favourable and 100 being the most favourable. Table 7s ranked from very low to very high, with a suitability index range.

Table 7: NBDC species specific habitat suitability index for grid S16

Bat Species	Suitability index	Suitability level
All Bats	**28**	**Moderate**
Soprano pipistrelle	39	Very high
Brown long eared bat	37	Very high
Common pipistrelle	44	Very high
Leisler's bat	38	Very high
Natterers bat	35	High
Whiskered bat	22	Low
Daubenton's bat	27	Low
Nathusius' pipistrelle	5	Very low
Lesser horseshoe bat	1	Very low

A record report from the national biodiversity data centre was also checked to see if any additional records are shown which differ from that of the BCI request. From the "National bat database of Ireland" report generated by NBDC[4], there were Leisler's bats, common pipistrelle, soprano pipistrelle, a Daubenton's bat and a brown long-eared bat recorded. These records were completed in 2009 and 2014. In this case, there is no additional records to add to the BCI records request, as seen in Table 8.

Ormond's mill, Loughmoe, Templemore, Co. Tipperary pNHA [Site code:002066] site *c*. 3.5 km north of the wind farm site. This mill has a colony of Natterer's bat and brown long-eared bats roosting here. This mill is an important nursery roost for the natterer's bat. Both of these species are dependent on the surrounding woodlands for foraging.

Brittas Castle was never fully finished, and had ashlar limestone walls, which through degradation, could give multiple roosting opportunities for the local bat population. There is also a dungeon in this castle, which could be an ideal hibernation roost, and so, the surrounding habitats would be of high importance for foraging for the local bat population. There is also an overgrown ruins of a church beside a graveyard in ruins, according to the first edition 6-inch mapping (1829-41), which is

[4] Information from the National Biodiversity Data Centre downloaded from Biodiversity Maps on 20/02/2024

located *c*. 1.5 km from Brittas Castle. This would potentially be of a high roosting potential also for the local bat population. There is also a “T-shaped” treeline in the northern section of the viable area, near T.4. This treeline was well established based on Mapgenie, (1995), which would be of importance for foraging for the local bat population. Field surveys carried out showed this “T”-shaped treeline is made up of Scots Pine with an understorey of hawthorn and ash. It was noted that there is both dead and live ash trees present here, both of which would be valuable to foraging, commuting, and roosting bats. There is Bridge Castle in the town of Thurles along the river Suir bank. This castle and the bridge itself would be of high roosting potential for the local bat population. These bats could potentially forage along the river and commute up to the wind farm site.

A data request was submitted to BCI for known roost records within 10km of the wind farm site. A total of 43 bat records were provided of which two were bat roosts. The closest roost to the wind farm site is within 1.32 km, this roost is from an unidentified bat. The other roosts outlined are within 7.42 km of the wind farm site, as declared by BCI, this is a whiskered bat *Myotis mystacinus* roost.

The BCI data shown in Table 8 shows bat data recorded in transect and ad hoc surveys with distances from the wind farm site provided, and that indicates seven species that have been recorded in the environs, including:

Common pipistrelle	*Pipistrellus pipistrellus*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Nathusius’ pipistrelle	*Pipistrellus nathusii*
Leisler’s bat	*Nyctalus leisleri*
Brown long-eared bat	*Plecotus auritus*
Daubenton’s bat	*Myotis daubentonii*
Whiskered bat	*Myotis mystacinus*

The only Natura 2000 sites designated for bats in Ireland are for lesser horseshoe bats (*Rhinolophus hipposideros*). The area of interest in Co. Tipperary is not within the potential range for this species.

Table 8: Sample BCI roost and survey data within 10 km of the wind farm site

Roosts		
Name	**Distance from centre of wind farm site**	**Species observed**
Private	*c.* 7.42 km	Unidentified bat
Private	*c.* 1.32 km	*Myotis mystacinus*
Transects		
Cabragh Bridge Transect	*c.* 6.43 km	Unidentified bat, *Myotis daubentonii, Nyctalus leisleri, Pipistrellus* spp.
Holycross Village Transect	*c.* 8.97 km	*Myotis daubentonii,* Unidentified bat
Inch House Looped Walk	*c.* 7.89 km	*Myotis daubentonii,* Unidentified bat
Kilbary Walkway Transect, Spot 1-10	*c.* 3.53 km	Unidentified bat
Monroe, Bouladuff Transect	*c.* 7.56 km	*Myotis daubentonii*, Unidentified bat
S15 (11) 2005-	*c.* 9.45 km	*Nyctalus leisleri, Pipistrellus pygmaeus, Pipistrellus pipistrellus), Pipistrellus spp.*
S15 (12) 2005-	*c.* 6.42 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri*, Unidentified bat, *Pipistrellus* spp., *Pipistrellus nathusii*
S15 (13) 2005-	*c.* 2.64 km	*Pipistrellus pipistrellus, Nyctalus leisleri, Pipistrellus pygmaeus*, *Pipistrellus* spp.
S15 (14) 2005-	*c.* 6.58 km	*Pipistrellus pygmaeus, Pipistrellus pipistrellus,* Pipistrellus spp., *Nyctalus leisleri,* Unidentified bat, *Pipistrellus nathusii*
S15 (15) 2005-	*c.* 10.87 km	*Pipistrellus* spp., *Pipistrellus pipistrellus, Nyctalus leisleri, Pipistrellus pygmaeus,* Unidentified bat
Thurles Bridge Transect	*c.* 3.70 km	*Myotis daubentonii*, Unidentified bat
Ad-hoc observations		
Consultancy Surveys	*c.* 3.72 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri*
BATLAS 2010	*c.* 9.19 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Myotis daubentonii*
BATLAS 2010	*c.* 12.83 km	*Pipistrellus pygmaeus, Myotis* spp.*, Myotis daubentonii*
BATLAS 2010	*c.* 9.37 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Myotis* spp.*, Myotis daubentonii*
BATLAS 2010	*c.* 5.16 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii, Plecotus auritus*
BATLAS 2010	*c.* 9.42 km	Unidentified bat, *Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis* spp.
BATLAS 2010	*c.* 7.91 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Myotis daubentonii*

Roosts		
Name	**Distance from centre of wind farm site**	**Species observed**
BATLAS 2010	*c.* 10.53 km	*Pipistrellus pygmaeus, Nyctalus leisleri*
BATLAS 2020	*c.* 10.40 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus*
BATLAS 2020	*c.* 11.91 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus*
BATLAS 2020	*c.* 8.60 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus*
BATLAS 2020	*c.* 8.97 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii*
BATLAS 2020	*c.* 6.38 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii, Myotis* spp.
BATLAS 2020	*c.* 5.32 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Myotis daubentonii, Myotis* spp.
BATLAS 2020	*c.* 4.58 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Myotis daubentonii*
BATLAS 2020	*c.* 5.71 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii, Myotis* spp.
BATLAS 2020	*c.* 1.46 km	*Pipistrellus pygmaeus*
BATLAS 2020	*c.* 6.42 km	*Pipistrellus pygmaeus*
BATLAS 2020	*c.* 4.33 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis* spp.
BATLAS 2020	*c.* 6.43 km	*Myotis* spp.
BATLAS 2020	*c.* 8.60 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii, Myotis* spp.
BATLAS 2020	*c.* 0.73 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii*
BATLAS 2020	*c.* 7.60 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Myotis daubentonii, Myotis* spp.
BATLAS 2020	*c.* 6.59 km	*Pipistrellus pygmaeus*
BATLAS 2020	*c.* 5.09 km	*Myotis daubentonii*
BATLAS 2020	*c.* 8.39 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri*
BATLAS 2020	*c.* 10.71 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus*
BATLAS 2020	*c.* 7.42 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus*
BATLAS 2020	*c.* 7.63 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri*
BATLAS 2020	*c.* 9.68 km	*Pipistrellus pipistrellus, Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii*
BATLAS 2020	*c.* 12.78 km	*Pipistrellus pipistrellus*

3.2 Habitat and roost suitability assessment

The habitat within the wind farm site is comprised of improved grassland, fen, old deciduous woodland, and commercial woodland. For the basis of this habitat assessment the detector locations are from the final autumn deployment which consisted of 10 detectors across the wind farm site

D.01, D.02 and D.03 are all situated on improved grasslands. D.04 is situated on the edge of a commercial deciduous woodland. D.05 is in a mature deciduous non-commercial woodland. D.06 is in fen with scattered willow trees. D.07 is located on the edge of an improved grassland which connects with the fen. D.08 is located on an improved grassland. D.09 is located on an improved grassland also. D.10 is located on an improved grassland.

Preliminary surveys of potential roost features found several structures of Low/Moderate/High potential roost within the wind farm site, some of which lie within the 300 m turbine buffer. Figure 5and Figure 6 shows the following roost features classed as moderate and higher within the wind farm site:

Table 9: Foraging/commuting bat habitat suitability within the wind farm site based on detector locations.

Detector location	Foraging features and assessment of vegetation removal required for detector locations/provisional turbine buffer (*c.*100 m)	Roost potential within *c.* 300 m of detectors of moderate or higher suitability
D.01	In an open field of improved grassland which contains treelines, providing good foraging and commuting features.	There is a mature beech treeline within 300 m of the turbine location which contains moderate potential trees.
D.02	In an open of field of improved grassland which contains treelines, providing good foraging and commuting features.	There is a mature beech treeline within 300 m of the turbine location which contains moderate potential trees.
D.03	In an open field of improved grassland which contains treelines, providing good foraging and commuting features	There is one potential moderate roost feature within 300 m of the turbine location. The remaining treelines contain low potential trees.
D.04	In a commercial broadleaf woodland, adjacent to the edge of drain which provides a high foraging and commuting zone. There will be extensive vegetation removal required for the outlined turbine location. High foraging and commuting potential within this area.	There are multiple moderate and high roosting potential trees within 300 m of the turbine locations.
D.05	In a broadleaf woodland with old growth trees. Adjoined by some commercially planted broadleaf trees. Very high foraging and commuting potential within this area.	There are multiple moderate and high roosting potential trees within 300 m of the turbine locations.
D.06	Located in a fen that has abundantly scattered Willow *Salix spp.* This is a high foraging and commuting area.	Within 300 m of moderate roosting features and possible high potential features.
D.07	Located on the edge of an improved grassland that is adjacent to the fen. This area has good connectivity to the adjoining areas and Suir river by the extensive network of treelines/hedgerows. These features (hedgerows/treelines) become slightly fragmented to the north of this location.	Within 300 m there is moderate potential roosting features.

Detector location	Foraging features and assessment of vegetation removal required for detector locations/provisional turbine buffer (*c.*100 m)	Roost potential within *c.* 300 m of detectors of moderate or higher suitability
D.08	In an open field of improved grassland. Within 80m of a confirmed bat roost at stone bridge and 50 metres adjacent t to the river.	Within 300 m is a confirmed bat roost at stone bridge on the river Suir.
D.09	In an open field of improved grassland. Within 100m of hedgerows that has connectivity to the river Suir and adjoining habitat which is mostly improved grassland. Moderate foraging and commuting as the hedgerows are slightly fragmented.	No moderate or higher potential roosting features within 300 m of this turbine location.
D.10	In an open field of improved grassland that is artificially drained and hedgerows/scrub that have been cut back and removed.	No moderate or higher roosting features within 300 m of this turbine location.

Preliminary surveys of potential roost features found several structures of low, moderate and high suitability within the wind farm site, some of which lie within the 300 m turbine zone of influence for bats. Figure 5 and Figure 6 shows the following roost features classed as low, moderate and high suitability throughout the wind farm site. There were multiple trees classed as having high potential roosting features on wind farm site:

- An ash tree (137) has multiple entrances and is suitable for multiple bats to roost at the same time.
- One tree which has dead ivy (143) with spaces between the ivy and stem of the tree for bats to roost in. There are also cavities on the north side of this tree, giving multiple entrances for roosting, and space for multiple bats to roost here.
- An ash tree (137) with big ivy stems, creating crevices, in which multiple bats could roost in.
- A beech tree (135) with multiple deadwood branches and high foraging potential surrounding the tree.
- Tree (131) with a cavity on the north side of it, and burls on the west side of it, giving multiple entrances for roosting.
- A beech tree (130) with multiple entrances and is suitable for multiple bats to roost at the same time.
- Tree (126) with multiple cavities with butt rot and welds, giving multiple entrances and is suitable for multiple bats to roost at the same time.
- An oak tree (120) which has been struck by lightning, and a high complex cavity *c.* 30m with ivy cover, giving multiple entrances and is suitable for multiple bats to roost at the same time.
- Tree (114) with cavity in the fork of the tree on the sheltered side, and is suitable for multiple bats to roost at the same time.
- Two oak trees (112) with multiple features, giving multiple entrances and is suitable for multiple bats to roost at the same time.

- Oak tree (113) with butt rot and possible cavities in the ivy, giving multiple entrances and is suitable for multiple bats to roost at the same time.
- Beech tree (109) with multiple cavities with butt rot, giving multiple entrances and is suitable for multiple bats to roost at the same time.
- Mature beech (82) with multiple cavities and butt rot, giving multiple entrances and is suitable for multiple bats to roost at the same time.
- Tree with transverse snaps (61), suitable for multiple bats to roost at the same time.
- Old oak tree (115) treeline *c*. 30m tall, with knot holes, tear outs and welds, giving the treeline collectively a high PRF due to multiple entrances and is suitable for multiple bats to roost at the same time.

All PRFs identified within the wind farm site and photographic evidence are located in **Appendix 1: Potential Roost Features and Roost Emergence/Re-entry Survey location**

3.2.1 Roost surveys

The locations of moderate or high roost potential can be seen in Figure 5 and Figure 6. Roost feature locations for which emergence and re-entry surveys were conducted are shown in Figure 7, while sample pictures of these locations can be found in **Appendix 1: Potential Roost Features and Roost Emergence/Re-entry Survey location**.

Table 10 provides a summary of emergence/re-entry surveys at potential roost features identified within the study area and undertaken over the study period.

Table 10: Survey of emergences/re-entry surveys and roost inspection surveys

Feature ID	Feature	PRF classification	Emergence/re-entry survey dates	Roost inspection survey dates	Conclusion
147	Lime tree	Moderate	Dawn: 12 May 2022	22 March 2022	No activity **No Confirmed Roost**
12	Ring of ash and alder, potentially foraging oasis	Low	Dawn: 12 May 2022	22 March 2022	Very low activity – three soprano pipistrelles **No Confirmed Roost**
24	Standing dead ash	Low	Dusk: 26 May 2022	22 March 2022	Multiple species foraging and commuting. **No Confirmed Roost**
148	Stone bridge on River Suir	Moderate	Dawn: 27 May 2022	22 March 2022	Common and soprano pipistrelle re-entered. **Confirmed Roost**
120	Lightning struck oak, highly complex cavity *c*.	High	Dusk: 12 July 2022	22 March 2022	Multiple species recorded.

Feature ID	Feature	PRF classification	Emergence/re-entry survey dates	Roost inspection survey dates	Conclusion
	30 m with ivy cover higher				**No Confirmed Roost**
135	Beech tree *c*. 30 m+ excellent of surrounding foraging, multiple deadwood branches, leafy ivy low but uncovered knot hole, large potential for unseen features	High	Dawn: 13 July 2022	22 March 2022	Common and soprano pipistrelles foraging. **No Confirmed Roost**
53	Multiple trees with features, cavities, tear aways. Right beside river with adjacent moderate foraging and commuting.	Moderate	Dusk: 31 August 2022	22 March 2022	Multiple species recorded. **No Confirmed roost**
149	Pump house	Moderate	Dusk: 24-October 2022	22 March 2022	Soprano pipistrelles and *Myotis* sp. were recorded. **No Confirmed roost**

3.2.2 Winter roost inspection surveys

On 15 February 2022, hibernation surveys were carried out on all identified PRFs that were considered suitable to hold hibernating bats. There were no hibernating bats observed in any of the possible PRFs noted. It is important to note that there was a pine tree (close to F.103) which was inspected using an endoscope. An active beehive was present in the pine tree and so, the tree could not be thoroughly inspected. It could be inspected, around where the bees were not present, in which no bats were observed. There was also a moderate ash tree (F.24) and a beech tree (F.114) inspected which had no bats present in either.

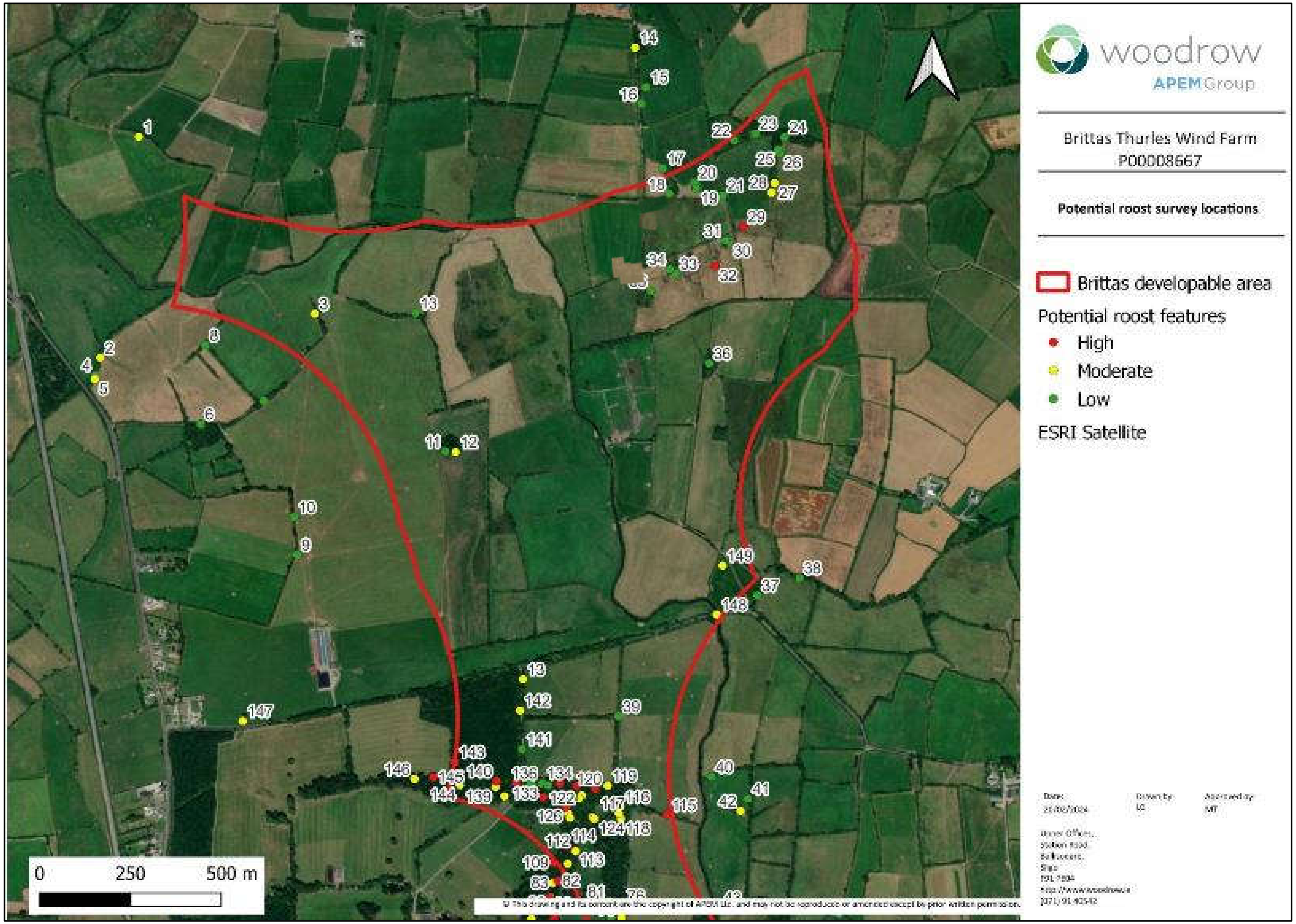

Figure 5: Potential roosting features of the northern section of the wind farm site

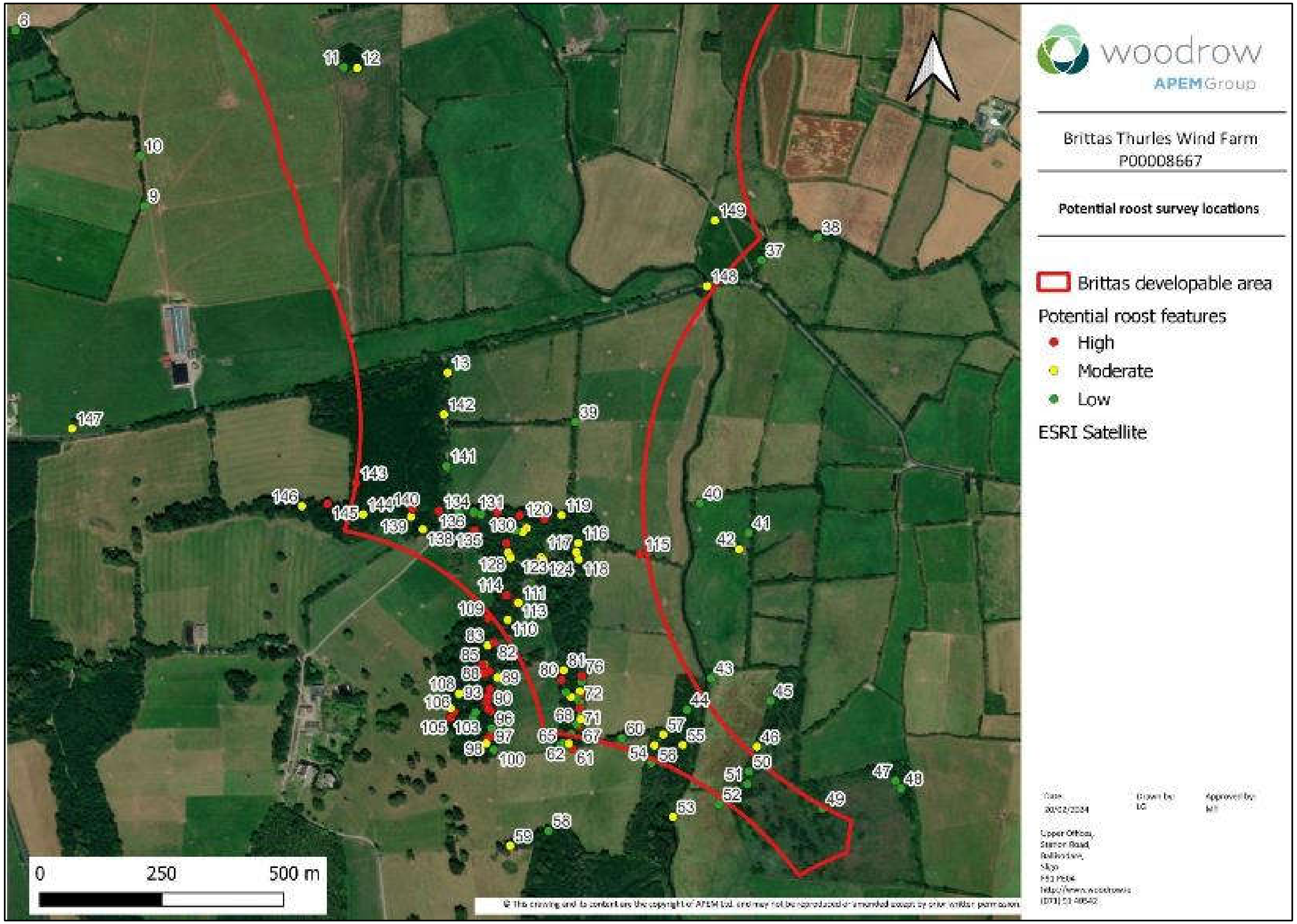

Figure 6: Potential roosting features of the southern section of the wind farm site

Figure 7: Roost survey locations for 2022

3.3 Bat activity transect surveys

The following section summarises the transect results recorded in the 2022 survey year. The total pass results, obtained using Elekon Batlogger M bat detectors, are presented in Table 11. The distribution of bats recorded along transects are displayed in Figure 8 , Figure 9**,** Figure 10, Figure 11 and Figure 12.

Transect 1: 11 May 2022 – see Figure 8The transect began at 23:30 on the 11 May 2022. The first bat recorded on the transect was a Leisler's bat which was detected commuting NE to SW over field between the two arms woodland. Other Leisler's bat foraging activity was concentrated near the union of the two smaller sections of the woods. There were soprano and common pipistrelles recorded foraging throughout the transect. There were several bats detected around the small 'finger' woodland associated with the abandoned quarry, which were found to be both common and soprano pipistrelles foraging above and along the edge of the woodland. A single brown long-eared bat was recorded and was associated with the woodland.

Transect 2: 26 May 2022 – see Figure 9

The transect began at 23:05 on the 26 May 2022. There were common pipistrelles and soprano pipistrelles recorded foraging and commuting throughout the transect.

Transect 3: 12 July 2022 – see Figure 10

The transect began at 23:11 on the 12 July 2022. There were soprano pipistrelles, Leisler's bats and common pipistrelles recorded foraging and commuting throughout the transect.

Transect 4: 31 August 2022 – see Figure 11

The transect began at 21:56 on the 31 August 2022. The majority of registrations were soprano pipistrelles noted to be foraging and commuting. Common pipistrelles were observed foraging. There were also brown long-eared passes and one Leisler's bat recorded.

Transect 5: 24 October 2022 – see Figure 12

The transect began at 19:50 on the 24 October 2022. There were soprano pipistrelles and common pipistrelles recorded foraging and commuting throughout the transect.

Table 11: Number of bat passes recorded during 2022 transect surveys

	Transect				
Species	**11 May 2022**	**26 May 2022**	**12 July 2022**	**31 August 2022**	**24 October 2022**
Myotis spp.	0	1	10	0	0
Leisler's bat	13	12	15	1	0
Common pipistrelle	33	35	42	50	6
Soprano pipistrelle	60	98	126	61	17
Brown long-eared bat	3	0	0	3	0
Total	**109**	**146**	**193**	**115**	**23**

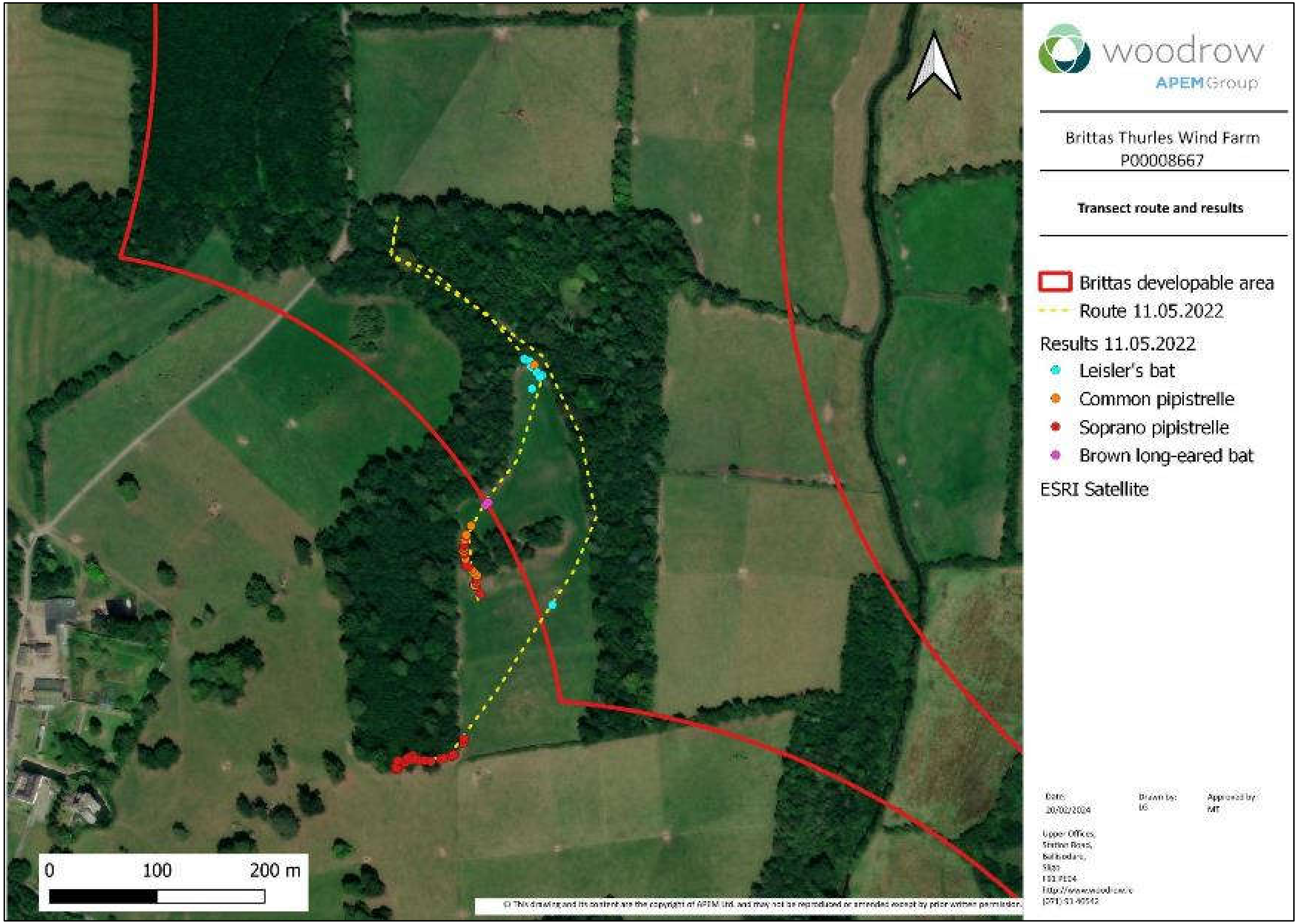

Figure 8: Bat distribution for transect on 11th May 2022

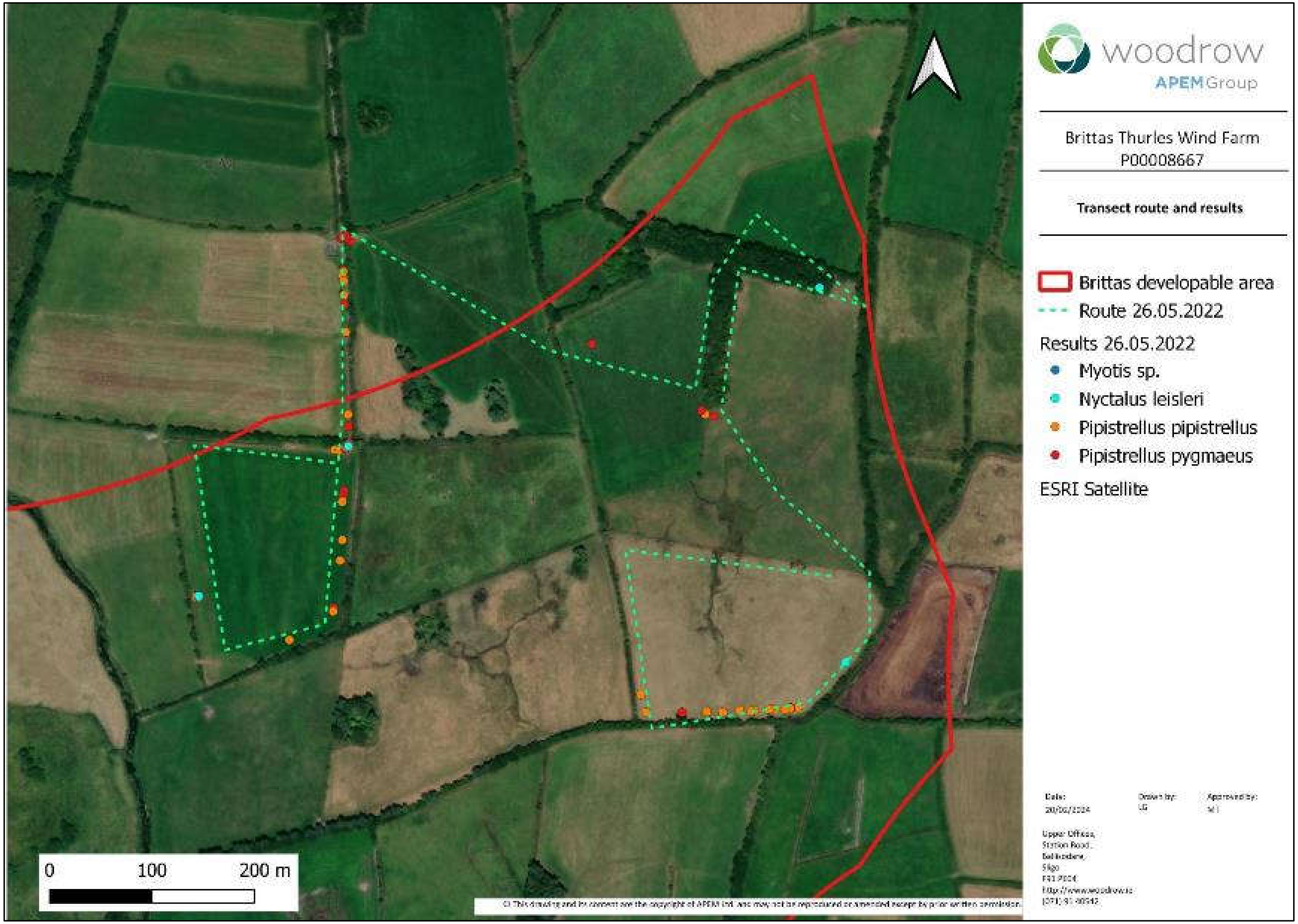

Figure 9: Bat distribution for transect on 26th May 2022

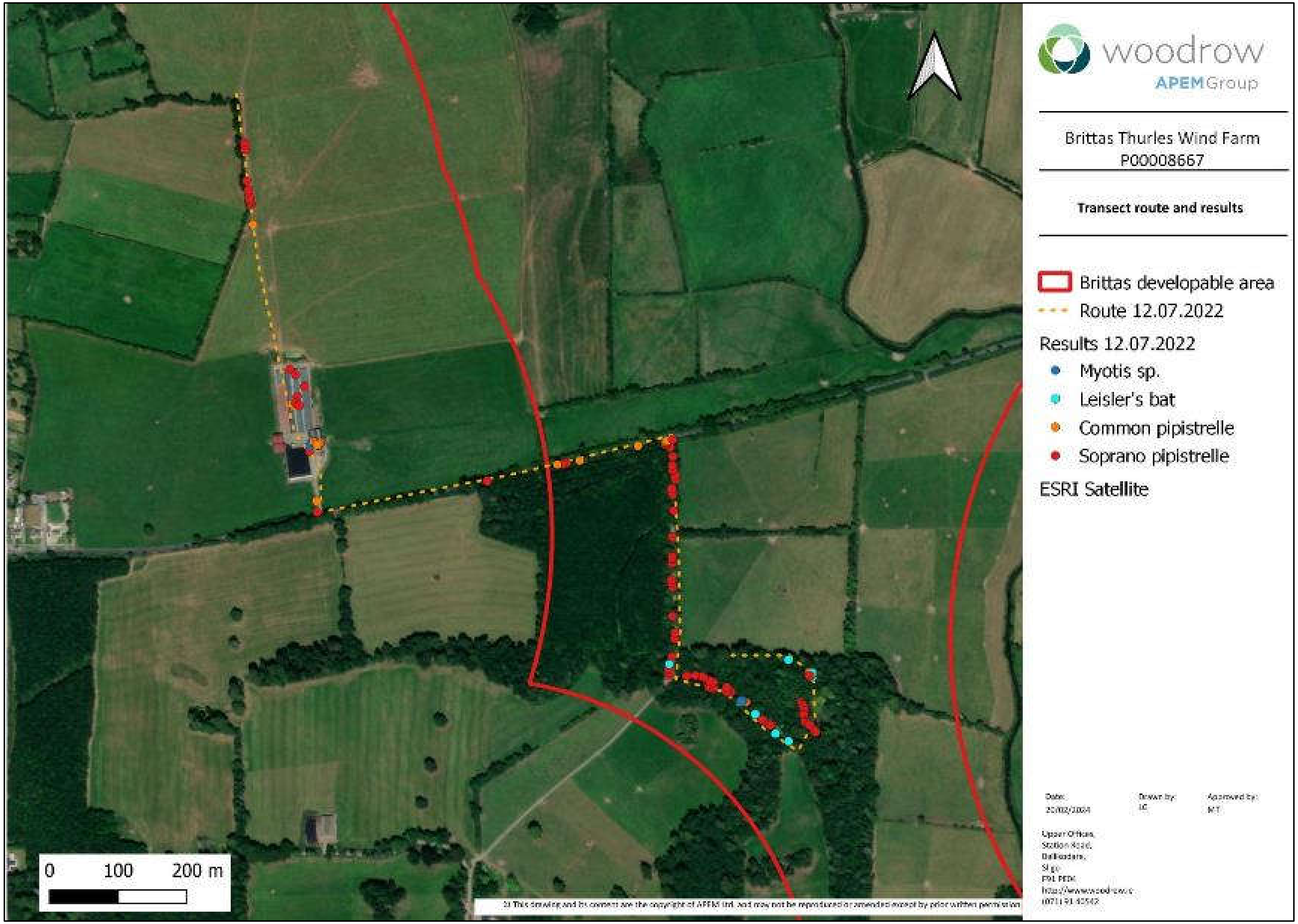

Figure 10: Bat distribution for transect on 12th July 2022

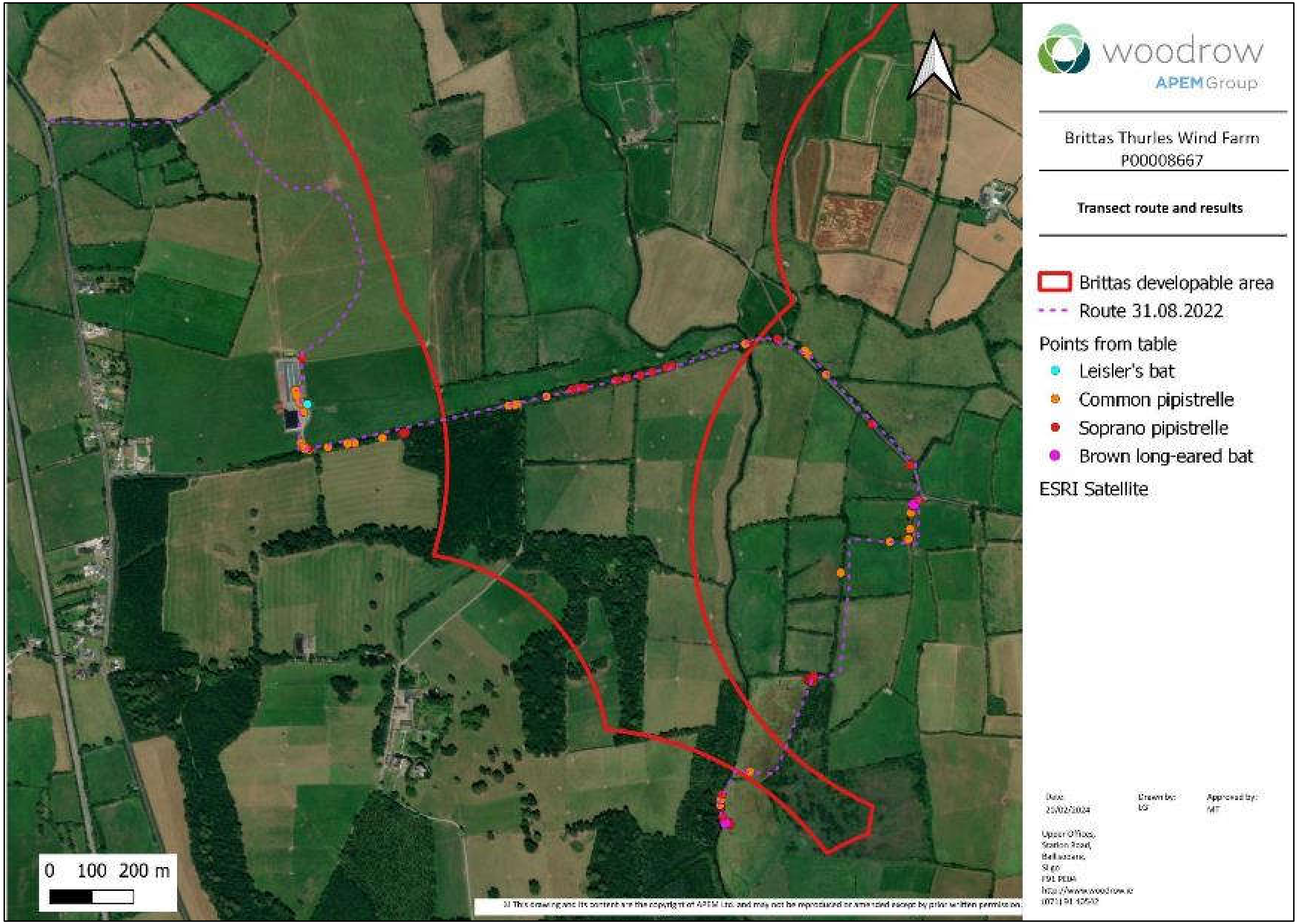

Figure 11: Bat distribution for transect on 31st August 2022

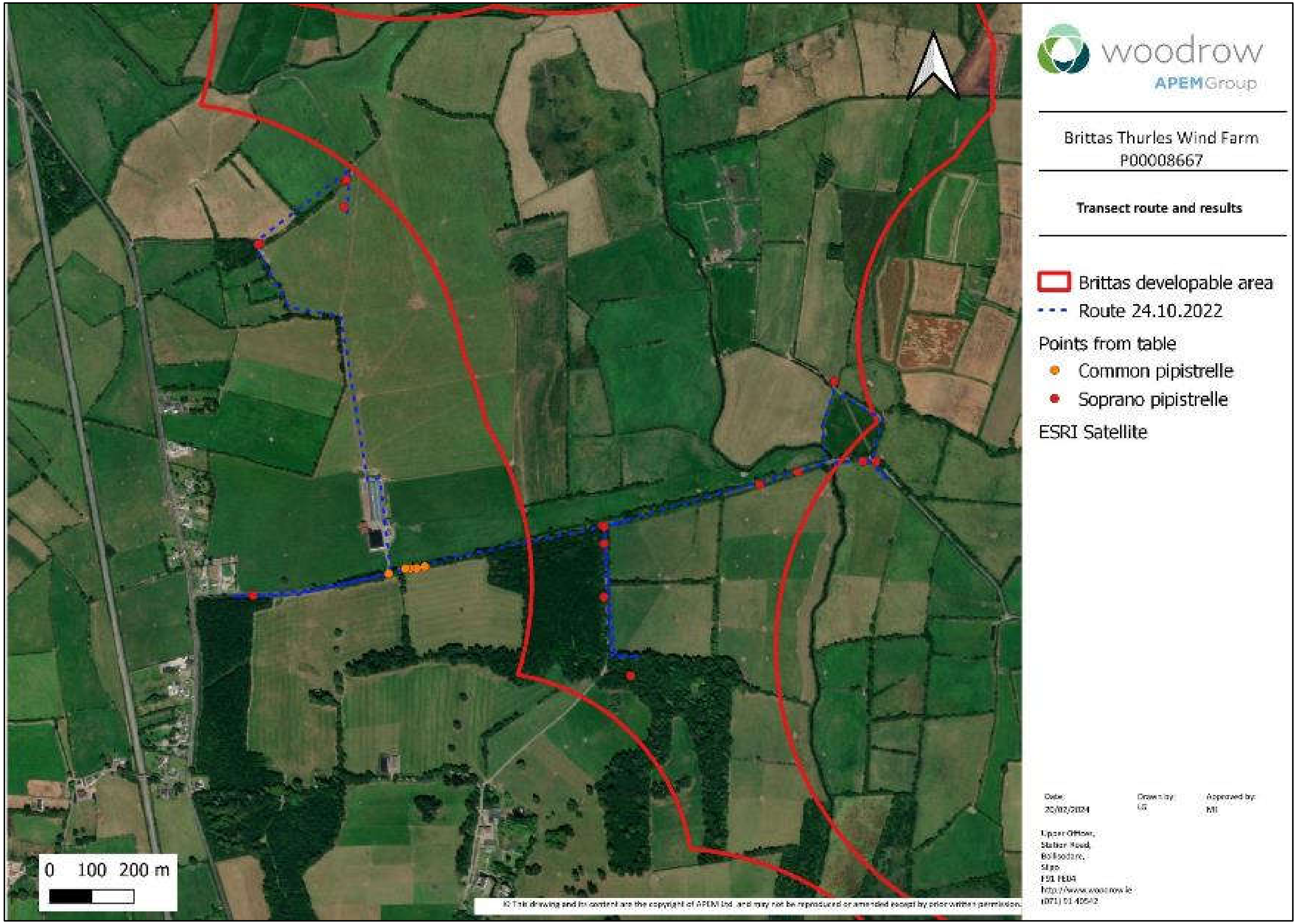

Figure 12: Bat distribution for transect on 24th October 2022

3.4 Static detector surveys

In compliance with NatureScot *et al*. (2021) guidelines, static bat detectors were deployed three times per season over the 2022 active seasons at or in areas adjacent to the proposed turbines as shown in Figure 4, with deployment dates and durations detailed in Table 4. Weather conditions during the three deployment periods were proven to be compliant with NatureScot *et al*. (2021) requirements and details are provided in **Appendix 2: Weather data for static deployment period**.

The following sections detail the results from static monitoring surveys for each of the three seasonal deployments: spring, summer, and autumn.

The average value in Table 12 represents the average bat passes per hour. The standard deviation shows how dispersed the data is from the average. A low standard deviation shows how the data is clustered around the average. A high standard deviation shows how the data is more spread out from the average. The interquartile range indicates the data that lies within the middle half of the data set. This data, excluding outliers are represented in the box plots in Appendix 4: R graphs of activity in relation to sunset and maps displaying the seasonal bat passes per hour for each species are provided in Appendix 5: Maps showing bat passes per hour.

The relationship between levels of bat activity and weather conditions, specifically wind speed and temperature, is displayed in **Appendix 2**. Geographical and temporal context for activity levels was examined through the analysis of the data using the software R. Graphs have been created which shows the level of activity at each detector in relation to the number of bat passes per hour and in relation to activity levels relative to sunset, see Appendix 4: R graphs of activity in relation to sunset.

3.4.1 Results for spring 2022 deployment

Each of the 10 detectors deployed over spring recorded for a total of 15 nights (8,512 mins) commencing from 11th May 2022, with the exceptions of D.07 which recorded for 14 nights (7,956 mins).

Across all the detectors there was a total of 21,204 bat passes recorded during the spring deployment. Bat passes were dominated by soprano pipistrelles (7,435 passes), common pipistrelles (7,378 passes) and Leisler's bats (5,804 passes). Other species were also recorded including *Myotis* spp. (502 passes), brown long-eared bats (82 passes) and *Pipistrellus* spp. (3 passes). Leisler's bats, who are a high-risk collision species, showed high activity at D.04, with an average of 26.69. Common and soprano pipistrelles both showed high activity at D.05, D.06 and D.07, with average values ranging between 6.17 and 41.16. Common pipistrelles also showed high activity at D.08, with an average of 7.73. This is discussed in Section 4.2.1

3.4.2 Results for summer 2022 deployment

Each of the 10 detectors deployed over summer recorded for a total of 20 nights (10,144 mins) commencing from 22nd August 2022, with the exception of D.01 which recorded for 18 nights (7,184 mins).

Across all the detectors there was a total of 12,240 bat passes recorded during the summer deployment. Bat passes were dominated by soprano pipistrelles (5,616 passes) followed by Leisler's bat (3,781 passes) and common pipistrelles (2,524 passes). Other species were recorded including *Myotis* spp. (291 passes), brown long-eared bats (27 passes), and Nathusius' pipistrelle (1 pass).

Leisler's bats again showed high activity level, with an average of 10.94 on site, this time at D.07. Common pipistrelles showed high activity at D.07, with an average of 10.94 at D.07. Soprano pipistrelles showed high activities at D.05, with an average value of 11.42 and at D.07 with an average value of 18.63. Soprano pipistrelles also showed moderate activity, with an average of at 4.59. This is discussed in Section 4.2.1.

3.4.3 Results for autumn 2022 deployment

Each of the 10 detectors deployed over autumn recorded for a minimum of 25 nights (21,983 mins) commencing from 29th September 2022, with the exception of D.05 and D.06 which failed. Detectors deployed at D.09 and D.10 recorded for significantly longer due to flooding that prevented safe collection and ran for 31 days (27, 448 mins) and 33 days (29,300 mins), respectively. Due to the extended deployment, data analysis was completed on 15 nights, from 17 October until 1 November 2022. These dates were chosen due to the localised flooding on the site, meaning that heavy rainfall would've occurred in the earlier dates of the deployment, resulting in non-compliant weather nights as per the NatureScot guidance (2021).

Across all the detectors there was a total of 11,610 bat passes recorded during the autumn deployment. Bat passes were dominated by common pipistrelles (5,778 passes), followed by Leisler's bats (2,421 passes) and soprano pipistrelles (2,905 passes). Other species were recorded including *Myotis* spp. (400 passes), *Pipistrellus* spp. (97 passes), brown long-eared bats (6 passes), and Nathusius' pipistrelle (3 pass). Leisler's bats showed moderate activity at D.09, with an average value of 4.06. Common pipistrelles showed high activity at D.07. Soprano pipistrelles showed moderate activity at D.07. These results are discussed in Section 4.

Leisler's bats peaked activity on the 26 October and 27 October 2022. It can be seen that this trend has occurred across all detectors on site at these times, although not to the extremity of D.09, which had 440 passes at one hour after sunset and 215 passes two hours after sunset on the 26 October 2022 and 397 passes one hour after sunset and 261 passes two hours after sunset on the 27 October 2022. At sunset, there were only 18 passes on the 26 October 2022 and 27 passes on the 27 October 2022 at D.09.

Table 12: Bat activity (average bat passes per hour, bp/h) for each bat species across all the deployments.
Notation: Std Dev = standard deviation and IQR = interquartile range
Activity level classification based on average bat passes per hour: < 2 bp/h = **Low**, 2 to < 5 bp/h = **Moderate**, ≥ 5 bp/h = **High**

Deployment		*Myotis* spp.			Leisler's bat			Nathusius' pipistrelle			Common pipistrelle			Soprano pipistrelle			*Pipistrellus* spp.			Brown long-eared bat		
		Average	Std Dev	IQR	Average	Std Dev	IQR	Average	Std Dev	IQR	Average	Std Dev	IQR	Average	Std Dev	IQR	Average	Std Dev	IQR	Average	Std Dev	IQR
Spring	D.01	0.13	0.43	0	2.47	4.39	3	0	0	0	0.78	1.43	1	0.56	1.25	0.25	0.02	0.13	0	0.13	0.55	0
	D.02	0.23	1.75	0	2.05	4.04	2	0	0	0	0.44	1.40	0	0.33	0.88	0	0.00	0.00	0	0.03	0.16	0
	D.03																					
	D.04	0.57	1.16	1	26.69	52.68	16.25	0	0	0	2.17	5.85	2	1.65	2.13	2	0.00	0.00	0	0.12	0.51	0
	D.05	0.04	0.23	0	4.55	8.07	5	0	0	0	6.17	14.27	4	7.28	12.70	7.25	0.00	0.00	0	0.05	0.28	0
	D.06	0.13	0.34	0	0.97	1.94	1	0	0	0	19.26	28.06	24.25	6.26	8.70	9	0.00	0.00	0	0.03	0.16	0
	D.07	0.55	0.98	1	2.86	6.14	3	0	0	0	18.39	20.01	25.25	41.16	52.10	53.75	0.00	0.00	0	0.03	0.16	0
	D.08	0.39	0.71	1	2.09	3.41	3	0	0	0	7.73	22.04	5	3.68	8.89	4	0.01	0.09	0	0.03	0.16	0
	D.09	0.30	0.57	0	2.88	5.47	4	0	0	0	2.23	3.38	3	1.47	2.02	2.25	0.00	0.00	0	0.11	0.41	0
	D.10	1.66	3.54	1	1.88	3.35	2	0	0	0	1.36	2.32	1.25	0.73	1.73	1	0.00	0.00	0	0.16	0.74	0
Summer	D.01	0.17	0.53	0	0.27	0.83	0	0	0	0	0.27	0.83	0	0.13	0.44	0	0	0	0	0.02	0.15	0
	D.02	0.07	0.29	0	0.39	0.87	0	0	0	0	0.39	0.87	0	0.65	1.81	1	0	0	0	0.02	0.12	0
	D.03	0.06	0.24	0	0.26	0.70	0	0	0	0	0.26	0.70	0	0.62	1.15	1	0	0	0	0.02	0.15	0
	D.04	0.05	0.25	0	0.94	4.14	0	0	0	0	0.94	4.14	0	4.59	5.26	5	0	0	0	0.02	0.18	0
	D.05	0.35	0.72	0	1.76	2.93	2	0	0	0	1.76	2.93	2	11.42	13.35	14.5	0	0	0	0.00	0.00	0
	D.06	0.01	0.09	0	0.27	0.93	0	0	0	0	0.27	0.93	0	0.24	0.82	0	0	0	0	0.00	0.00	0
	D.07	0.21	0.73	0	10.94	14.26	15	0	0	0	10.94	14.26	15	18.63	22.40	20	0	0	0	0.02	0.15	0
	D.08	0.31	0.58	0.5	1.17	3.22	1	0	0	0	1.17	3.22	1	1.52	1.97	2	0	0	0	0.02	0.12	0
	D.09	0.17	0.42	0	0.79	1.22	1	0	0	0	0.79	1.22	1	1.16	1.67	2	0	0	0	0.04	0.20	0
	D.10	0.16	0.48	0	0.31	0.79	0	0.01	0.09	0	0.31	0.79	0	0.54	1.13	1	0	0	0	0.01	0.09	0
Autumn	D.01	0.06	0.40	0	0.06	0.45	0	0.00	0.00	0	0.19	1.36	0	0.06	0.40	0	0.06	0.00	0	0.01	0.11	0
	D.02	0.01	0.08	0	0.12	1.24	0	0.00	0.00	0	0.69	5.99	0	0.25	1.53	0	0.25	0.08	0	0.00	0.00	0
	D.03	0.04	0.28	0	0.29	1.95	0	0.00	0.07	0	0.28	1.94	0	0.10	0.74	0	0.10	0.05	0	0.00	0.00	0
	D.04	0.02	0.15	0	0.02	0.13	0	0.00	0.00	0	0.99	4.40	0	1.58	6.51	0	1.58	0.00	0	0.00	0.00	0
	D.05																					
	D.06																					
	D.07	0.32	2.24	0	0.02	0.22	0	0.00	0.06	0	8.63	37.65	0	4.40	13.98	0	4.40	0.06	0	0.00	0.06	0
	D.08	0.09	0.48	0	0.09	0.55	0	0.00	0.00	0	1.10	8.17	0	0.36	1.54	0	0.36	0.08	0	0.00	0.06	0
	D.09	0.07	0.54	0	4.06	33.75	0	0.00	0.00	0	0.64	3.95	0	0.23	1.62	0	0.23	0.47	0	0.00	0.00	0
	D.10	0.01	0.16	0	0.09	0.66	0	0.00	0.00	0	2.20	9.17	0	0.74	3.58	0	0.74	0.05	0	0.00	0.00	0

3.4.4 Automated static surveys at height 2023

Throughout the deployment at height, 139 bat passes were recorded. The majority of these passes were identified as Leisler's bats (125 passes), with the remaining passes made up of common pipistrelles (7 passes) and soprano pipistrelles (7 passes). Average bat passes per hour can be seen in Table 13.

Table 13: Average bat passes per hour for each species across the deployment at height.

Location	Species	Average	Std Dev	IQR
H.01	*Myotis* sp.	0.00	0.00	0
	Leisler's bat	0.11	0.52	0
	Nathusius' pipistrelle	0.00	0.00	0
	Common pipistrelle	0.01	0.09	0
	Soprano pipistrelle	0.00	0.08	0

4 DISCUSSION

4.1 Summary of roost survey results

As detailed in 3.2.1 Roost surveys, there was only one confirmed roost. Table 10 details the summarised results of roosts surveys conducted on the wind farm site in 2022 and shows the locations of where these surveys were carried out. Images of these can also be found in Appendix 1: Potential Roost Features and Roost Emergence/Re-entry Survey location.

From the survey results, there was one confirmed roost at stone bridge (PRF 148), where three re-entries were registered. There were also common and soprano pipistrelles and Leisler's bats foraging and commuting throughout the area. This bridge roost would offer protection from predators, and be of relative humidity and a constant temperature, given that the river Suir passes through it. The river would also act as a primary area for food sources. There is over sail and overrun areas crossing this bridge, which may cause some disturbance to the roosting species. Mitigation measures should be put in place to minimise this disturbance.

There were no other confirmed roosts, with little to no activity during the first two surveys at PRF 147 and PRF 12. There were common and soprano pipistrelles and Leisler's bats recorded foraging and commuting at the remaining survey locations (PRF 24, PRF 120, PRF 135, PRF 53, and PRF 149). Although no species were observed emerging or re-entering these features on these given dates, this does not mean they are not used as roosts.

Hinds and Davidison-Watts (2022) discuss the fission and fusion behaviour of tree dwelling bats wherein bats regularly switch roosting sites. Fusion behaviour is where bats of a colony are present all in the one roost, while fission behaviour is where bats switch between roosting sites and disperse or interchange with other populations or colonies of bats. This roost-switching behaviour is influenced by microclimatic conditions and seasonal and phenological changes, parasite avoidance, and other factors. This dynamic nature of this behaviour makes it challenging to definitively confirm or rule out the existence of any bat roost during punctual observations or surveys. Therefore, trees with potential roost features, even in the absence of confirmed bat roosting, should be considered as roosts and will require appropriate mitigation measures if these features are to be removed as part of the proposed development.

There is a pNHA Ormod's Mill, Loughmoe, Temploemore [Site code: 002066] (*c.* 3.5 km from site), which has a nursery roost for the Natterer's bat of national importance. There are also brown long-eared bats roosting here. Although this roost is outside the viable area and the zone of influence from turbines, with no surveys carried out, it is very important to note this roost. There is potential for these species to commute and forage south along the river Suir from the mill roost and be present within the site. Natterer's bats are known to commute up to 6 km from the roost to core foraging areas. They like to commute along tree-lined river corridors, which are visible along the river between the mills and Thurles. They have a preference for mature semi-natural broadleaf woodlands, which is present near D.04 and D.05. Brown long-eared bats also prefer foraging near woodlands and follow linear features to get there.

While the roost at Ormond's Mill is of national importance and there is potential for indirect impacts such as removal of linear features having an impact on foraging routes for both species, data collected during the 2022 static deployments shows low activity from both these species at the proposed development Site, therefore, no impacts are anticipated on the pNHA populations.

4.2 Summary of bat activity survey results

During the 2022 seasons, bat activity was recorded within the wind farm site for a minimum of six species, including common pipistrelles, soprano pipistrelles, Nathusius' pipistrelle, Leisler's bats, *Myotis* spp., and Brown long-eared bats. The majority of bat activity was attributed to common and soprano pipistrelles. Soprano pipistrelles were recorded in all months during transect and static surveys and were the most active species for static surveys during all of the seasonal deployments, with a total of 15,956 passes. Common pipistrelles were the second most active species recorded on the site during all of the seasonal deployments with a total of 15,680 passes. Activity within the wind farm site was largely recorded in proximity to habitat features that were assessed as being suitable for foraging and commuting bats, i.e. forestry edge habitat. Below is a summary of activity by species, also see Table 13**.**

4.2.1 Pipistrelle species

As mentioned above, common and soprano pipistrelles were recorded across the wind farm site, during all deployments in 2022 and were the most active species within the wind farm site. There was a total of 31,740 passes detected throughout the three deployments. Soprano pipistrelles were the most active species at the wind farm site, accounting for 35.4 % of total bat activity. Common pipistrelle accounted for 34.8 % of total bat activity on site, while Nathusius' pipistrelles had four bat passes throughout the three deployments. There were 94 passes identified as social calls, with one social call identified in spring and 93 social calls identified in autumn. The spring social calls could suggest the gathering of females to locate or establish maternity roosts, giving the time of these calls. The remaining calls identified in autumn, could also signify another interaction between individuals, such as defending a territory and calling their young. Another possible reason is a mating call, given that these calls were identified in October. Due to a lack of studies on social calls, a clear explanation for these types of calls is not possible.

4.2.1.1 Soprano pipistrelle

Data analysis shows that soprano pipistrelles were the species recorded to have low to high activity levels across all deployments. They had high activity at D.05, D.06 and D.07 in spring, and D.05 and D.07 in summer. They showed moderate activity at D.08 in spring, D.04 in summer and D.07 in autumn. D.04 and D.09 had moderate activity level in spring. D.10 also had moderate activity levels in autumn. The remaining locations were of low activity.

D.07 is located on the edge of an improved grassland that is adjacent to the fen. This area has good connectivity to the adjoining areas and Suir river by the extensive network of treelines/hedgerows. These features (hedgerows/treelines) become slightly fragmented to the north of this location. The riparian habitat and good connectivity, being of moderate foraging and commuting potential as per Collins *et al.* (2016), explains the constant high activity of sopranos in these areas. Another location of high activity was D.05 in spring and summer. This detector was placed on a feature, along edge of broadleaf plantation and improved grassland and is just outside the 300 m zone of influence at T.9.

Soprano pipistrelles were also the most active species recorded during transect activity surveys. The transects covered areas of commercial broadleaf woodlands, with high foraging and commuting potential. There is also a drain edge adjacent to the woodland, which creates a riparian habitat preferred by the soprano pipistrelle. This could explain the high levels of activity recorded during the transect surveys by this species.

During the deployments at height, a total 139 bat passes were recorded with 5% identified as soprano pipistrelles. This demonstrates that soprano pipistrelle can occasionally fly at higher altitudes, rendering the species vulnerable to wind turbines, and explain why this is one of the species considered of high collision risk by NatureScot *et al.* (2021). This vulnerability aligned with the species being common and widespread also explains previous investigations into bat collisions at wind farm sites across the UK (Mathews *et al.*, 2016), which found common and soprano pipistrelle species to be amongst the most commonly recorded casualties during searches of turbines. However, the low activity levels of soprano pipistrelle observed during this deployment suggest that erecting a turbine in the location where the existing temporary met mast is situated may not significantly impact their local populations. This could be attributed due to the habitat characteristics (open area) where the met mast is placed, which may not be preferred by soprano pipistrelles, as they are more reliant on linear features for commuting between roosts and foraging areas.

4.2.1.2 Common pipistrelle

Data analysis shows common pipistrelles had low to high activity levels across the site. They had high activity levels at D.05, D.06, D.07 and D.08 in spring, and D.07 in summer and autumn. They had moderate activity levels at D.04 and D.09 in spring, and at D.10 in autumn. The remaining locations were of low activity.

Another species of high collision risk is the common pipistrelle (NatureScot *et al.*, 2021, Mathews *et al.*, 2016 Just like the soprano pipistrelle, D.07 is commonplace of high activity in spring and summer, with up to 400 bat passes per hour. Common pipistrelles rely on linear features to navigate their way through areas. Common pipistrelles are a generalist species in terms of favourable habitat suitability and foraging/commuting areas, which can again explain the high activity levels at this detector in each season. This can also explain the high levels of activity in spring at D..05, D.06, and D.08, as these areas are within the broadleaf woodland in the south of the site and also go adjacent to the river Suir, providing high foraging and commuting potential for this species. The proposed felling at T.5 takes away the "T"-shaped treeline. This would result in the loss of both foraging and roosting features for common pipistrelles. Adequate mitigation measures and post construction monitoring are recommended, especially at the "T"-shaped treeline due to the lack of survey data, will need to be put in place in areas of proposed felling to ensure there is reduced impacts on these species for commuting and foraging.

Similarly to soprano pipistrelles, out of total 139 bat passes, 5% of bat passes recorded during the deployments at height were identified as common pipistrelles. Common pipistrelles occupy similar niches and present similar behaviour to soprano pipistrelles, thus also being classified as high collision risk by NatureScot (2021). Consequently, similar conclusions to those drawn above for soprano pipistrelles can be applied here for common pipistrelles.

4.2.1.3 Nathusius' pipistrelle

There were also two passes of a Nathusius' pipistrelle at D.10 during the summer deployment and D.03 during the autumn deployment. Accordingly to NatureScot (2021), this species is classified as a high-risk collision and migratory species. However, due to the very low activity levels detected during the surveys, it can be assumed that these passes could be isolated events and the proposed development will have minimal impacts on this species.

4.2.2 Leisler's bat

Leisler's bats were classed as having high activity levels at D.04 in spring and D.07 in summer. They showed moderate activity at D.01, D.02, D.05, D.07, D.08 and D.09 in spring. They also showed moderate activity at D.09 in autumn. The remaining locations were of low activity.

Leisler's bats were recorded having high activity at D.04 in spring, with 200 bat passes per hour as seen in Figure A5.2. This detector was placed on an oak tree in the woodland slightly southwest of the wind farm site. D.07 was also of high activity in summer. This detector is located on the edge of an improved grassland that is adjacent to the fen. This area has good connectivity to the adjoining areas and Suir river by the extensive network of treelines/hedgerows. These features (hedgerows/treelines) become slightly fragmented to the north of this location.

Leisler's bats will frequently fly at heights greater than other species (Carlin and Mitchell-Jones, 2009) and are also found to frequently fly in open areas (NatureScot, 2023) generally increasing their risk of turbine collision. During the deployment at height, Leisler's accounted for 89% of the total passes for this deployment. This demonstrates the high-risk activity of Leisler's bats and their distinctively high flight patterns.

In 2022, Leisler activity at D.02 was moderate in spring at ground level. Due to the activity seen at height, it can be assumed that there is potential risk of collision if commuting between T.1 and T.6.

This could increase the risk of collision between T1 and T6 due to the open areas, which Leisler's bat also favour while commuting (Elmeros *et al*. (2016)).

From the desk study, the woodland around D.04 has been felled and regenerated. It was clear felled in or before 1995, let regenerate between 1995 – 2000 and was clear felled again in 2001. Between 2006 and 2012, it seems to have been kept cut back. However, from 2011 – 2013, there is visible regeneration again and has been let continue to grow until this present day. The southern part of this woodland was established well at D.05, and felling had taken place, and an understorey began to regenerate. The presence of mature trees, creates good potential for roosting Leisler's bats are a known tree roosting species, making this woodland all the more important. Leisler's bats tend to avoid cluttered areas when foraging, being more commonly found above or just below tree canopies. The mature trees present in this woodland would influence a higher insect population (Knuff *et al.* 2020*)* This could explain the high activity levels in spring in this area. They are also known for switching between tree roosts and so, it cannot be confirmed if one tree is not used for roosting just because there was an absence of that given day. It is possible that there could be more activity not picked up by the detector due to it being placed within the woodland with the placement of trees and the overhead canopy interfering with detector range and Leisler's bats echolocations. This detector is also within the 300 m zone of influence to T.8. This area is of improved grassland, in which Leisler's bats like to forage over, and do not depend on linear features. This is increasing the collision risk between this species and the turbine. Mitigation will be needed.

There was also moderate activity at D.09, as seen in Figure A5.2 during the autumn deployment, with 400 bat passes per hour recorded. Although just classed as a moderate activity level, D.09 is of significant importance to the local Leisler's bat population here. The development of a turbine here and the felling associated with this installation will have direct negative effects on the local Leisler's population in this area. When Leisler's bats echolocate, they can be heard up to 80 m away from the detector (NatureScot, 2021). The turbine T.7 is within the 80 m buffer from placement of D.09. This high-risk collision species is very vulnerable in this area, especially with bat passes per hour rates of 400 bp/h. Based on data analysis, it shows activity peaks on the 26 and 27 October 2022.. This heightened social activity on these two nights could be attributed to the localised flooding which occurred during the autumn season. The heavy rain in the nights previously would have created unfavourable foraging conditions, giving a spike in foraging activity on subsequent nights of favourable foraging conditions.

Further analysis shows that the busy activity is primarily one to two hours after sunset on both these nights at D.09. It can be seen that this trend has occurred across all detectors on site at these times, although not to the extremity of D.09. Sunset was at 6.12pm and 6.10pm respectively, so there is no suspicion of a roost within the 80 m echolocation detection range for Leisler's bats given that this species is known for earlier emergences. Leisler's are also known to travel between foraging and roosting sites, with some having been recorded travelling up to 13.4 km in Ireland (Shiel *et al.,* 1999) The surrounding habitats here within an 80 m buffer are improved grasslands and hedgerows. Improved grassland is of local foraging importance to this species as two-thirds of Leisler's bats in Ireland was spent over pastures and drainage canals (EUROBATS, 2019). There is also the river Suir in close proximity (*c.* 150 m) to D.09, which provides great foraging opportunities. Both the water body and improved grasslands are critical feeding areas for this species (EUROBATS, 2019).

There were also no roosts identified within this area. Leisler's bats prefer to roost within trees. However, surveying and pinpointing roosts in trees is a very challenging task. Leisler's bats are one of the many species which exhibit roost-switching behaviours in trees. Leisler's bats were observed switching between tree roosts between every two and ten days (Waters *et al.,* 1999).

It is recommended that mitigation methods should be implemented for T.7 due to the activity of this high-risk collision species. Some mitigation methods which could be implemented are a rotary-swept area buffer, blade rotation alteration or smart curtailment. During the deployments at height, 139 bat passes were recorded and 90% of these passes (125 passes) were identified as Leisler's bats. This demonstrates the high turbine collision risk of Leisler's bats and their distinctively high flight behaviour, especially when these results are compared to the other detected species. This could increase the risk of collision between T1 and T6 due to the open areas, which Leisler's bat also favour while commuting (Elmeros *et al*., 2016). This species usually flies high and commute in the open at heights of 10 m or even greater, which is evident from passes recorded at 50 m during the static at height survey. There was low activity from Leisler's at D.03 during summer and autumn deployment. Analysis cannot be made for spring at D.03, due to an equipment failure. This detector at height shows the open area flight paths taken by Leisler's bats, and the distinctively high flight behaviour. This shows the importance of mitigation requirements (such as feathered idling and feathered curtailment) to help reduce potential impacts on this high-risk collision species.

Leisler's bats were recorded during all of the four transect activity surveys.

4.2.3 *Myotis* species

During the 2022 survey period, *Myotis* sp. were all of low activity. They were active at all of the detector locations during each of the three seasons.

There were *Myotis* sp. recorded during two of the five transect activity surveys.

4.2.4 Brown long-eared bat

It is acknowledged that accurately monitoring brown long-eared activity can prove quite difficult as this species is known to make low amplitude calls and frequently forage using their eyes or ears rather than echolocation (Collins, 2016 and Russ, 2012). As a result, brown long-eared bats are frequently underrepresented in surveys which rely on the use of bat detectors.

The average activity levels recorded for this species at all locations during each of the deployments was low. There were no brown long-eared bats recorded during three of the transect activity surveys.

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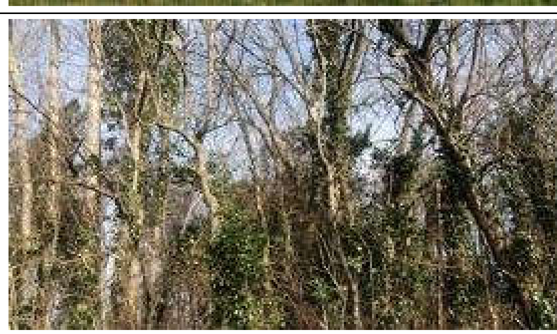
FEATURES AND ROOST EMERGENCE/RE-ENTRY SURVEY LOCATION

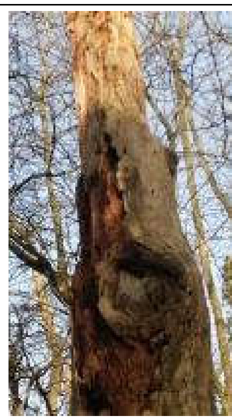
	Roosting potential	PRF picture
	Moderate	
dead wood	PRF - (Moderate)	
	Moderate	
nch	Low	

	Roosting potential	PRF picture
	Moderate	
	Low	
	Low	
	Low	
eline, leafy ivy	Low	

	Roosting potential	PRF picture
tures potential, also	Low	
y foraging mirage	Low	
near feature now	Moderate	
ry 20m approx..	Low	
d of trees. Cavities	Moderate	

	Roosting potential	PRF picture
avities	Low	
	Low	
awthorn, hawthorn	Low	
vities	Low	

	Roosting potential	PRF picture
op. Cavity visible	Low	
standing deadwood	Low	
lgerow	Low	
ivy present	Low	

	Roosting potential	PRF picture
	Low	
	Low	
anch on tree with	Low	
ree. No lower cavities	Low	

	Roosting potential	PRF picture
ey of pine	Moderate	
mixed dead wood and	Moderate	
	Low	
, poor connectivity	Low	

	Roosting potential	PRF picture
ities	Low	
	Low	
e standing deadwood t's quite small	Low	
ce. Just pine with	Low	

	Roosting potential	PRF picture
ng	Low	
te forage with stream	Low	
roosting potential trees	Low	
feature located close nuting area	Low	

	Roosting potential	PRF picture
erent trees. No other aging area and	Low	
s. Butt rot, cavities, no aging and commuting	Moderate	
ting along river with	Low	
ize limits to no more	Low	

	Roosting potential	PRF picture
commuting	Low	
a possible high ue to surrounding area land adjacent	Moderate	
moderate commuting	Low	
e in moderate foraging	Low	
s boggy wetland area	Low	

	Roosting potential	PRF picture
uting and foraging	Low	
al	Low	
commuting area	Low	
vities, tear aways. t moderate foraging	Moderate	
	Low	

	Roosting potential	PRF picture
ing. Tree with multiple cavity	Moderate	
ivy but lots of cavities	Moderate	
e	Moderate	
plantation, very leafy	Low	

	Roosting potential	PRF picture
one – two knot holes,	Moderate	
s, but no visible ones	Low	
sverse snaps similar	High	
	Low	

	Roosting potential	PRF picture
	Moderate	
osting potential	Low	
all cavities	Low	

	Roosting potential	PRF picture
	Low	
and cavities	High	
	Low	

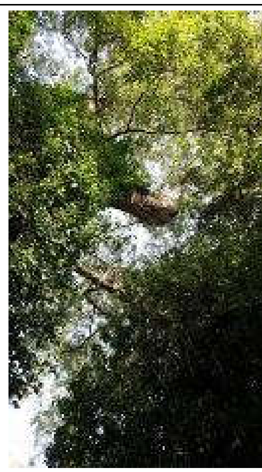
	Roosting potential	PRF picture
	Moderate	
	Low	
, especially in ivy	High	

	Roosting potential	PRF picture
	Low	
	High	
	Moderate	

	Roosting potential	PRF picture
	Low	
	High	
	Low	
	Moderate	

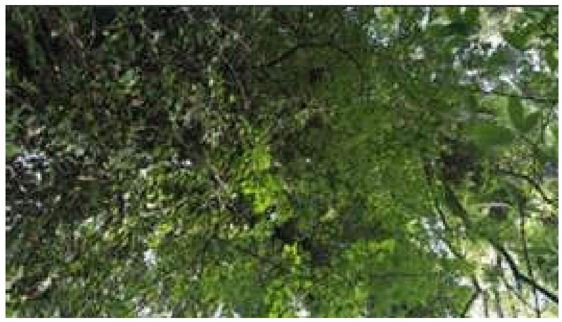
	Roosting potential	PRF picture
s such as bark peeling	Low	
bark peeling and	High	
snapped branch	Moderate	
ities and butt rot	High	

	Roosting potential	PRF picture
nap	Moderate	
	Moderate	
	High	
e during inspection	High	

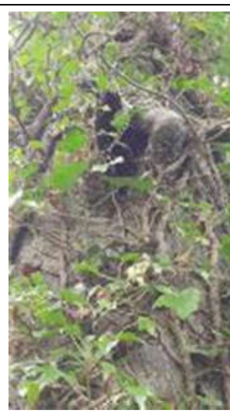
	Roosting potential	PRF picture
	High	
	High	
g	Moderate	
	High	

	Roosting potential	PRF picture
	High	
	High	
	High	
	High	

	Roosting potential	PRF picture
	High	
	Low	
	High	
	High	

	Roosting potential	PRF picture
	Moderate	
s	Low	
	Moderate	
	Low	
	Low	

	Roosting potential	PRF picture
res due to ivy coverage	Low	
	High	
	High	
	Moderate	
	Moderate	

	Roosting potential	PRF picture
s and butt rot	High	
	Moderate	
	Moderate	
tures	High	

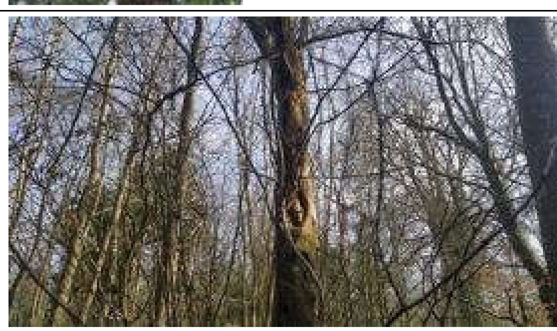
	Roosting potential	PRF picture
ies in ivy	High	
e tree	High	
ne *c.* 30m tall, knot high collectively	High	

	Roosting potential	PRF picture
	Moderate	
	Moderate	
	Moderate	
s	Moderate	

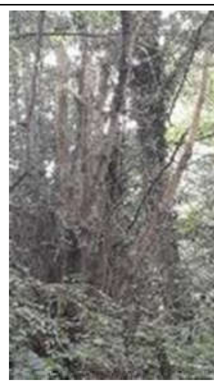
	Roosting potential	PRF picture
plex cavity *c*. 30m with	High	
	Moderate	
in main stem	Moderate	

	Roosting potential	PRF picture
	Moderate	
e	Moderate	
tween two trees	Low	

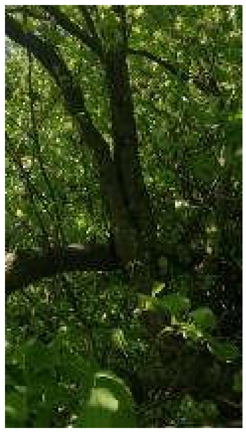
	Roosting potential	PRF picture
rot and welds	High	
al	Moderate	
multiple entry points	Moderate	
	Moderate	

	Roosting potential	PRF picture
es	High	
ls on west side	High	
up stem	Low	
large ivy weld	Moderate	

	Roosting potential	PRF picture
d snap branch	Low	
rrounding foraging, eafy ivy low but ential for unseen	High	
t treeline with field has	Low	
ating crevices, in which	High	

	Roosting potential	PRF picture
	Moderate	
foraging	Moderate	
e stems near a swampy	High	
	Low	

	Roosting potential	PRF picture
wind break, linear	Moderate	
etween it and the stem n north side	High	
	Moderate	
	High	

	Roosting potential	PRF picture
ssessed individually	Moderate	
s on an area of	Moderate	
	Moderate	
	Moderate	

APPENDIX 2: WEATHER DATA FOR STATIC DEPLOYMENT PERIODS

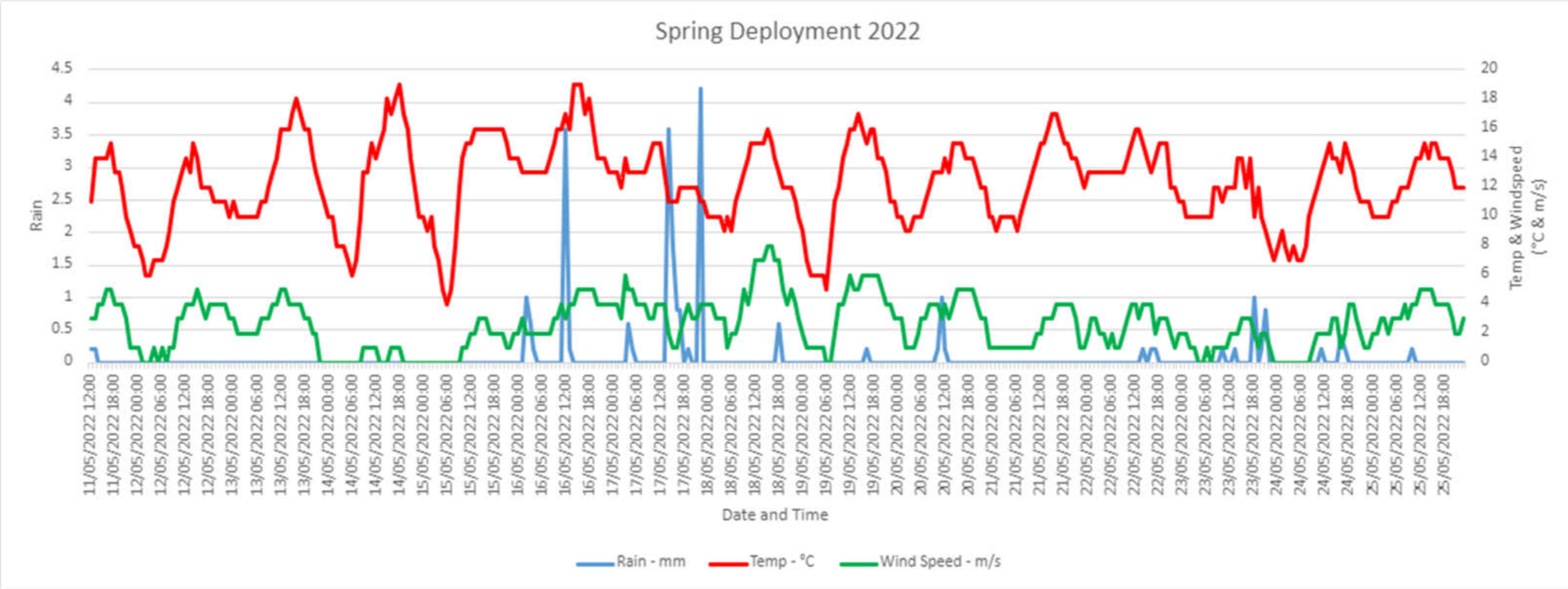


Figure A2.1 - Mean hourly weather conditions for the duration of the 2022 Spring deployment

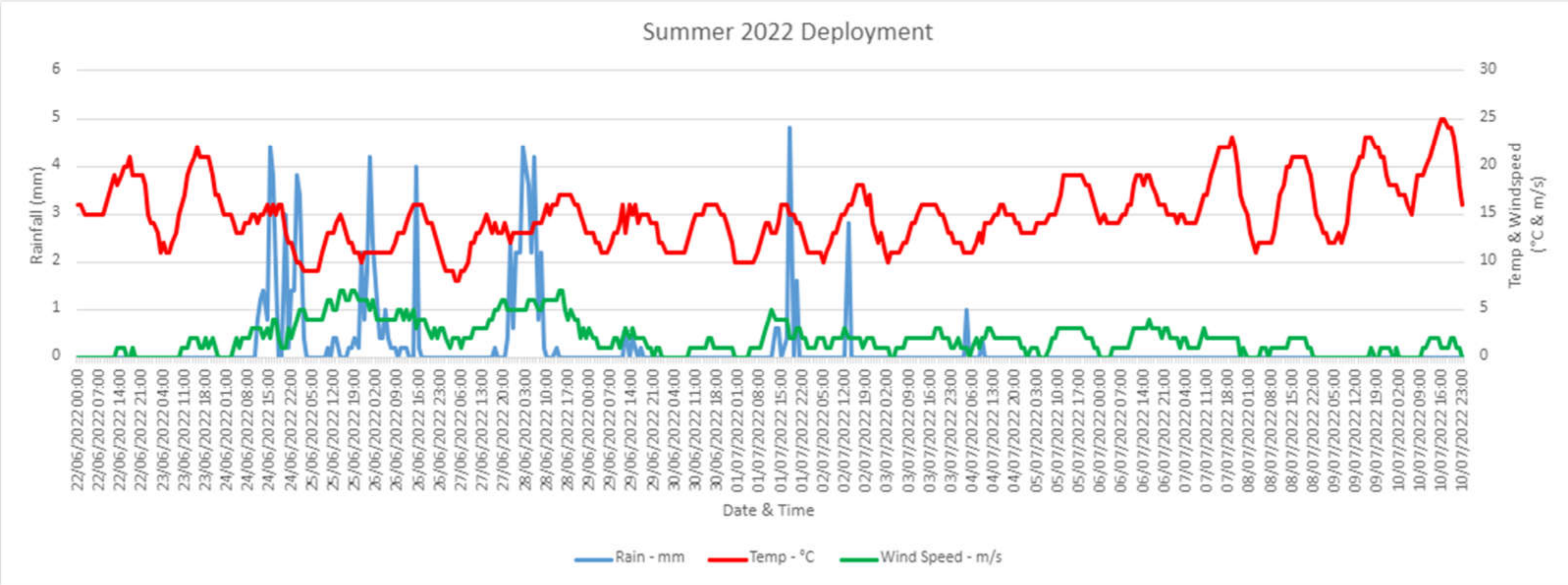


Figure A2.2 - Mean hourly weather conditions for the duration of the 2022 Summer deployment

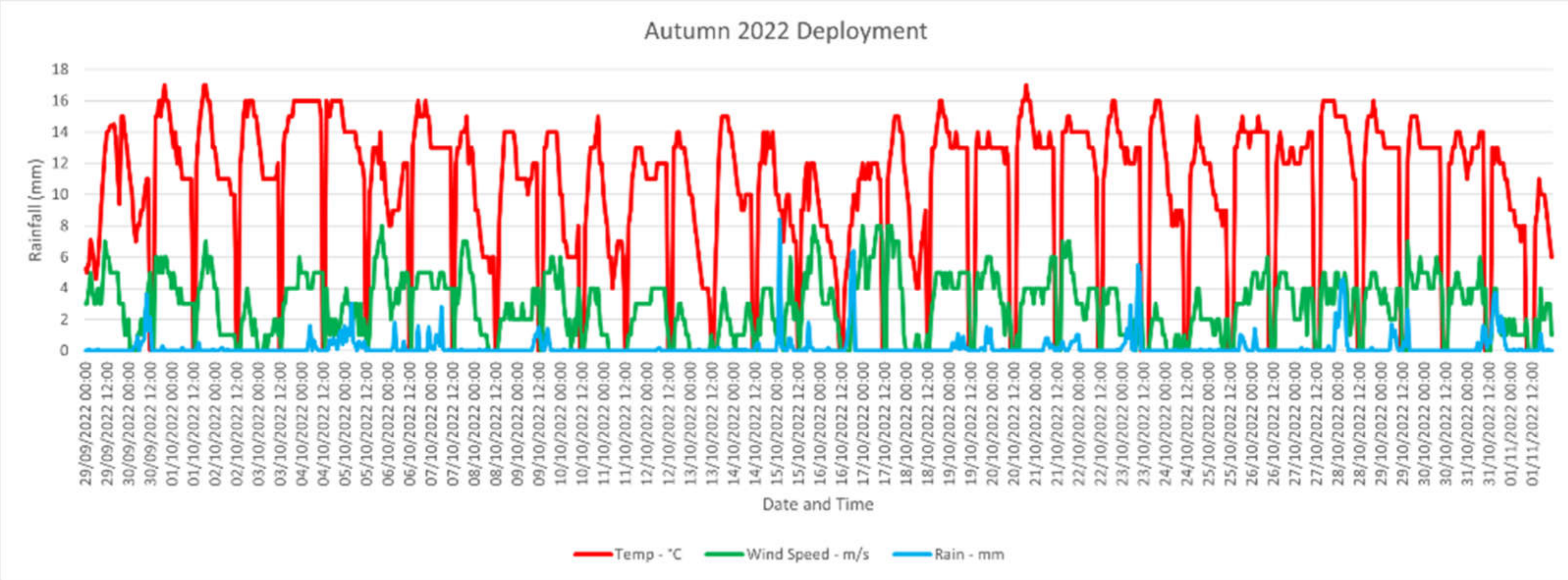


Figure A2.3 - Mean hourly weather conditions for the duration of the 2022 Autumn deployment

APPENDIX 3: STATIC LOCATIONS 2022

Plate 150 - D.01

Plate 151 - D.02

Plate 152 - D.03

Plate 153 - D.04


Plate 154 - D.05


Plate 156 - D.07


Plate 155 - D.06


Plate 157 - D.08


Plate 158 - D.09


Plate 159 - D.10

APPENDIX 4: R GRAPHS OF ACTIVITY IN RELATION TO SUNSET

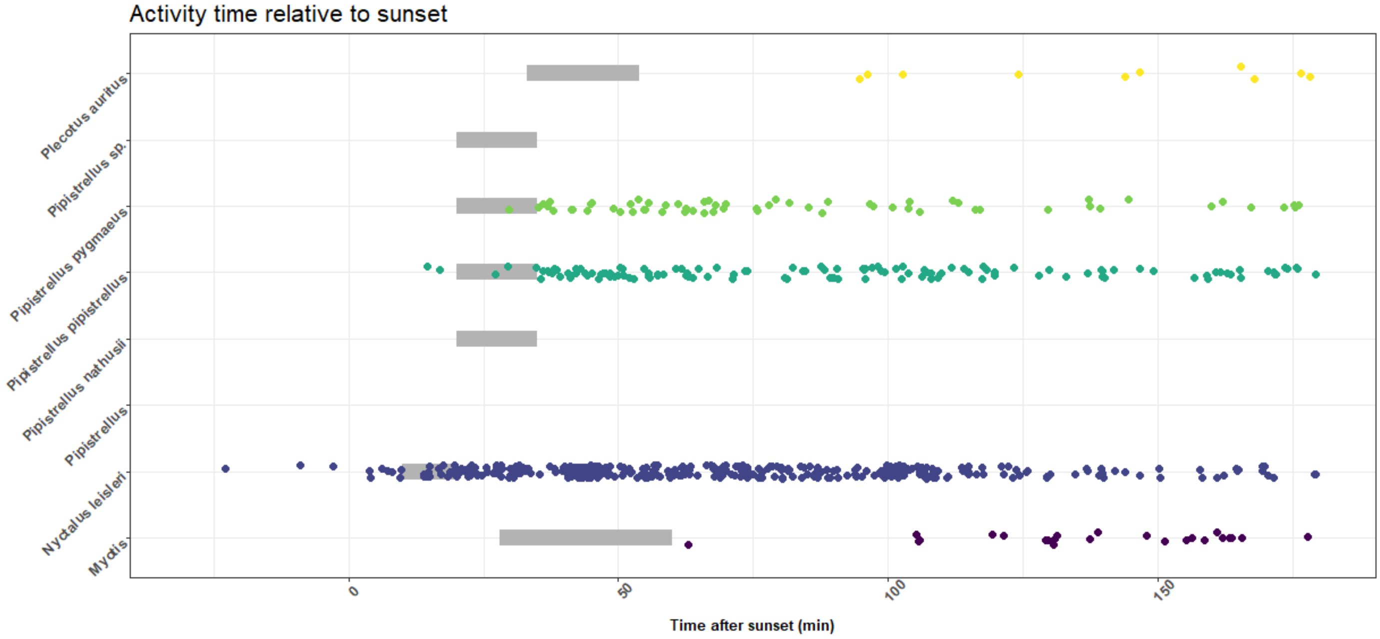


Plate 160 – **Detector 1 (D.01) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

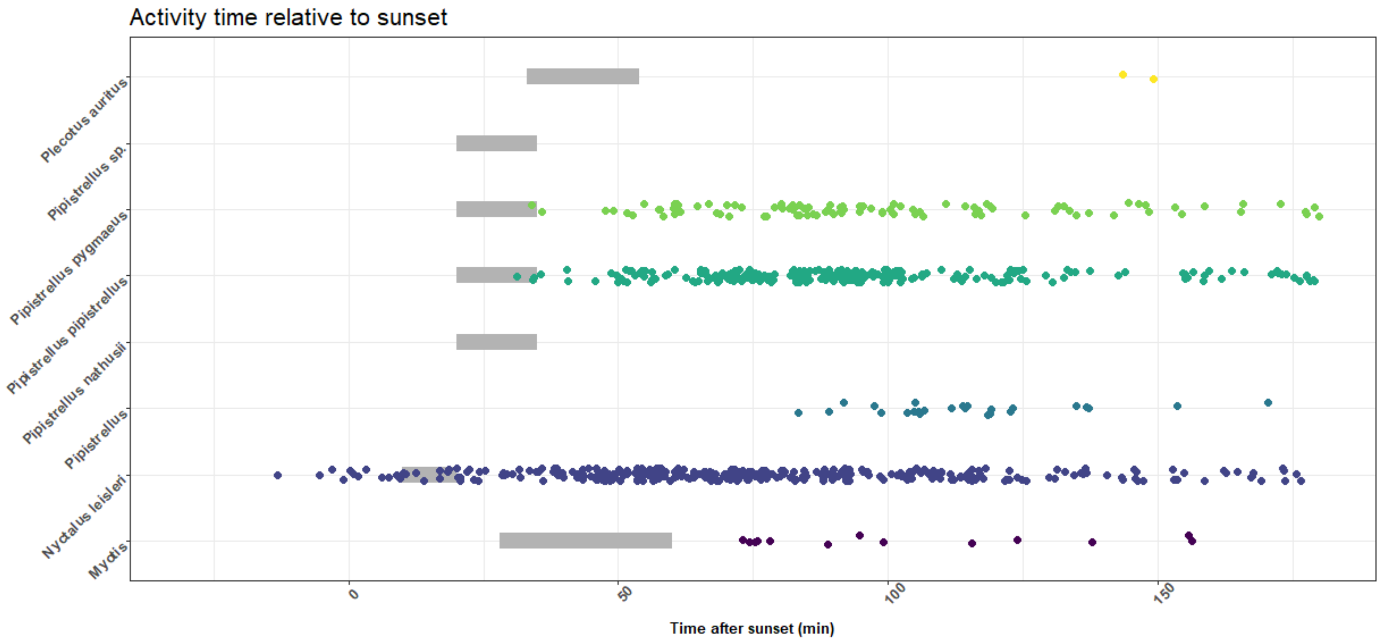


Plate 161 – **Detector 2 (D.02) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

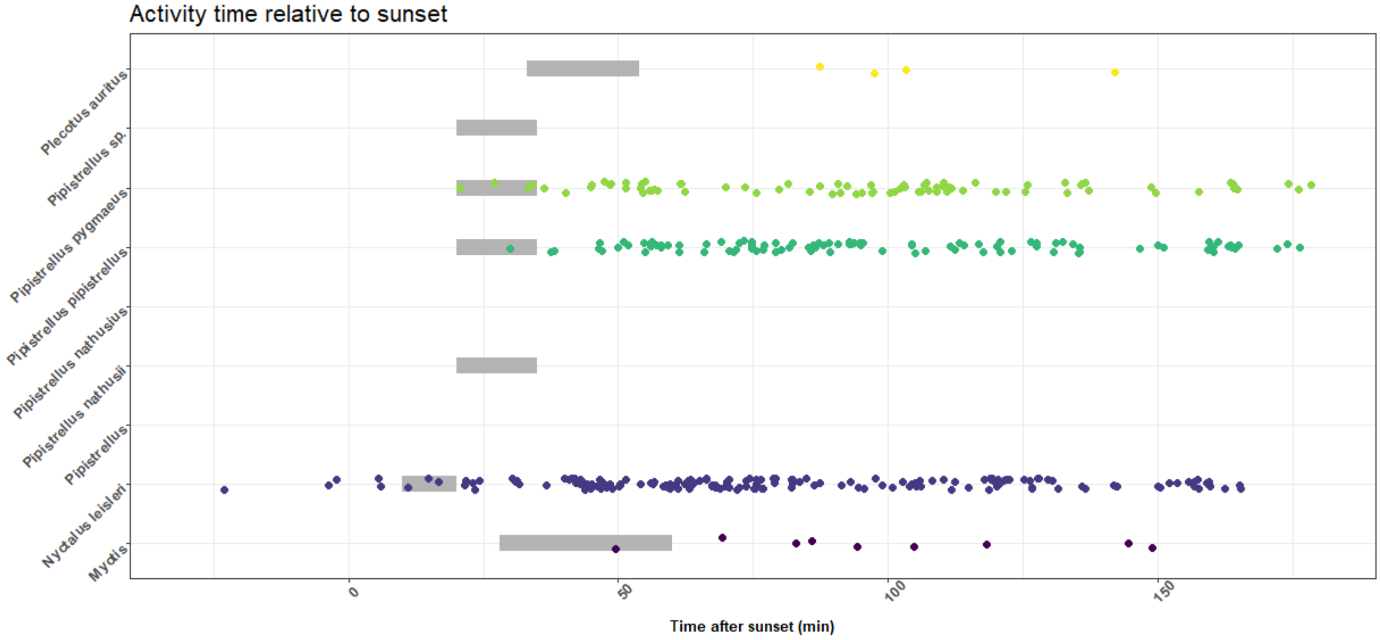


Plate 1622 – **Detector 3 (D.03) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

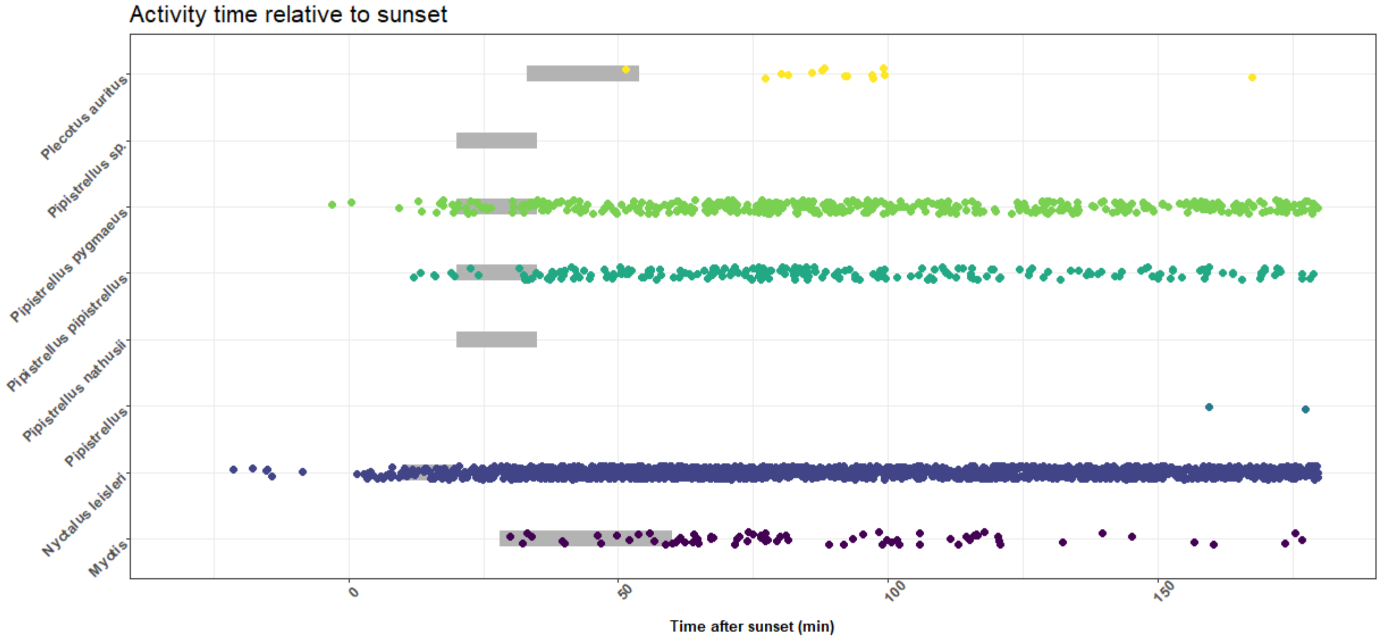


Plate 163 – **Detector 4 (D.04) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

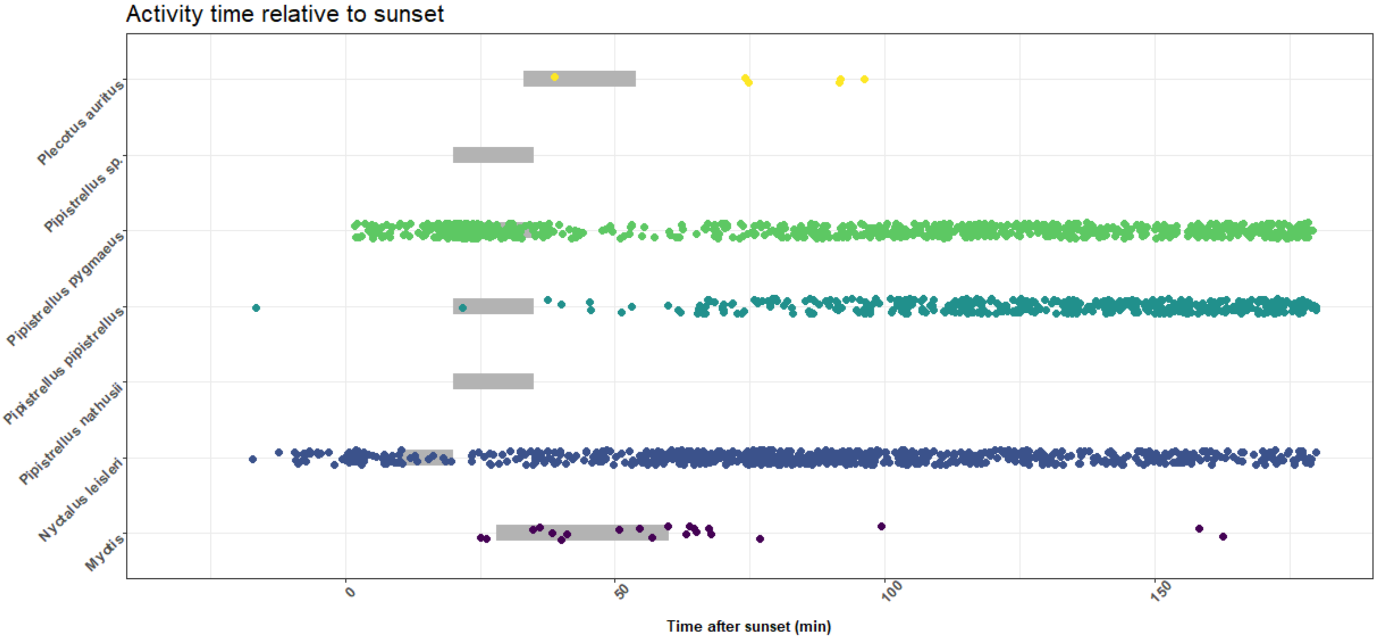


Plate 1643 – **Detector 5 (D.05) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

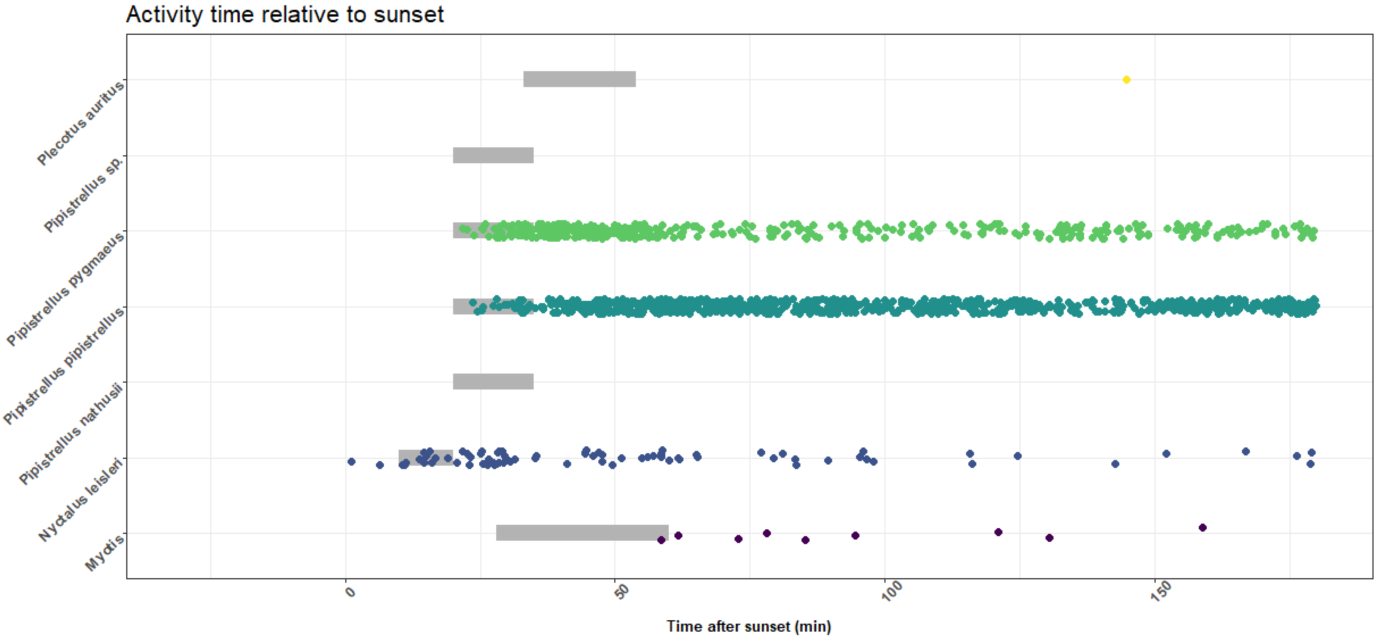


Plate 165 – **Detector 6 (D.06) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

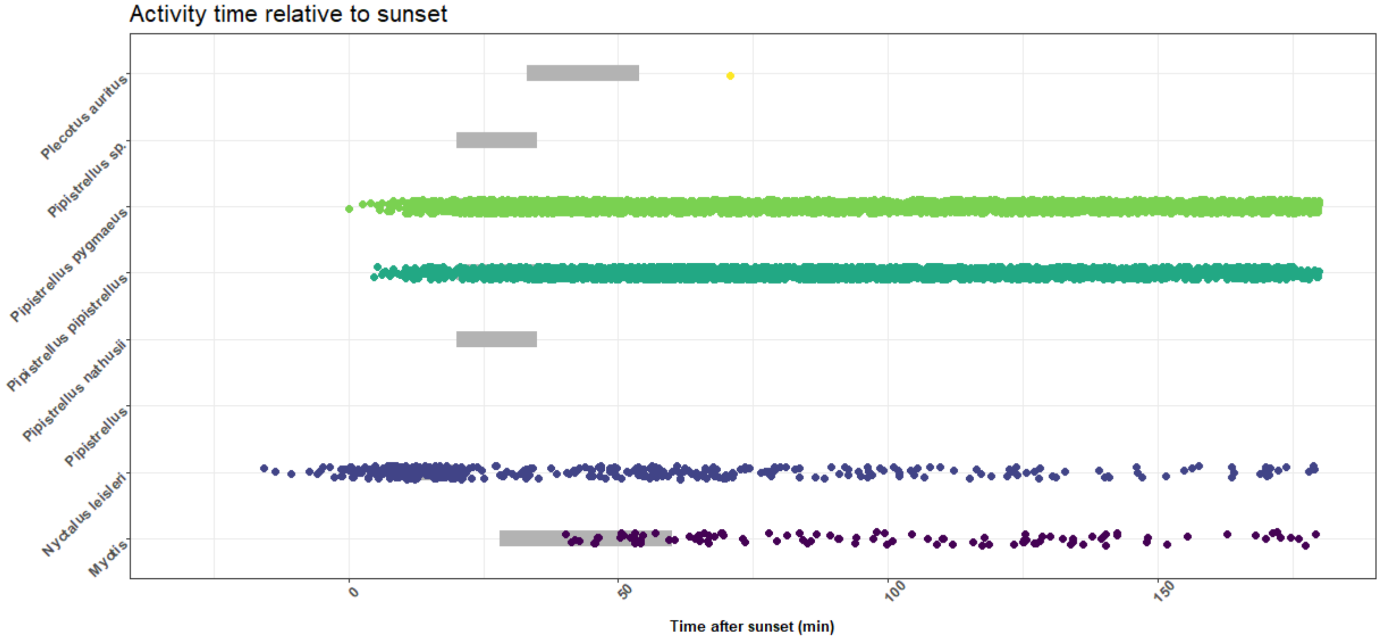


Plate 1664 – **Detector 7 (D.07) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

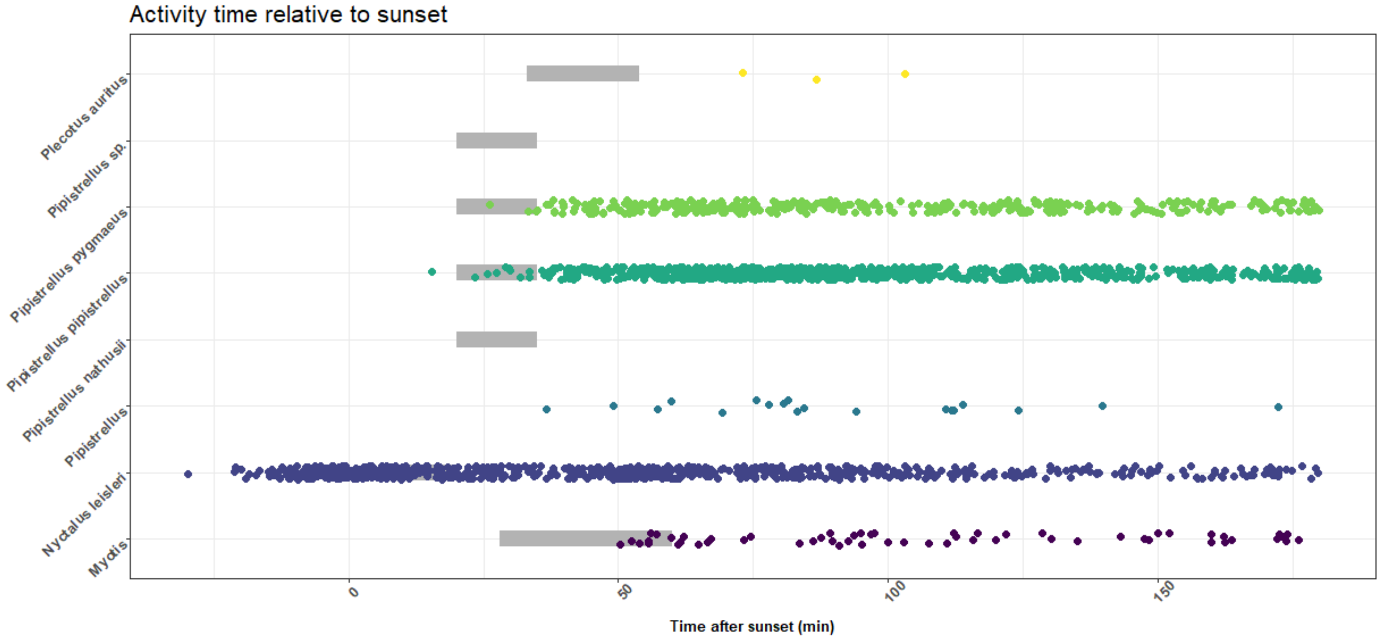


Plate 167 – **Detector 8 (D.08) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

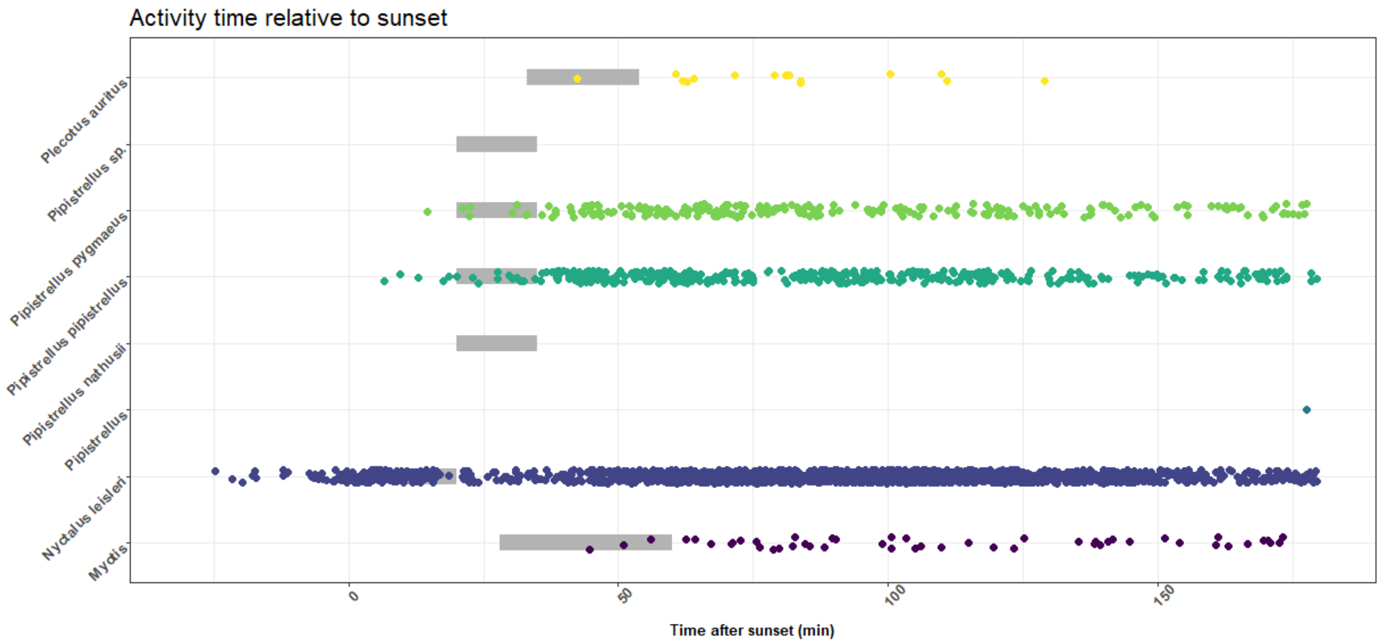


Plate 1685 - **Detector 9 (D.09) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

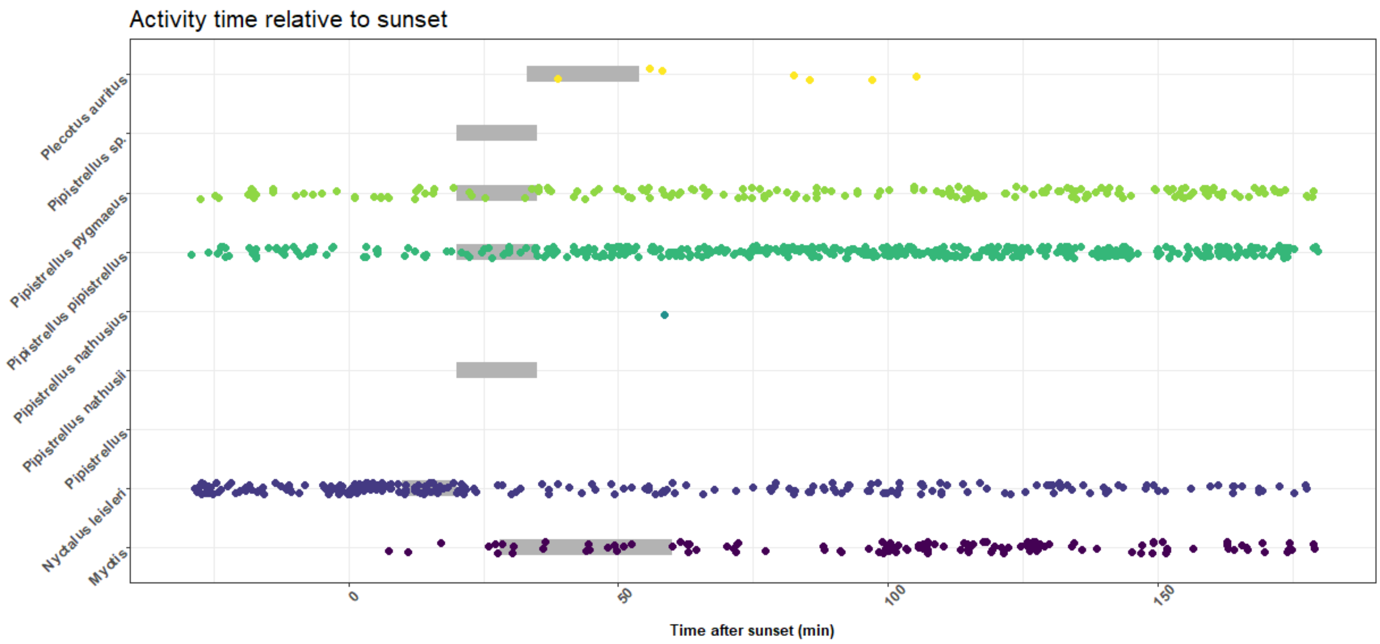


Plate 169 – **Detector 10 (D.10) activity patterns by species relative to sunset. Gray boxes indicate literature-documented activity times, while coloured boxes denote observed activity during the survey.**

APPENDIX 5: MAPS SHOWING BAT PASSES PER HOUR

Figure A5.1: *Myotis* species - maps showing bat passes per hour

Figure A5.2: Leisler's bats - maps showing bat passes per hour

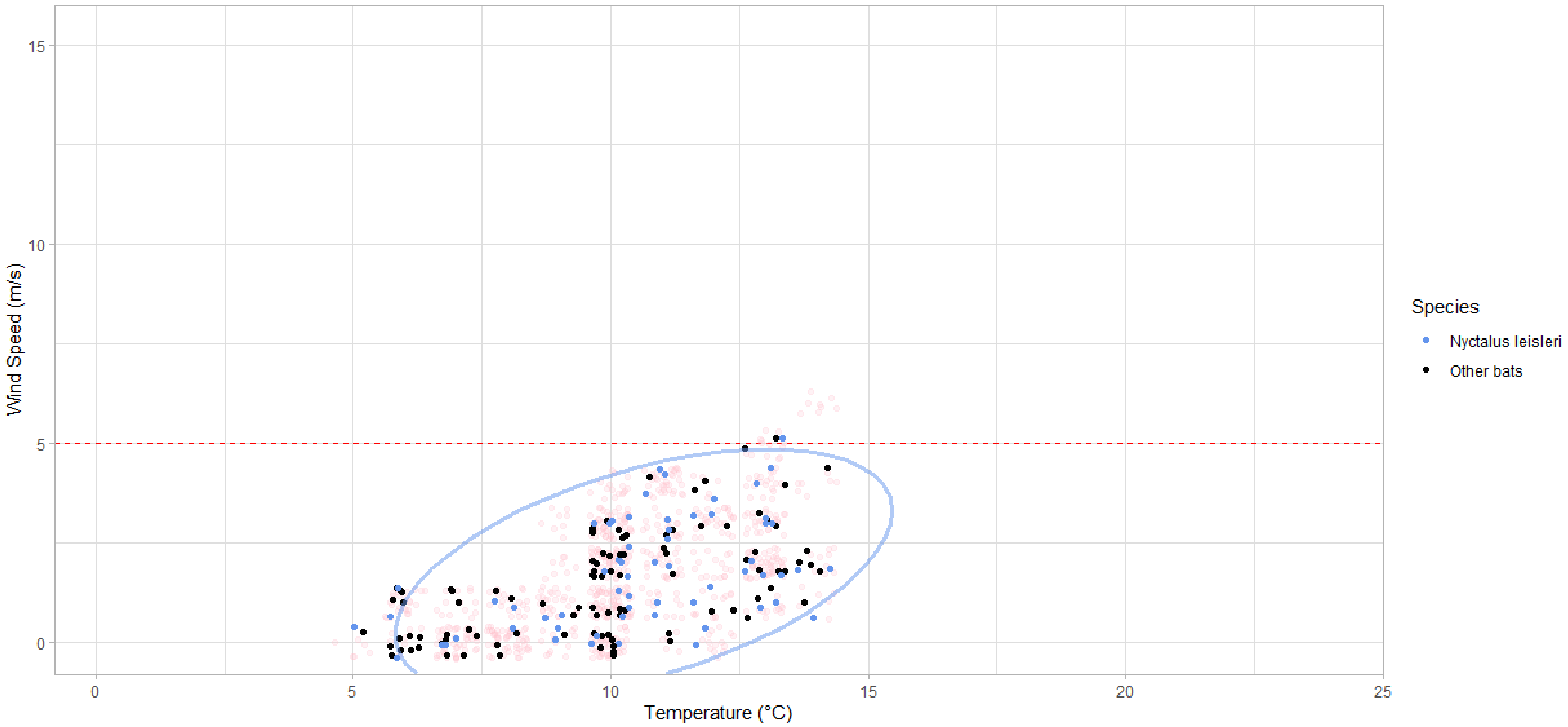
Figure A5.3: Common pipistrelle - maps showing bat passes per hour

Figure A5 3: Soprano pipistrelle - maps showing bat passes per hour

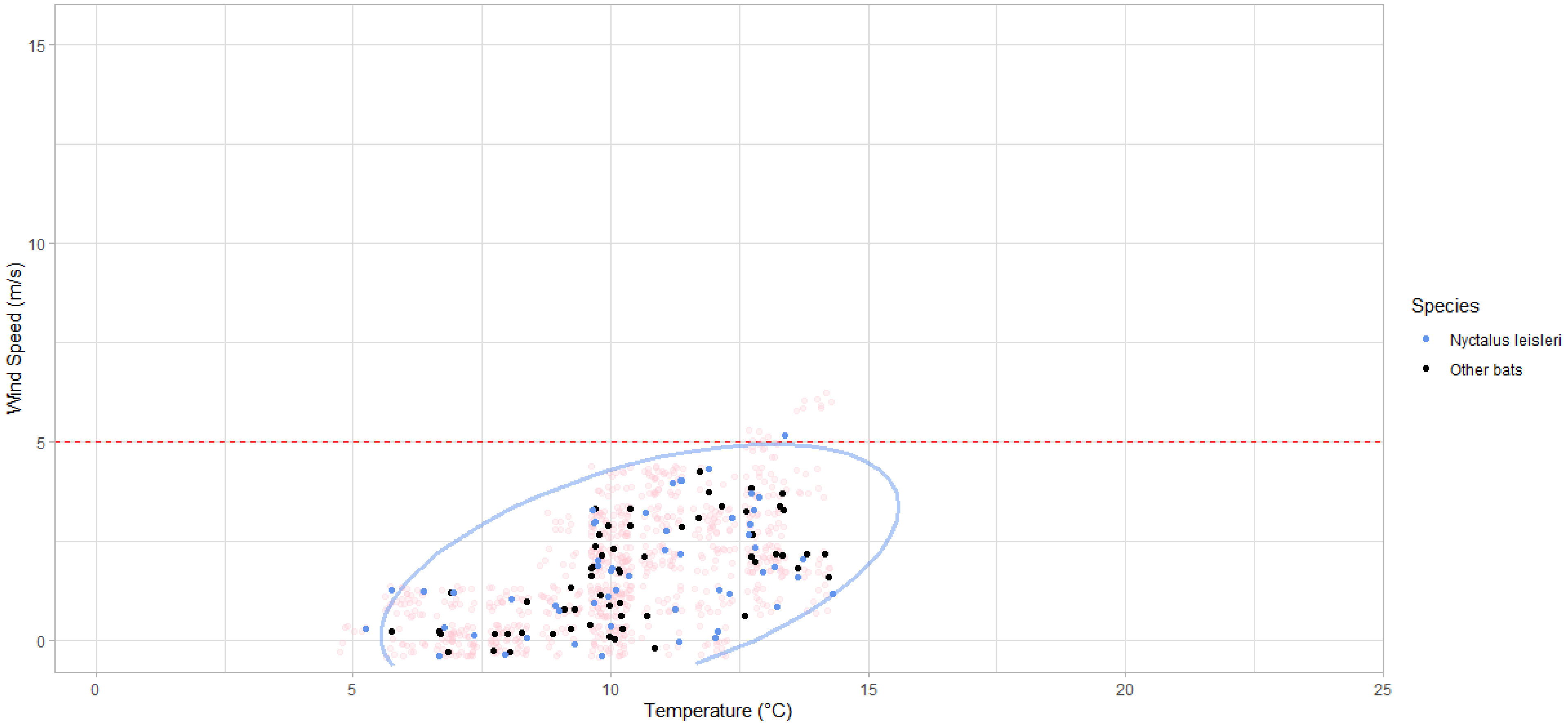
Figure A5.4: Brown long-eared bat - maps showing bat passes per hour

APPENDIX 6: WEATHER DATA SHOWING 95% INTERVAL ELLIPSE OF BP/H BY WIND SPEED (M/S) VS TEMPERATURE (°C)

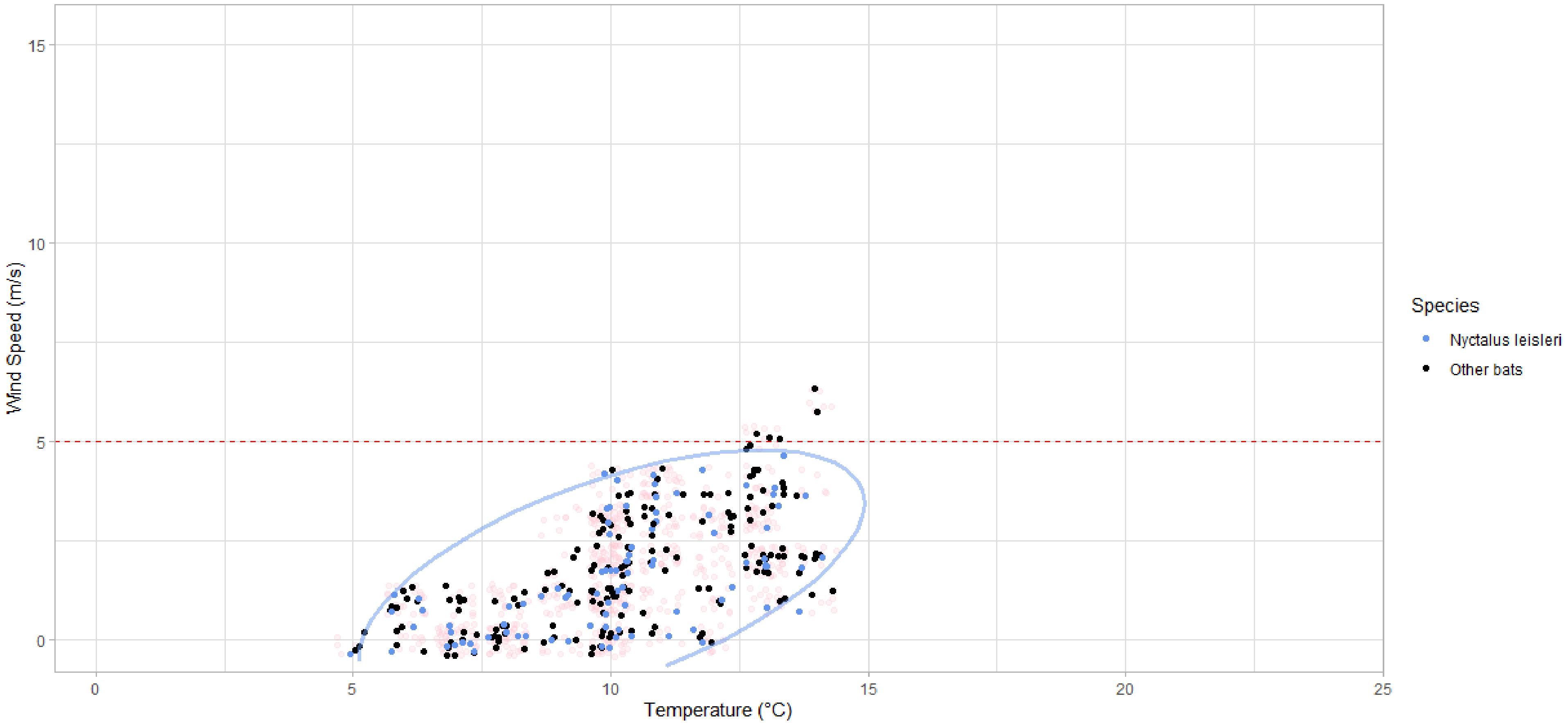
Spring



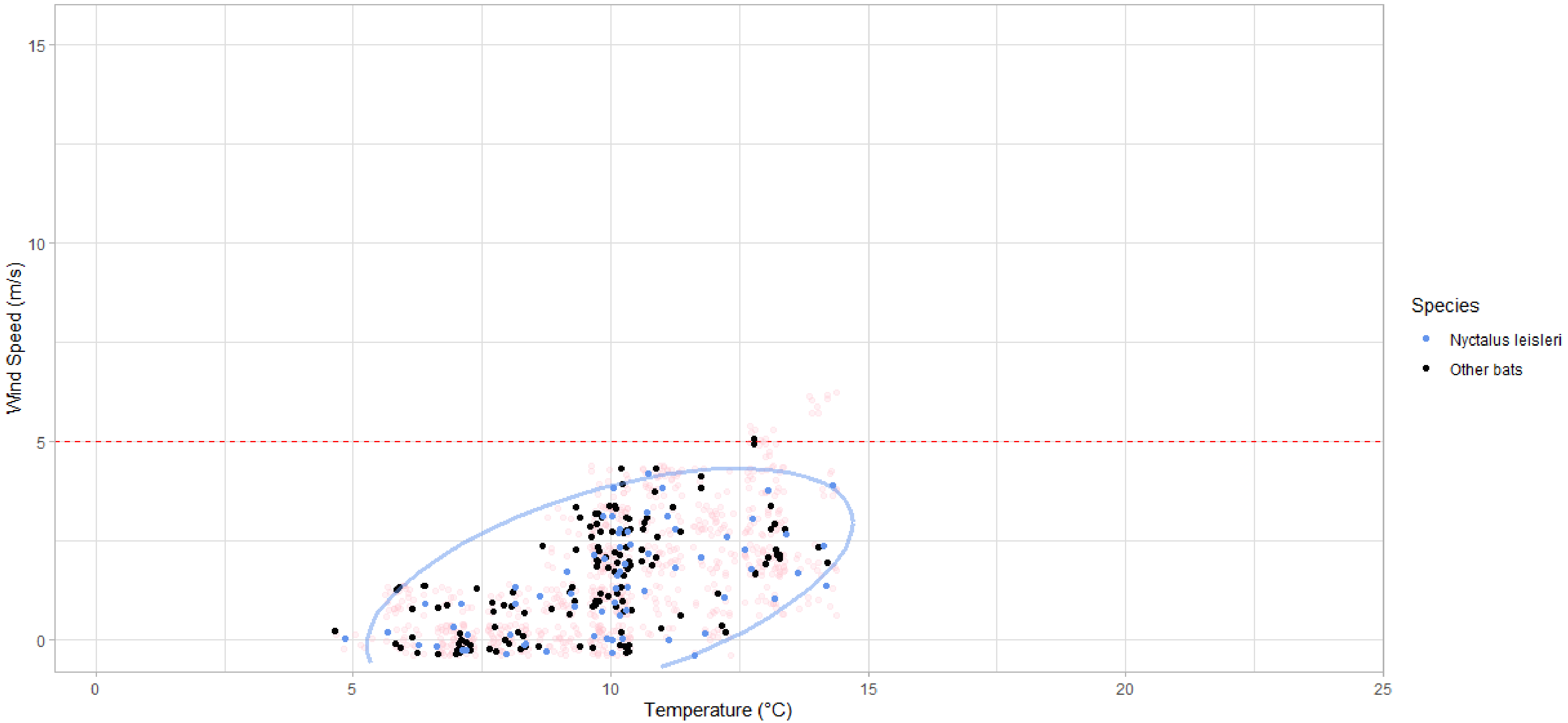
A6.1: Weather data at detector 1 (D.01) vs bat activity



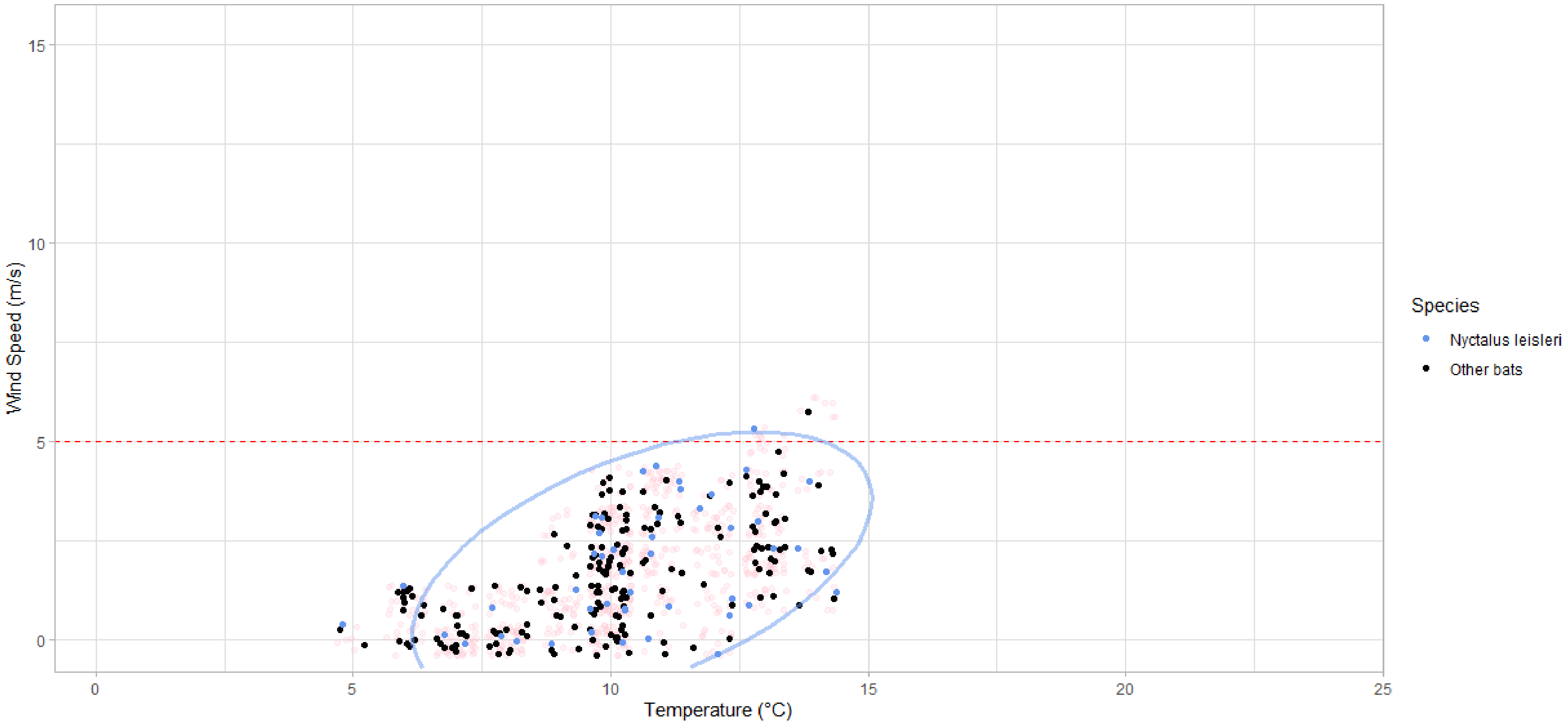
A6.2: Weather data at detector 2 (D.02) vs bat activity



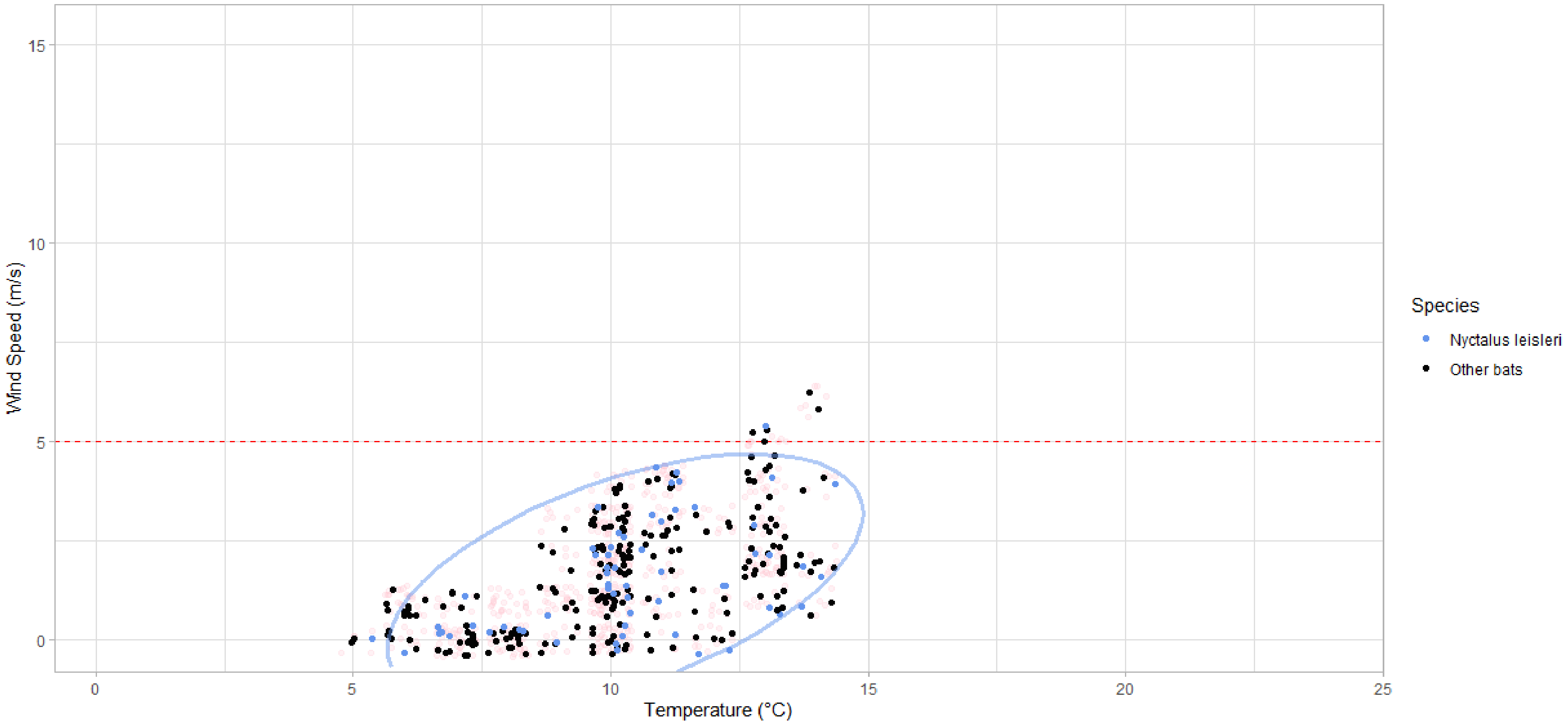
A6.3: Weather data at detector 4 (D.04) vs bat activity



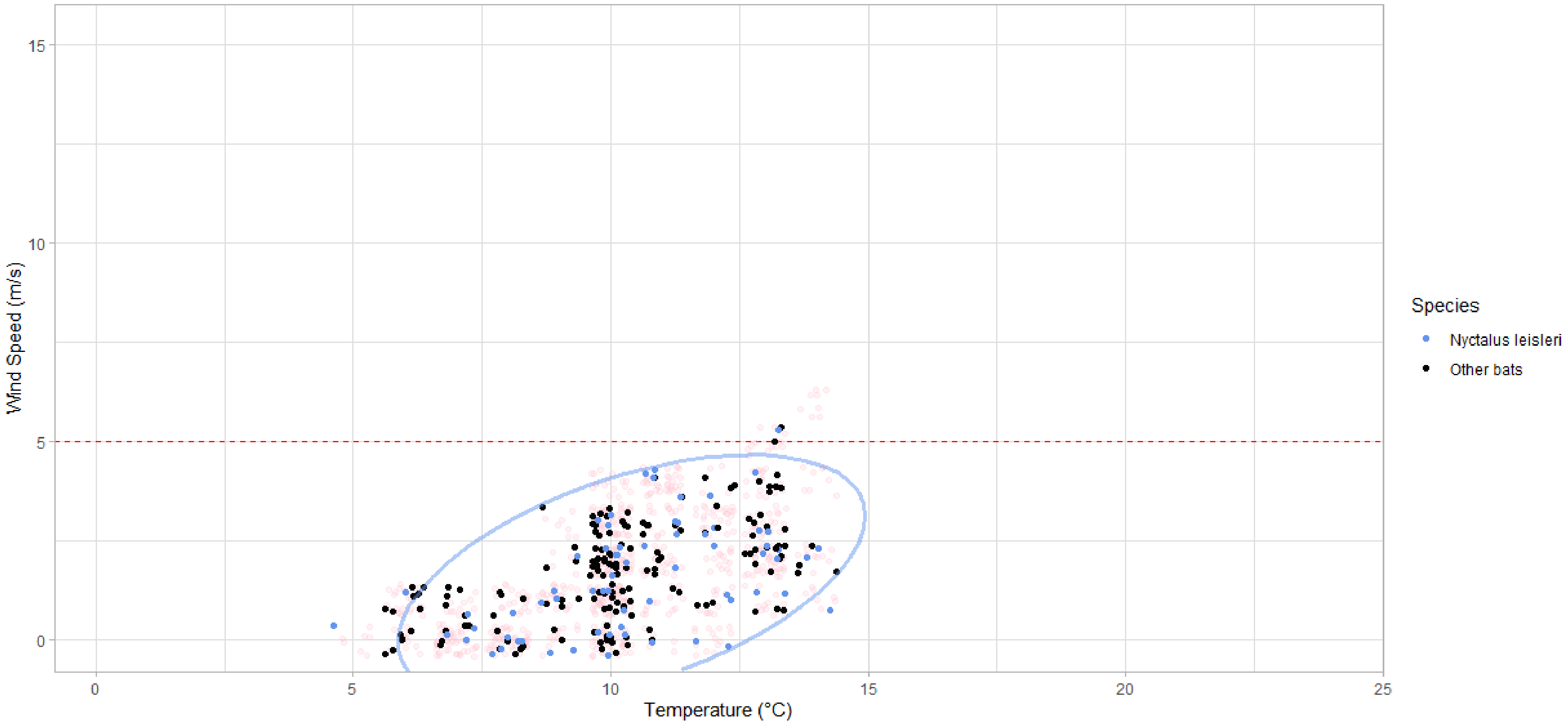
A6.4: Weather data at detector 5 (D.05) vs bat activity



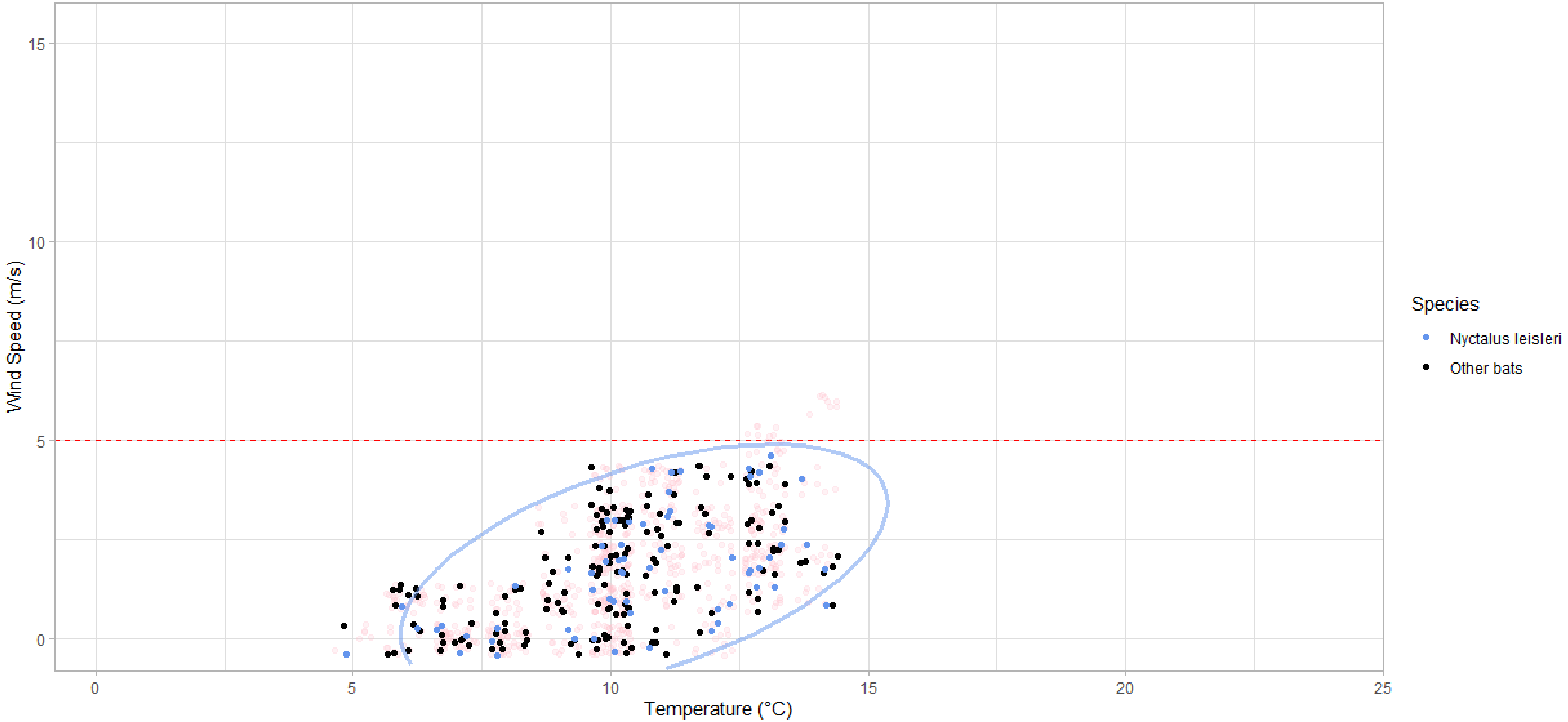
A6.5: Weather data at detector 6 (D.06) vs bat activity



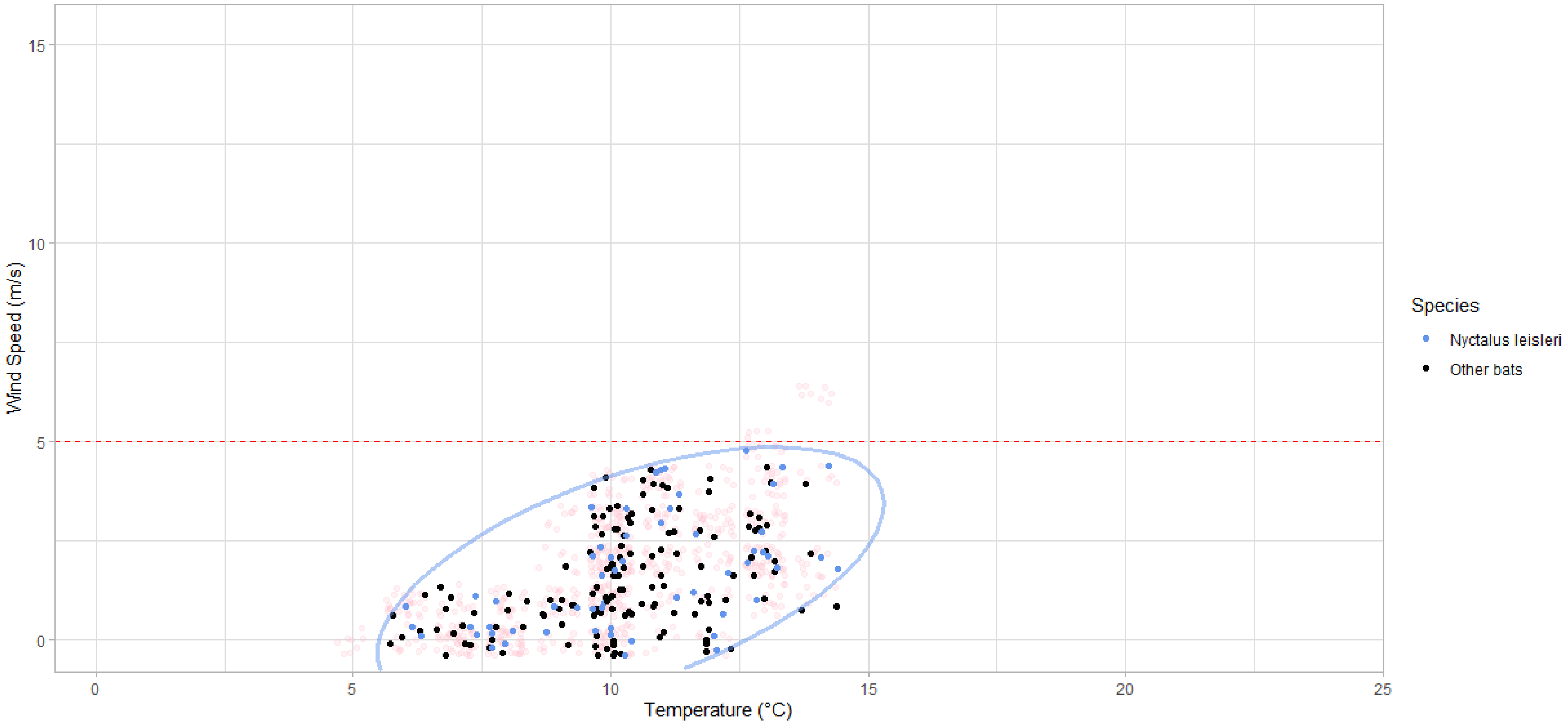
A6.6: Weather data at detector 7 (D.07) vs bat activity



A6.7: Weather data at detector 8 (D.08) vs bat activity

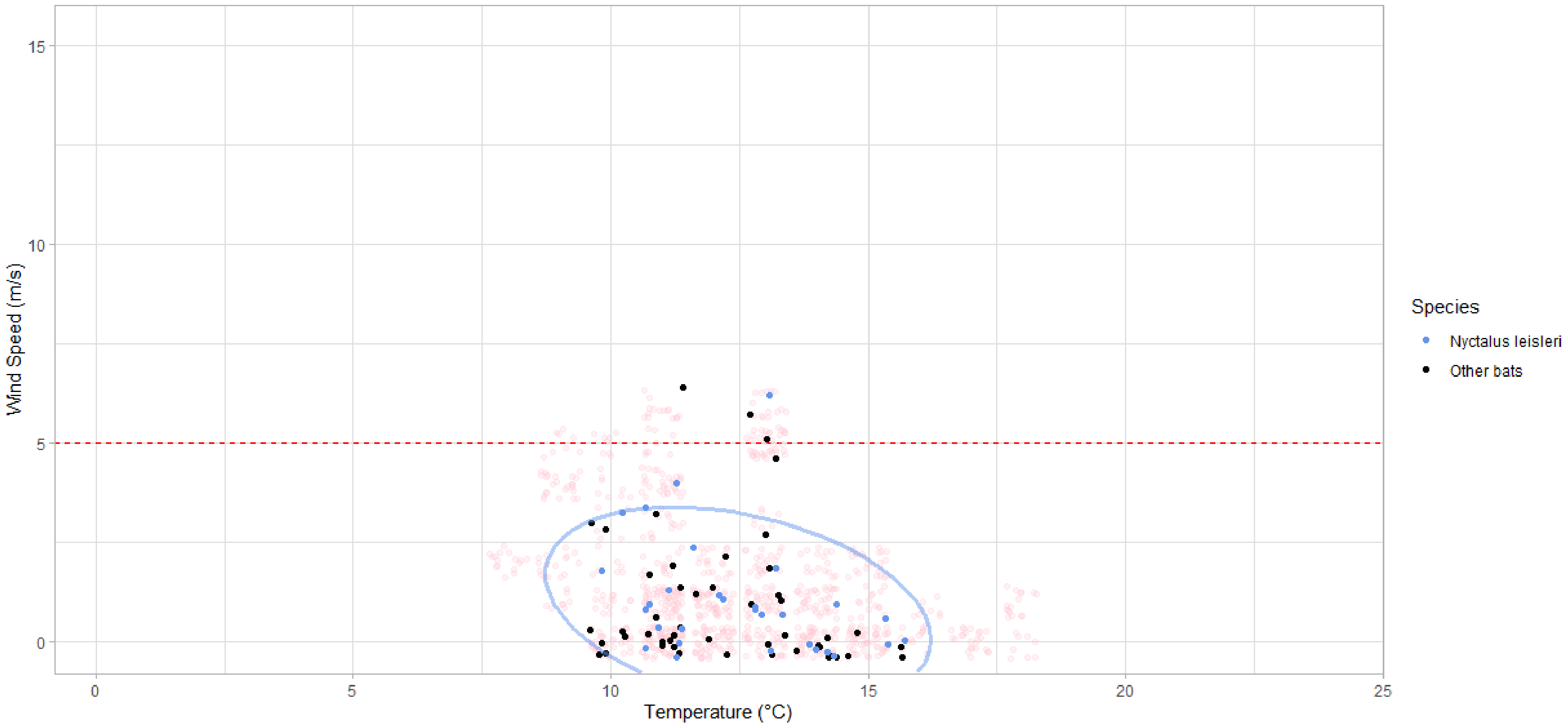


A6.8: Weather data at detector 9 (D.09) vs bat activity

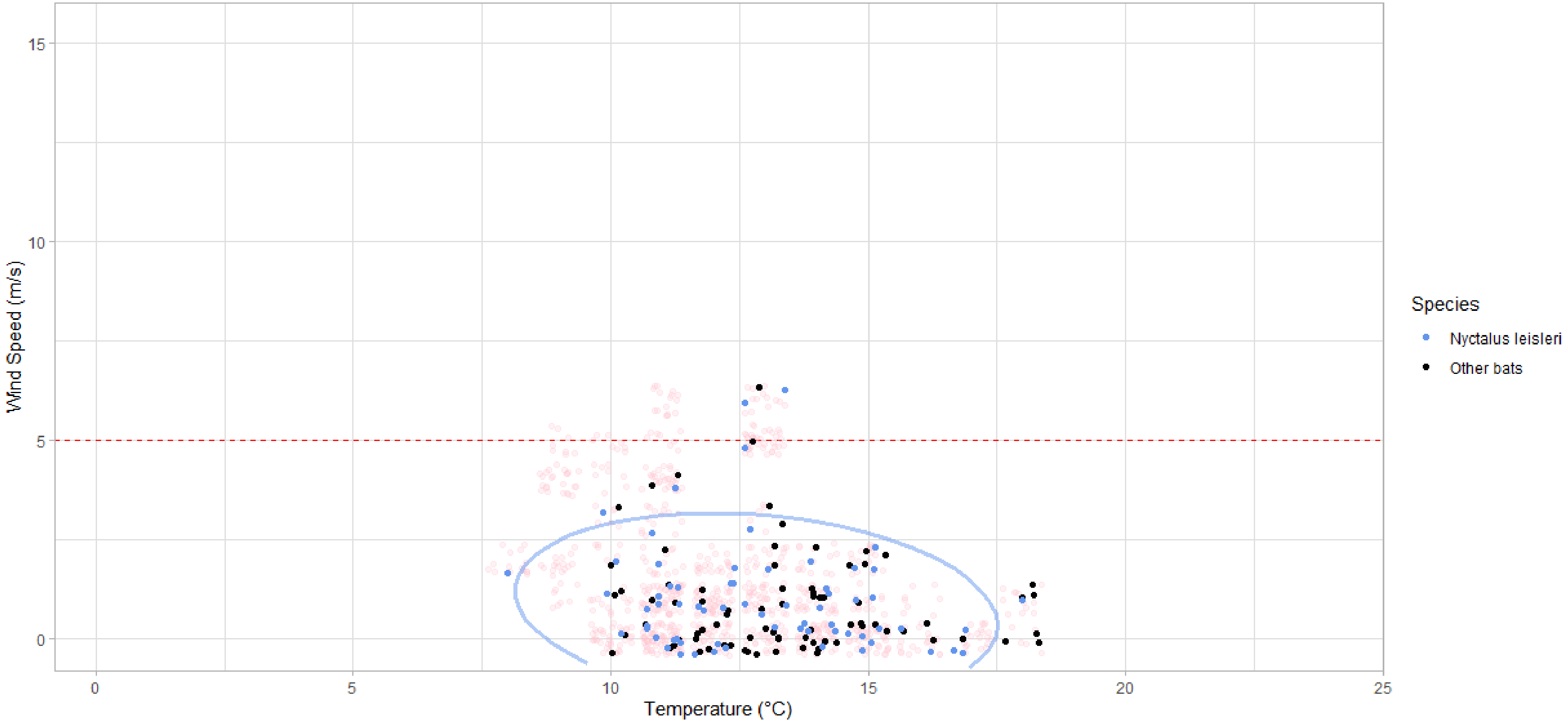


A6.9: Weather data at detector 10 (D.10) vs bat activity

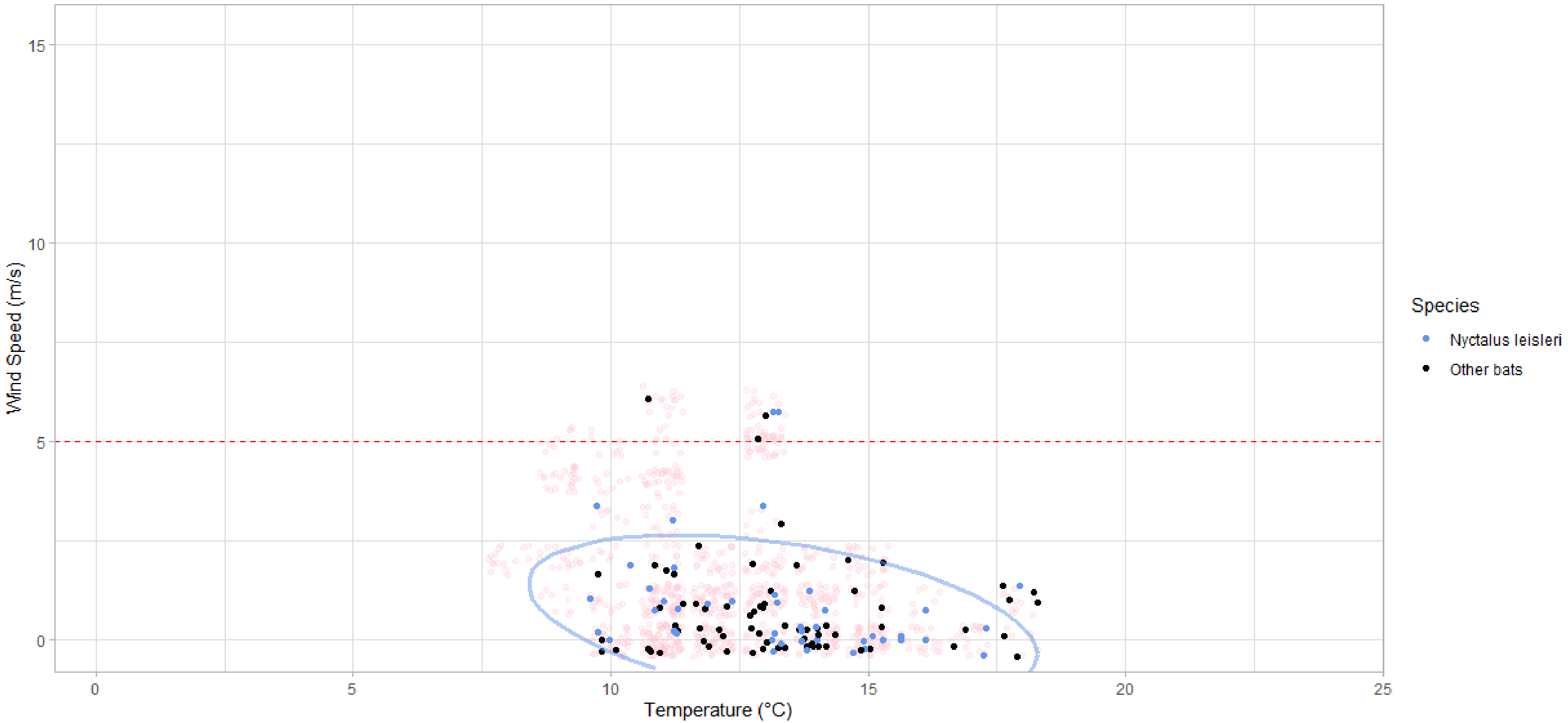
Summer



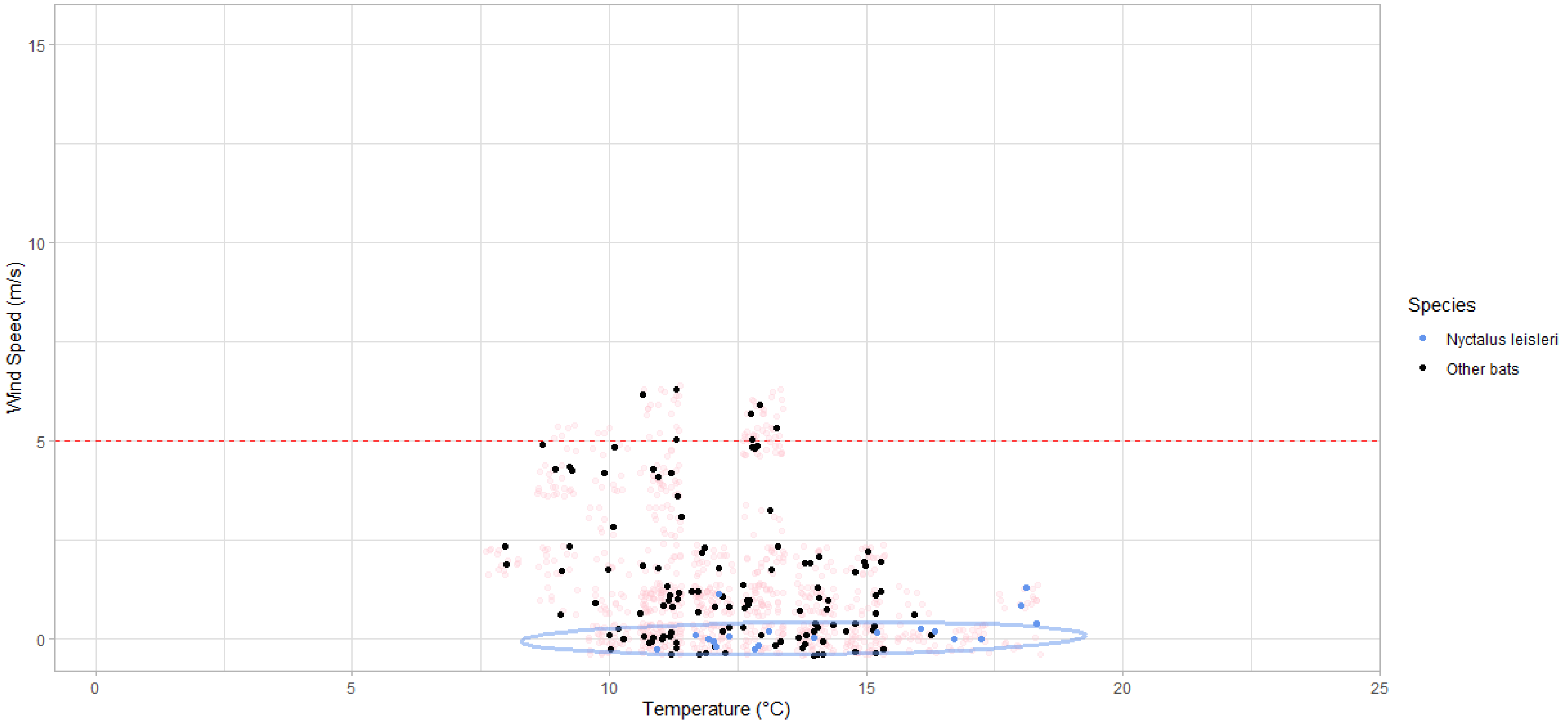
A6.10: Weather data at detector 1 (D.01) vs bat activity



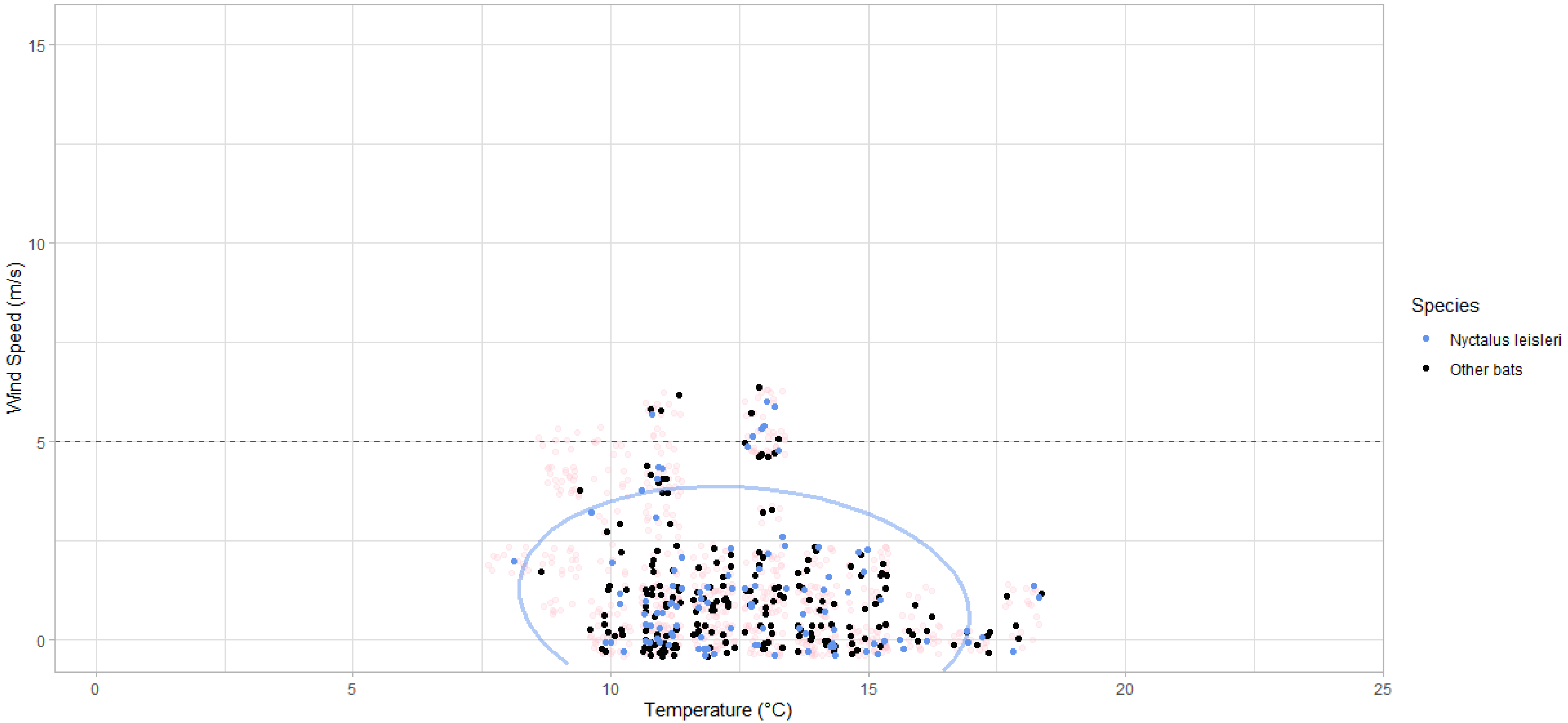
A6.11: Weather data at detector 2 (D.02) vs bat activity



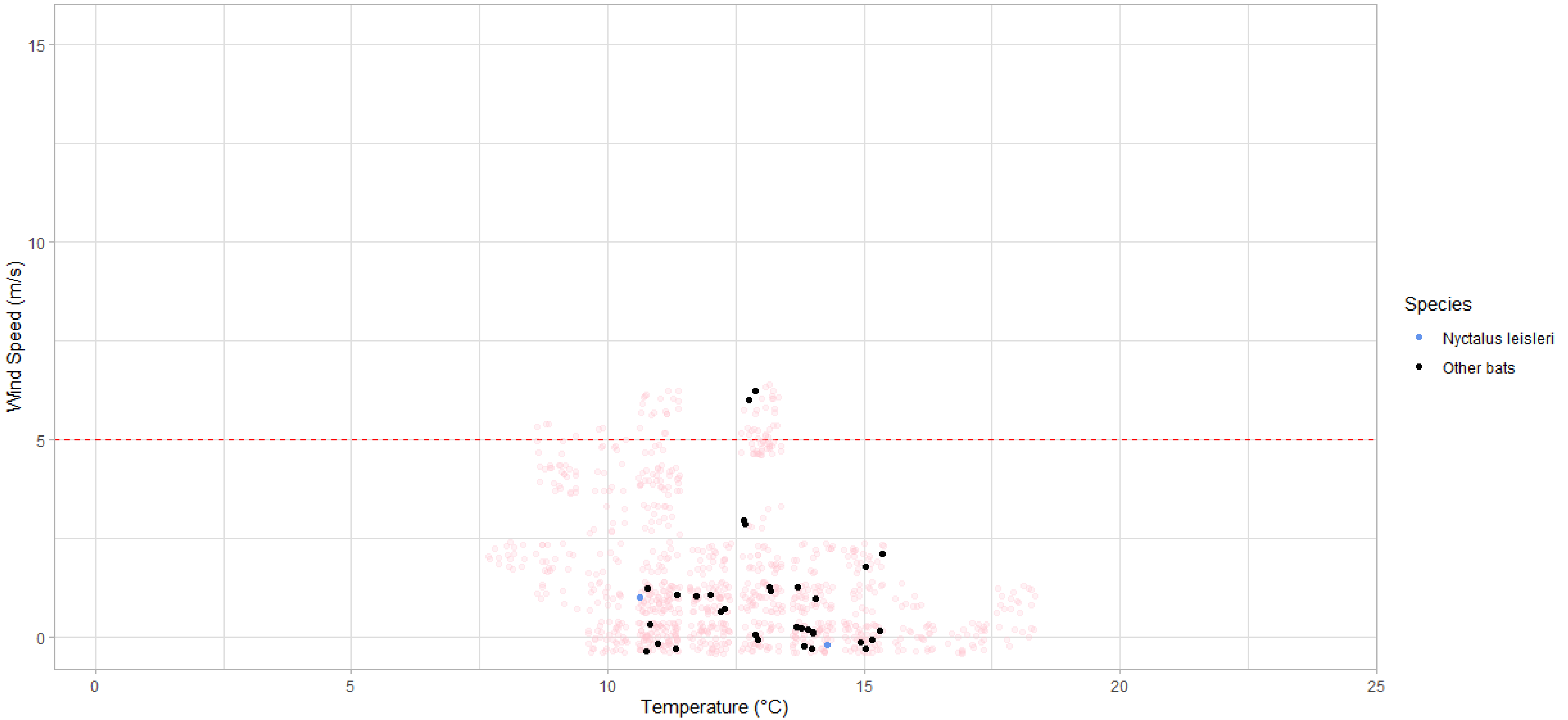
A6.12: Weather data at detector 3 (D.03) vs bat activity



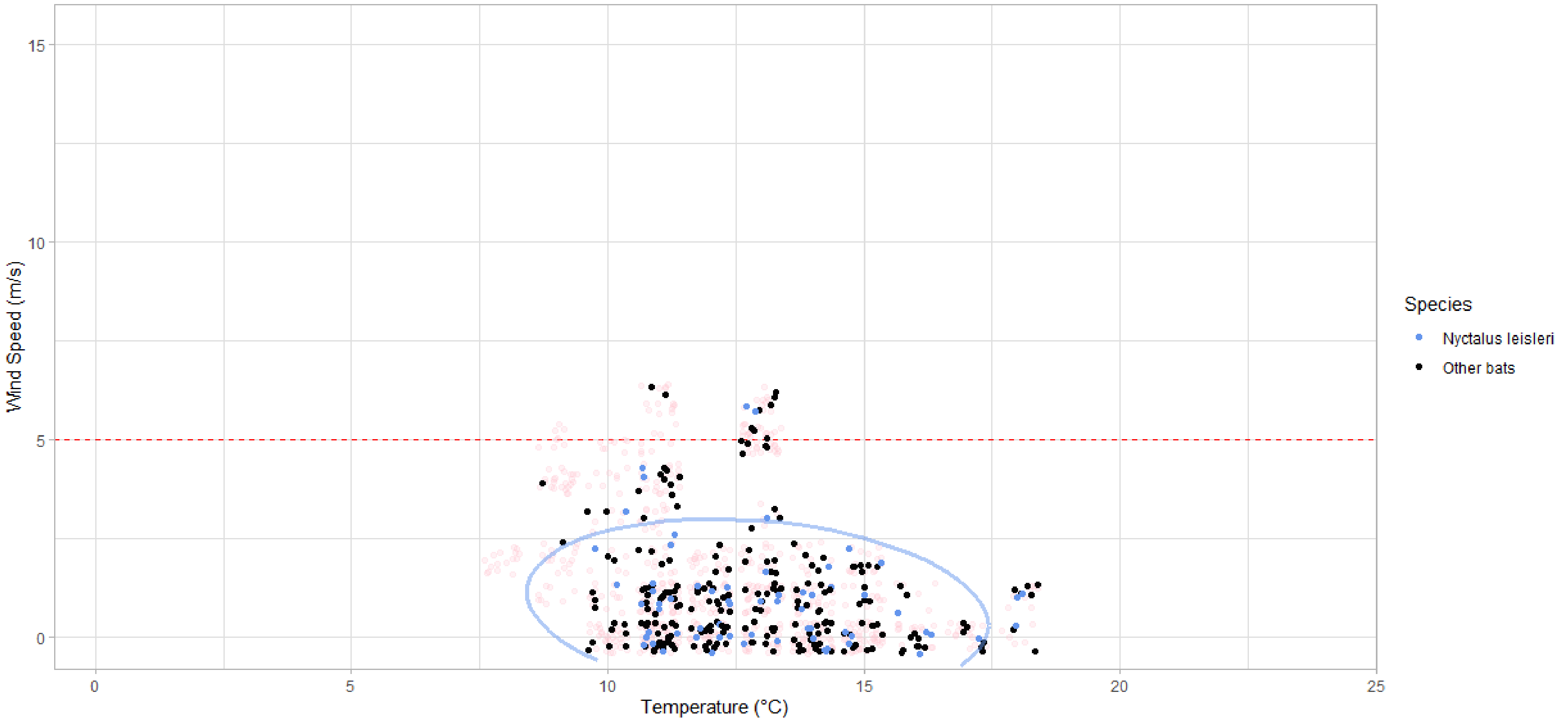
A6.13: Weather data at detector 4 (D.04) vs bat activity



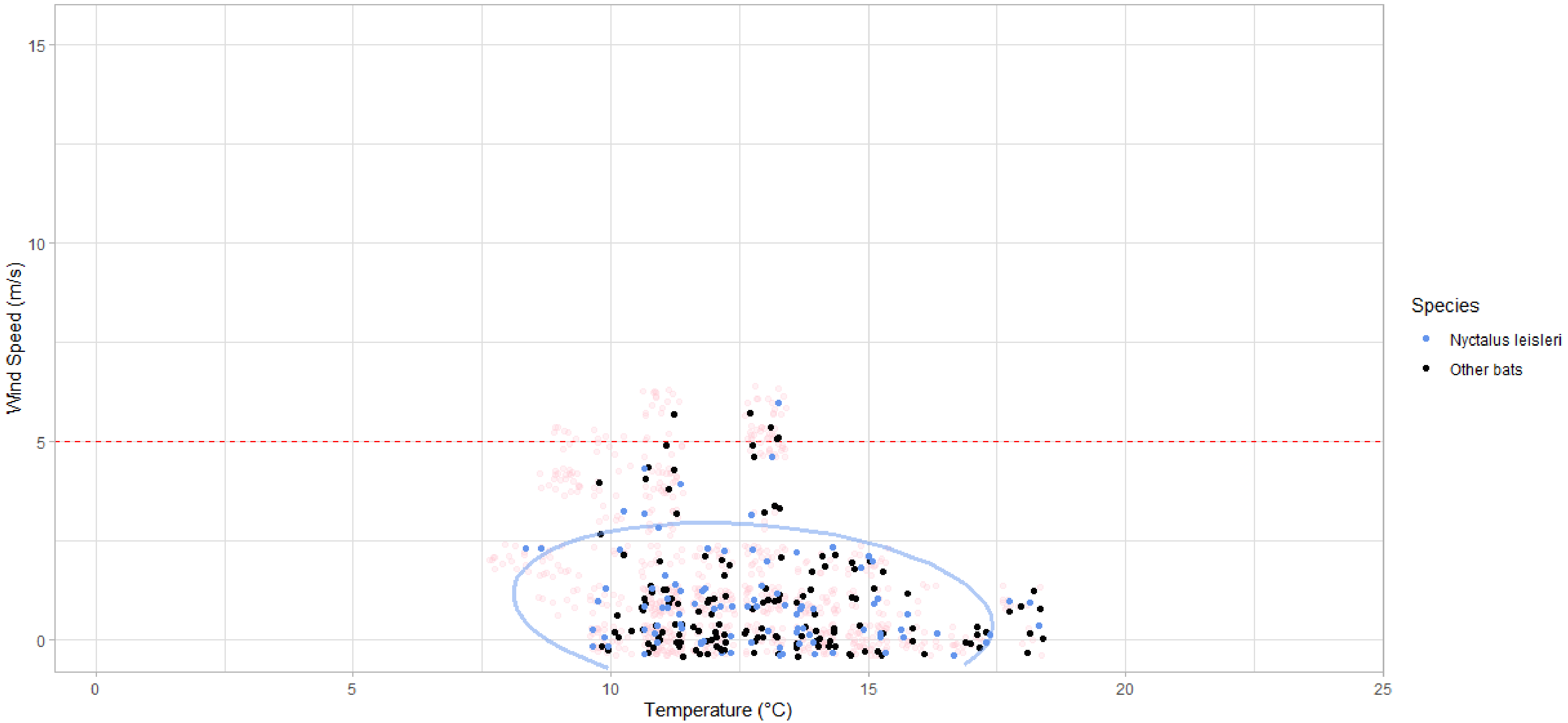
A6.14: Weather data at detector 5 (D.05) vs bat activity



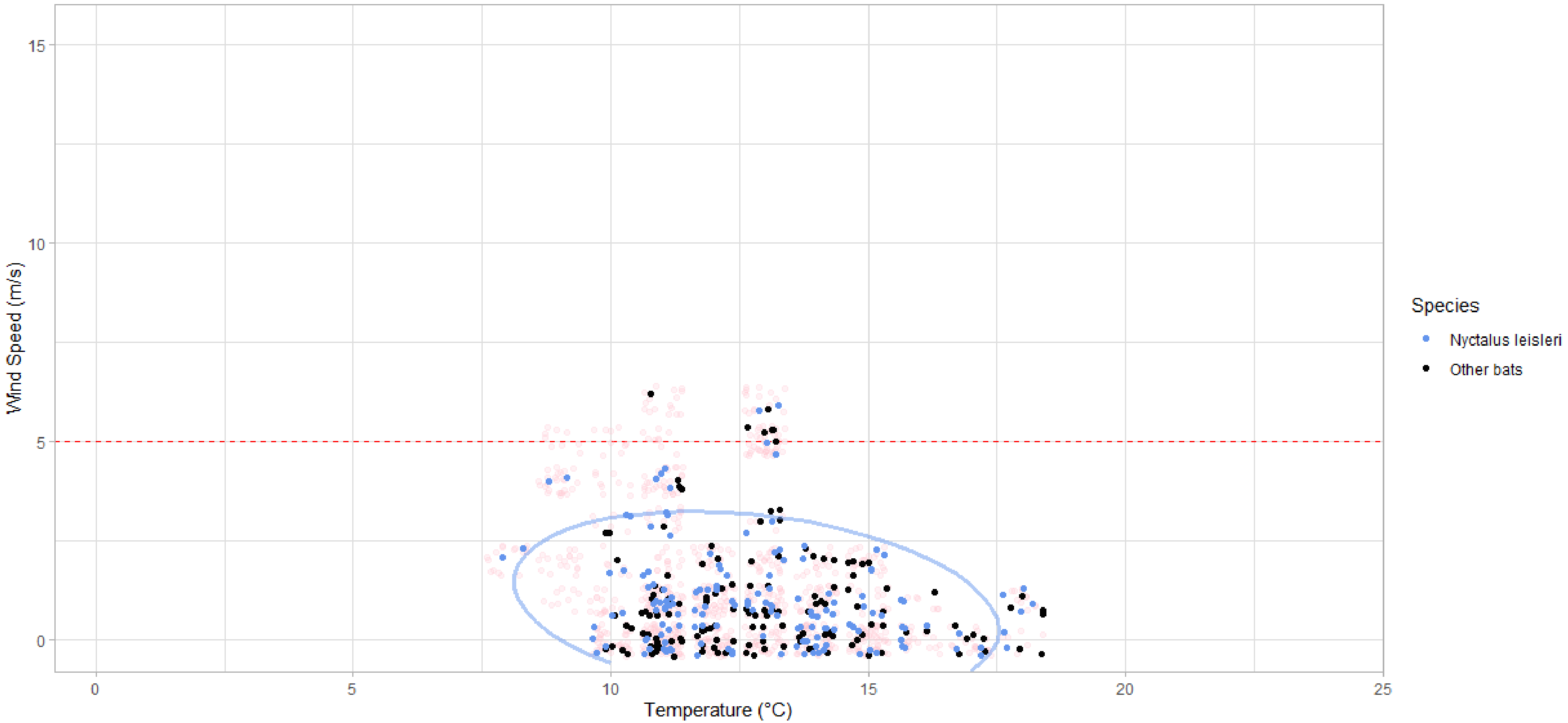
A6.15: Weather data at detector 6 (D.06) vs bat activity



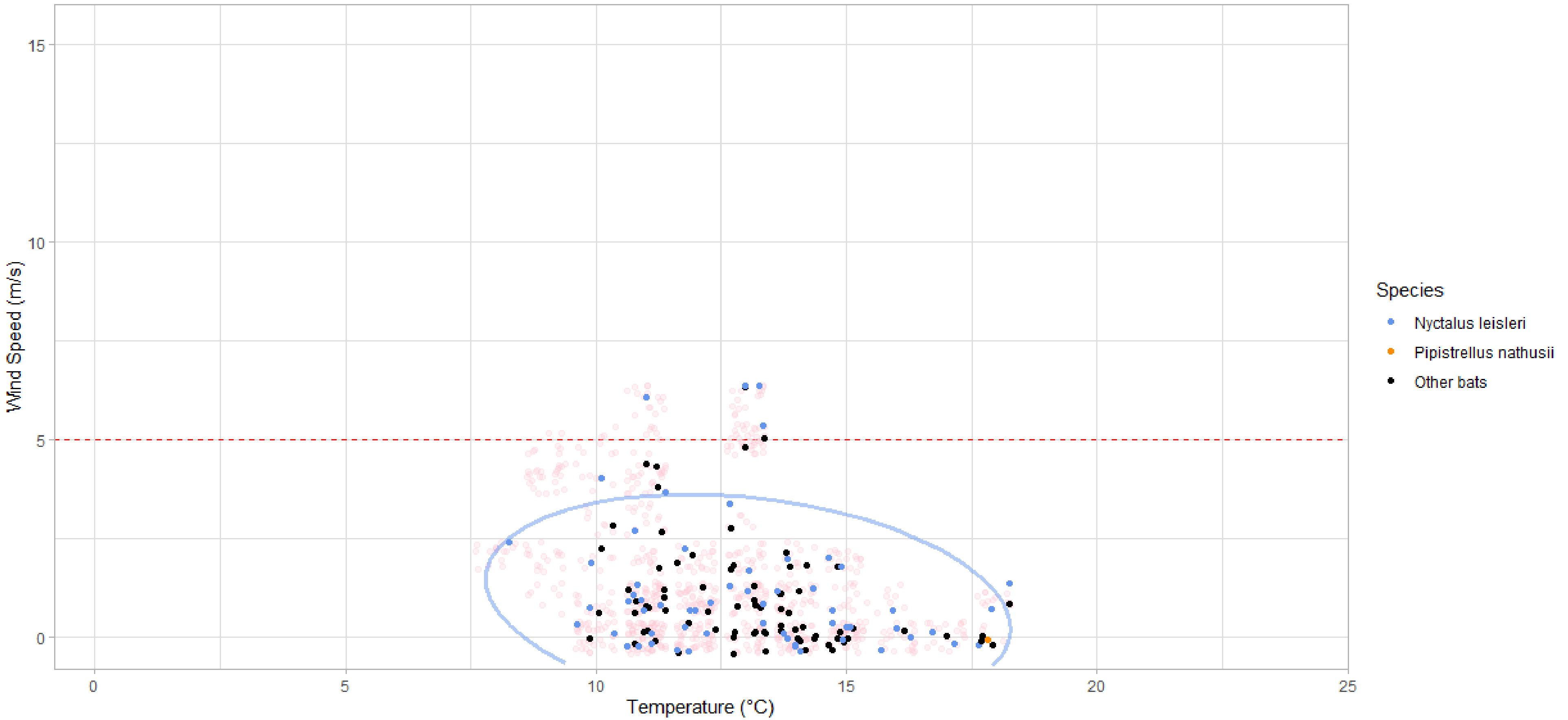
A6.16: Weather data at detector 7 (D.07) vs bat activity



A6.17: Weather data at detector 8 (D.08) vs bat activity

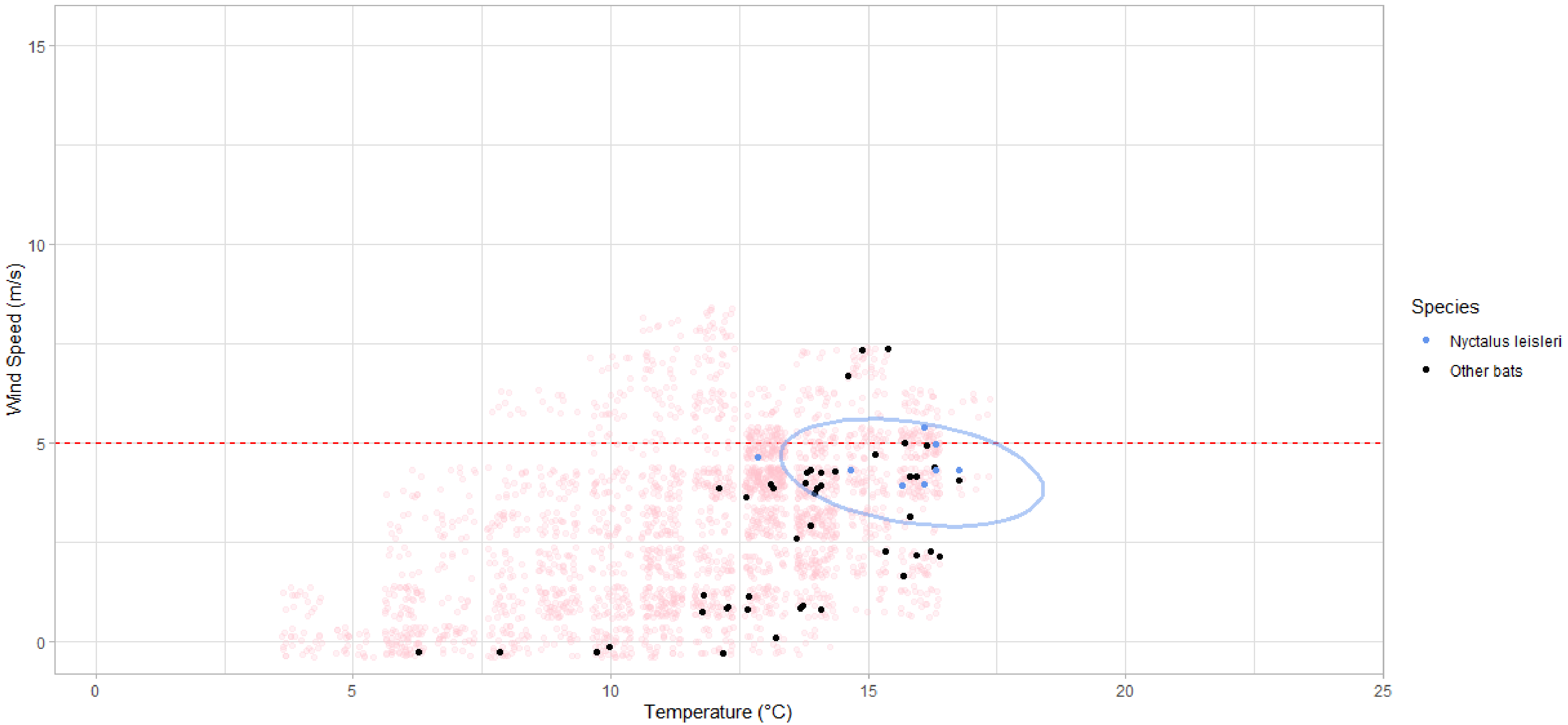


A6.18: Weather data at detector 9 (D.09) vs bat activity

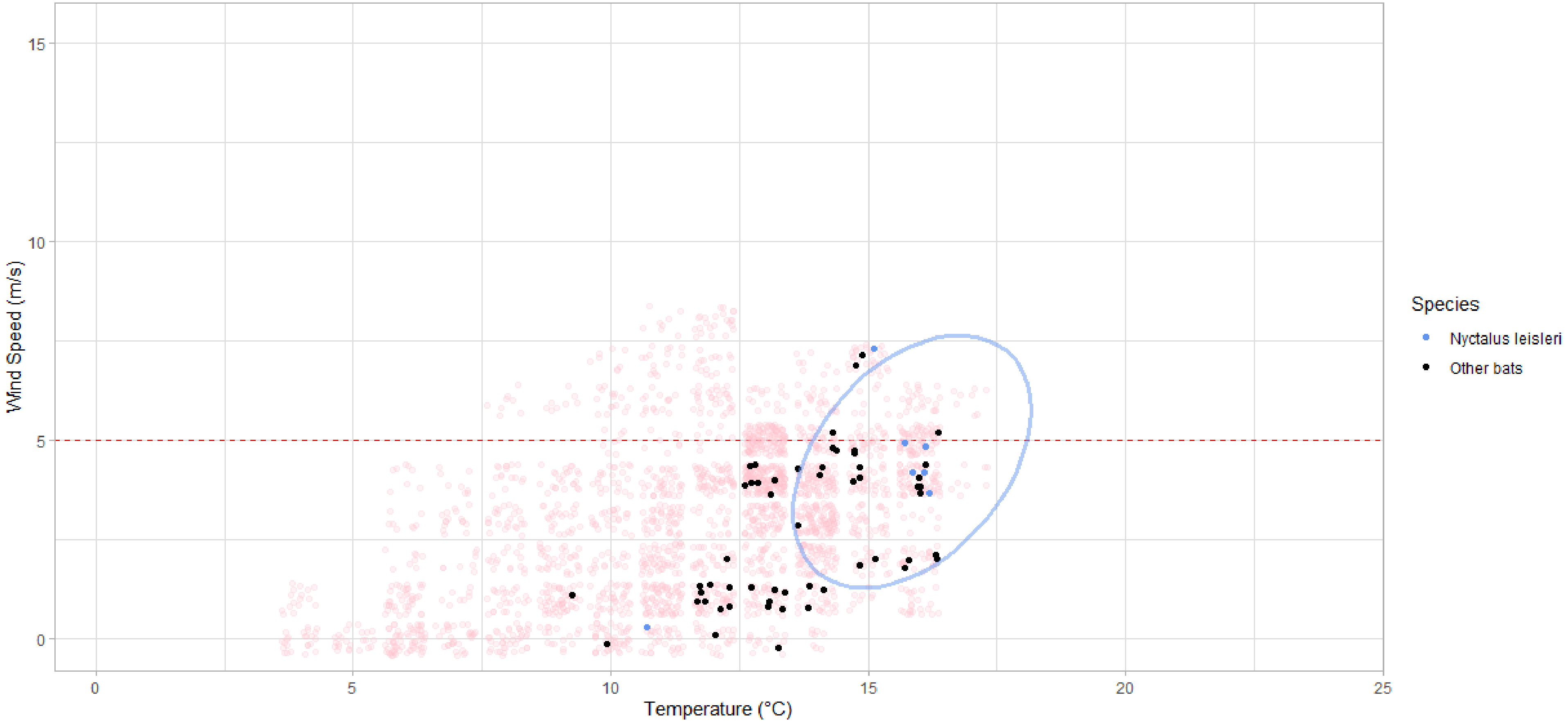


A6.19: Weather data at detector 10 (D.10) vs bat activity

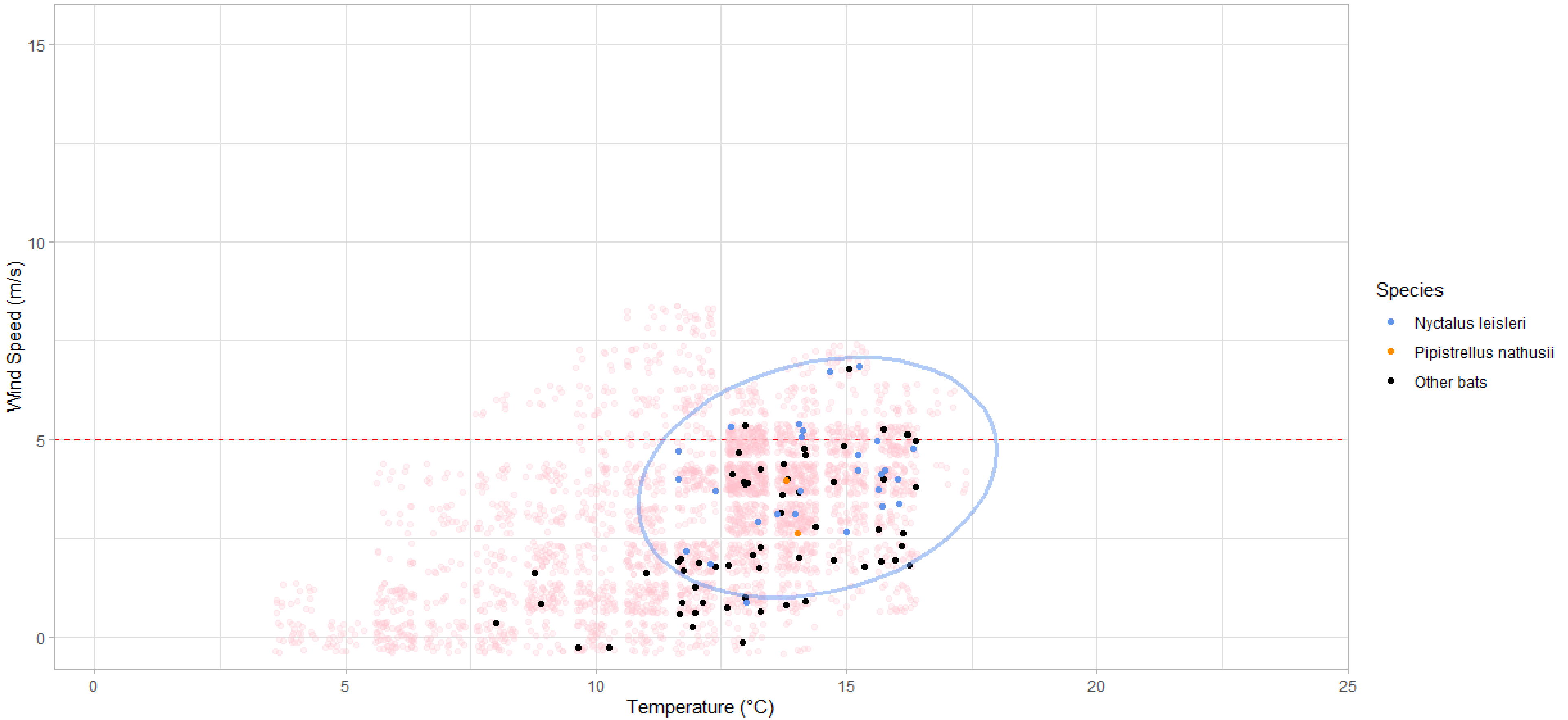
Autumn



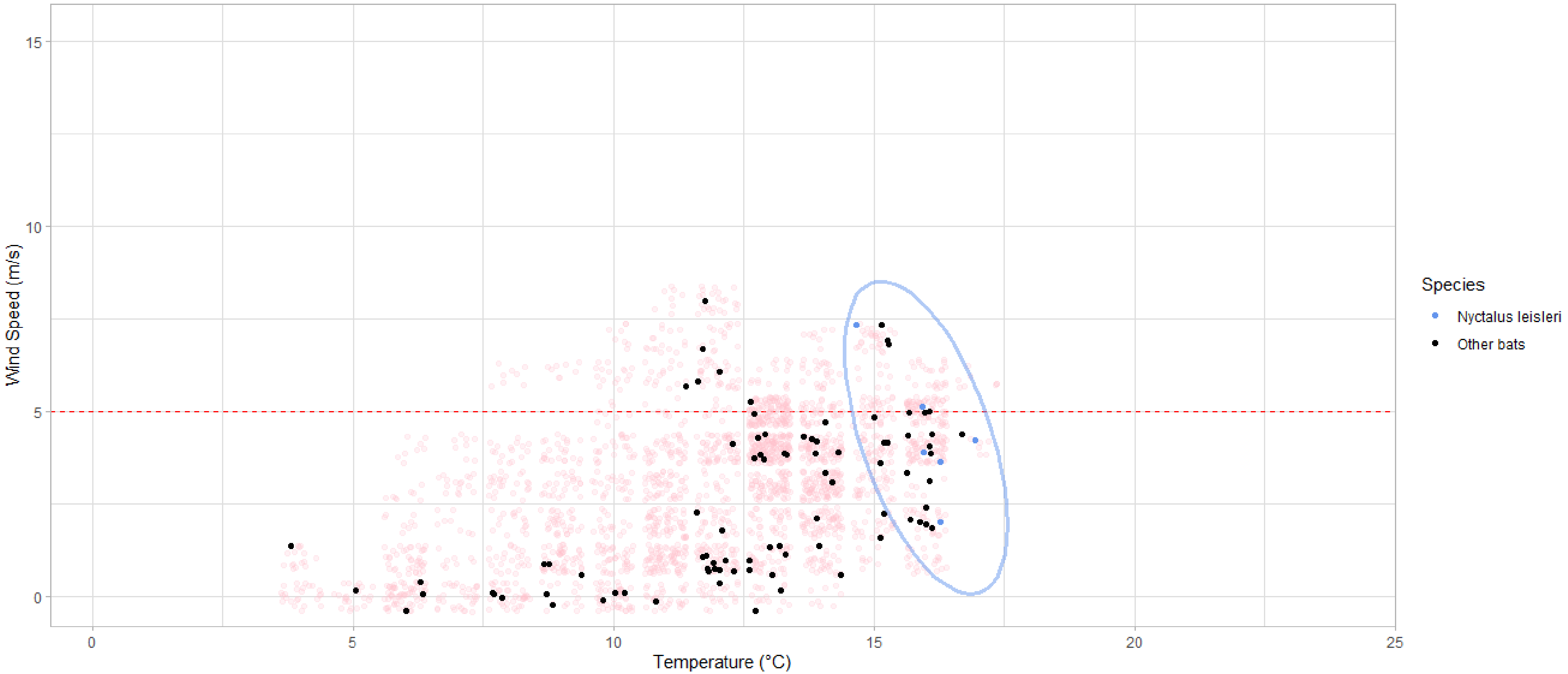
A6.20: Weather data at detector 1 (D.01) vs bat activity



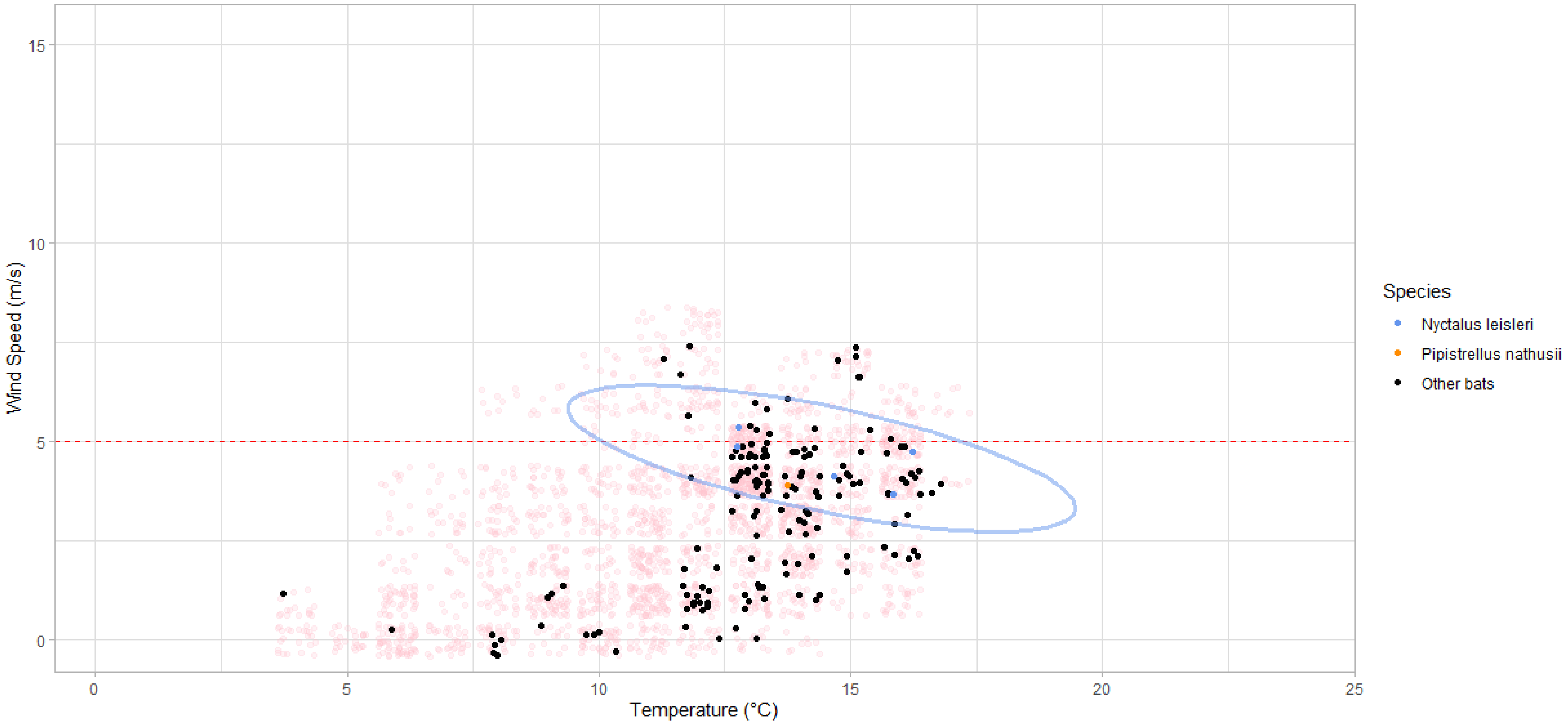
A6.21: Weather data at detector 2 (D.02) vs bat activity



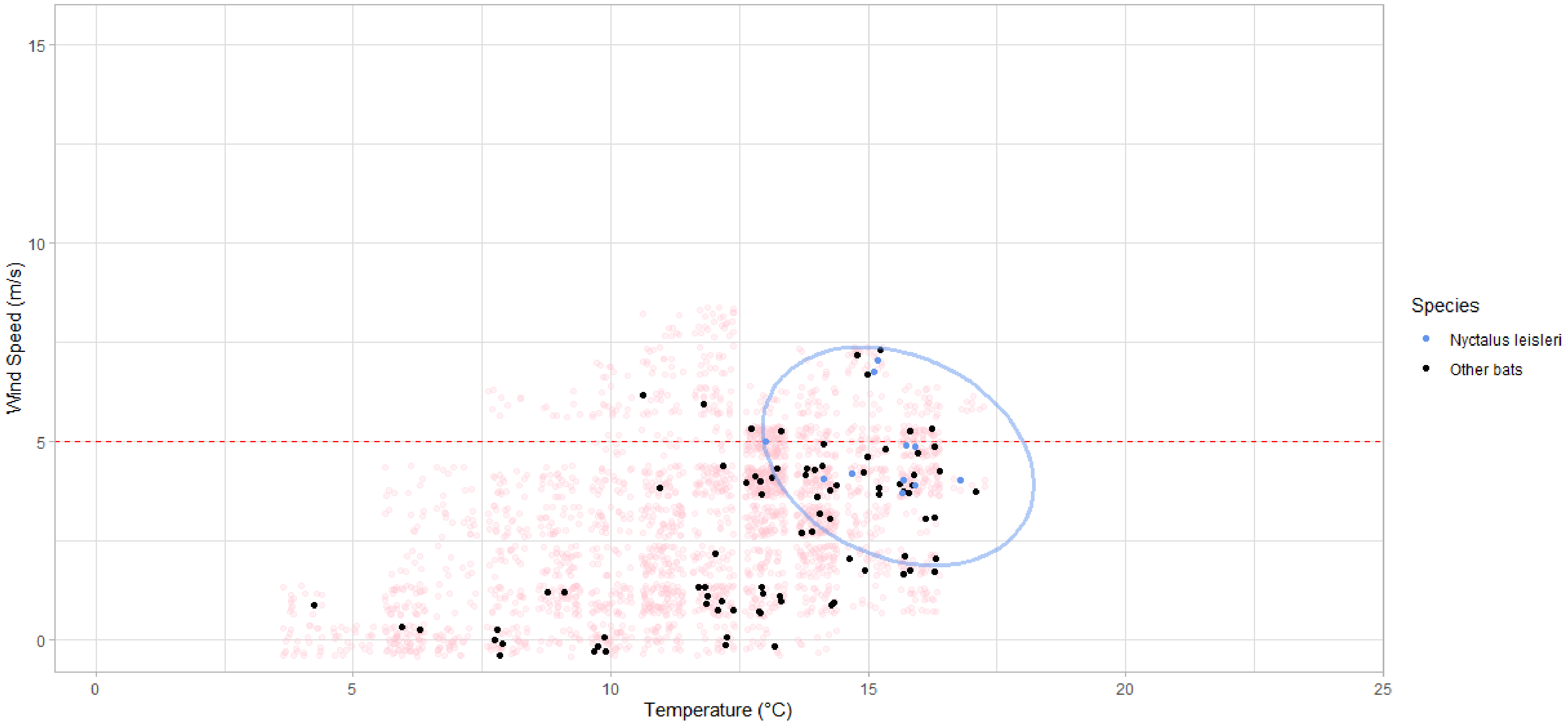
A6.22: Weather data at detector 3 (D.03) vs bat activity



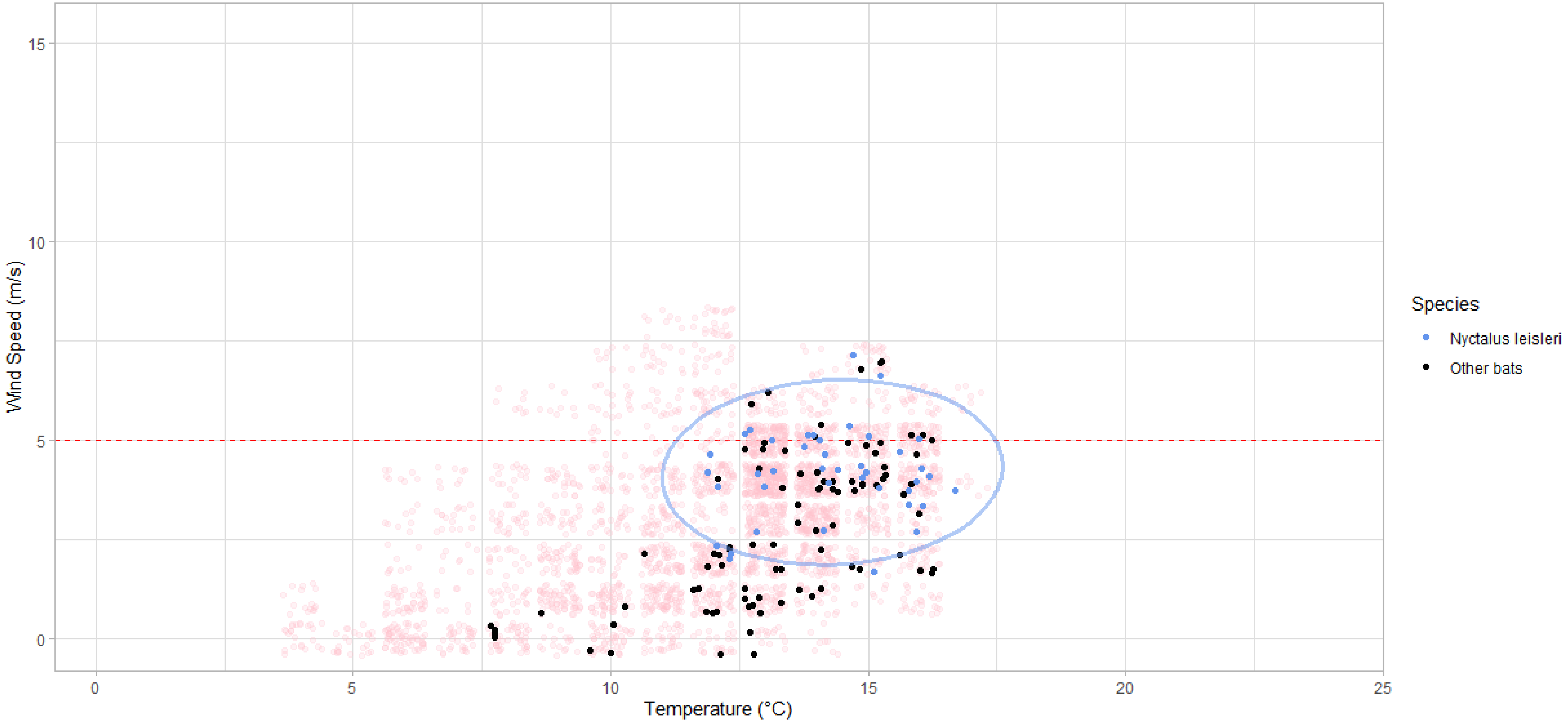
A6.23: Weather data at detector 4 (D.04) vs bat activity



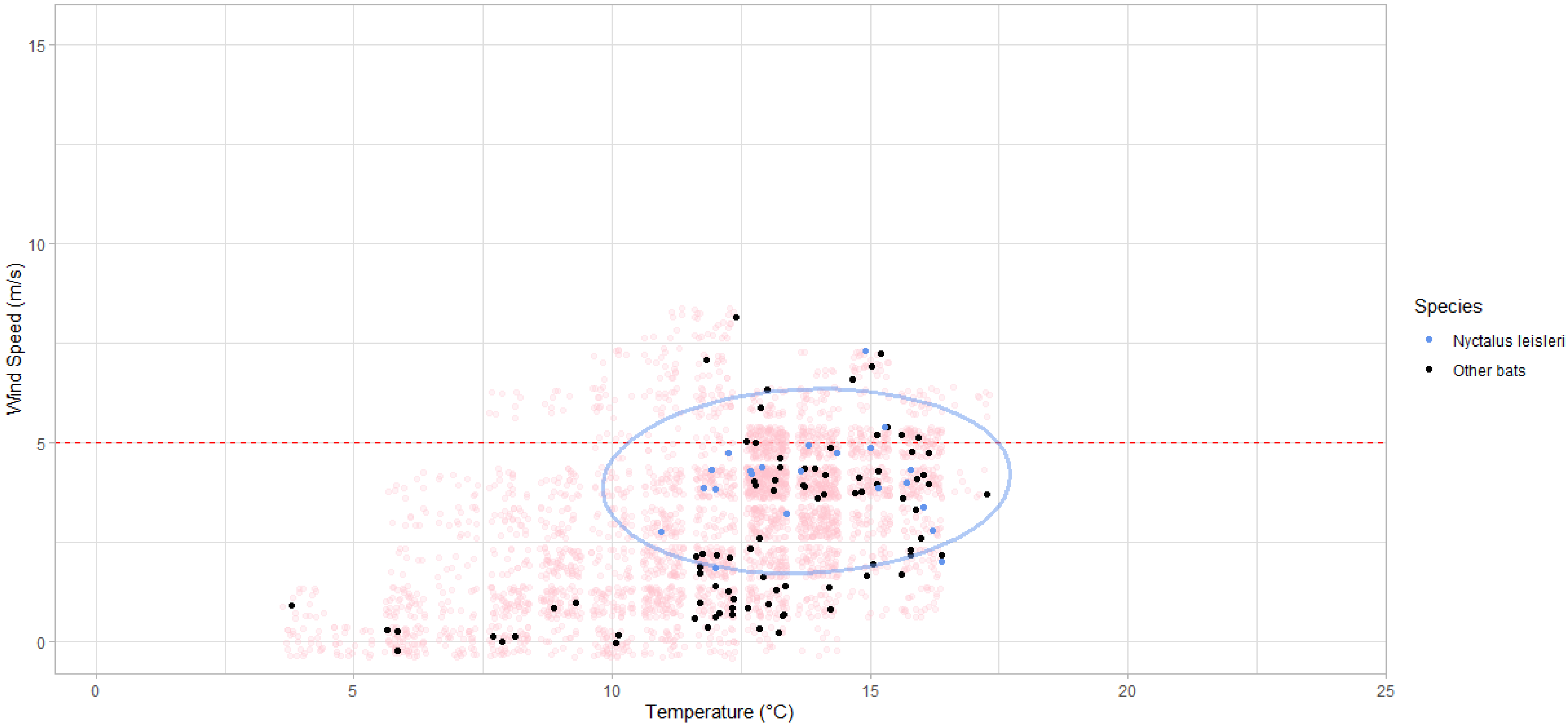
A6.24: Weather data at detector 7 (D.07) vs bat activity



A6.25: Weather data at detector 8 (D.08) vs bat activity



A6.26: Weather data at detector 9 (D.09) vs bat activity



A6.27: Weather data at detector 10 (D.10) vs bat activity

Appendix 6.C Aquatic Assessment Results

Section 1: Table 6C.1 shows the full list of taxa recorded during the Q-values assessment and which group they belong to. It also shows the indicator group the species belongs to. The different groups (Group A- Group E) are an indicator of water quality with A being least polluted and E being most polluted. Group A signifies good water quality which is unpolluted as the group is the most sensitive to pollutants. Group E signifies poor-quality water which is polluted.

Section 2 includes photos (Figure 2 to Figure 24) of the ten sample sites.

Section 3 shows the map of survey locations

Section 1

Table 6C.1 List of macroinvertebrate taxa and proportional abundance (%) recorded at each site sampled.

Group	Taxon	Indicator Group*	WQ1	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQ10
Coleoptera	Dytiscidae	C	44.8%	30.3%	0.0%	0.0%	6.6%	0.0%	19.2%	15.1%	20.8%
	Elmidae	C	0.0%	0.0%	14.3%	0.0%	6.6%	0.0%	0.0%	0.0%	0.0%
Crustacea	*Asellus aquaticus* (L.)	D	1.5%	5.1%	9.5%	0.0%	6.6%	4.8%	1.0%	6.8%	2.1%
	Gammarus sp.	C	0.0%	20.2%	4.8%	46.7%	26.3%	19.2%	48.1%	13.7%	20.8%
Diptera	Chironomidae (non-*Chironomus* spp.)	C	0.0%	0.0%	14.3%	0.0%	3.3%	4.8%	0.0%	0.0%	0.0%
	Chironomus sp.	E	0.0%	5.1%	33.3%	2.3%	0.0%	4.8%	0.0%	2.7%	0.0%
	Dicranota	C	0.0%	0.0%	0.0%	1.9%	1.3%	1.9%	0.0%	0.0%	0.0%
	Simuliidae	C	0.0%	0.0%	0.0%	4.7%	0.7%	0.0%	0.0%	0.0%	0.0%
	Tipulidae	C	0.0%	0.0%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Ephemeroptera	Baetidae (non-*Baetis* spp.)	B	0.0%	0.0%	0.0%	9.3%	0.0%	0.0%	0.0%	0.0%	6.3%
	Baetis rhodani/alanticus	C	0.0%	10.1%	0.0%	18.7%	19.7%	19.2%	19.2%	20.5%	0.0%
	Caenis sp.	C	1.5%	0.0%	4.8%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%
	Ephemera danica (Müller)	A	0.0%	20.2%	4.8%	2.3%	0.0%	9.6%	4.8%	1.4%	0.0%
	Serratella ignita (Poda)	C	0.0%	0.0%	0.0%	4.7%	13.2%	4.8%	0.0%	0.0%	0.0%
Gastropoda	Lymnaeidae (*Radix balthica* (L.))	D	11.9%	0.0%	0.0%	0.0%	0.0%	1.0%	2.9%	1.4%	2.1%

	Planorbidae	C	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%
	Potamopyrgus antipodarum (Gray)	C	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%
Hemiptera	Corixidae	C	14.9%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	34.2%	41.7%
	Sialis sp.	D	3.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	2.7%	2.1%
Hirudinea	Glossiphoniidae	D	0.0%	2.0%	4.8%	0.0%	0.7%	19.2%	0.0%	0.0%	0.0%
Plecoptera	*Leuctra* sp.	B	0.0%	2.0%	0.0%	0.9%	3.3%	1.9%	0.0%	0.0%	0.0%
Odonata	Zygoptera (Spp. Indet.)	B	17.9%	2.0%	4.8%	0.0%	0.0%	1.0%	0.0%	0.0%	2.1%
Oligochaeta	Lumbricidae (incl. *Eiseniella* sp.)	C	0.0%	0.0%	0.0%	4.7%	4.6%	0.0%	0.0%	0.0%	0.0%
	Enchytraeidae	D	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%
	Tubificidae	E	1.5%	0.0%	0.0%	1.4%	0.0%	1.0%	0.0%	1.4%	0.0%
Trichoptera	Hydropsychidae	C	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	1.0%	0.0%	0.0%
	Limnephilidae	B	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Polycentropodidae	C	0.0%	0.0%	4.8%	0.5%	0.7%	0.0%	1.9%	0.0%	0.0%
	Sericostoma personatum (Spence)	B	0.0%	0.0%	0.0%	0.0%	6.6%	0.0%	0.0%	0.0%	0.0%
Total Abundance			**67**	**99**	**21**	**214**	**152**	**104**	**104**	**73**	**48**

*Macroinvertebrate groupings according to their sensitivity to organic pollution: Group A=*Sensitive*; Group B=*Less Sensitive*; Group C=*Tolerant*; Group D=*Very Tolerant*; Group E=*Most Tolerant* (Toner et al., 2005)

Section 2

Figure 1: WQ1 in the River Suir

Figure 2: WQ1 on the River Suir

Figure 1 and Figure 2 show the condition of the River Suir for the first sampling point (WQ1). This sample point had group C indicator species present, which are tolerant of pollutants in the water. This sample point scored a Q value of Q3, which means the water quality is poor. The Water Framework Directive (WFD) status of this sample point is poor.

Figure 3: WQ2 in the River Suir

Figure 4: WQ2 in the River Suir


Figure 5: Crayfish trap being set at WQ2 in the River Suir

Figure 3 and Figure 4 show the condition of the River Suir for the second sampling point (WQ2). This sample point had no indicator species group, Q value or WFD status assigned as the kick sampling survey could not be completed. The substrate was too soft, and there was no suitable kick sampling habitat. Figure 5 shows the surveyor setting the crayfish trap in the River Suir at WQ2 sample point.

Figure 6: WQ3 in the River Suir

Figure 7: WQ3 in the River Suir

Figure 8: Crayfish trap being set at WQ3 in the River Suir

Figure 6 and Figure 7 show the condition of the River Suir for WQ3 sampling point. This sample point had group B indicator species present, which are sensitive of pollutants in the water. This sample point scored a Q value of

Q3-4, which means the water quality is moderate. The Water Framework Directive (WFD) status of this sample point is moderate. Figure 8 shows the surveyor setting the crayfish trap in the River Suir at WQ3 sample point.

Figure 9: WQ4 in the River Suir

Figure 10: WQ4 in the River Suir

Figure 9 and Figure 10 show the condition of the River Suir for WQ4 sampling point. This sample point had group C indicator species present, which are tolerant of pollutants in the water. This sample point scored a Q value of Q3, which means the water quality is moderate. The Water Framework Directive (WFD) status of this sample point is poor.

Figure 11: WQ5 in the River Suir


Figure 12: WQ5 in the River Suir

Figure 11 and Figure 12 show the condition of the River Suir for WQ5 sampling point. This sample point had group B indicator species present, which are sensitive of pollutants in the water. This sample point scored a Q value of Q3-4, which means the water quality is moderate. The Water Framework Directive (WFD) status of this sample point is moderate.

Figure 13: WQ6 in the Rossesstown River

Figure 14: WQ6 in the Rossesstown River

Figure 13 and Figure 14 show the condition of the Rossestown River for WQ6 sampling point. This sample point had group C indicator species present, which are tolerant of pollutants in the water. This sample point scored a Q value of Q3, which means the water quality is poor. The Water Framework Directive (WFD) status of this sample point is poor.


Figure 15: WQ7 in the Rossesstown River


Figure 16: WQ7 in the Rossesstown River

Figure 15 and Figure 16 show the condition of the Rossestown River for WQ6 sampling point. This sample point had group C indicator species present, which are tolerant of pollutants in the water. This sample point scored a Q value of Q3, which means the water quality is moderate. The Water Framework Directive (WFD) status of this sample point is poor.

Figure 17: WQ8 in the River Suir


Figure 18: WQ8 in the River Suir


Figure 19: WQ8 in the River Suir

Figure 17, Figure 18 and Figure 19 show the condition of the River Suir for WQ8 sampling point. This sample point had group B indicator species present, which are sensitive of pollutants in the water. This sample point scored a Q value of Q3-4, which means the water quality is moderate. The Water Framework Directive (WFD) status of this sample point is moderate.

Figure 20: WQ9 in the River Suir


Figure 21: WQ9 in the River Suir

Figure 20 and Figure 21 show the condition of the River Suir for WQ9 sampling point. This sample point had group C indicator species present, which are tolerant of pollutants in the water. This sample point scored a Q value of Q3, which means the water quality is poor. The Water Framework Directive (WFD) status of this sample point is poor.


Figure 22: WQ10 in the River Suir


Figure 23: WQ10 in the River Suir

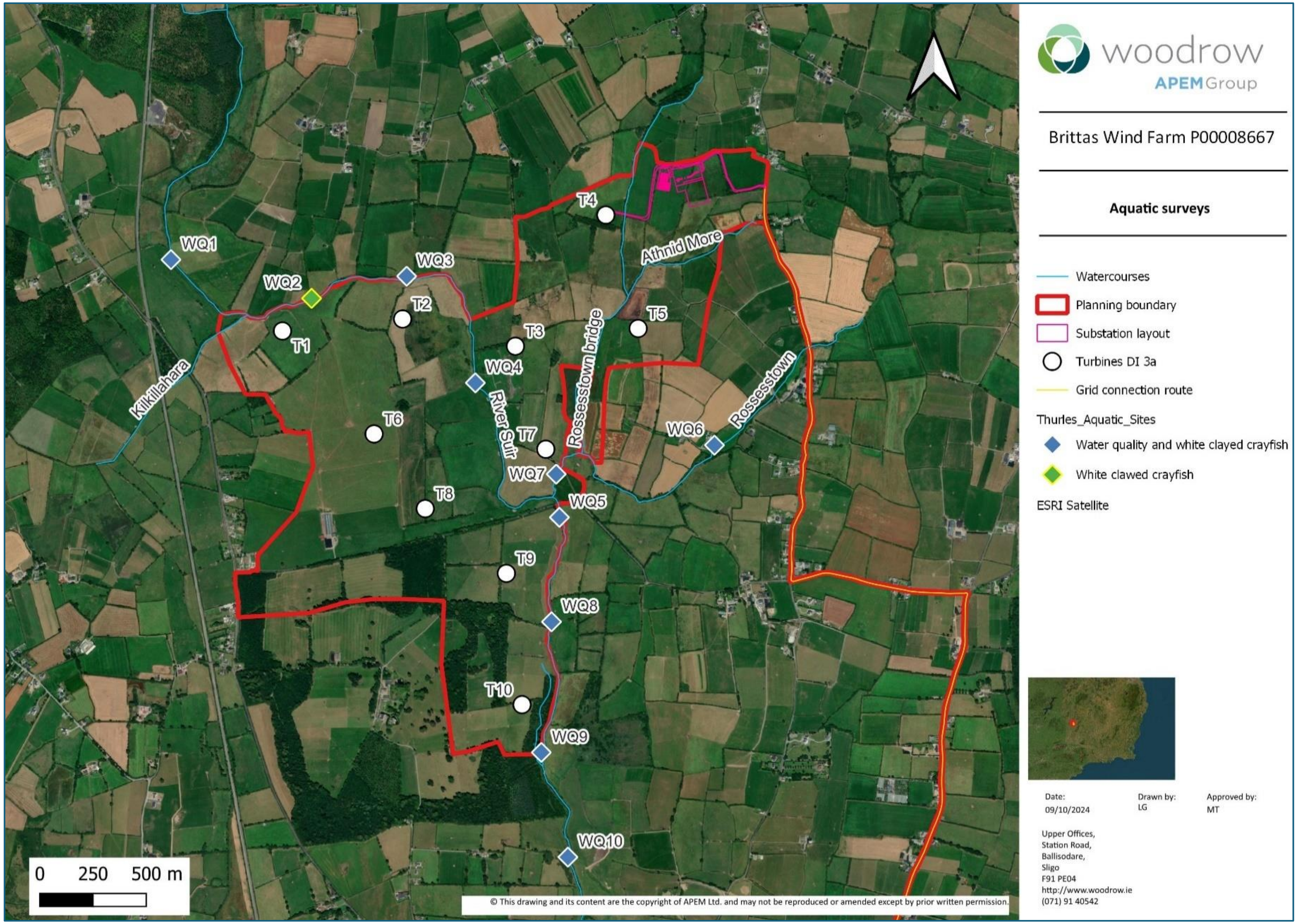
Figure 24: WQ10 in the River Suir

Figure 22, Figure 23 and Figure 24 show the condition of the River Suir for WQ10 sampling point. This sample point had group C indicator species present, which are tolerant of pollutants in the water. This sample point scored a Q value of Q3, which means the water quality is poor. The Water Framework Directive (WFD) status of this sample point is poor.


Figure 25: An inaccessible sample point

Figure 25 shows the sample point for Kilkillahara. This sample point was inaccessible, and no surveys were completed here.

Section 3


woodrow
APEM Group
Brittas Wind Farm P00008667
Aquatic surveys
Watercourses
Planning boundary
Substation layout
Turbines DI 3a
Grid connection route
Thurles_Aquatic_Sites
Water quality and white clayed crayfish
White clawed crayfish
ESRI Satellite
Date:
09/10/2024
Drawn by:
LG
Approved by:
MT
Upper Offices,
Station Road,
Ballisodare,
Sligo
F91 PE04
http://www.woodrow.ie
(071) 91 40542
WQ1
WQ2
WQ3
WQ4
WQ5
WQ6
WQ7
WQ8
WQ9
WQ10
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
Athnid More
Rossesstown bridge
Rossesstown
River Suir
Kilkillahara
0 250 500 m
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Appendix 6. D

Existing ecological records for protected and/or notable species (10 km) – Full table

- The second column indicates species list on Annex II & IV of Habitats Directive, with third column indicating bird species listed on Annex I of the Birds Directive and the fourth column shows species protected under the Wildlife Act, as amended
- Key to Red List Status: EX = Extinct; RE = Regional Extinct; CR = Critically Endangered; EN = Endangered; NT = Near Threatened; VU = Vulnerable; LC = Least Concern; DD = Data Deficient; blank = not listed
- Data sources: 1. NBDC = National Biodiversity Recorded Centre, 2. NPWS = National Parks & Wildlife Service, 3. BCI = Bat Conservation Ireland

Species name	Hab. Dir. (An. II / IV)	Wildlife Acts	Red list status	Most recent record	Data source
Ash (*Fraxinus excelsior*)			LC	2009	1
Beech *(fagus sylvatica*)				2018	1
Branched bur-reed (*Sparganium erectum*)			LC	2008	1
Charlock (*Sinapis arvensis*)			LC	2018	1
Common club-rush (*Schoenoplectus lacustris*)			LC	2008	1
Common dog-violet (*Viola riviniana*)			LC	2020	1
Common duckweed *(Lemna minor*)			LC	2005	1
Common fumitory (*Fumaria officinalis*)			LC	2019	1
Common ivy (*Hedera helix subsp. Helix*)			LC	2018	1
Common nettle (*Urtica dioica*)			LC	2018	1
Common ragwort (*Senecio jacobaea*)			LC	2017	1
Cow parsley (*Anthriscus sylvestris*)			LC	2017	1
Cowslip (*Primula veris*)			LC	2014	1
Curled pondweed (*Potamogeton crispus*)			LC	2008	1
Groundsel (*Senecio vulgaris*)			LC	2018	1
Hawthorn (*Crataegus monogyna*)			LC	2008	1
Herb-Robert (*Geranium robertianumL*)			LC	2018	1
Ivy (*Hedera helix*)			LC	2018	1

Ivy-leaved toadflax (*Cymbalaria muralis*)				2018	1
Lesser celandine (*Ranunculus ficaria*)			LC	2018	1
Red clover (*Trifolium pratense*)			LC	2019	1
Red valerian (*Centranthus* ruber)				2018	1
Reed canary-grass (*Phalaris arundinaceae*)			LC	2008	1
Water-cress (*Rorippa nasturtium-aquaticum*)			LC	2008	1
Maidenhari spleenwork (*Asplenium trichomanes*)			LC	2018	1
Rustyback (Ceterach officinarum)			LC	2018	1
Ancylus fluviatilis			LC	2017	1
Anodonta			VU	2011	1
Arion (Kobeltia)				1984	1
Bithynia			LC	2008	1
Brown lipped snail (*Cepaea (Cepaea) nemoralis*)			LC	1984	1
Cellar snail (*Oxychilus (Oxychilus) cellarius*)			LC	1984	1
Common chrysalis snail (*Lauria (Lauria) cylindracea*)			LC	1984	1
Dusk mussel (*Anodonta (Anodonta) anatine*)			VU	2017	1
Lake limpet (*Acroloxus lacustris*)	Y	Y	LC	2014	1
Netted slug (*Deroceras (deroceras) reticulatum*)			LC	1984	1
Pisidium				2017	1
Smooth glass snail (*Aegopinella nitidula*)			LC	1984	1
Sphaerium				2017	1
Strawberry snail (*Trochulus (trochulus) striolatus*)			LC	1984	1
Two-toothed door snail (*Clausilia (clausilia) bidentata*)			LC	1984	1
Freshwater white-clawed crayfish (*Austropotamobius pallipes)*	Y	Y	CR	2015	1
Asellus				2017	1
Gammarus				2017	1

Gammarus duebeni				2011	1
Acari				2014	1
Aceria cephalonea				2015	1
Glossiphonia				2008	1
Glassiphonia complanata				2008	1
Lumbricidae				2017	1
Lumbriculidae				2014	1
Tubificidae				2011	1
Amaurobius spider				2019	1
Agabus beetle *(Gaurodytes) bipustulatus*				2007	1
Beetle - *Anacaena lutescens*				2007	1
Beetle - *Elmidae*				2011	1
Beetle - *Elmis aenea*				2017	1
Beetle - *Helophorus (atracthelophorus) brevipalpis*				2007	1
Beetle - *Hydrobius fuscipes*				2007	1
Beetle - *Hydroporus striola*				2007	1
Beetle - *Hydroporus tessellatus*				2007	1
Beetle - *Ilybius fuliginosus*				2007	1
Beetle - *Ilybius quadriguttatus*				2007	1
Beetle - *Limnius volckmaria*				2017	1
Brimstone butterfly *(Gonepteryx rhamni)*				2019	1
Grenn-veined white butterfly *(Pieris napi)*				2019	1
Meadow brown butterfly *(Maniola jurtina)*				2006	1
Orange-tip butterfly *(Anthocharis cardamines)*				2019	1
Peacock butterfly *(Inachis io)*				2019	1
Ringlet butterfly *(Aphantopus cardamines)*				2006	1
Small tortoiseshell butterfly *(Aglais urticae)*				2020	1
Speckled wood butterfly *(Pararge aegeria)*				2021	1
Caddisfly *(Allotrichia pallicornis)*				2015	1

Caddisfly *(Athripsodes cinereus)*				2015	1
Caddisfly *(Glossosomatidae)*				2014	1
Caddisfly *(Hydropsyche)*				2017	1
Caddisfly *(Hydropsyche angustipennis)*				2015	1
Caddisfly *(Hydropsyche pellucidula)*				2015	1
Caddisfly *(Hydropsyche siltalai)*				2015	1
Caddisfly *(Hydroptilidae)*				2017	1
Caddisfly *(Lepidostomatidae)*				2014	1
Caddisfly *(Leptoceridae)*				2017	1
Caddisfly *(Limnephilidae)*				2011	1
Caddisfly *(Polycentropus)*				2014	1
Caddisfly *(Polycentropus flavomaculatus)*				2015	1
Caddisfly *(Rhyacophila)*				2017	1
Caddisfly *(Rhyacophila dorsalis)*				2015	1
Caddisfly *(Sericostoma)*				2017	1
Caddisfly *(Silo nigricornis*				2015	1
Caddisfly *(Tinodes waeneri)*				2015	1
Banded demoiselle damselfly (*Calopteryx splendens*)			LC	2011	1
Common hawker dragonfly (*Aeshna juncea*)				2020	1
Large red damselfly (*Pyrrhosoma nymphula*)				2006	1
Andrena (*Andrena)* clarkella				2017	1
Bombus lucorum agg.				2019	1
Early bumble bee (*Bombus (Pyrobombus)* pratorum)				2016	1
Early mining bee *(Andrena (Trachandrena) haemorrhoa)*				2013	1
Gooden's nomad bee (*Nomada goodeniana*)				2017	1
Halictus (Halictus) rubicundus				2017	1
Large red tailedbumble bee *(Bombus (melanobombus) lapidaries)*				2019	1

Alainites muticus				2017	1
Angler's curse (*Caenis luctuosa*)				1991	1
Baetis				2017	1
Baetis rhodani				1991	1
Canis				1991	1
Caenis rivulorum				2017	1
Centroptilum luteolum				1991	1
Mayfly - Ecdyonurus				2017	1
Mayfly - *Ecdyonurus dispar*				1991	1
Mayfly - Green drake (*Ephemera Danica*)				2017	1
Mayfly – *Heptagenia*				2014	1
Mayfly - *Rhithrogena*				2011	1
Mayfly – *Serratella ignita*				2017	1
Cinnabar moth (*Tyria jacobaeae)*				2017	1
Straw grass-veneer moth (Agriphilia straminella)				2006	1
Udea lutealis moth				2006	1
Isoperla grammatica moth				1984	1
Flatworm - *Dendrocoelum*				2008	1
Blunt-tailed snake millipede (*Cylindroiulus punctatus*)				1996	1
Brachychaeteuma bagnalli millipede				1996	1
Stonefly - *Leuctra*				2017	1
Stonefly – *Nemouridae*				2011	1
True bug – *Aphelocheirus (Aphelocheirus) aestivalis*				2005	1
True bug – Common backswimmer (*Notonecta (notonecta) glauca)*				2011	1
True fly - *Ceratopogonidae*				2008	1
True fly – *Chironomidae*				2017	1
True fly – *Conchapelopia melanops*				1992	1
True fly – Cricotopus annulator				1992	1

True fly – *Cricotopus bicinctus*				1992	1
True fly – *Cricotopus fuscus*				1992	1
True fly – *Cricotopus trifascia*				1992	1
True fly - *Dicranota*				2017	1
True fly – *Nilotanypus dubius*				1992	1
True fly – *Orthocladius glabripennis*				1992	1
True fly – *Orthocladius oblidens*				1992	1
True fly – *Orthocladius obumbratus*				1992	1
True fly – *Orthocladius rubicundus*				1992	1
True fly – *Orthocladius wetterensis*				1992	1
True fly – *Paracladius conversus*				1992	1
True fly – *Parametriocnemus stylatus*				1992	1
True fly – *Potthastia gaedii*				1992	1
True fly – *Potthastia longimana*				1992	1
True fly – *Rheocricotopus effusus*				1992	1
True fly – S*imuliidae*				2017	1
True fly – *Synorthocladius semivirens*				1992	1
True fly – *Tipulidae*				2014	1
True fly – *Tvetenia calvescens*				1992	1
True fly – *Tvetenia discoloripes*				1992	1
True fly – *Tvetenia verralli*				1992	1
True fly – *Virgatanytarsus triangularis*				1992	1
Common Frog (*Rana temporaria*)	V			2018	1
Brown Long-eared Bat (*Plecotus auritus*)	Y	Y		2009	1, 3
Lesser Noctule (*Nyctalus leisleri*)	Y	Y		2018	1, 3
Daubenton's Bat (*Myotis daubentonii*)	Y	Y		2018	1, 3
Natterer's Bat (*Myotis nattereri*)	Y	Y		N/A	1, 3
Pipistrelle (*Pipistrellus pipistrellus sensu lato*)	Y	Y		2018	1, 3
Soprano Pipistrelle (*Pipistrellus pygmaeus*)	Y	Y		2018	1, 3

West European Hedgehog (*Erinaceus europaeus*)		Y		2021	1
Eurasian Badger (*Meles meles*)		Y		2008	1
Red fox (*vulpes vulpes*)				2018	1
Wood mouse (Apodemus sylvaticus)				2010	1
Pine Marten (*Martes martes*)		Y		2018	1, 2
European Otter (*Lutra lutra*)	Y	Y		2015	1, 2