



KILLEAN WIND FARM: BASELINE BAT SURVEYS 2022 AND 2023

Report to Renewable Energy
Systems Ltd



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KILLEAN WIND FARM: BAT SURVEYS 2022 AND 2023

INTRODUCTION

1. This report presents the results of bat survey work at the proposed Killean Wind Farm, Argyll, with initial surveys during August and September 2022 and the main surveys during April-September 2023. Tom Lowe and Stuart Piner undertook the surveys, both highly experienced ecological surveyors with over 20 years surveying for renewable energy projects each (including bats, exceeding CIEEM competency requirements).

STUDY AREA

2. The site is located about 22 km north of Campbeltown in Argyll. The bat survey area was chosen to include the proposed wind farm's potential zone of ecological influence. It included the wind farm site plus a 500 m buffer. The extent of the survey area is shown in Figure 7.2.1. It is a mix of open moorland and conifer plantation, covering a total area of 8.1 km². The site lies within the Argyll West and Islands NatureScot Natural Heritage Zone (NHZ 14).

BAT SURVEY METHODS

Bat Survey Methods

3. The bat survey programme was designed with reference to the recent SNH/Natural England *et al.* (2019) guidance on 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation'. The surveys comprised the following:
 - **Walked transect surveys** - access was restricted to the parts of the site that could be accessed safely at night - the transect routes walked are shown in Figure 7.2.1.
 - Initial surveys, autumn 2022 – two transect-based surveys were carried out, one on 15 August and one on 14 September 2022.
 - Main surveys, 2023 - six transect-based surveys were carried out on 3 April, 22/25 May, 12-13 June, 17 July, 5 August and 20-21 September 2023.
 - **Automated surveys** -
 - Initial surveys, autumn 2022 - static detectors were deployed at ten locations across the survey area representative of the available habitats. Each was sampled for a target 20





nights covering autumn (August/September). A total of 200 bat-nights' coverage was obtained. The locations of the recorders are shown in Figure 7.2.1.

- Main surveys, 2023 - each of ten locations was sampled for at least 30 nights, covering spring (April/May), summer (June/July) and autumn (August/September). A total of 704 bat-nights' coverage was obtained. The locations of the recorders are shown in Figure 7.2.1 (updated from the previous 2022 surveys to reflect subsequent changes to the proposed wind farm layout).
4. Surveys at height were considered unnecessary at this site, given the generally low-quality bat habitats present (predominantly conifer plantation and open moorland).

Bat Survey Results

Bat walking transects

5. The results of the walked bat transect surveys are summarised in Table 7.2.1, which gives the number of passes recorded for each species on each of the two surveys carried out during August and September 2022 and each of the six surveys between April and September 2023. Overall numbers were very low, but six species were recorded, including soprano pipistrelle, common pipistrelle and Daubenton's bat.

TABLE 7.2.1. Number of bat passes recorded during the walkover transect surveys, August-September 2022 and April-September 2023.

Species	Scientific name	Aug 2022	Sep 2022	Apr 2023	May 2023	Jun 2023	July 2023	Aug 2023	Sep 2023
Daubenton's bat	<i>Myotis daubentonii</i>	1	1	0	2	2	0	1	0
Natterer's bat	<i>Myotis nattereri</i>	1	0	0	0	0	0	0	0
Unidentified <i>Myotis</i> species	<i>Myotis sp.</i>	0	0	0	1	0	0	2	0
Noctule	<i>Nyctalus noctula</i>	4	0	0	0	0	0	0	0
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	2	4	0	1	1	0	0	0
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	8	8	0	1	2	0	1	0
Brown long-eared bat	<i>Plecotus auritus</i>	1	0	0	0	0	0	0	2





6. The distributions of bat records during these walkover surveys are plotted in Figures 7.2.2 (common and soprano pipistrelle) and 7.2.3 (other species). The number of locations in these Figures is lower than the number of passes in Table 7.2.1 due to multiple passes being recorded at single locations. Most records were along the forest edge in the western part of the survey area. There were no records over the open moorland habitat in the eastern half of the survey area in either autumn 2022 or during the 2023 surveys.

Bat Static Bat Recorder Results

7. The raw numbers of records of each species in each season during the bat static recorder surveys are summarised in Table 7.2.2 (August-September 2022, and Table 7.2.3 (April-September 2023).

Table 7.2.2. Bat static recorder surveys, August-September 2022, showing the raw number of bat passes at each location.

Species	1	2	3	4	5	6	7	8	9	10	Total
Daubenton’s	4	21	4	1	43	3	0	2	0	1	79
Natterer’s	12	6	7	0	9	0	2	1	1	1	39
Myotis sp	12	37	5	1	52	5	0	2	0	2	116
Noctule	7	35	3	5	8	6	1	0	0	0	65
Common pipistrelle	26	402	63	2	36	96	10	2	2	0	639
Soprano pipistrelle	91	455	89	7	27	1130	1	2	2	3	1807
Brown long-eared	9	25	3	4	3	6	0	2	1	1	54

Table 7.2.3. Bat static recorder surveys, April-September 2023, showing the raw number of bat passes at each location.

Species	1	2	3	4	5	6	7	8	9	10	Total
Daubenton’s bat	6	35	12	0	14	28	4	1	46	25	171
Natterer’s bat	14	4	0	0	3	1	2	2	16	1	43
Myotis sp	45	38	2	0	5	25	6	1	56	13	191
Leisler’s bat	1	27	7	0	7	1	2	0	15	13	73
Noctule	0	2	1	0	1	4	0	0	9	0	17
Common pipistrelle	24	1819	22	4	29	98	31	20	551	39	2637
Soprano pipistrelle	24	3654	22	4	39	258	19	13	1836	171	6040
Brown long-eared	3	188	3	0	4	15	0	1	116	18	348





8. Bat pass rates are presented in Table 7.2.4 (August-September 2022) and Table 7.2.5 (April – September 2023) as medians following Lintott *et al.* (2018), but also as means, as the median values were predominantly zeros. These highlight the low overall bat activity.
9. In the August-September 2022 surveys (Table 7.2.4), Soprano pipistrelle *Pipistrellus pygmaeus* was the most frequently recorded species, with higher numbers at locations 2 and 6. Common pipistrelle *Pipistrellus pipistrellus* were also recorded regularly, with location 2 holding the highest numbers of this species. Four additional species were also recorded but in lower numbers: Daubenton’s bat *Myotis daubentonii*, Natterer’s bat *Myotis nattereri*, noctule *Nyctalus noctule* and brown long-eared *Plecotus auratus*. Location 2 held the most records for these species too.
10. In the 2023 surveys (Table 7.2.5), only three locations/species exceeded a zero median (due to the large number of zero records). Soprano pipistrelle *Pipistrellus pygmaeus* was the most frequently recorded species, with higher numbers at locations 2 and 9. Common pipistrelle *Pipistrellus pipistrellus* were also recorded regularly, with location 2 holding the highest numbers of this species. Five additional species were also recorded but in lower numbers: Daubenton’s bat *Myotis daubentonii*, Natterer’s bat *Myotis nattereri*, Leisler’s bat *Nyctalus leisleri*, noctule *Nyctalus noctule* and brown long-eared *Plecotus auratus*. Locations 2 and 9 held the most records for these species, too (though the only other locations/species exceeding a median of zero bat passes per night was soprano pipistrelle at location 6).

Table 7.2.4. Bat static recorder surveys, August-September 2022, showing the mean and median number of bat passes per hour per night at each location (median given in brackets).

Species	1	2	3	4	5	6	7	8	9	10
Daubenton’s	0.19 (0)	1.31 (1)	0.18 (0)	0.05 (0)	1.87 (1)	0.14 (0)	0 (0)	0.09 (0)	0 (0)	0.05 (0)
Natterer’s	0.57 (0)	0.38 (0)	0.32 (0)	0 (0)	0.39 (0)	0 (0)	0.1 (0)	0.05 (0)	0.05 (0)	0.05 (0)
Myotis sp	0.57 (0)	2.31 (2)	0.23 (0)	0.05 (0)	2.26 (2)	0.24 (0)	0 (0)	0.09 (0)	0 (0)	0.09 (0)
Noctule	0.33 (0)	2.19 (1.5)	0.14 (0)	0.24 (0)	0.35 (0)	0.29 (0)	0.05 (0)	0 (0)	0 (0)	0 (0)
Common pipistrelle	1.24 (0)	25.13 (9.5)	2.86 (1.5)	0.1 (0)	1.57 (1)	4.57 (1)	0.48 (0)	0.09 (0)	0.1 (0)	0 (0)
Soprano pipistrelle	4.33 (0)	28.44 (28)	4.05 (2)	0.33 (0)	1.17 (1)	53.81 (18)	0.05 (0)	0.09 (0)	0.1 (0)	0.14 (0)
Brown long-eared	0.43 (0)	1.56 (1)	0.14 (0)	0.19 (0)	0.13 (0)	0.29 (0)	0 (0)	0.09 (0)	0.05 (0)	0.05 (0)





Table 7.2.5. Bat static recorder surveys, April-September 2023, showing the mean and median number of bat passes per hour per night at each location (median given in brackets).

Species	1	2	3	4	5	6	7	8	9	10
Daubenton's bat	0.012 (0)	0.043 (0)	0.018 (0)	0 (0)	0.017 (0)	0.059 (0)	0.008 (0)	0.003 (0)	0.055 (0)	0.032 (0)
Natterer's bat	0.028 (0)	0.005 (0)	0 (0)	0 (0)	0.004 (0)	0.002 (0)	0.004 (0)	0.005 (0)	0.02 (0)	0.002 (0)
Myotis sp	0.088 (0)	0.046 (0)	0.003 (0)	0 (0)	0.006 (0)	0.05 (0)	0.013 (0)	0.003 (0)	0.069 (0)	0.018 (0)
Leisler's bat	0.002 (0)	0.03 (0)	0.01 (0)	0 (0)	0.008 (0)	0.002 (0)	0.004 (0)	0 (0)	0.018 (0)	0.015 (0)
Noctule	0 (0)	0.002 (0)	0.002 (0)	0 (0)	0.002 (0)	0.007 (0)	0 (0)	0 (0)	0.011 (0)	0 (0)
Common pipistrelle	0.036 (0)	2.49 (0.048)	0.03 (0)	0.013 (0)	0.032 (0)	0.184 (0)	0.063 (0)	0.056 (0)	0.59 (0)	0.047 (0)
Soprano pipistrelle	0.043 (0)	4.87 (0.421)	0.029 (0)	0.011 (0)	0.044 (0)	0.547 (0.033)	0.038 (0)	0.038 (0)	1.948 (0)	0.193 (0)
Brown long-eared	0.006 (0)	0.208 (0)	0.004 (0)	0 (0)	0.005 (0)	0.022 (0)	0 (0)	0.002 (0)	0.135 (0)	0.02 (0)

- Figure 7.2.4 shows the distribution of the two main bat species recorded in the autumn 2022 surveys, soprano pipistrelle and common pipistrelle. This highlights the locations where these species were more frequently located, within the rides in the coniferous forest. There was only very low activity in the more open moorland habitats.
- Figures 7.2.5 - 7.2.10 show the distributions of the six more abundant bat species recorded during the 2023 surveys, Daubenton's bat (Figure 7.2.5), natterer's bat (Figure 7.2.6), Leisler's bat (Figure 7.2.7), common pipistrelle (Figure 7.2.8), soprano pipistrelle (Figure 7.2.9) and brown long-eared bat (Figure 7.2.10). As in 2022, these species were more frequently located within the rides and fringes of the coniferous forest, with very low activity in the moorland habitats.





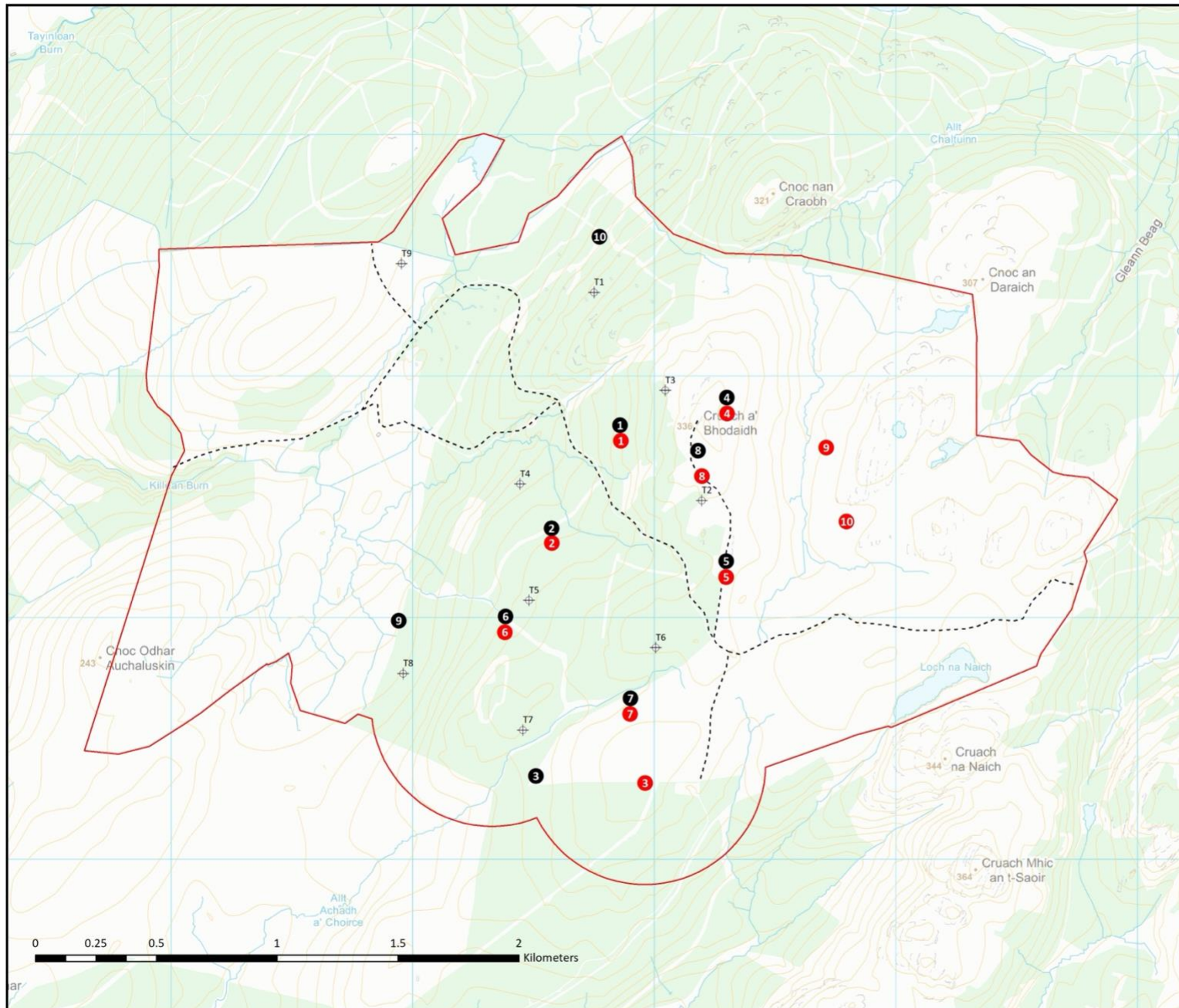
Killeen Wind Farm: Bat Surveys, 2022 and 2023

FIGURE 7.2.1

Transect survey route and static detector locations

KEY:

- Static bat detector locations 2023
- Static bat detector locations
- ⊕ Proposed turbines (EIAR)
- - - Bat walkover transects
- Ecology survey area



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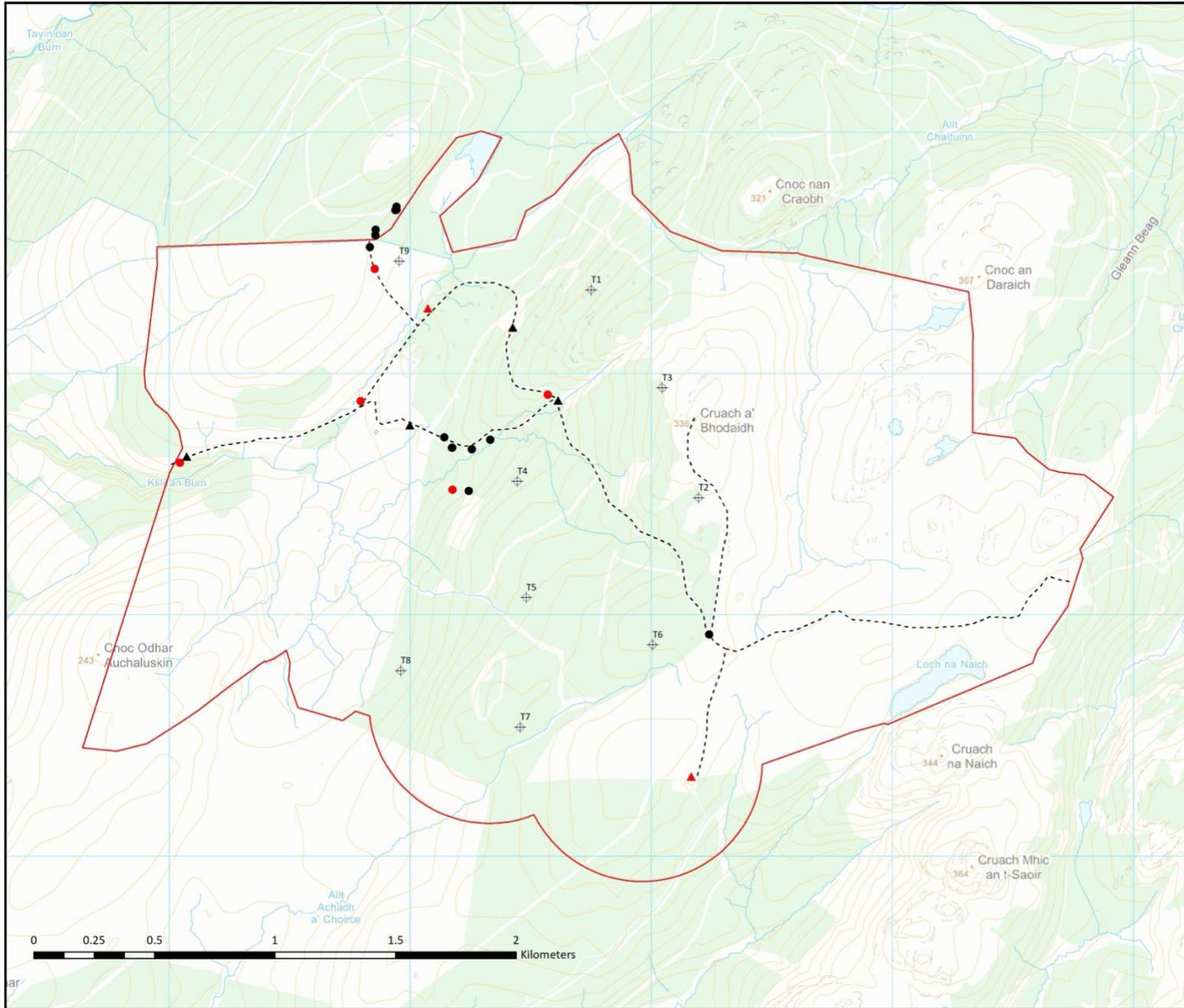
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BAT SURVEYS
2022 AND 2023

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Killean Wind Farm: Bat Surveys, 2022 and 2023

FIGURE 7.2.2

Transect survey: Pipistrelle records

- KEY:**
- ⊕ Proposed turbines (EIAR)
 - Bat walkover transects
 - Ecology survey area
- Autumn 2022**
- Common Pipistrelle
 - Soprano Pipistrelle
- 2023**
- ▲ Common Pipistrelle
 - ▲ Soprano Pipistrelle



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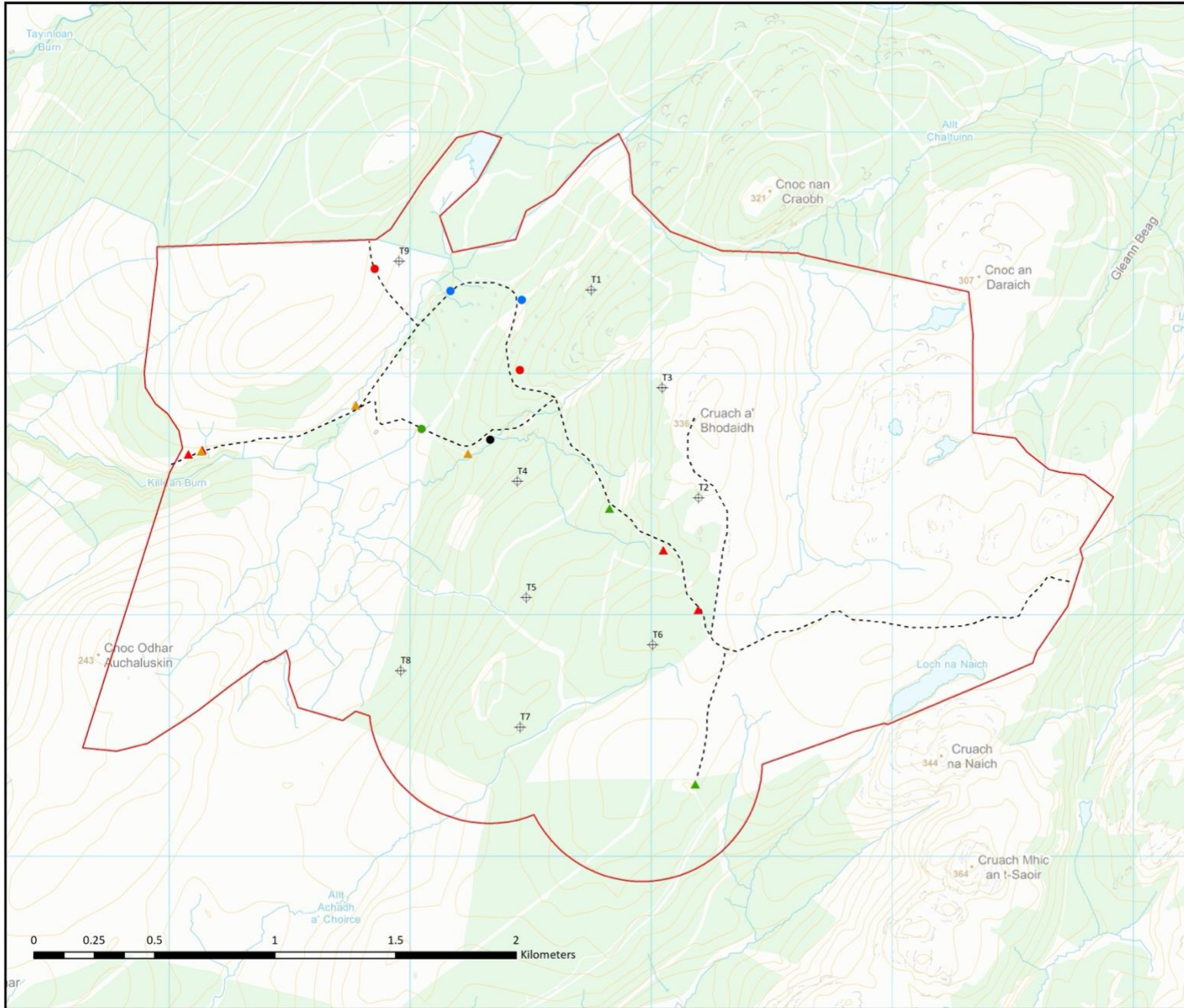
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Killean Wind Farm: Bat Surveys, 2022 and 2023

FIGURE 7.2.3

**Transect survey:
other species records**

- KEY:**
- ⊕ Proposed turbines (EIAR)
 - Bat walkover transects
 - ▭ Ecology survey area

- Autumn 2022**
- Daubenton's
 - Natterer's
 - Noctule
 - Brown Long-eared

- 2023**
- ▲ Daubenton's
 - ▲ Myotis sp
 - ▲ Brown Long-eared



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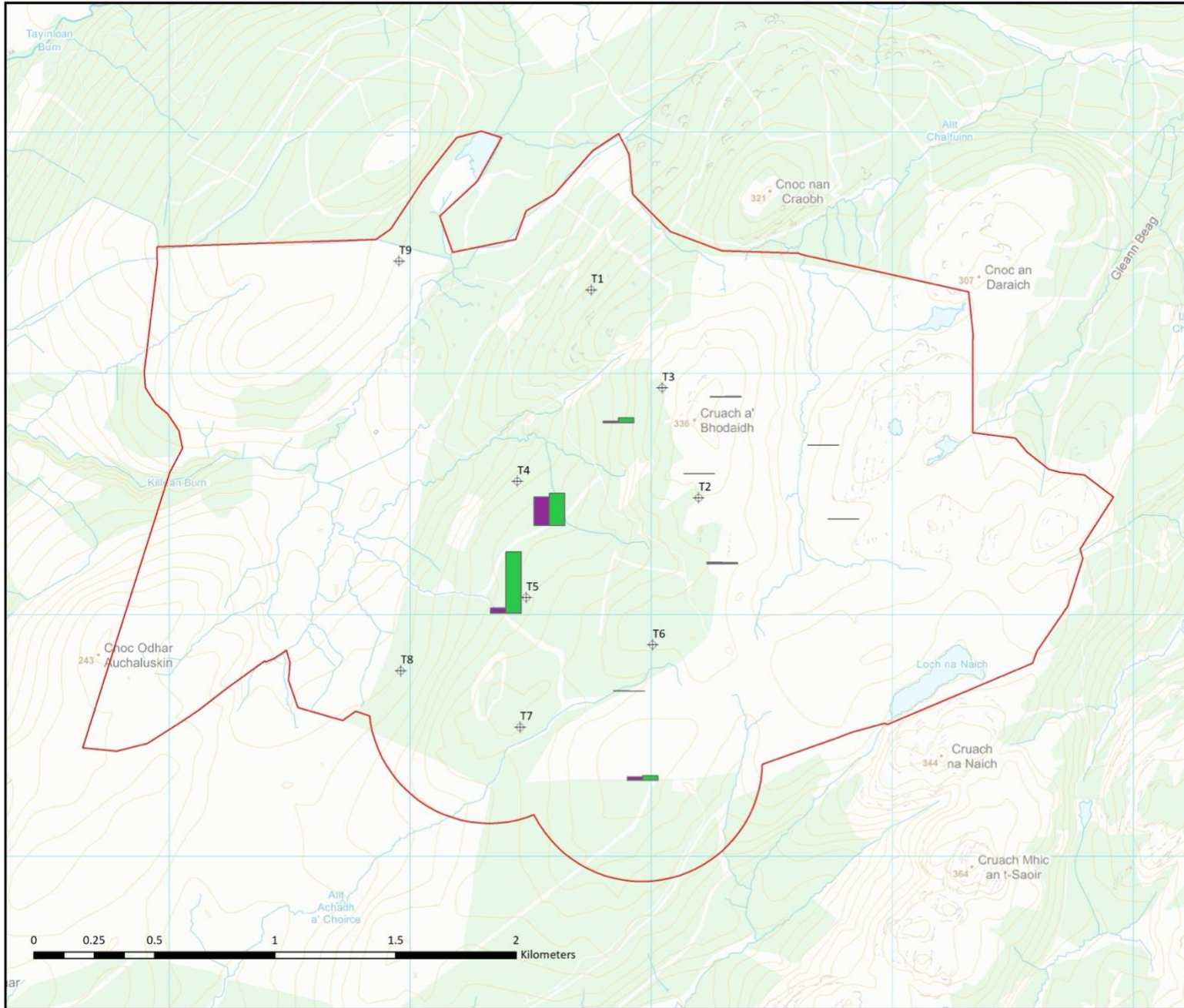
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2022 AND 2023**

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**Killean Wind Farm:
Bat Surveys**

FIGURE 7.2.4

**Static survey autumn
2022: pipistrelles**

KEY:

Mean pass rate

27

Common Pipistrelle
Soprano Pipistrelle

Proposed turbines (EIAR)

Ecology survey area



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Killean Wind Farm: Bat Surveys, 2023

FIGURE 7.2.5

Static recorder mean
passes per night:
Daubenton's Bat

KEY:

⊕ Proposed turbines (EIAR)

□ Ecology survey area

Mean bat pass rate

0.063

■ Daubenton's spring

■ Daubenton's summer

■ Daubenton's autumn

● Additional recorder (zero records)



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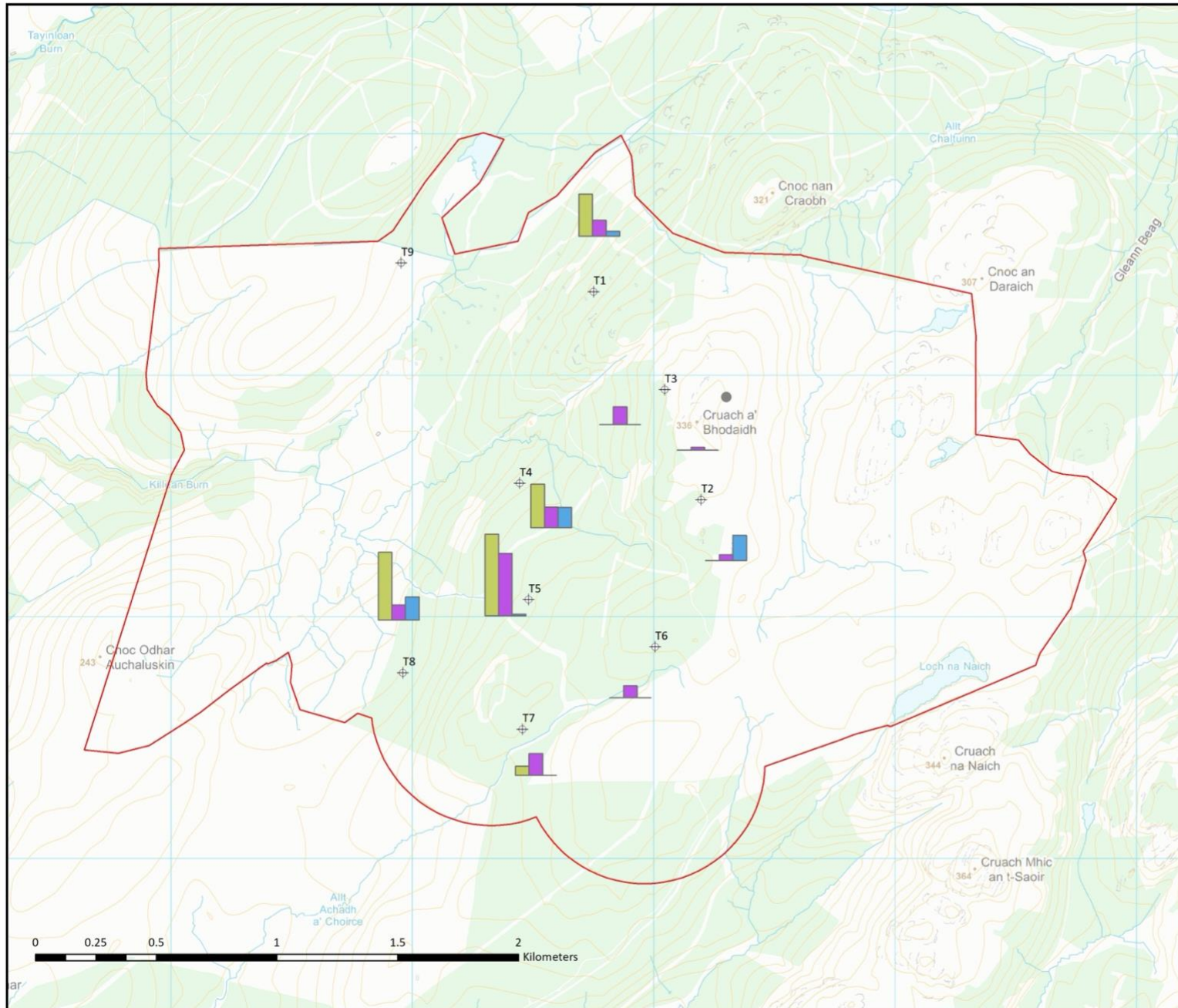
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BAT SURVEYS
2023

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Killean Wind Farm: Bat Surveys, 2023

FIGURE 7.2.6

Static recorder mean
passes per night:
Natterer's Bat

KEY:

- Ecology survey area
- 0.018
- Natterer's spring
- Natterer's summer
- Natterer's autumn
- Additional recorder (zero records)
- Proposed turbines (EIAR)



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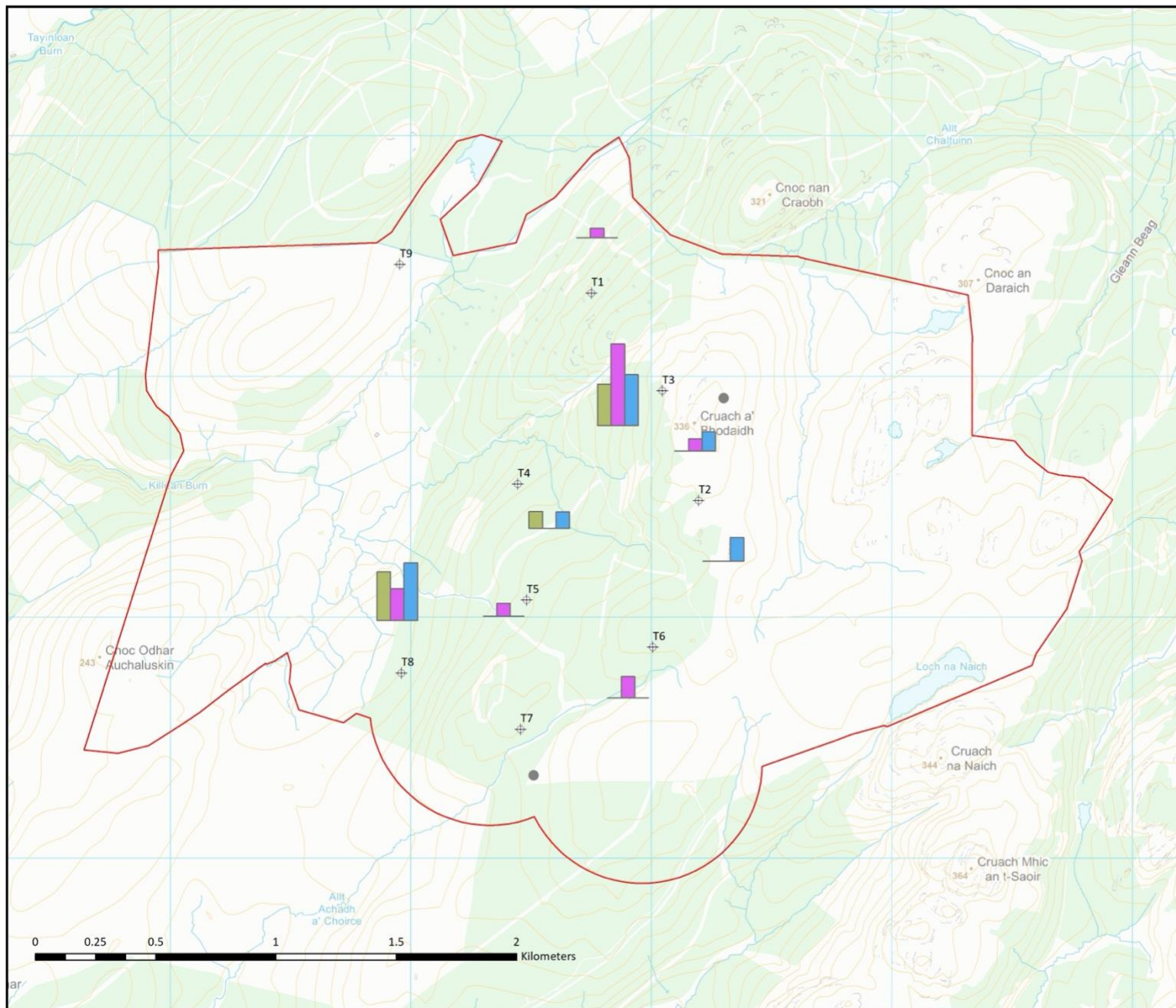
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BAT SURVEYS
2023

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Killean Wind Farm: Bat Surveys, 2023

FIGURE 7.2.7

Static recorder mean passes per night: Leisler's Bat

- KEY:**
- ⊕ Proposed turbines (EIAR)
 - ▭ Ecology survey area
 - Mean bat pass rate**
 - 0.043
 - Leisler's spring
 - Leisler's summer
 - Leisler's autumn
 - Additional recorder (zero records)



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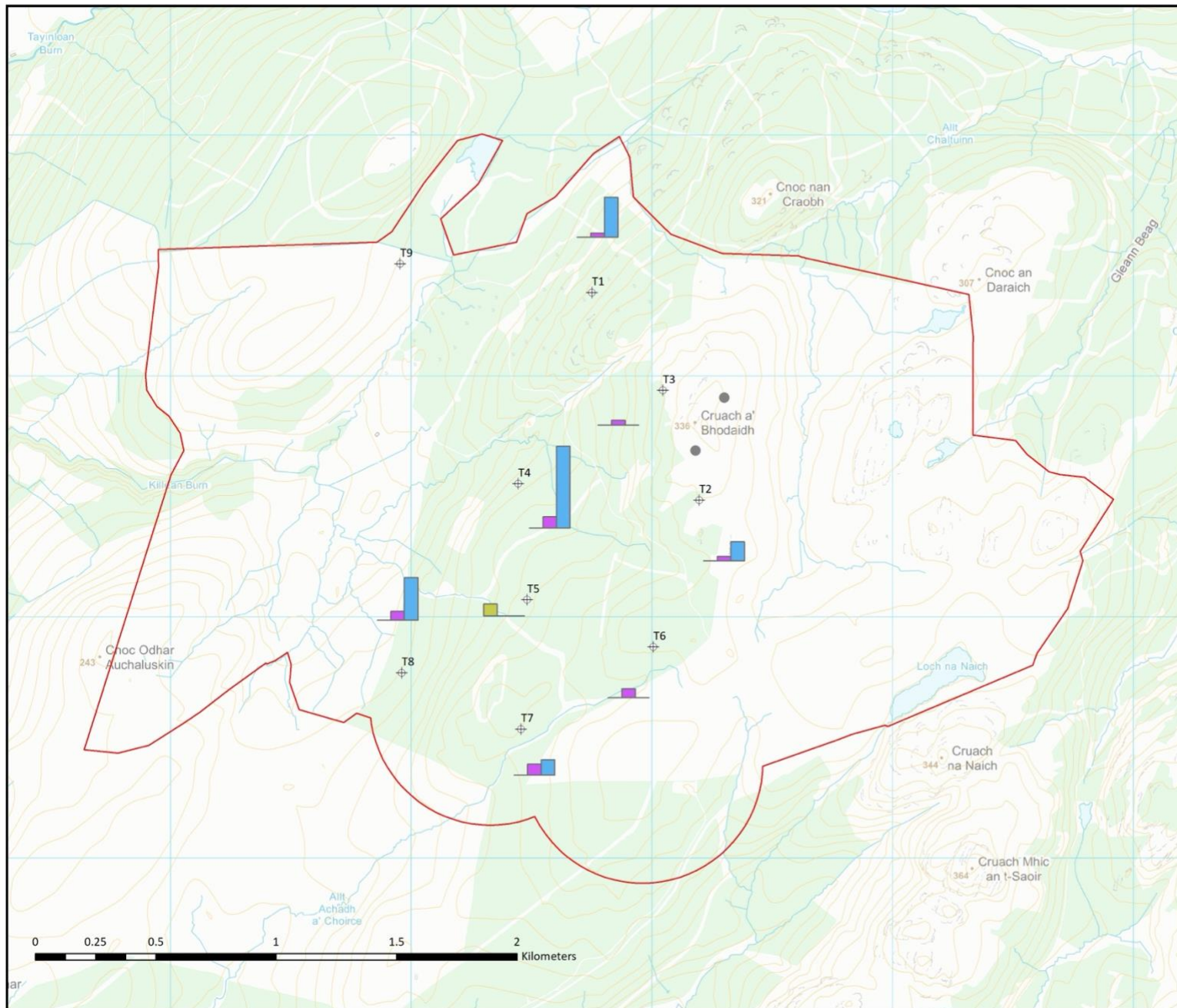
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**BAT SURVEYS
2023**

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0 0.25 0.5 1 1.5 2 Kilometers



Killean Wind Farm: Bat Surveys, 2023

FIGURE 7.2.8

Static recorder mean
passes per night:
Common Pipistrelle

KEY:

⊕ Proposed turbines (EIAR)

Ecology survey area

Mean bat pass rate

2.5

Common Pipistrelle spring

Common Pipistrelle summer

Common Pipistrelle autumn



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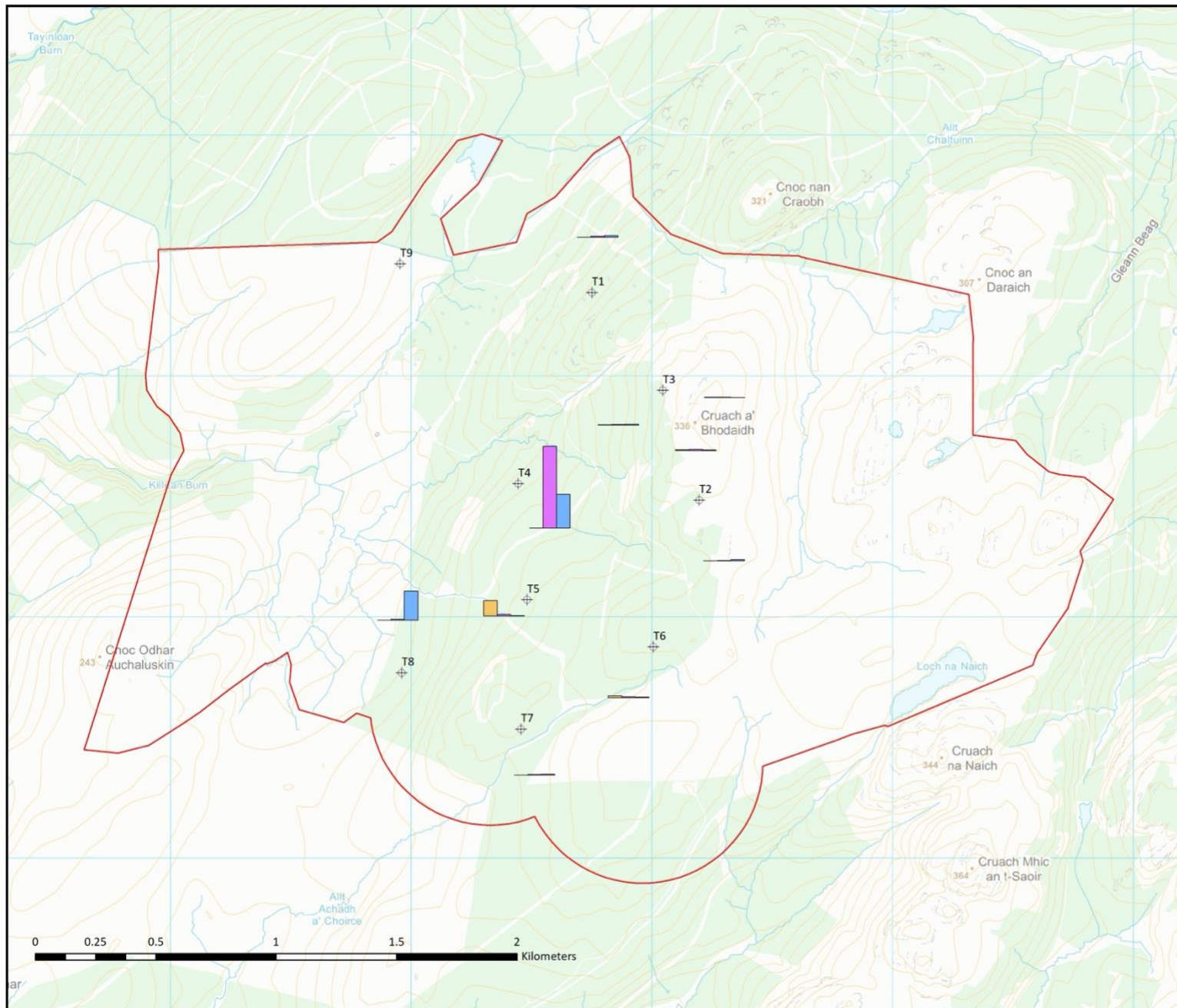
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BAT SURVEYS
2023

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Killean Wind Farm: Bat Surveys, 2023

FIGURE 7.2.9

Static recorder mean
passes per night:
Soprano Pipistrelle

KEY:

⊕ Proposed turbines (EIAR)

▭ Ecology survey area

Mean bat pas rate

4.3

Soprano Pipistrelle spring

Soprano Pipistrelle summer

Soprano Pipistrelle autumn



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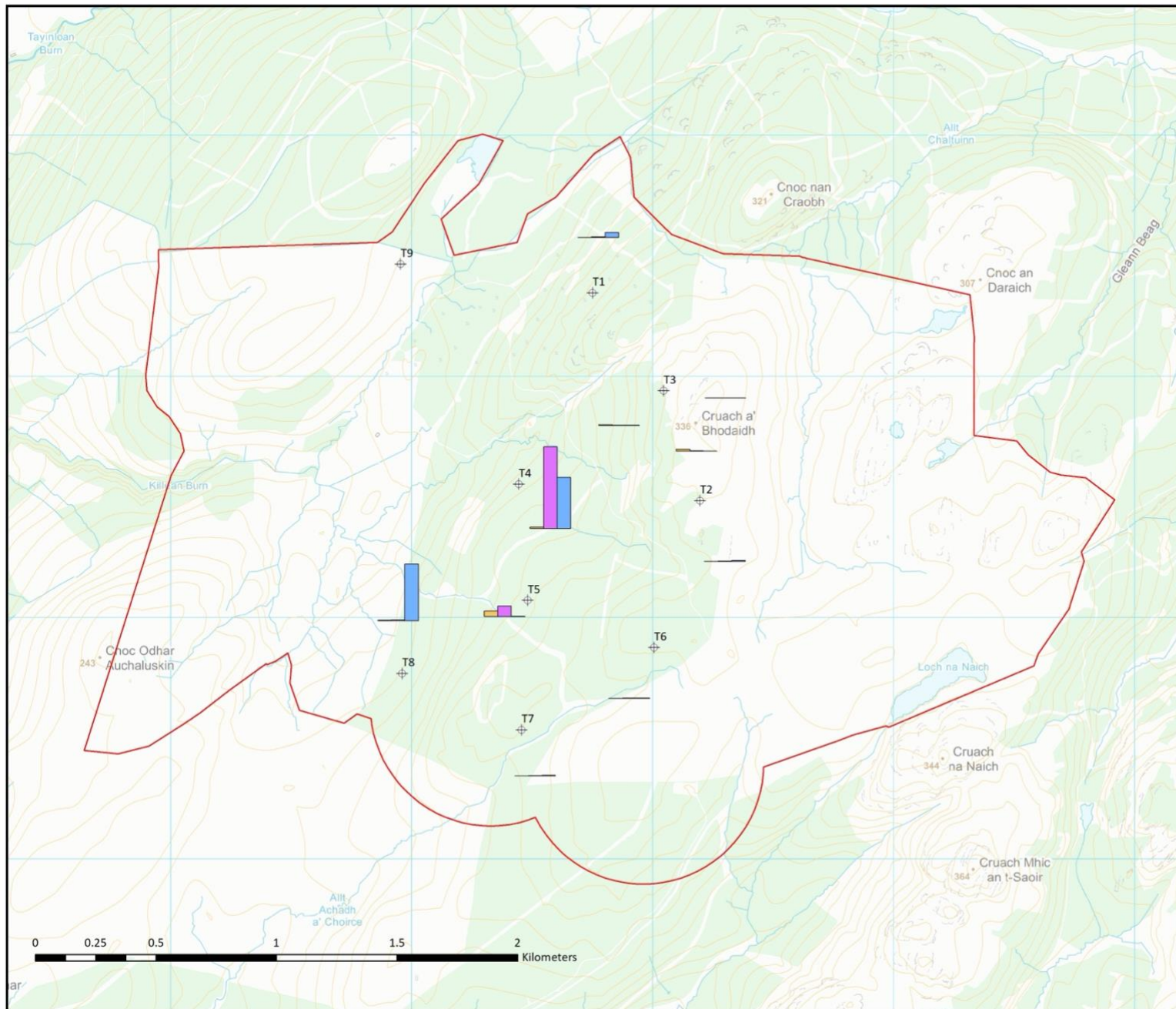
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BAT SURVEYS
2023

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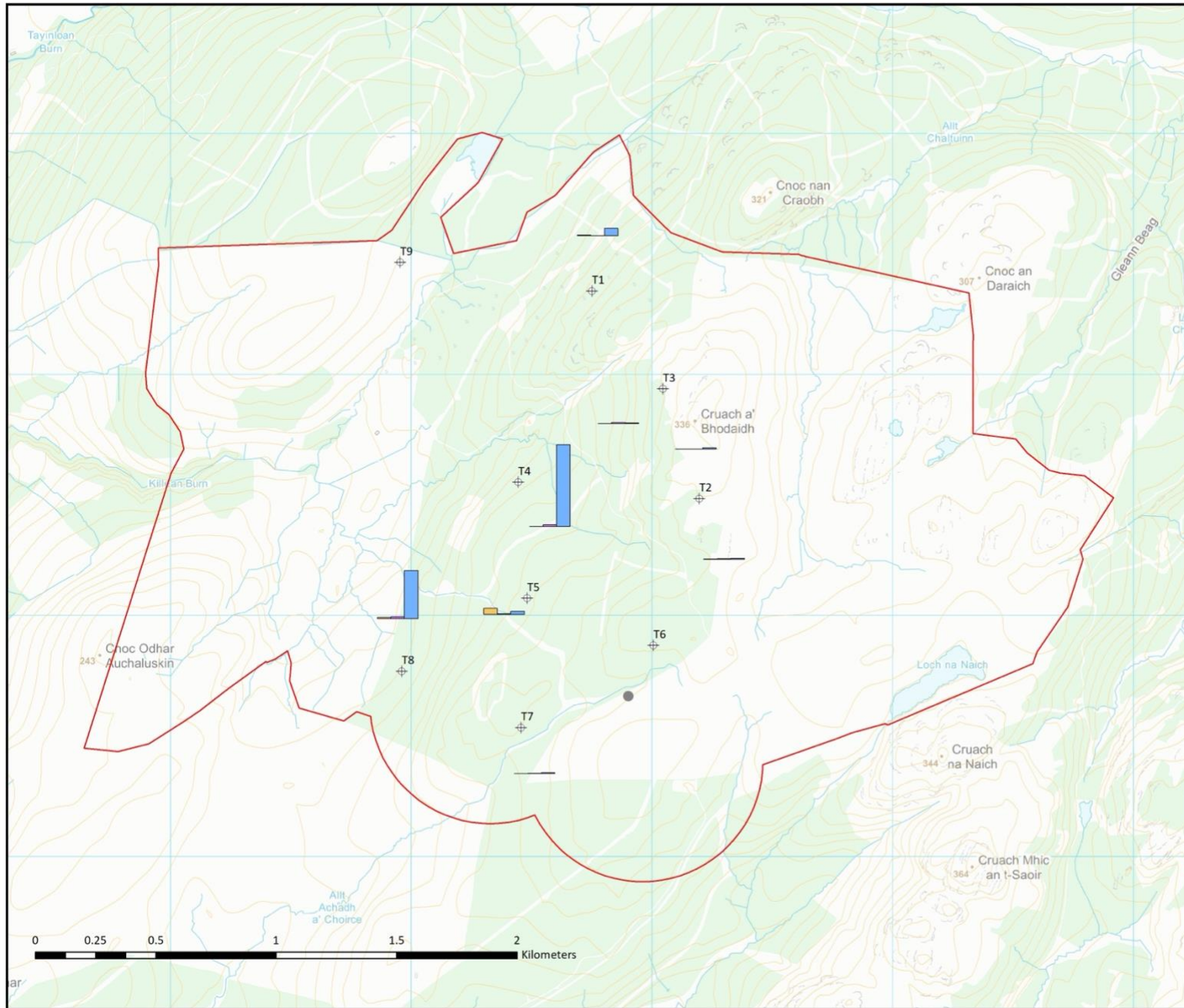




**Killean Wind Farm:
Bat Surveys, 2023**

FIGURE 7.2.10

**Static recorder mean
passes per night:
Brown Long-eared Bat**



KEY:

- ⊕ Proposed turbines (EIAR)
- ▭ Ecology survey area

Mean bat pass rate

0.34

- ▭ Brown Long-eared spring
- ▭ Brown Long-eared summer
- ▭ Brown Long-eared autumn
- Additional recorder (zero records)



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2023**

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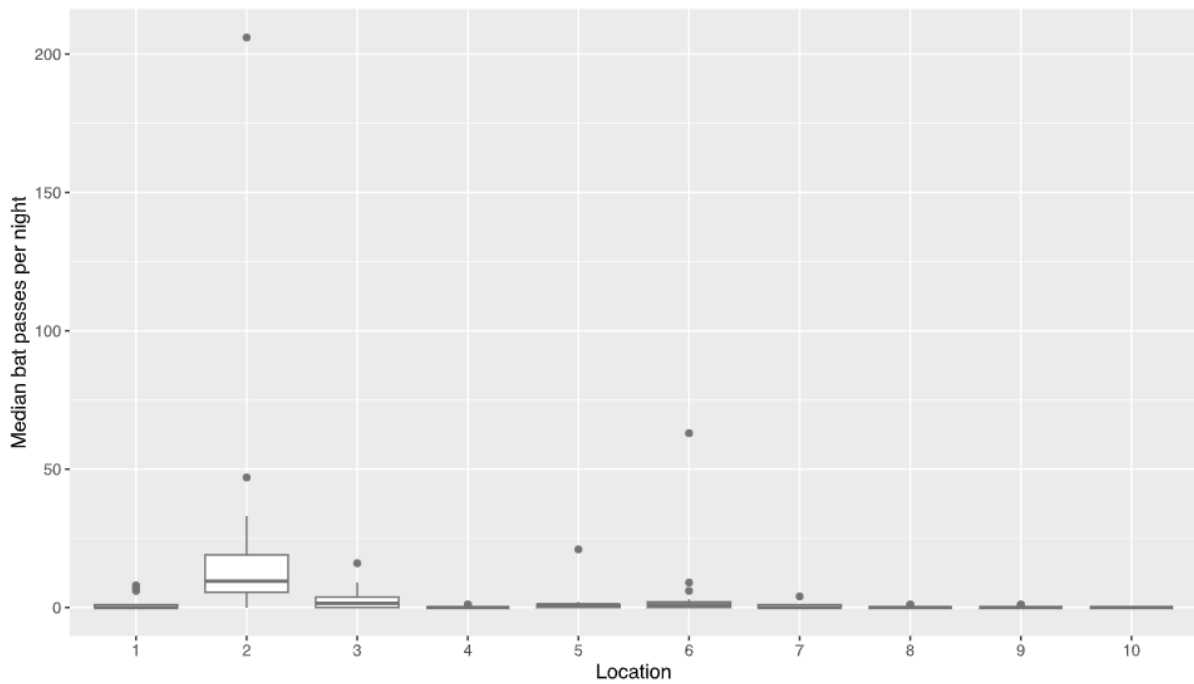




13. Figure 7.2.11 shows the activity levels of the five more abundant bat species over the autumn 2022 survey period at each of the ten survey locations. Each plot shows the median value for each season (horizontal line), 25-75% quartiles (box), 90% percentile (whisker) and individual outliers (dots). This shows the variability in the pass rates recorded, in addition to the median values. Overall, it indicates further the generally low levels of bat activity across the site, with higher numbers recorded only a very small number of occasions.

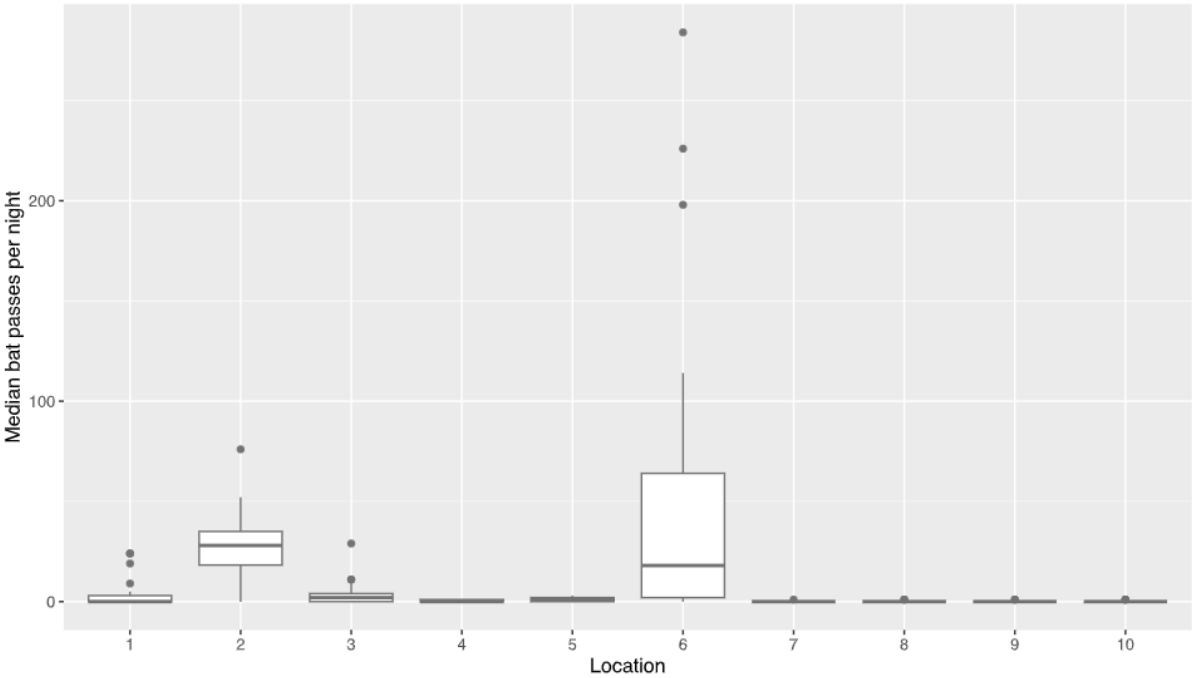
Figure 7.2.11. Bat activity by recorder location: bat activity level (median pass rate per night) recorded across each night of the bat survey for each of the ten survey locations (see Figure 7.2.1).

(a) Common Pipistrelle

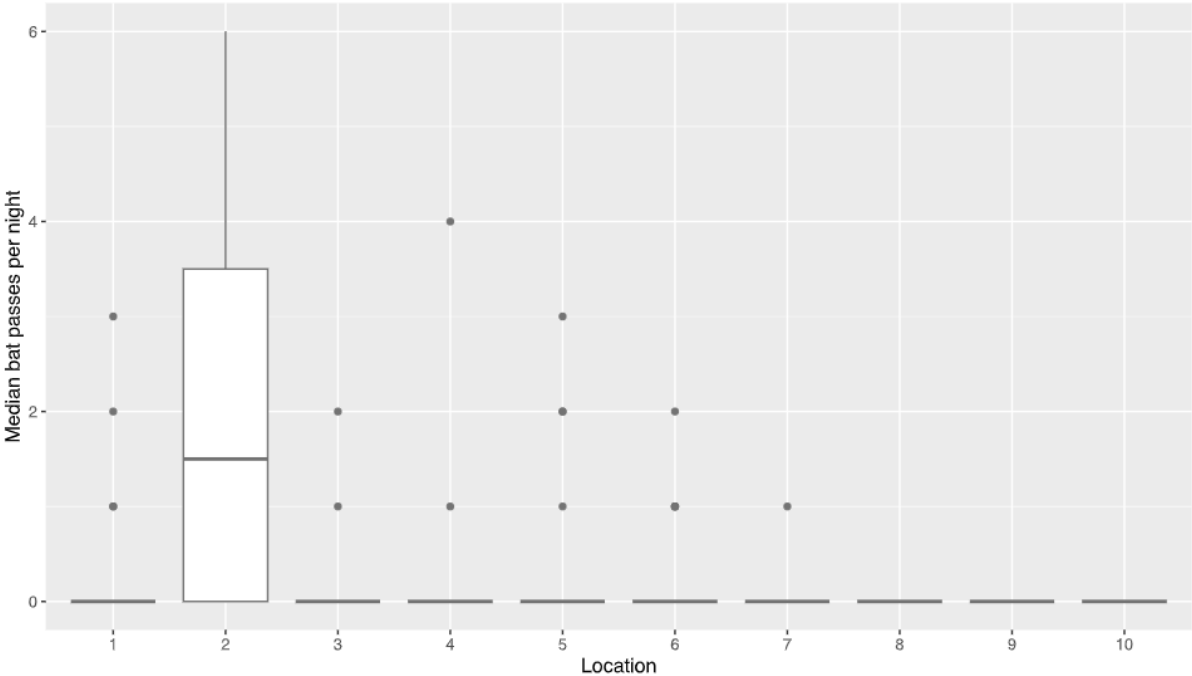




(b) Soprano Pipistrelle

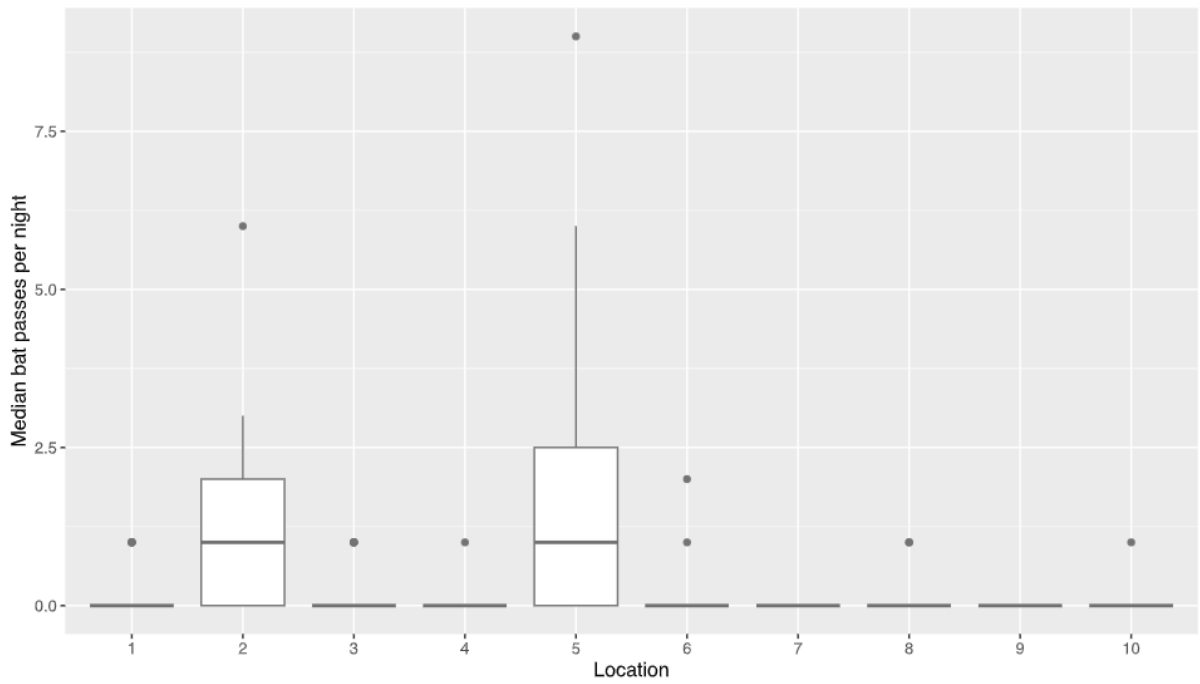


(c) Noctule

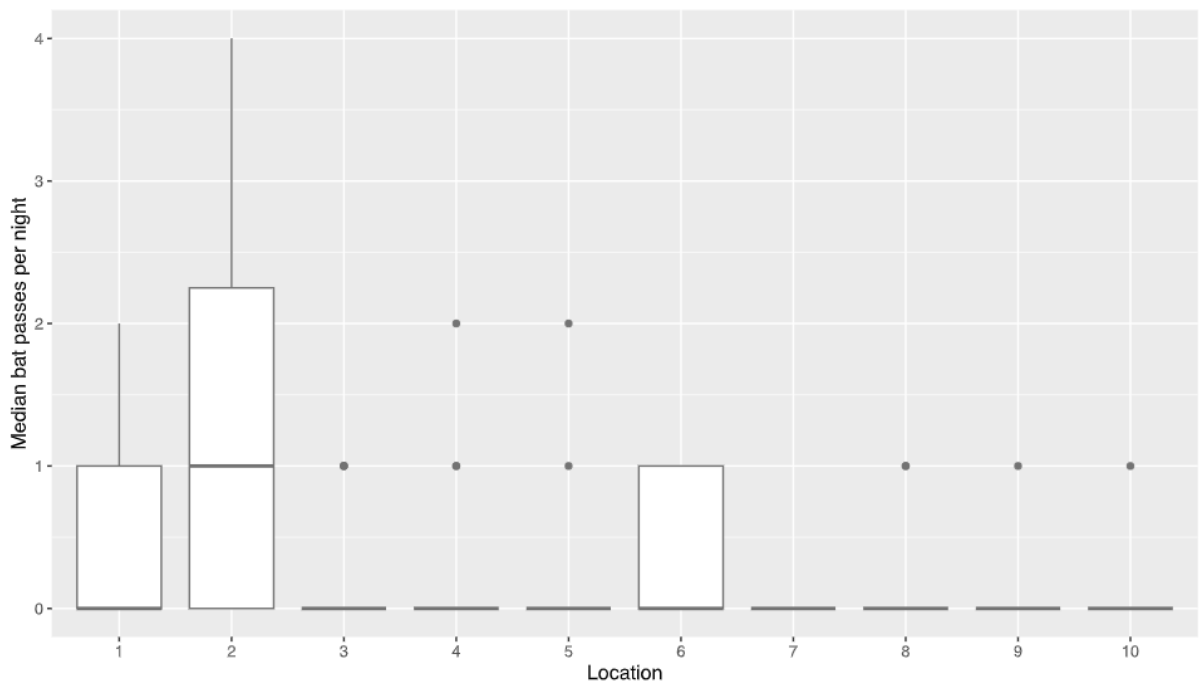




(d) Daubenton's bat



(e) Brown long-eared bat

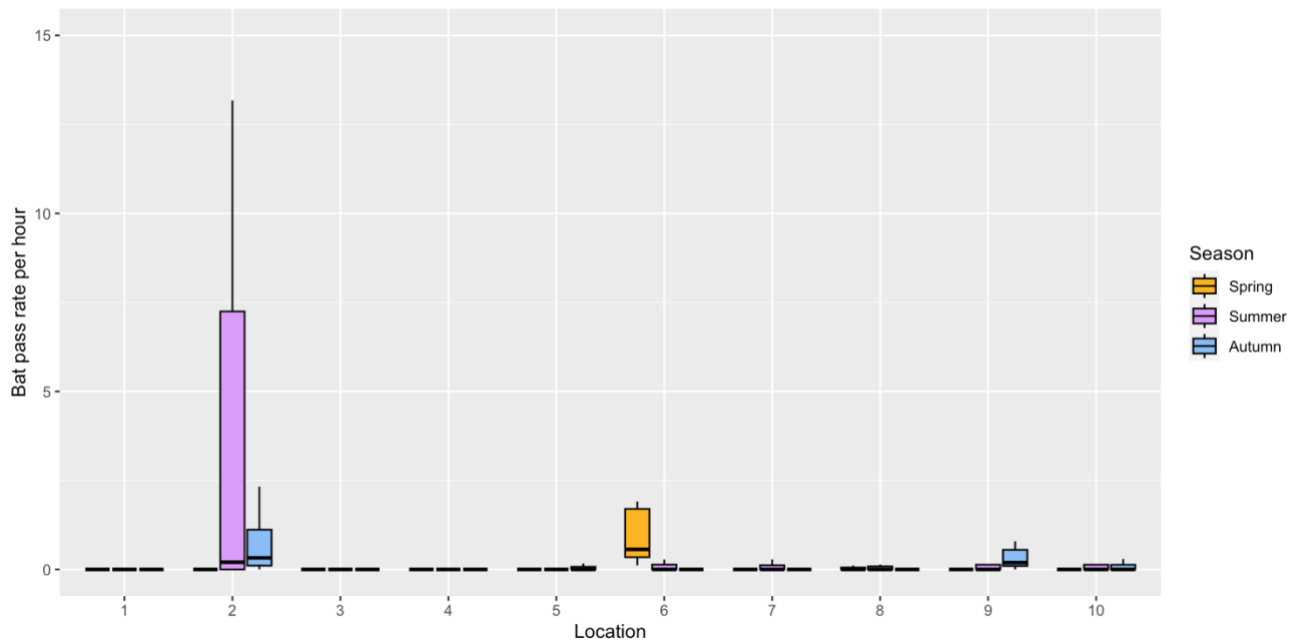




14. Figure 7.2.12 shows the activity levels of the five more abundant bat species over the 2023 survey period at each of the ten survey locations. Each plot shows the median value for each season (horizontal line), 25-75% quartiles (box), and 90% percentile (whisker). This shows the variability in the pass rates recorded, in addition to the median values. Overall, it indicates further the generally low levels of bat activity across the site, with higher numbers recorded on only a very small number of occasions.

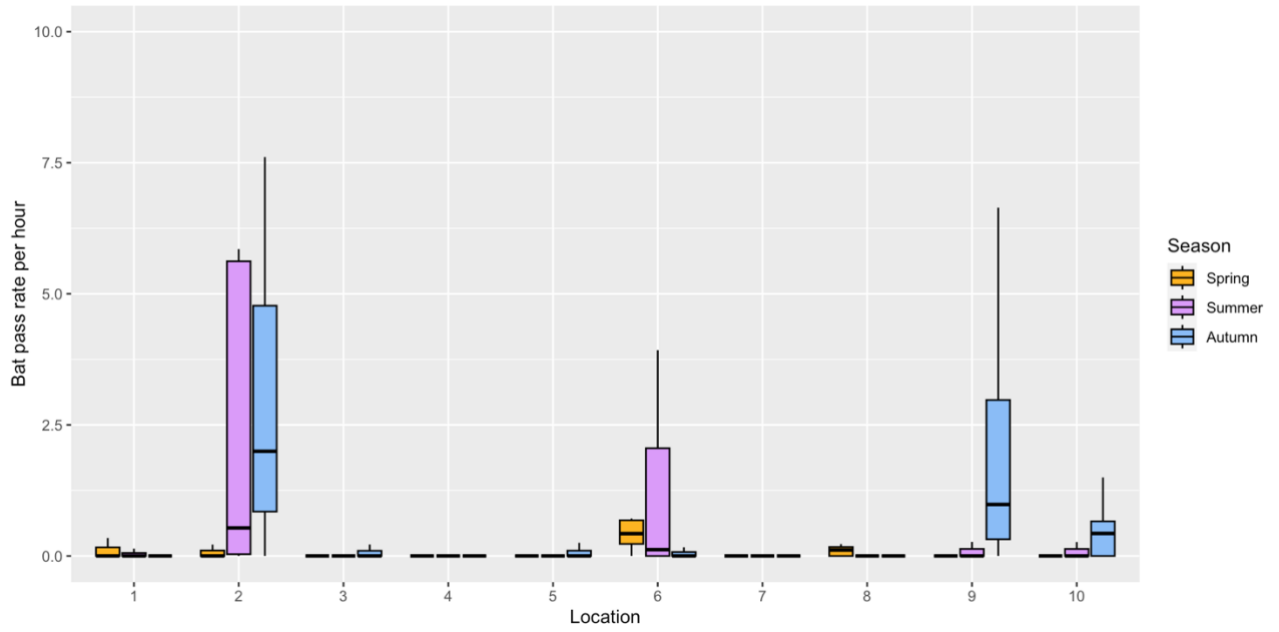
Figure 7.2.12. Bat activity by recorder location: bat activity level (median pass rate per night) recorded across each night of the bat survey for each of the ten survey locations (see Figure 7.2.1).

(a) Common Pipistrelle

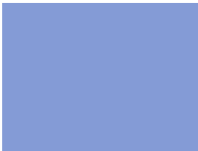
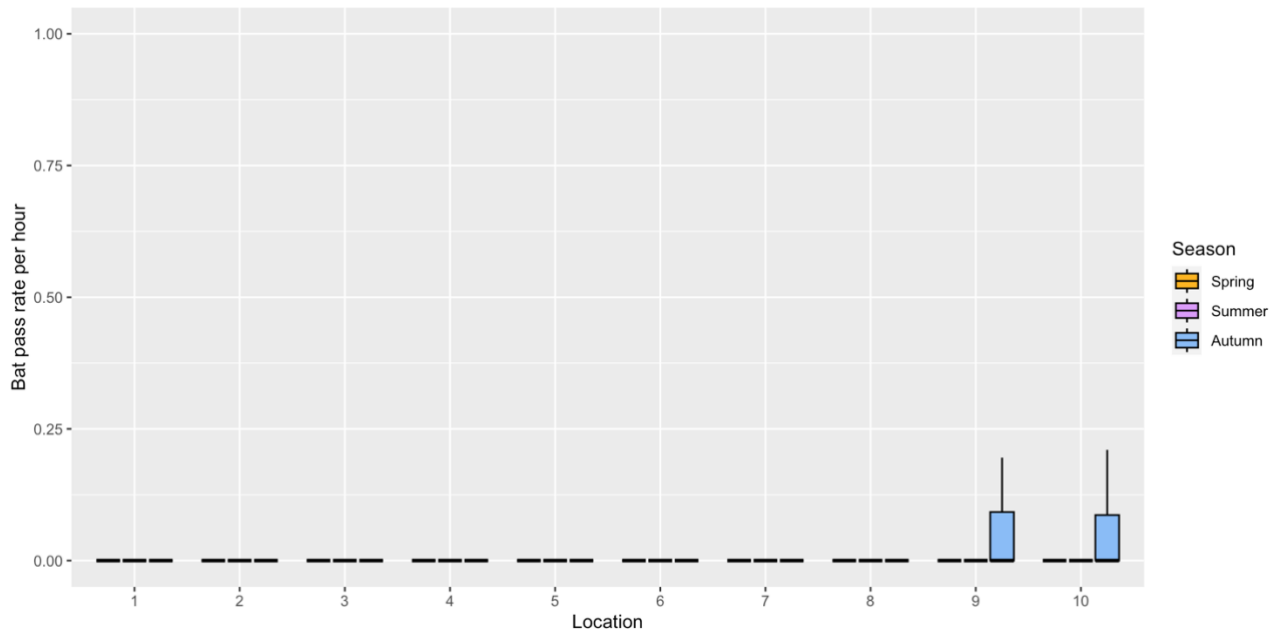




(b) Soprano Pipistrelle

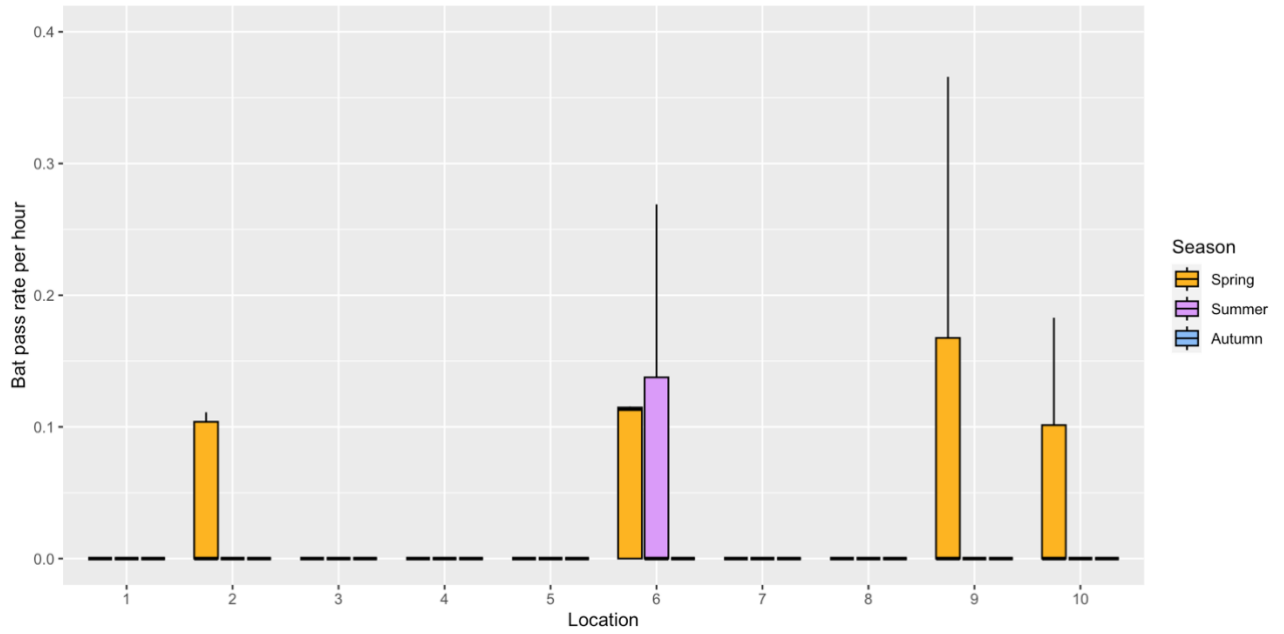


(c) Leisler's Bat

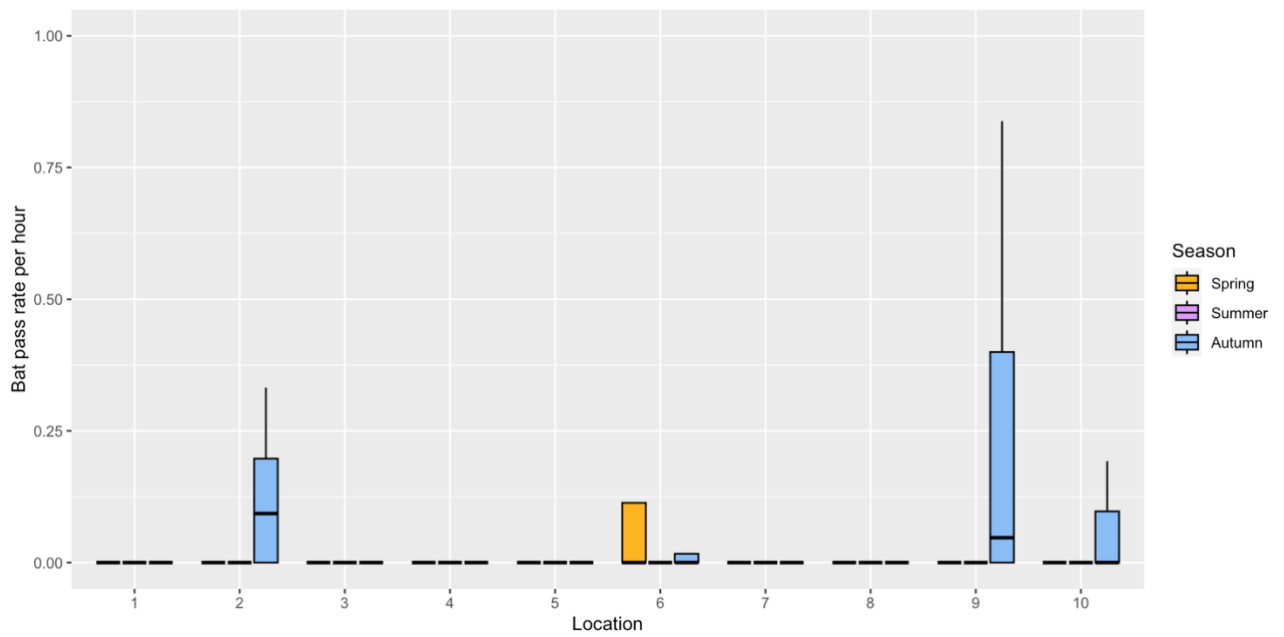




(d) Daubenton's bat



(e) Brown long-eared bat





CONCLUSIONS

15. The baseline bat surveys have shown the survey area to hold generally low levels of bat activity. Seven species of bat were recorded in total during the surveys. Soprano and common pipistrelles were much the more frequently recorded species. Other less abundant species comprised: Daubenton's bat Natterer's bat, Leisler's bat, noctule and brown long-eared bats.
16. The bat numbers recorded within the proposed development in autumn 2022 and in 2023 were generally low, reflecting the low-quality bat habitat across the survey area (coniferous forest and moorland). The recommended Ecobat software (Lintott *et al.* 2018) was not available for further assessment¹, but it was still clear that the survey area was of low value to bats. The surveys did not identify any area of high bat activity that would require buffering in the wind farm design, and overall, it is unlikely that bats would be a major problem for a wind farm development at this site.

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¹ <http://ecobat.org.uk/>



