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Monitoring of Microbats at Slate Gully Adit (Pit 8), Wilpinjong Coal Mine, NSW for 2025

for

Peabody Energy Pty Ltd

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Prepared by: Biodiversity Monitoring Services
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1.0 Introduction

Biodiversity Monitoring Services (BMS) was engaged by Wilpinjong Coal Pty Ltd (WCPL) to undertake the 2025 annual microbat monitoring at the abandoned oil shale mine (adit) in Slate Gully, Wilpinjong Coal Mine (WCM). This adit supports colonies of two microbat species: the Eastern Horseshoe-bat (*Rhinolophus megaphyllus*) and Large Bent-winged Bat (*Miniopterus orianae oceanensis*, formerly known as Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*). Monitoring undertaken since April 2017 indicates that less than 50 Eastern Horseshoe-bats inhabit the mine workings throughout the year. From exit counts conducted to date, numbers of this species do not vary substantially throughout the year. Counts of the Large Bent-winged Bat inhabiting the mine vary considerably more throughout the year.

WCPL is approved to mine Slate Gully (Pit 8) adjacent to the adit. Topsoil stripping at the northern end of Slate Gully began in November 2019. Overburden extraction in Slate Gully began in early 2020 approximately 600m to the northeast of the adit. Previous plans estimated Pit 8 to come within 150m of the adit in approximately 2021. However, by February 2023 only a clean water drain had been constructed within 150m of the adit, with the nearest active cut in Pit 8 remaining still approximately 430m away. By February 2024, topsoil stripping had occurred approximately 100m from the adit, with the Pit 8 active cut still approximately 350m from the adit. As of February 2025, the active cut is approximately 190m from the adit, with the extraction coming past the adit in late 2025. Bats within the workings have been subject to vibration and noise, and once exiting have been, and will be, subject to artificial lighting (Linley 2016). There is also the potential for dust and fumes associated with the open cut operations. Generally there is a paucity of scientific literature on the impacts of mining (and the above impacts) on cave-roosting bats.

Exit counts of bats leaving the adit, as well as capture of exiting bats[1], has been undertaken over the past nine years to determine what species are utilising the adit and how their numbers and sexual composition change throughout the year (Fly By Night 2017; Fly By Night 2018; Fly By Night 2019; Biodiversity Monitoring Services 2025). This has given a firm basis to monitor colonies of the two species roosting within the workings as the adjacent area is strip mined for coal. Previously we recommended that continual monitoring of bat activity via an ultrasonic bat call detector would provide a superior method to monitor the roost long term. This report details the results of automated monitoring over a 12-month period from January 2025 to December 2025, as well as concurrent monthly hand counts of bats exiting the workings.

[1] Harp trapping was conducted over the period 2017-2019 (autumn, winter, summer) and then discontinued at the request of NSW DCCEEW (formerly OEH at the time). Enough data was obtained to determine the site was not a breeding roost, but forms an important overwintering and seasonal roost, with composition of sex/age/individuals in the roost changing seasonally. Harp trapping was again conducted at the adit in July 2024 to determine if the species/sex/age composition of the roost had changed between monitoring events.

2.0 Survey Methodologies

Manual Exit Counts

Bats were counted leaving the adit by Andrew Lothian (BMS) each month. The counter was in position half an hour before sunset, and counts were conducted until no more bats exited for a period of 10 minutes (or more bats flew into the roost than flew out in a 10 minute period). Due to differences in flight behaviour (speed and direction of travel upon exit), an assessment could be made of the species composition of bats leaving the adit, although this assessment is becoming increasingly difficult with the new counting position and multiple exit apertures. Notes were made of the time of first bat exiting the adit, the total number of bats exiting the adit, and the presence of each of the target species. This methodology has been published recently (Lothian and Hoye 2023).

Although the method has remained the same over time, the position of counting was forced to change in 2023 with the installation of a new steel box culvert creating multiple exit points for the bats. Instead of lying down near the entrance counting bats as they flew over (or to the side in the case of Horseshoe-bats), the counter must now be located further out from the entrance to allow observation of both the end of the culvert and the natural aperture over the culvert. It took a few months to choose the optimal position, potentially resulting in manual counts conducted from April 2023 beingless accurate than previous counts. Using a torch to light the entrance created delays in exit by some individual bats, and sitting side-on to the adit made it difficult to differentiate bats from the rock wall behind (as opposed to being backlit by the sky). The new counting position increases the likelihood of miscounting Eastern Horseshoe-bats, however, over summer when Bent-winged bats are absent, more focus can be applied to this species.

A new setup was trialled in 2025 which appears to balance the need for lighting the entrance and the disturbance this causes to the exiting bats. A torch is placed on the ground approximately 1-2m in from of the tunnel, pointing upward and outward. This allows bats exiting the tunnel to be uplighted, without creating disturbance by pointing lights back at the adit. It still remains difficult to count both the tunnel and the existing aperture over the top.

Automated Echolocation Call Detection

An Anabat Express detector (Titley Scientific) was placed twenty metres in front of the entrance of the mine adit to sample microbats on a nightly basis (**Figure 2-1**; **Plate 2-1**). The detector was powered via a 12 volt gel cell battery connected to a small solar panel. Files were downloaded monthly in conjunction with manual counts of bats exiting the workings. This allowed a nightly activity index of the two target microbat species to be determined. While the nightly activity cannot be directly compared to numbers of each species roosting within the workings, together with exit counts it provides an estimation/index of bat numbers.

Previous echolocation survey indicated that placement of a detector a distance of approximately 20 metres from the adit provided the best indicator of bat activity for the two species (Fly By Night 2019). The Eastern Horseshoe-bat undertakes circling behaviour when it exits the adit at dusk. Therefore, echolocation call activity undertaken at the adit gives inflated activity for this species. From presence during the counts, Eastern Horseshoe-bats tend to come and go frequently, particularly at the start of the night. Large Bent-winged Bat tend to all come out in a short space of time then return in smaller groups through the night.

Figure 2-1: Location of Slate Gully Adit (WCPL 2026). Note topsoil stripping has passed adit, and the extraction pit is almost level with the adit (pit progression is southward).

Plate 2-A: Slate Gully adit entrance prior to installation of steel pipe to maintain opening in the event of a collapse (mid 2019), also prior to installation of steel box tunnel (Apr 2023). Detector and solar panel setup 20m in front of adit.

3.0 Weather

Weather conditions on manual count nights (and the two nights prior) were recorded. Data was obtained from the Wilpinjong Meteorological Station, approximately 4.5km west of the adit.

Table 3-1: Weather conditions during survey (Peabody Energy 2026).

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Comments
16/12/2023	15.3	32.9	0	
17/12/2023	13.6	35.8	0	
18/12/2023	21.4	38.1	0	Hot, 0% cloud, no wind, no rain but humid
28/01/2024	17.5	29.7	0	
29/01/2024	20.5	37.6	0	
30/01/2024	24.7	33.0	0	Hot, 0% cloud, moderate wind, no rain but humid
10/02/2024	18.6	24.5	0	
11/02/2024	18.5	25.3	0	
12/02/2024	16.6	32.9	0	Hot, 0% cloud, no wind, no rain but humid
23/03/2024	11.5	23.2	0	
24/03/2024	14.7	27.6	0	
25/03/2024	10.5	28.9	0	Mild, 0% cloud, no wind, no rain, full moon
27/04/2024	5.1	21.4	0	
28/04/2024	6.3	24.6	0.2	
29/04/2024	6.8	24.8	0.6	Mild, 100% cloud, no wind, light rain first 15min, no moon at time of count
20/05/2024	0.7	18.2	0	
21/05/2024	2.9	18.8	0	
22/05/2024	4.0	18.9	0.2	Cold, 0% cloud, no wind, no rain, full moon
15/06/2024	9.1	12.6	9.6	
16/06/2024	4.7	14.9	0	
17/06/2024	2.5	15.8	0	Cold, 75% cloud, no wind, no rain but recent – wet ground, gibbous moon
30/06/2024	6.5	16.4	12.0	
01/07/2024	5.1	14.1	0.6	
02/07/2024	4.0	13.2	0	Cold, 100% cloud, no wind, light rain before exit time, waning crescent
10/08/2024	6.3	20.7	0.4	
11/08/2024	9.3	18.1	0	
12/08/2024	8.8	15.5	0	Cold, 100% cloud, light wind, light rain during count
07/09/2024	7.9	27.8	0.2	
08/09/2024	9.0	18.3	0	

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Comments
09/09/2024	5.3	20.6	0.4	Cool, 0% cloud, no wind, no rain, waxing crescent
01/10/2024	9.1	23.3	0	
02/10/2024	8.1	21.4	0	
03/10/2024	10.3	20.8	0	Cool, 0% cloud, no wind, no rain, no moon during count
12/11/2024	15.9	23.5	0.2	
13/11/2024	13.7	29.9	0	
14/11/2024	12.7	29.8	0.4	Mild, 0% cloud, strong wind, no rain but been wet this week, near full moon
16/12/2024	21.1	35.2	0	
17/12/2024	18.5	36.2	0	
18/12/2024	16.7	27.4	0	Cool, 100% cloud, strong wind, no rain, no moon during count
21/01/2025	13.2	34.5	0	
22/01/2025	16.3	36.2	0	
23/01/2025	18.8	27.6	0	Mild, 100% cloud, moderate wind, no rain, no moon during count
09/02/2025	17.6	33.4	6.0	
10/02/2025	16.5	24.0	24.2	
11/02/2025	15.7	25.8	3.8	Warm, 0% cloud, light wind, no rain but 20mm of rain overnight and this morn so ground wet, full moon rising straight ahead of adit
23/03/2025	20.0	26.7	0	
24/03/2025	19.6	26.7	0	
25/03/2025	19.8	25.6	0	Mild, 100% cloud, strong wind, no rain, no moon during count
26/04/2025	12.4	22.5	4.4	
27/04/2025	12.8	17.0	7.4	
28/04/2025	9.6	24.1	0.2	Cool, 50% cloud, no wind, no rain but wet ground so rain over previous night/morning, no moon during count
26/05/2025	6.4	13.2	17.8	
27/05/2025	9.4	15.5	22.2	
28/05/2025	6.7	16.2	0	Cold, 0% cloud, no wind, no rain but saturated ground so substantial rain previous night/morning, no moon during count
14/06/2025	-0.3	16.2	0	
15/06/2025	1.5	16.5	0	
16/06/2025	-0.5	16.2	0	Cold, 0% cloud, no wind, no rain, no moon during count
20/07/2025	-2.7	15.9	0	
21/07/2025	-0.2	17.0	0	
22/07/2025	5.2	18.6	6.4	Cold, 100% cloud, no wind, no rain, no moon during count

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)	Comments
31/08/2025	-0.4	19.0	0	
01/09/2025	0.9	20.0	0	
02/09/2025	5	-	0.2	Cold, 0% cloud, no wind, no rain, half-gibbous moon overhead during count
23/09/2025	2.1	18.5	0	
24/09/2025	4.3	20.9	0	
25/09/2025	5.4	21.2	0	Mild, 0% cloud, no wind, no rain, no moon during count
18/10/2025	16.0	28.5	0	
19/10/2025	12.1	29.9	0	
20/10/2025	12.0	34.7	0	Warm, 0% cloud, no wind, no rain, no moon during count
09/11/2025	11.7	23.4	0	
10/11/2025	7.9	25.3	0	
11/11/2025	6.4	26.3	0	Mild, 0% cloud, light wind, no rain, no moon during count
15/12/2025	13.4	32.5	0	
16/12/2025	18.4	27.3	0	
17/12/2025	17.7	33.6	0	Warm, 0% cloud, light wind, no rain, no moon during count, dusty
17/01/2026	-	-	-	
18/01/2026	-	-	-	
19/01/2026	-	-	-	Mild, 0% cloud, strong wind, no rain, no moon during count, dusty

4.0 Results

Manual Exit Counts

Under the previous adit inspection/monitoring regime (2017-2019), exit counts were conducted over two nights alongside trapping of bats. Data comparing total exit counts over the last eight years are presented in **Table 4-1**. Count data from monthly surveys since June 2019 are presented in **Table 4-2**.

Table 4-1: Counts of bats exiting adit during April, June and December surveys from 2017-2025

	Apr 2017	**Apr 2018**	**Apr 2019**	**Apr 2020**	**Apr 2021**	**Apr 2022**	**Apr 2023**	**Apr 2024**	**Apr 2025**
Minimum count	603	640	460	55	289	527	221	534	390
Maximum count	669	705	603	55	289	527	221	534	390

	Jun 2017	**Jun 2018**	**Jun 2019**	**Jun 2020***	**Jun 2021**	**Jun 2022**	**Jun 2023**	**Jun 2024**	**Jun 2025**
Minimum count	665	1000	94	92	788	705	363	390	739
Maximum count	720	1029	94	246	823	705	363	390	739

	Dec 2017	**Dec 2018**	**Dec 2019**	**Dec 2020**	**Dec 2021**	**Dec 2022***	**Dec 2023**	**Dec 2024**	**Dec 2025**
Minimum count	10	9	12	20	15	15	3	9	12
Maximum count	10	9	12	20	15	22	5	9	12

*Note: two counts were conducted in June 2020 due to a required maintenance visit. Access issues in 2022 meant there were two December counts due to a late November count. January count in 2023 was one day late, resulting in two February counts.

Table 4-2: Hand counts of bats exiting adit, and detector activity levels adjacent to the adit since monthly counts began in June 2019 – total (confident), raw # passes (all calls for all species). Detector located 20m from adit entrance in forest vegetation so more than just adit occupants are recorded. MIOR denotes *Miniopterus orianae oceanensis*. RMEG denotes *Rhinolophus megaphyllus*. VTRO denotes *Vespadelus troughtoni*. VPUM denotes *Vespadelus pumilus* (could be high calling *Vespadelus troughtoni* which is known from the area).

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
24 Jun 2019	94	94	-	MIOR/RMEG	14 (11)	740 (487)	952
29 Jul 2019	93	93	-	MIOR/RMEG	42 (34)	850 (597)	1376
21 Aug 2019	99	99	17:45/18:45	MIOR/RMEG	114 (104)	707 (492)	1222
23 Sep 2019	267	267	18:15/19:30	MIOR/RMEG	88 (79)	873 (602)	1431
29 Oct 2019	80	80	19:44/20:29	MIOR/RMEG	NA	NA	569
22 Nov 2019	29	29	19:50/20:45	RMEG	Data Missing	Data Missing	Data missing
19 Dec 2019	12	12	20:20/21:20	RMEG	24 (14)	96 (59)	240
09 Jan 2020	8	8	20:29/21:15	RMEG	2 (1)	354 (274)	671
19 Feb 2020	59	59	19:56/21:00	MIOR/RMEG	Data missing	Data missing	Data missing
23 Mar 2020	17	17	19:33/20:20	RMEG	10 (10)	417 (311)	1365
21 Apr 2020	55	55	17:52/18:55	MIOR/RMEG	53 (45)	403 (225)	866
18 May 2020	66	66	17:25/18:35	MIOR/RMEG	Data missing	Data missing	Data missing
18 Jun 2020	92	92	17:21/18:20	MIOR/RMEG	10 (8)	354 (230)	612
25 Jun 2020*	246	246	17:19/18:32	MIOR/RMEG	18 (16)	570 (400)	816
15 Jul 2020	518	499	17:32/18:31	MIOR/RMEG	16 (13)	541 (332)	786
13 Aug 2020	682	682	17:43/18:55	MIOR/RMEG	18 (16)	580 (389)	845
08 Sep 2020	538	538	18:05/19:29	MIOR/RMEG	15 (10)	585 (440)	1012
14 Oct 2020	66	66	19:33/20:30	MIOR/RMEG	17 (13)	782 (727)	1362
18 Nov 2020	16	16	20:09/20:49	RMEG	5 (4)	261 (191)	508

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
23 Dec 2020	20	20	20:27/20:59	RMEG	7 (6)	229 (161)	511
28 Jan 2021	12	12	20:26/21:06	RMEG	22 (22)	436 (383)	1357
24 Feb 2021	27	1	19:57/19:37	VPUM?/RMEG	20 (16)	350 (283)	956
17 Mar 2021	47	28	19:32/20:21	MIOR/RMEG	14 (13)	284 (200)	1357
18 Apr 2021	289	270	17:52/19:02	MIOR/RMEG	15 (10)	698 (495)	942
12 May 2021	518	498	17:24/18:24	MIOR/RMEG	4 (4)	1092 (936)	1277
15 Jun 2021	823	788	17:16/18:26	MIOR/RMEG	1 (1)	794 (653)	979
12 Jul 2021	497	497	17:24/18:20	MIOR/RMEG	19 (17)	528 (399)	603
04 Aug 2021	419	419	17:45/18:40	MIOR/RMEG	29 (24)	548 (471)	787
10 Sep 2021	890	890	18:08/19:10	MIOR/RMEG	19 (17)	748 (588)	991
04 Oct 2021	624	624	19:15/20:20	MIOR/RMEG	37 (32)	897 (714)	1383
01 Nov 2021	28	28	19:44/20:30	MIOR(1)/RMEG	42 (37)	524 (439)	1037
02 Dec 2021	15	15	20:14/20:54	RMEG	7 (4)	398 (285)	706
19 Jan 2022	8	8	20:31/21:11	RMEG	21 (20)	751 (575)	1220
17 Feb 2022	17	17	20:05/20:45	RMEG	18 (12)	268 (146)	427
16 Mar 2022	29	29	19:35/20:25	VTRO?/RMEG	9 (5)	1013 (823)	1722
21 Apr 2022	527	527	17:47/18:27	MIOR/RMEG	4 (3)	1059 (908)	1594
16 May 2022	396	396	17:25/18:15	MIOR/RMEG	2 (1)	856 (705)	1026
21 Jun 2022	705	705	17:16/18:06	MIOR/RMEG	2 (2)	1068 (929)	1300
29 Jul 2022	661	661	17:30/18:30	MIOR/RMEG	15 (13)	651 (505)	866
18 Aug 2022	974	974	17:47/18:30	MIOR/RMEG	12 (6)	1199 (1017)	1497
27 Sep 2022	1050	1050	18:10/19:10	MIOR/RMEG	7 (6)	1124 (1013)	1435

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
28 Oct 2022	-	-	-	-	5 (4)	757 (605)	1046
7 Dec 2022*	22	22	20:13/20:43	MIOR(1)/RMEG	17 (15)	830 (761)	1281
28 Dec 2022	15	15	20:29/20:59	RMEG	8 (5)	327 (213)	444
01 Feb 2023*	6	6	20:24/20:54	RMEG	18 (15)	561 (371)	761
15 Feb 2023	19	17	20:10/20:40	RMEG	13 (11)	749 (640)	1305
14 Mar 2023	278	278	19:34/20:24	MIOR/RMEG	20 (16)	916 (747)	1484
26 Apr 2023***	221	221	17:36/18:46	MIOR/?	24 (22)	1101 (1027)	3829
22 May 2023***	323-388	288	17:03/18:13	MIOR/?	6 (5)	553 (394)	716
18 Jun 2023	363	363	17:05/18:14	MIOR/RMEG	14 (7)	502 (399)	643
17 Jul 2023	225	225	17:24/18:34	MIOR/RMEG	4 (2)	519 (405)	590
26 Aug 2023	666	666	17:47/19:16	MIOR/RMEG	0 (0)	1158 (999)	1432
19 Sep 2023	731	731	18:13/20:13	MIOR/RMEG	4 (2)	502 (415)	1707
25 Oct 2023	27	23	19:34/20:38	MIOR/RMEG	5 (4)	240 (178)	679
23 Nov 2023^	4	4	20:01?(20:15)/ 20:41	RMEG	1 (1)	59 (16)	1163
18 Dec 2023	5	3	20:29/20:59	RMEG	7 (4)	32 (9)	793
30 Jan 2024	11	8	20:23/21:04	RMEG	5 (4)	67 (29)	1060
12 Feb 2024	10	9	20:10/20:55	RMEG	18 (16)	39 (12)	734
25 Mar 2024	729	729	19:15/20:05	MIOR/RMEG?	25 (23)	66 (23)	1858
29 Apr 2024	534	534	17:35/18:45	MIOR/RMEG	2 (1)	124 (61)	967
22 May 2024	351	351	17:24/18:34	MIOR/RMEG?	2 (2)	157 (45)	787
17 Jun 2024	390	390	17:22/18:28	MIOR/RMEG	5 (5)	177 (61)	1464

Survey Date	Max. count	Min. count	First/last bat	Species present	# RMEG passes	# MIOR passes**	Total passes
02 Jul 2024^^	N/A harp	147	NA harp	MIOR/RMEG	13 (11)	105 (44)	1903
12 Aug 2024	176	174	17:32/18:32	MIOR	14 (11)	130 (66)	616
09 Sep 2024	1178	912	18:07/19:51	MIOR/RMEG	2 (2)	70 (25)	2217
03 Oct 2024	735	735	18:17/19:36	MIOR/RMEG	0 (0)	109 (10)	1385
14 Nov 2024	20	20	19:58/20:38	MIOR(12)/RMEG	0 (0)	92 (49)	1595
18 Dec 2024	9	9	20:30/21:09	MIOR(1?)/RMEG	8 (6)	78 (33)	709
23 Jan 2025	7	7	20:24/21:04	MIOR(1)/RMEG	10 (10)	45 (17)	1258
11 Feb 2025	97	97	20:03/20:43	MIOR/RMEG	16 (9)	110 (37)	684
25 Mar 2025	254	254	19:19/20:18	MIOR/RMEG	12 (10)	100 (52)	1695
28 Apr 2025	390	390	17:32/18:41	MIOR/RMEG	4 (2)	160 (39)	858
28 May 2025	503	503	17:20/18:50	MIOR/RMEG	3 (3)	148 (36)	1064
16 Jun 2025	739	739	17:17/18:27	MIOR/RMEG/ other spp?	3 (2)	170 (45)	650
22 Jul 2025	638	638	17:40/19:00	MIOR/RMEG	8 (6)	130 (40)	954
02 Sep 2025*	690	690	17:51/19:41	MIOR/RMEG	1 (1)	129 (33)	1348
25 Sep 2025	680	680	18:18/19:28	MIOR/RMEG	11 (11)	68 (25)	1721
20 Oct 2025	26	26	19:36/20:15	MIOR(6?)/RMEG	10 (9)	44 (28)	377
11 Nov 2025	30	29	19:53/20:22	RMEG	11 (10)	39 (6)	596
17 Dec 2025	12	12	20:18/20:58	MIOR(2)/RMEG	4 (4)	63 (34)	916
19 Jan 2026	8	8	20:28/20:59	RMEG	NA	NA	NA

*Two counts were conducted in June 2020 due to a required maintenance visit. Access issues in 2022 meant the November count was pushed back into early December, resulting in two December counts. January count in 2023 was one day late, resulting in two February counts. August count in 2025 was late, resulting in two September counts.

**# *M. orianae oceanensis* passes will include background level of *Vespadelus vulturnus* passes as data has been pooled for the two species whose call characteristics overlap in this region.

***New steel box culvert installed 26 April 2023. New setup means counting location is further out from entrance, which makes it very hard to note presence or absence of Eastern Horseshoe-bat unless they are observed during twilight. Also took a few months to work out the best counting position. Also took the bats a bit of time to acclimatise to and start using the tunnel.

^Access to adit was delayed. Previous night's monitoring data suggests bats first exit was at 20:01, but only got to adit at 20:15 to start count. Bats exiting the adit during this time may have been missed in the nightly count. Consider this an underestimate.

^^Adit was harp trapped for media release and to confirm composition of colony. No count was made, other than measuring bats pulled out of harp trap across adit for an hour around exit time.

Cells marked "Data missing" are nights/months where there has been an equipment failure that was not picked up until the next count. "NA" denotes data that is not yet available due to analysis not being completed.

Automated Echolocation Call Detection

The automated echolocation call detection equipment operated successfully throughout 2025. Issues in 2020 were rectified by more frequent formatting of memory cards. As with previous years, activity of the Eastern Horseshoe-bat (*Rhinolophus megaphyllus*) was generally low and relatively consistent (**Figures 4-1a** to **4-1g**). Wet weather caused mild conditions through much of 2021-2022, meaning activity was much more stable than earlier years, with no obvious seasonal change in activity. 2023 started off with slightly elevated activity (though not comparable to that seen in 2019), but returned to low even activity levels from end of May. Activity was consistently low in 2024, with only slight increases in activity in March-April and August-September. Activity was similarly low in 2025 with only slight increases in activity February-April and mid August- mid October. Activity peaked for 2025 in early April. Historically, activity for this species declines over winter and increases between mid-September and late April. The 2020 October-December period was characterised by pulses of increased activity on occasional nights (50-100 passes over average), but few large spikes in activity were observed through 2021-2025. While oscillations in activity from night to night are seen, the overall picture is one of relative stability in 2024-2025, with slight seasonal increase in autumn and spring. Since May 2023, activity levels rarely exceeded 25 passes per night. Monthly count data supports this with Eastern Horseshoe-bat numbers varying from 8 to 29 over the summer months from December 2017 to December 2022, but dropping to 3 to 11 over November-December 2023-24. November-December counts in 2025 were in the range of the earlier years; 8-29. Numbers from our monthly counts provide no evidence for gross changes in Eastern Horseshoe-bat numbers through spring-summer 2019. It could be that during the peak of the drought, individuals may have moved into the area either to escape bushfires to the east, or simply to access more permanent water sources in the vicinity of the adit. Though not resulting in increases in the Slate Gully adit occupation, other roosts likely exist in the local area, particularly when considering the type of shelter used by this species (avens in boulders and caves with dark zones; *pers. obs.* author). Alternatively, bats may have needed to spend more time foraging for insects in the drought, leading to increased activity to satisfy energetic requirements. Kohles *et al.* (2024) found bat foraging bouts and foraging distance both increased when insects were less abundant. Steady activity through 2021-2022 could be a result of more stable climatic conditions, with weather generally milder than expected throughout the year. However, whilst relatively steady in the beginning of 2023, activity appears to decline from June 2023 and continue through into 2024. Late 2024 and 2025 saw some resurgence, but not near the levels seen from 2019 to early 2021. The removal of these water sources by the approaching mine pit may potentially explain the reduction in numbers by late 2023.

Long-term averaged climatic data from site was not available at the time of writing. Gulgong Post Office monthly climate statistics show higher than average maximum temperatures for all but July 2025, and higher than average minimum temperatures for February-May and July, August and October (BOM 2026, data based on 1970-2019). 2025 rainfall was above average in January, March, May and September. 2025 rainfall was below average in February, April, June, July and October and well below average in August, November and December (BOM 2026, data based on 1881-2025). As per Kohles *et al.* (2024), we might expect that declining availability of insects in dry conditions may increase activity demands in order to meet food requirements.

Reductions in activity with no concurrent reduction in actual counts of individuals over the summer months could be indicative of reduced microphone sensitivity over time. The microphone was replaced with a brand new unit in February 2024 with no obvious improvement in call activity suggesting declining microphone sensitivity has not been an issue.

Activity levels of the Large Bent-winged Bat (*Miniopterus orianae oceanensis*) showed greater seasonal variation and the night to night variation was greater than that of the Eastern Horseshoe-bat (**Figures 4-2a** to **4-2g**). While activity increased during 2020 from February, the increase in activity during 2021 was seen in early April. 2022 saw an increase in activity in mid April, suggesting an even later return from summer maternity roosts with subadults than that seen in 2021. 2023-2024 saw increases from late February of each year. 2025 the increase built from early March. Monthly counts support this, suggesting that there is yearly variation, with Large Bent-winged Bats returning between mid-February and late March, with the majority arriving by mid-April. 2020 activity peaked in late August-September, while 2021 showed peaks in June and October. Peaks in 2022 occurred in April and June-July, while 2023 data showed peaks in April-May and August. 2024 showed peaks in March-April, mid-June and September, with high activity continuing into December. 2025 data shows activity peaks in June, with activity declining from September onwards. In early years, there seemed to be a large decline in activity in mid-late October as bats leave for summer/maternity roosts. This decline pushed back to early November in 2022, and shifted forward to late September in 2023. While there was a decline through late October in 2024 and 2025, activity resurged and remained relatively high all the way through to December, with Bent-winged Bats being picked up in both October/November and December counts (albeit in low numbers) in both years. Typically by late November activity appears to be reduced to a level that indicates all bats are gone from the cave and only general foraging activity for the species is being picked up outside the cave entrance. This pattern mirrors that from counts of bats exiting the workings undertaken since April 2017, whereby Large Bent-winged Bats are gone by late October/early November (Fly By Night 2017; Fly By Night 2018; Fly By Night 2019). Within this pattern, large oscillations in activity of this species did occur from night to night. While activity levels sometimes varied by only a few passes per night at other times it varied by up to 1800 passes per night. 2024 showed the most volatility in activity indices. This did not change much in 2025 with variation across nights still seen. This nightly variation could reflect changes in the number of individuals roosting within the workings, as well as other factors including ambient temperature and prey abundance. Rain can interfere with the effectiveness of the microphone, so the volatility over 2021-2022 could be due to wet conditions. As La Nina subsides, we have not seen a reduction in volatility, suggesting this is not the cause of the night by night variation. The yearly pattern of use at Slate Gully is similar to that recorded at urban roosts in Sydney and Newcastle (Hoye and Spence 2004).

The increase in variability in activity of Large Bent-winged Bat is in stark contrast to the continued decline in activity variability in Eastern Horseshoe-bat being seen over the years of monitoring. This (and the fact the microphone was replaced in February 2024) suggest the changes are not a result of changing microphone sensitivity.

Data used to monitor Large Bent-winged Bat activity is a combination of call pulse identifications. Due to the huge volume of calls generated by continuous recording each year, we have used an automated call identification analysis program (Ana-lyse© A.J. Hoye) to label the data. In the region around Mudgee, call pulses for Large Bent-winged Bats in cluttered environments are very similar to those of the Little Forest Bat (*Vespadelus vulturnus*) and Chocolate Wattled Bat (*Chalinolobus morio*). Because of the overlap in call parameters, a combination of these species was used to generate various indices for Large Bent-winged Bat activity. The large numbers of cave roosting bats using the adit should dwarf the number of either of the other tree roosting species. As such, the background level of tree-roosting bat activity could be considered relatively constant through the year (noting tree roosting species will have reduced activity over winter). If we subtract that constant activity of Little

Forest/Chocolate Wattled Bats away from the pooled activity figure, seasonal variation in Large Bent-winged activity should still be seen. This is why there is activity recorded for Large Bent-winged Bats over the summer period when there are none present in counts. By looking at recorded activity levels over the November-January 2020 period when Large Bent-winged were absent from the adit, a background level of activity of 50-250 call pulses was able to be observed. This is likely to be the background level of Little Forest Bat activity. That activity was slightly higher in the summer months of 2021, and approached 400 pulses/night (in some cases surpassed 800 pulses/night) in summer months in 2022-2025. For consistency's sake, the correction factor has been retained at 150 pulses/night across all years (noting that background activity is likely to have increased on par with increases seen in Large Bent-winged Bat activity in the recent years). The low level of Large Bent-winged Bat activity seen over the summer months when individuals have vacated the mine workings probably represents males and non-breeding females present in a nearby roost that still forage over the site. Individuals can travel at least 10km (perhaps up to 30km) from a roost to feed in a night.

Correlation of bat activity with blast dates has the potential to reveal changes in activity as a result of "pulse" disturbance. "Pulse disturbance" is typically short term in nature and can often be of higher magnitude/intensity (e.g. blasting). Blast dates (Pits 3 and 8) from March 2020 to December 2025 were plotted against activity index of both species (**Figure 4-3**). Only Pit 8 blast dates were provided in 2020 which may explain the increase in blast occurrences in 2021. Pit 3 had not experienced a blast between April 2021 and January 2025. There were 21 blasts in Pit 3 throughout 2025. As the Pit 3 blasts are just the other side of the ridge from the adit, they have been included. Pit 7 could also be close to the adit, but has not been included in these analyses, and hasn't seen a blast since September 2023. Large Bent-winged Bat activity declined after some blasts, and increased after others, i.e. there was little correlation between bat activity at the roost and blasting activity. The magnitude of the changes also differed each time. Currently, there does not appear to be any clear change in activity of either species relative to blast dates.

Potential "press disturbance" (disturbance associated with constant long term phenomena which may not necessarily be high impact in nature) impacts as a result of increased activity within the vicinity of the adit will be analysed as mining advances toward the adits location. Examples of "press disturbance" include light spill from mine or noise from machinery, both of which have been noted during monthly counts through 2024 and 2025.

As a requirement within the Biodiversity and Blast Management Plans, video surveillance and review of recorded footage is undertaken with each blast conducted in Pit 8 (Slate Gully). Footage is reviewed five minutes pre and post blast event to evaluate potential impacts to the adit and bat activity. Of the 2020 data collected and reviewed, blast activity was not seen to disturb or induce diurnal bat flight activity outside of the adit. No disturbances (bats leaving adit during daylight) were observed during 2021, 2022 or 2023 monitoring (pers. comm. Josh Frappell; pers. comm. James Heesterman). In April 2024 Kieren Bennetts notified Andrew Lothian of adit video footage from the time post their most recent blast (presume 26 April 2024). This footage contained approximately four frames of a vague object moving from right to left of the culvert immediately after the blast. After reviewing the footage, BMS concludes that the object is likely to be falling debris (dust cloud) from the adit entrance rather than an exiting bat. This explains the dirt that continually accumulates at the bottom right hand corner of the culvert each month which BMS removes during count visits. There were no recorded diurnal exits observed on camera during 2025. BMS have no data to assess whether bats are roused and undertaking diurnal flight within the adit. For blasts that were more than four days from other blasts, short term responses of Eastern Horseshoe-bat (**Figure 4-4**) and Large Bent-winged Bat (**Figure 4-**

5) were plotted. Data is presented for the five days leading up to a blast, and the five days after. Data has been summarised into means with standard errors. Two potential hypotheses exist for disturbance of bats post blasting. The first is an increase in activity as bats have been roused into activity by the pressure/sound waves. The second could be a reduction in activity whereby bats are reluctant to leave the safety of the adit due to the recent disturbance. A lack of variation in activity after a blast, outside of the variation seen prior to the blast, would be considered an absence of impact. Blast density in 2025 was much higher than previous years.

Unfortunately, out of 74 blast events in 2025, only two were independent of other blasts (more than four days from other blasts). For this reason, all figures and analyses have been recalculated using data from three days before and three days after a blast (2020-2025). This now increases the number of blast events analysed from 79 to 129.

It can be observed from raw data that in 58 of 130 blasts, Eastern Horseshoe-bat activity declined from the night before to the night of (after) the blast. 57 of 130 blasts saw an increase in activity, and 15 blasts saw no change in activity. Not only does this show mixed responses, but when referring to **Figure 4-4** on average the response is a decrease in activity on the night before the blast as well as the night of the blast (both of very small magnitude). Large Bent-winged Bat activity declined in 70 of 130 blast nights relative to previous nights, which is also seen in average data (**Figure 4-5**). 58 of 130 blasts saw an increase in activity, while 2 blasts saw no change in activity. In the case of the Bent-winged Bat, the magnitude of the decline was no greater than variation seen in nights prior to the blast. The mixed results and small changes relative to normal nightly variation in activity suggest no impact from blasting in Pits 3 or 8 on the two bat species. The slight declining trend in Bent-winged Bats did not carry forward to 2024-25, with some of the highest pass rates of Bent-winged Bat occurring in 2024. Neither species' decline was more than what would be expected from nightly variation, and overlapping Standard Error bars suggest changes are not likely to be significant. One-way Repeated Measures ANOVAs were run on the activity data over the seven nights (from 130 independent blast events). Neither Eastern Horseshoe-bat nor Large Bent-winged Bat activity were significantly different between any of the nights.

Additional analyses were conducted on Eastern Horseshoe-bat and Large Bent-winged Bat activity pre and post blasts, but were restricted to the winter period when bats may utilise torpor to conserve energy. One-way Repeated Measures ANOVAs showed no significant differences between nightly activity before and after blasts, but power of both analyses was low due to small sample size (only 35 winter blast events). BMS will monitor this metric going forward as more data becomes available.

As bat activity did not seem to change in response to mine blasts, BMS investigated changes in bat activity with minimum nightly temperature. Minimum temperature was amplified so changes in temperature could be viewed at the scale of changes in bat activity. In 2021 there appeared to be an inverse response in bat activity with minimum temperature. As minimum temperature drops, bat activity is increased. However, in 2022 the relationship seemed to change seasonally, or when the Large Bent-winged Bat was present/absent. From early April to early October, Large Bent-winged Bat activity roughly correlated directly with minimum overnight temperature (i.e. as minimum temperature goes up, activity goes up). This happens to be the period in which Large Bent-winged Bat inhabit the adit as a non-breeding roost. 2023 saw a similar relationship to 2022, with activity positively correlated with minimum temperature over the early April to early September period. Over the warmer months, the relationship between temperature and activity was poorly defined. Whether this has to do with the absence of Bent-winged Bats, or if it is a product of minimum overnight temperature having no

control over activity above a certain temperature threshold is unable to be determined. 2025 saw the return of the inverse relationship between activity and temperature over the April to September period, with no clear relationship outside of this period. As there is no clear relationship seen, it is likely that other climatic variables contribute to bat activity each night (i.e. moon phase, wind speed, time of minimum temperature, etc.).

Regressions were run on confident Eastern Horseshoe-bat (R.megC) and Large Bent-winged Bat (M tot + Vvul P/Po) against minimum temperature. There was a very small positive correlation between R.megC and minimum temperature (r^2=0.0013, not significant). There was a small negative relationship between Large Bent-winged Bat activity and minimum nightly temperature (r^2=0.037, significant $p < 0.001$). This is not a surprising result, as the Bent-winged Bats leaving over summer means there are less individuals present (hence less activity) when minimum temperatures are likely to be higher. When adjusted for the April to October period, the Bent-winged Bat relationship changes to a neutral/no relationship (r^2=0.000). Overall this suggests the relationship between bat activity and minimum nightly temperature are very weak.

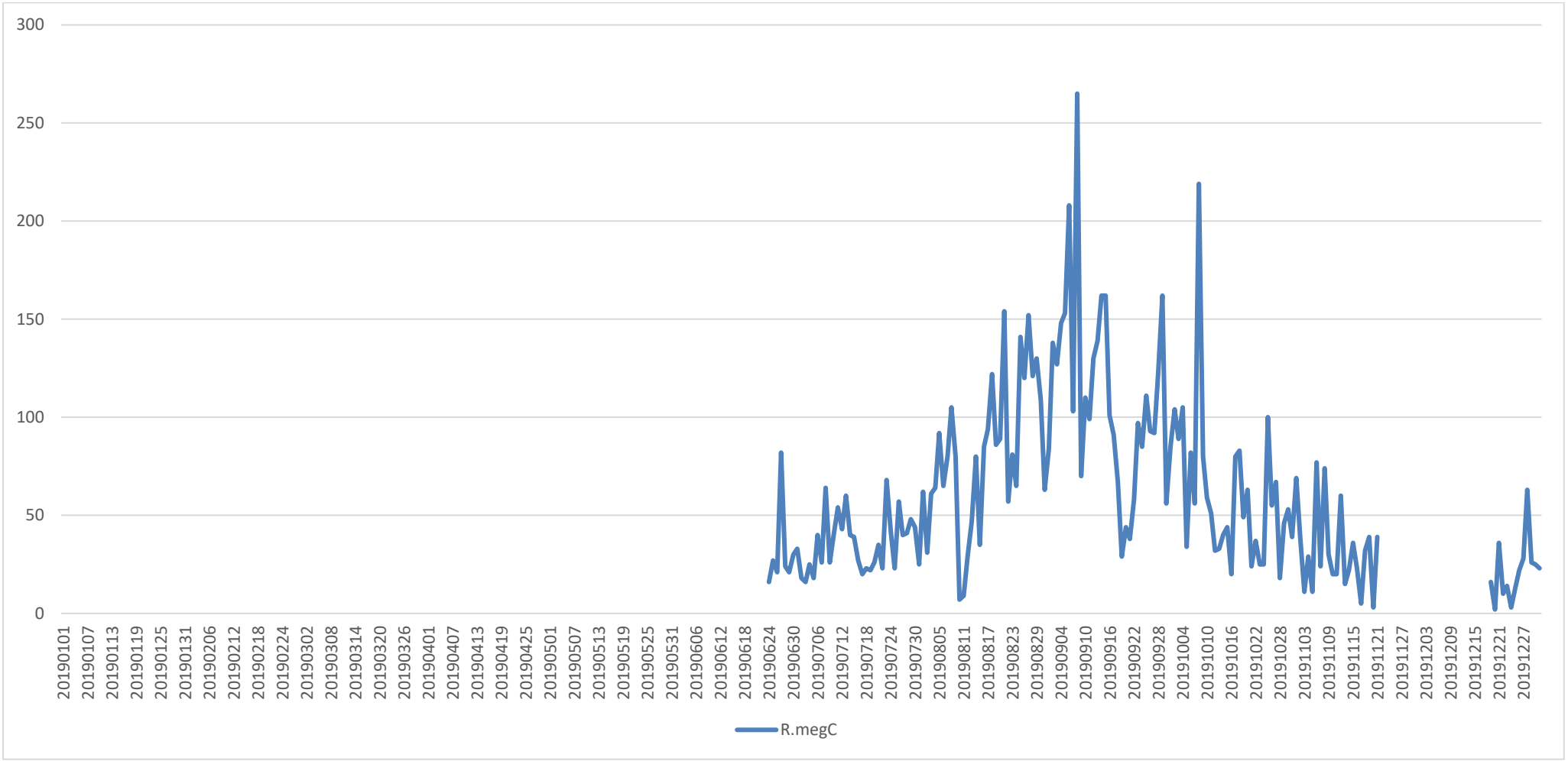


Figure 4-1a: Nightly Eastern Horseshoe-bat activity in 2019

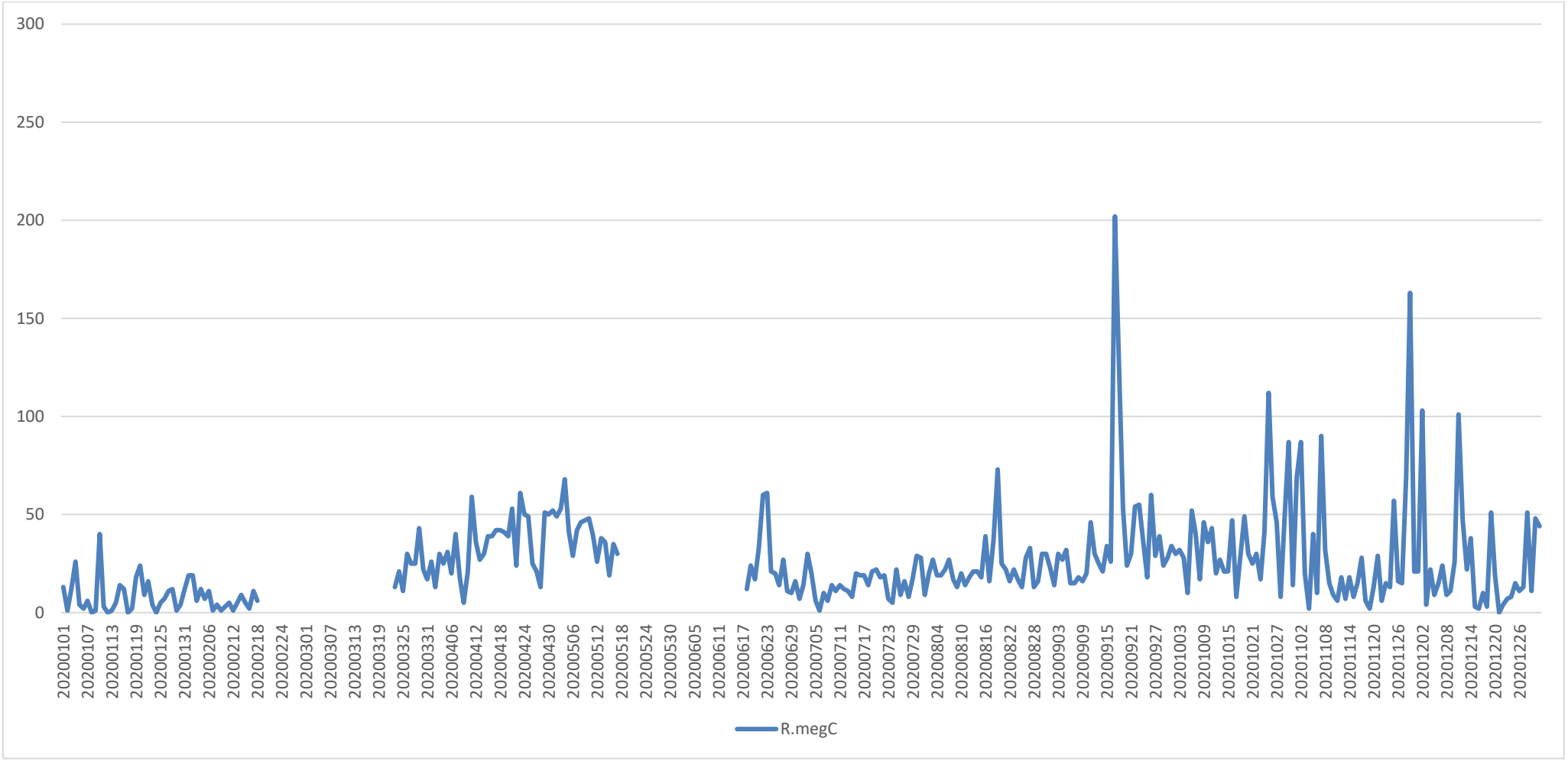


Figure 4-1b: Nightly Eastern Horseshoe-bat activity in 2020

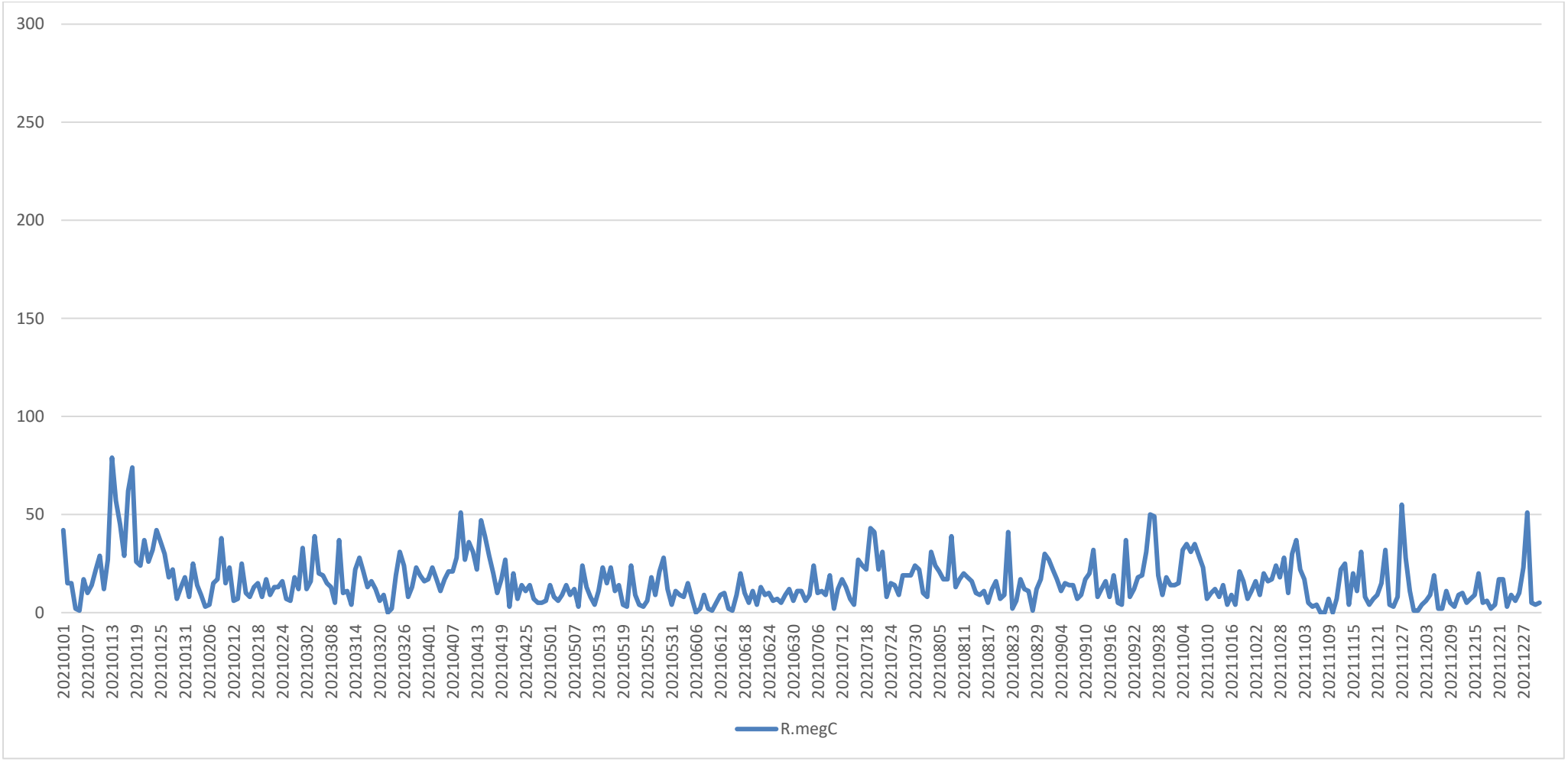


Figure 4-1c: Nightly Eastern Horseshoe-bat activity in 2021

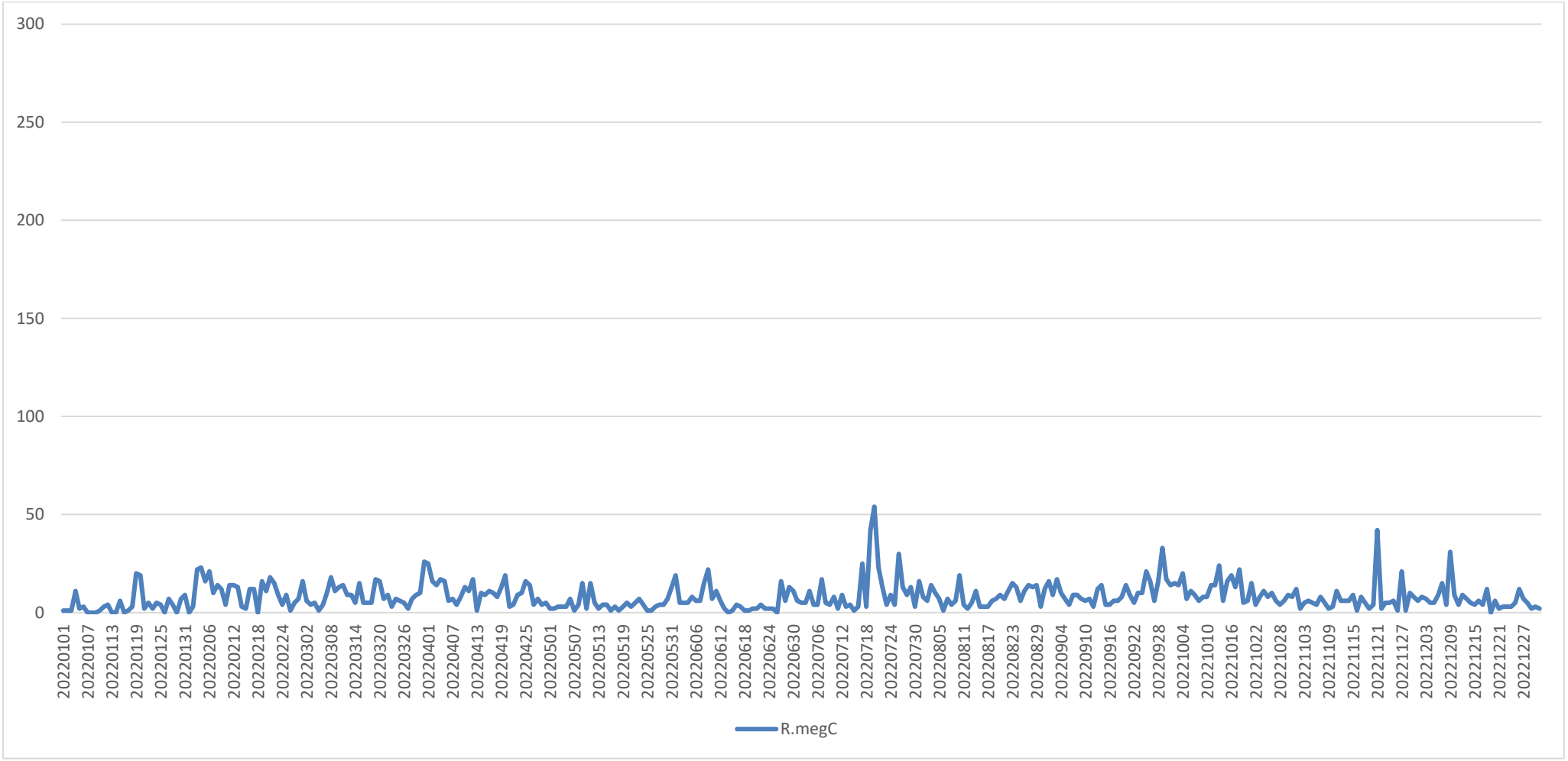


Figure 4-1d: Nightly Eastern Horseshoe-bat activity in 2022

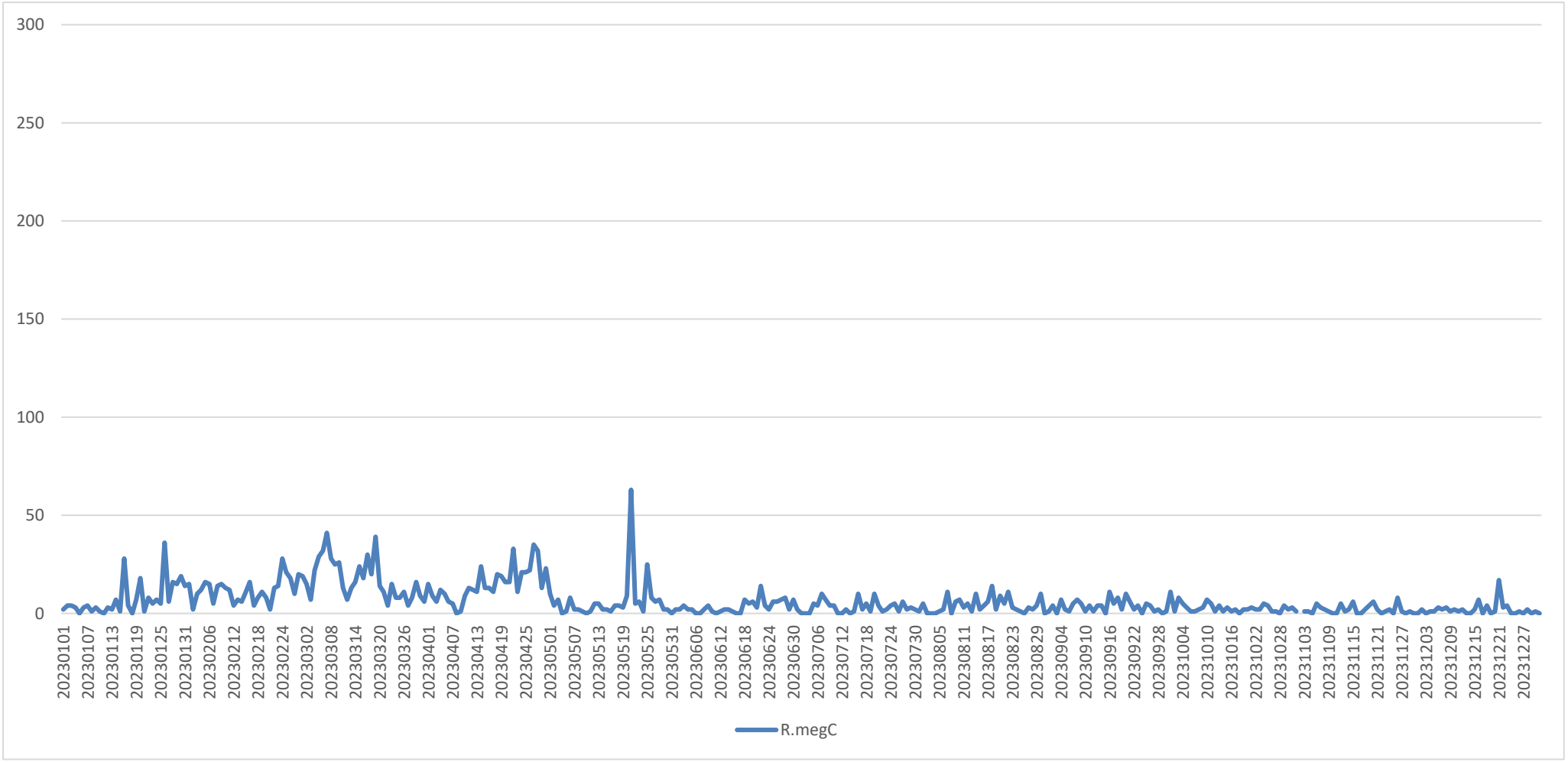


Figure 4-1e: Nightly Eastern Horseshoe-bat activity in 2023

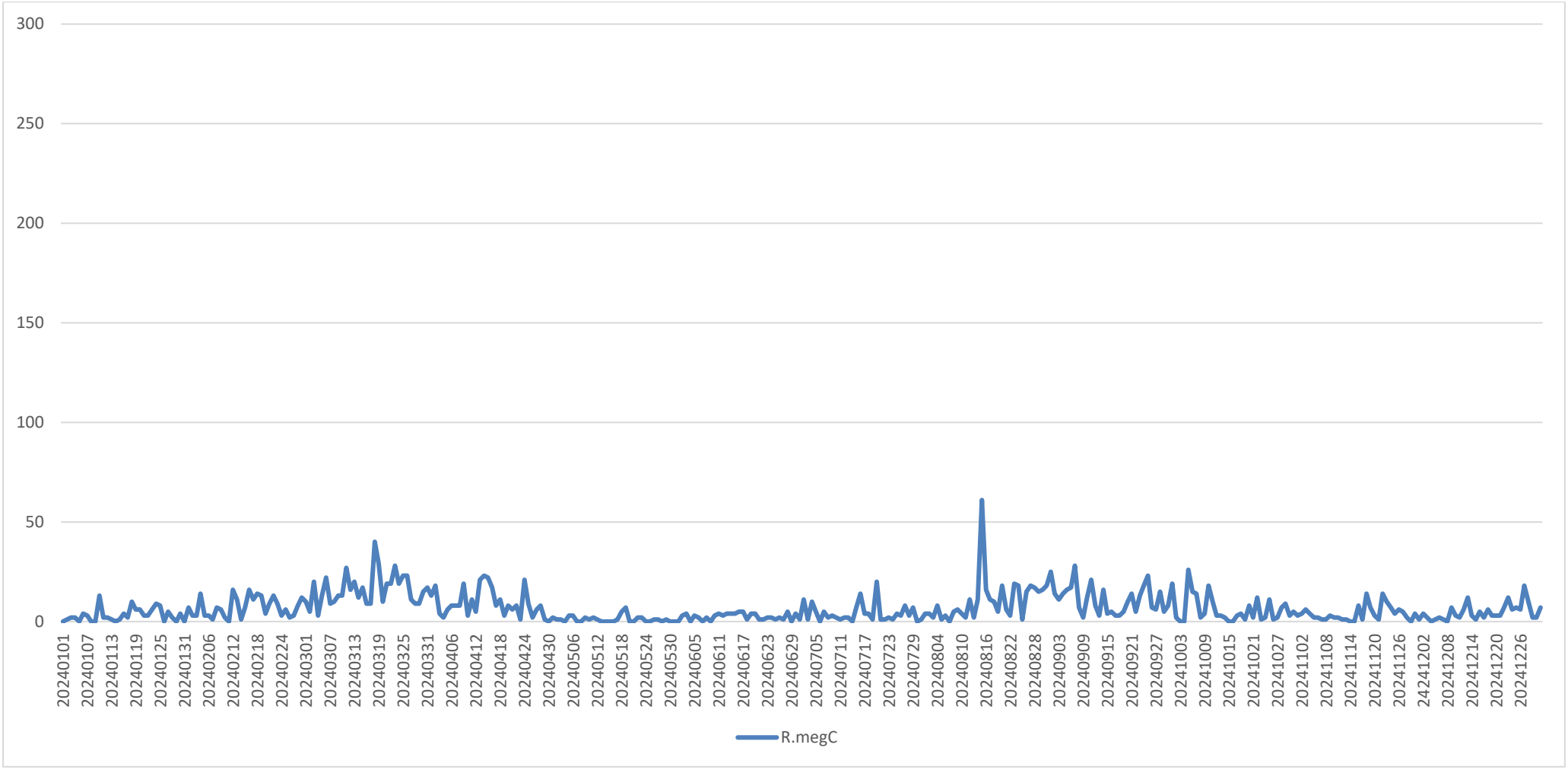


Figure 4-1f: Nightly Eastern Horseshoe-bat activity in 2024

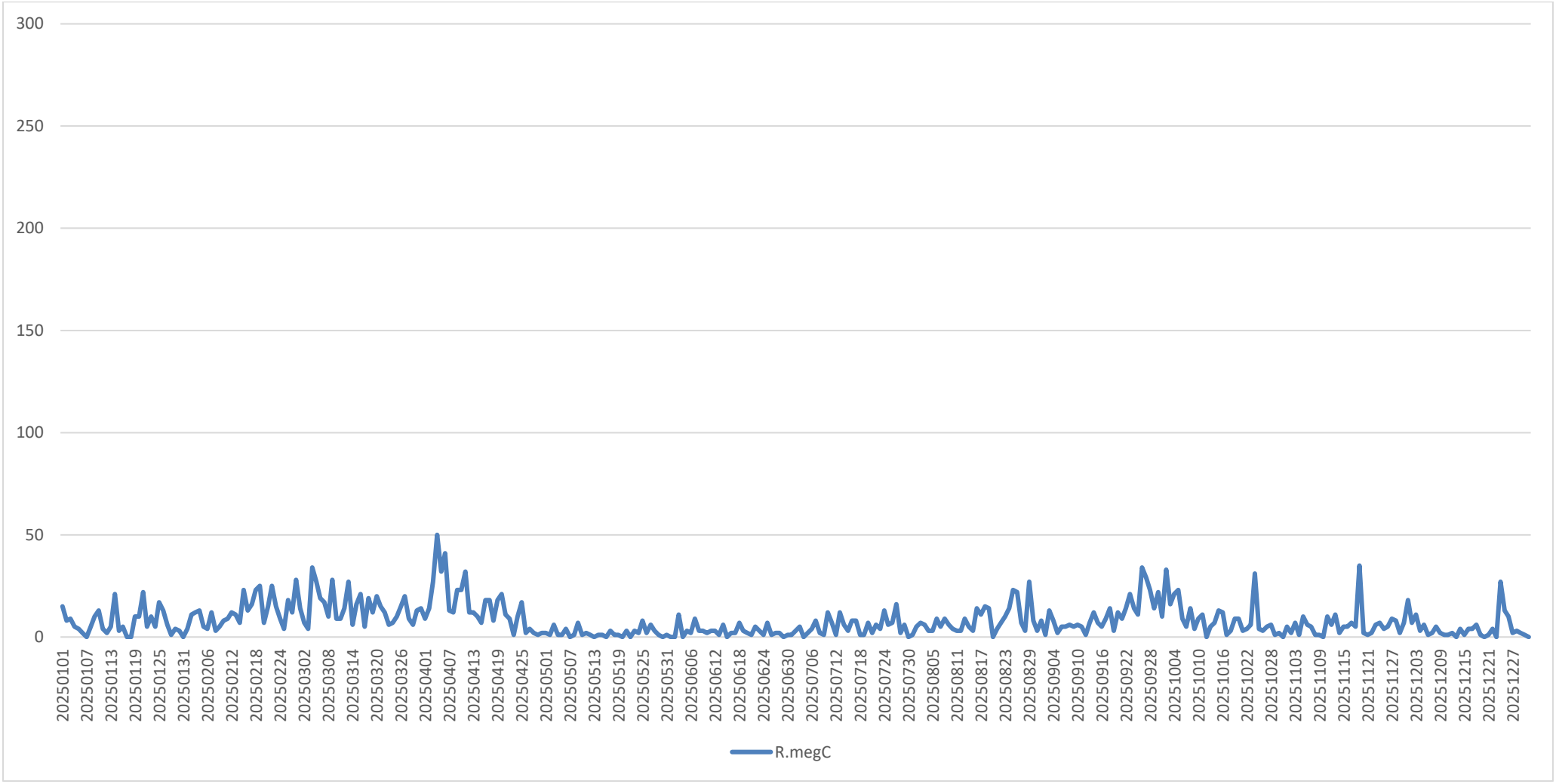


Figure 4-1g: Nightly Eastern Horseshoe-bat activity in 2025

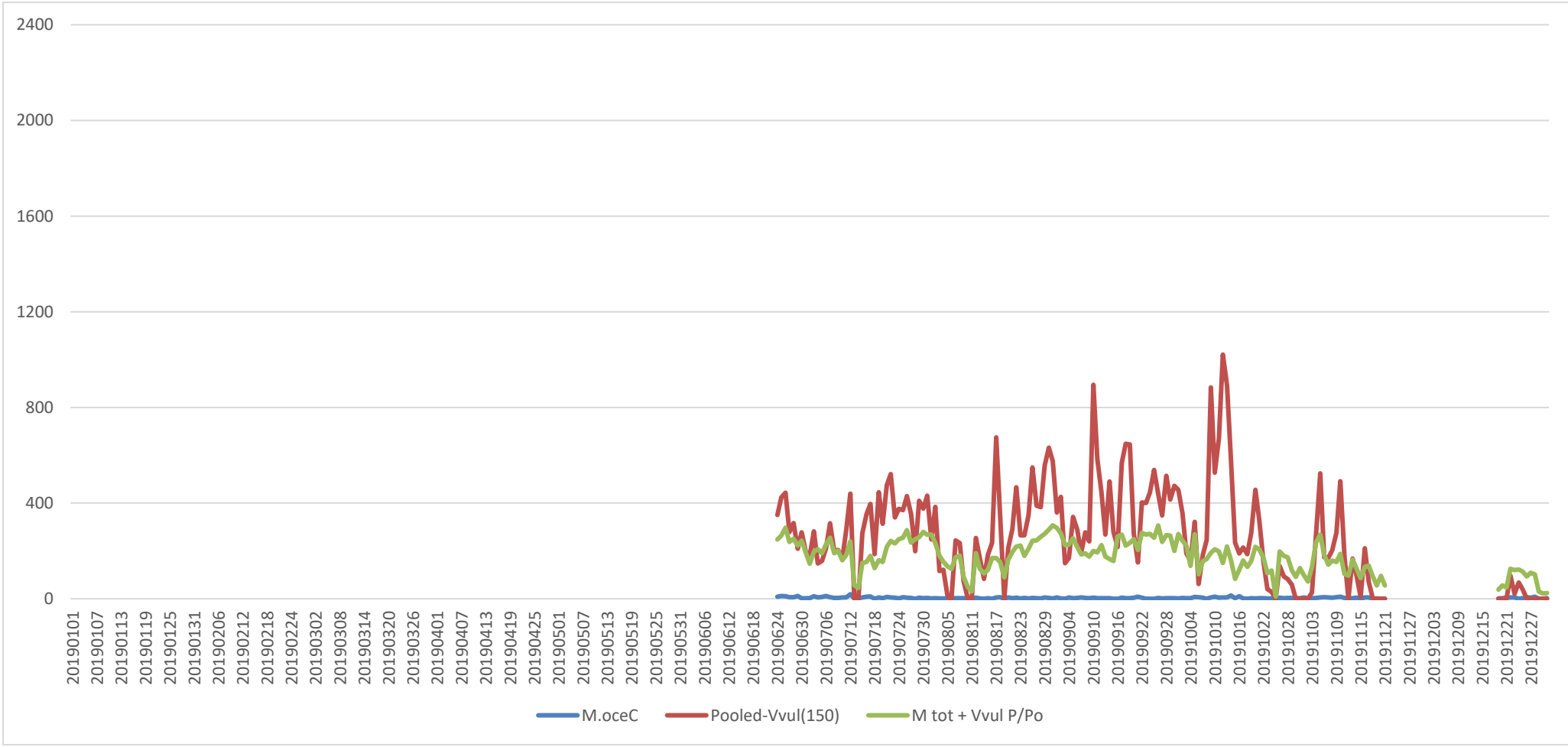


Figure 4-2a: Nightly Large Bent-winged Bat activity in 2019. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

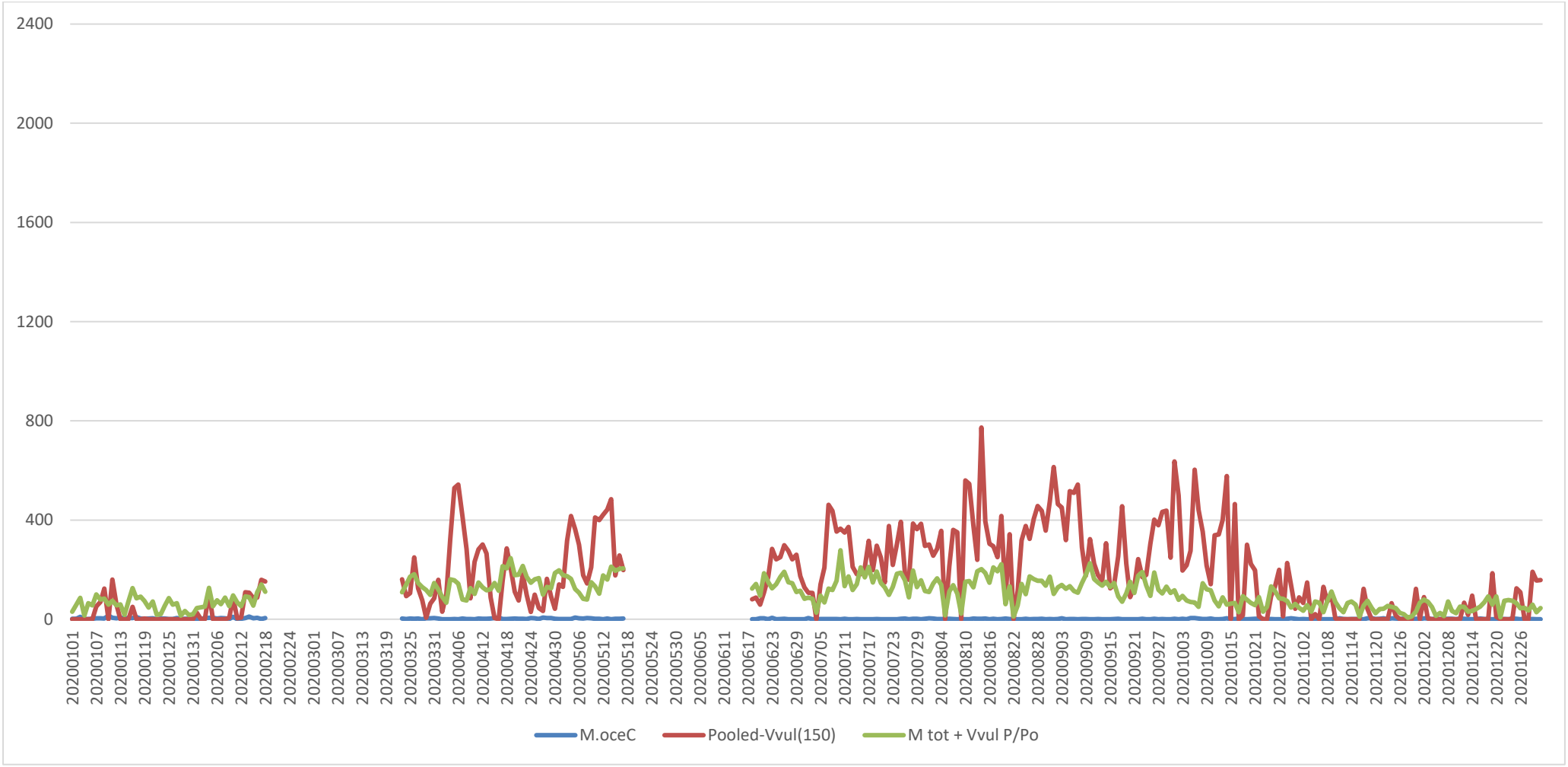


Figure 4-2b: Nightly Large Bent-winged Bat activity in 2020. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

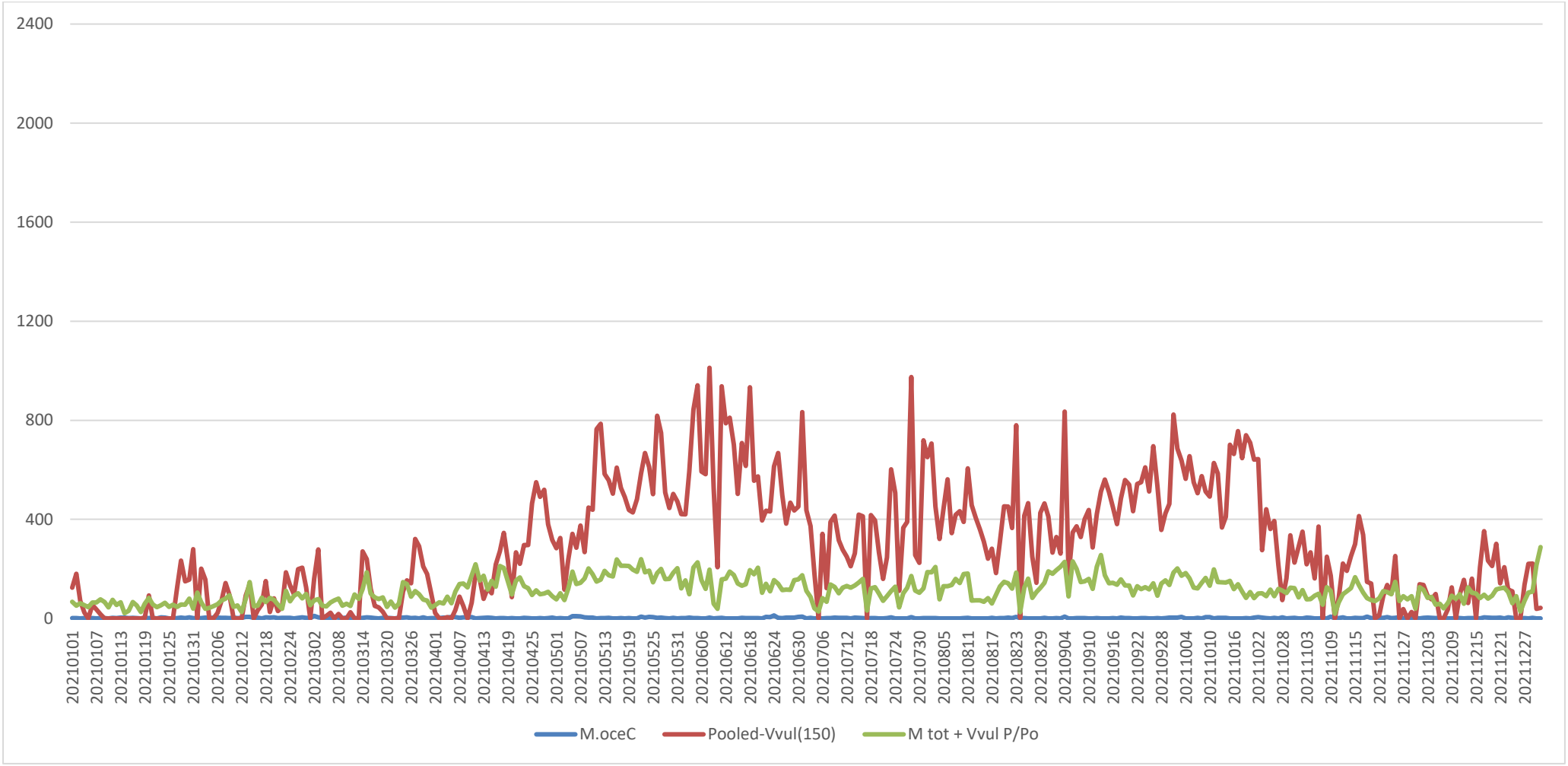


Figure 4-2c: Nightly Large Bent-winged Bat activity in 2021. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

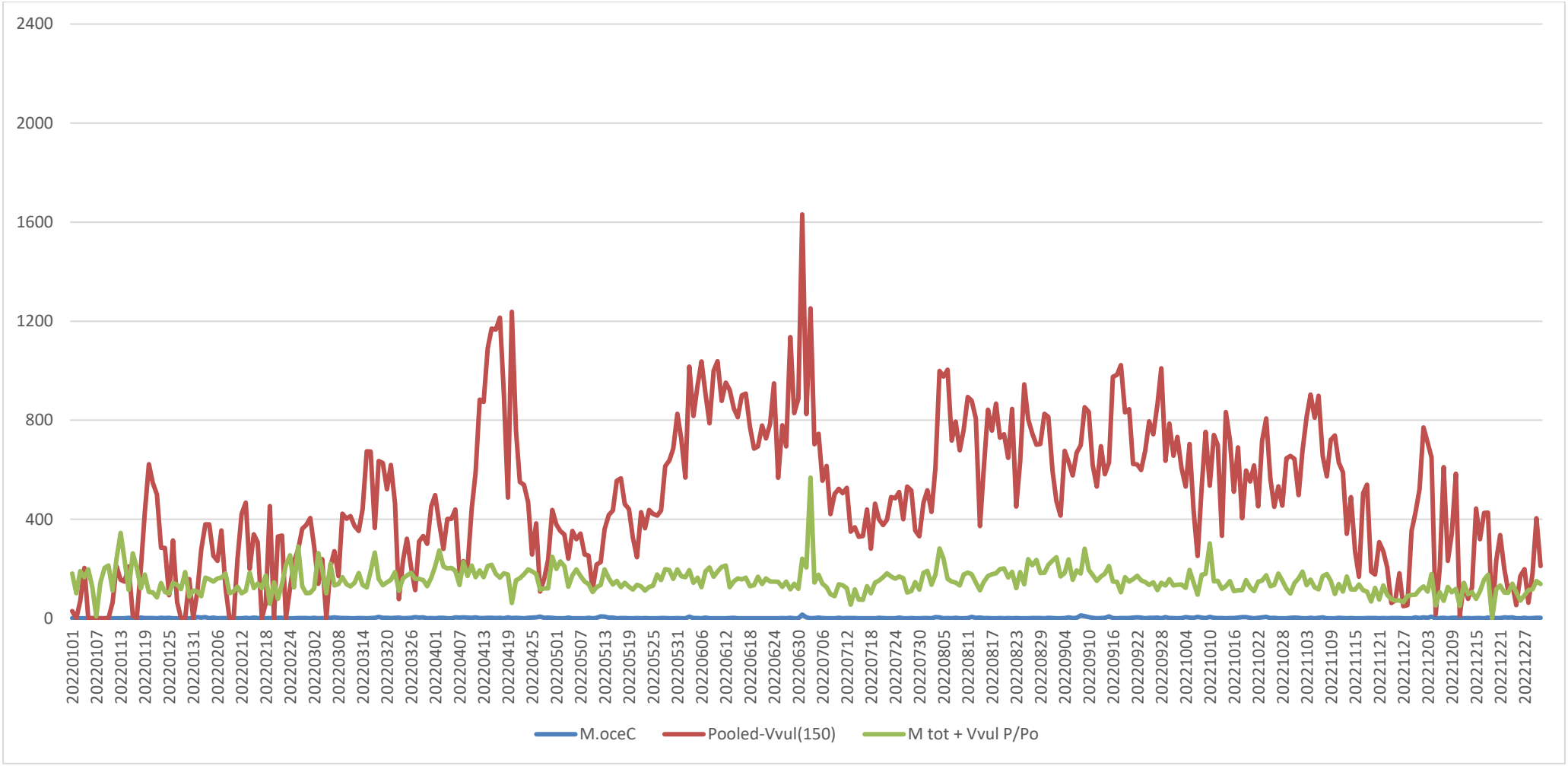


Figure 4-2d: Nightly Large Bent-winged Bat activity in 2022. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

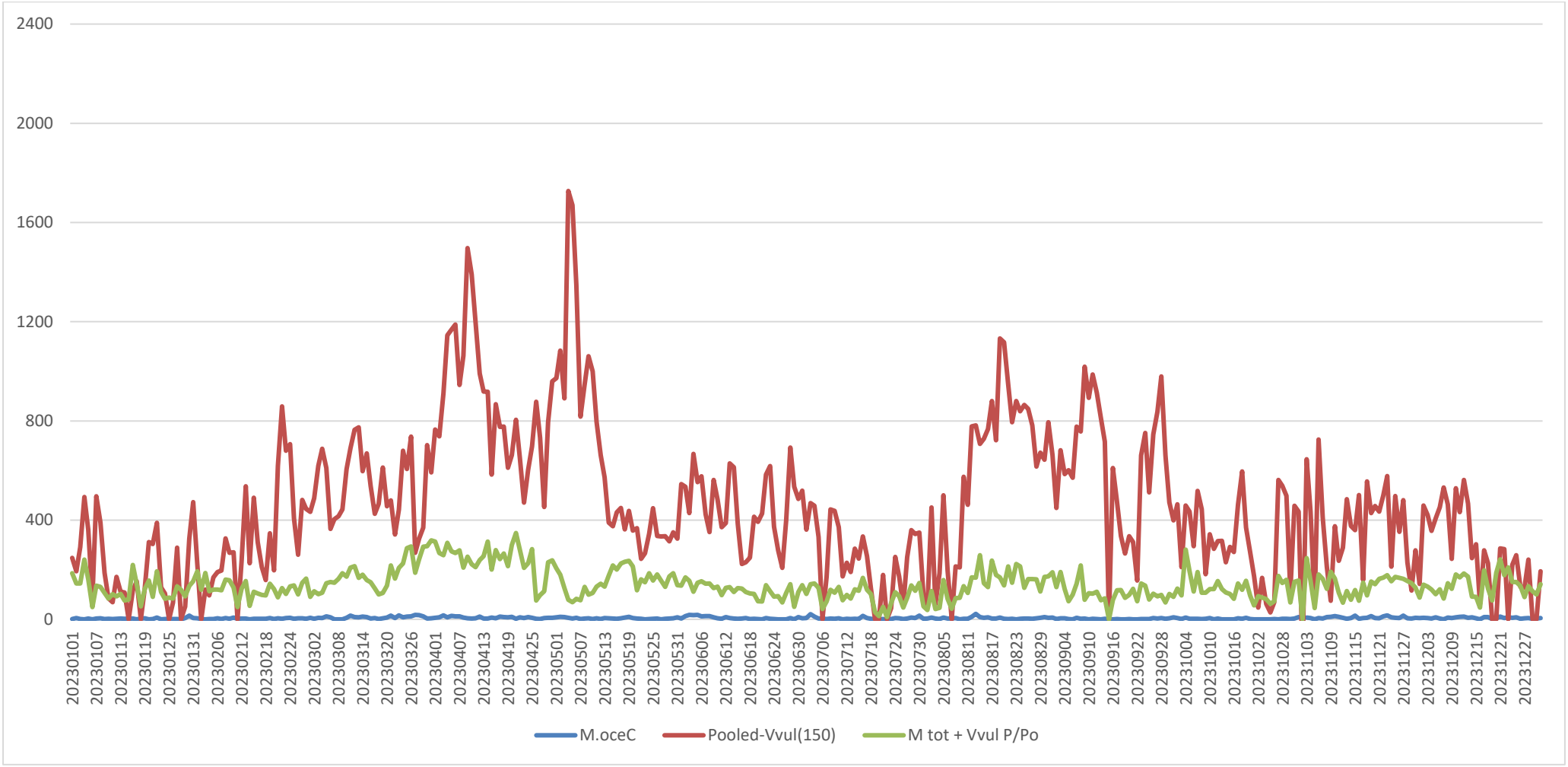


Figure 4-2e: Nightly Large Bent-winged Bat activity in 2023. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

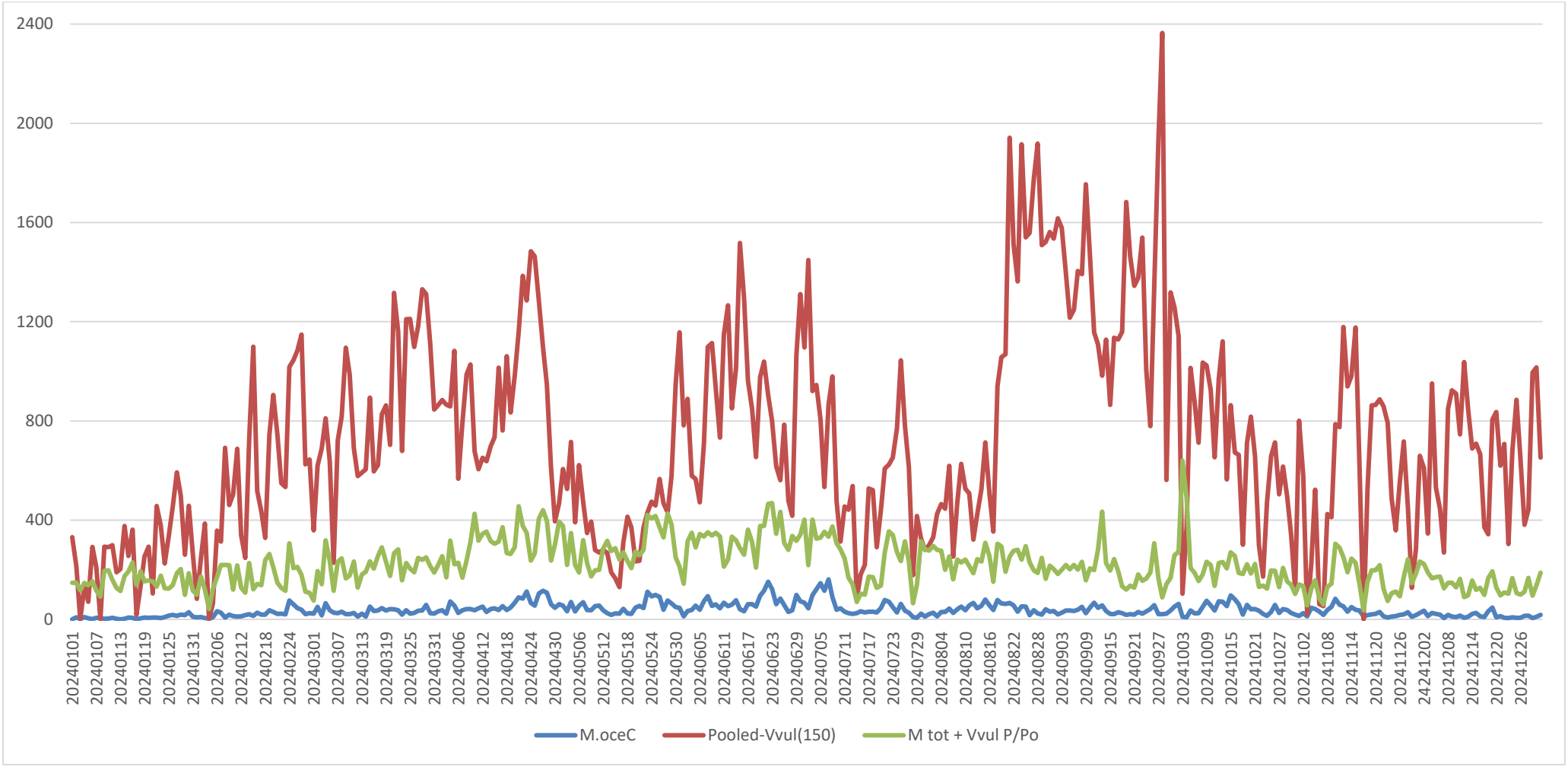


Figure 4-2f: Nightly Large Bent-winged Bat activity in 2024. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.

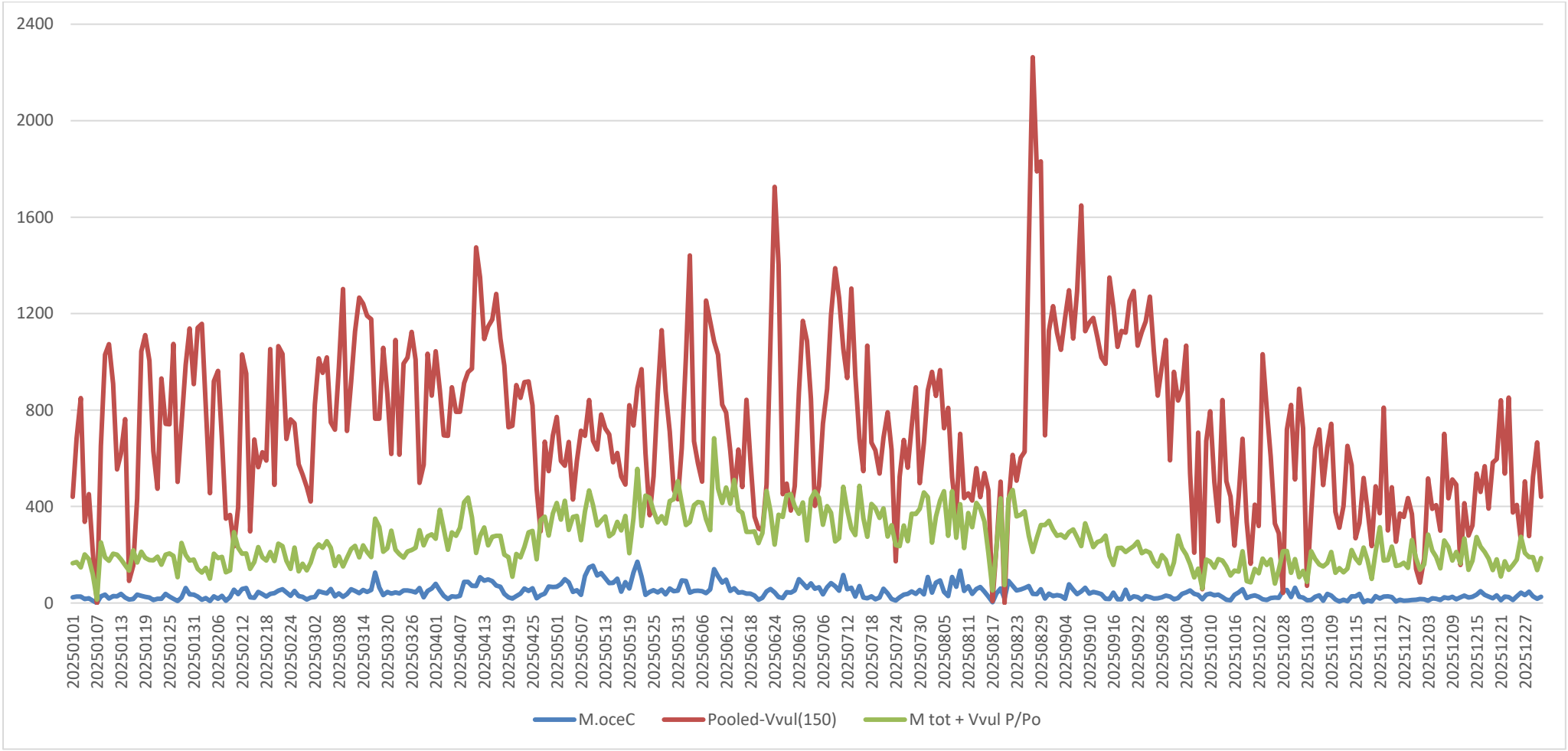
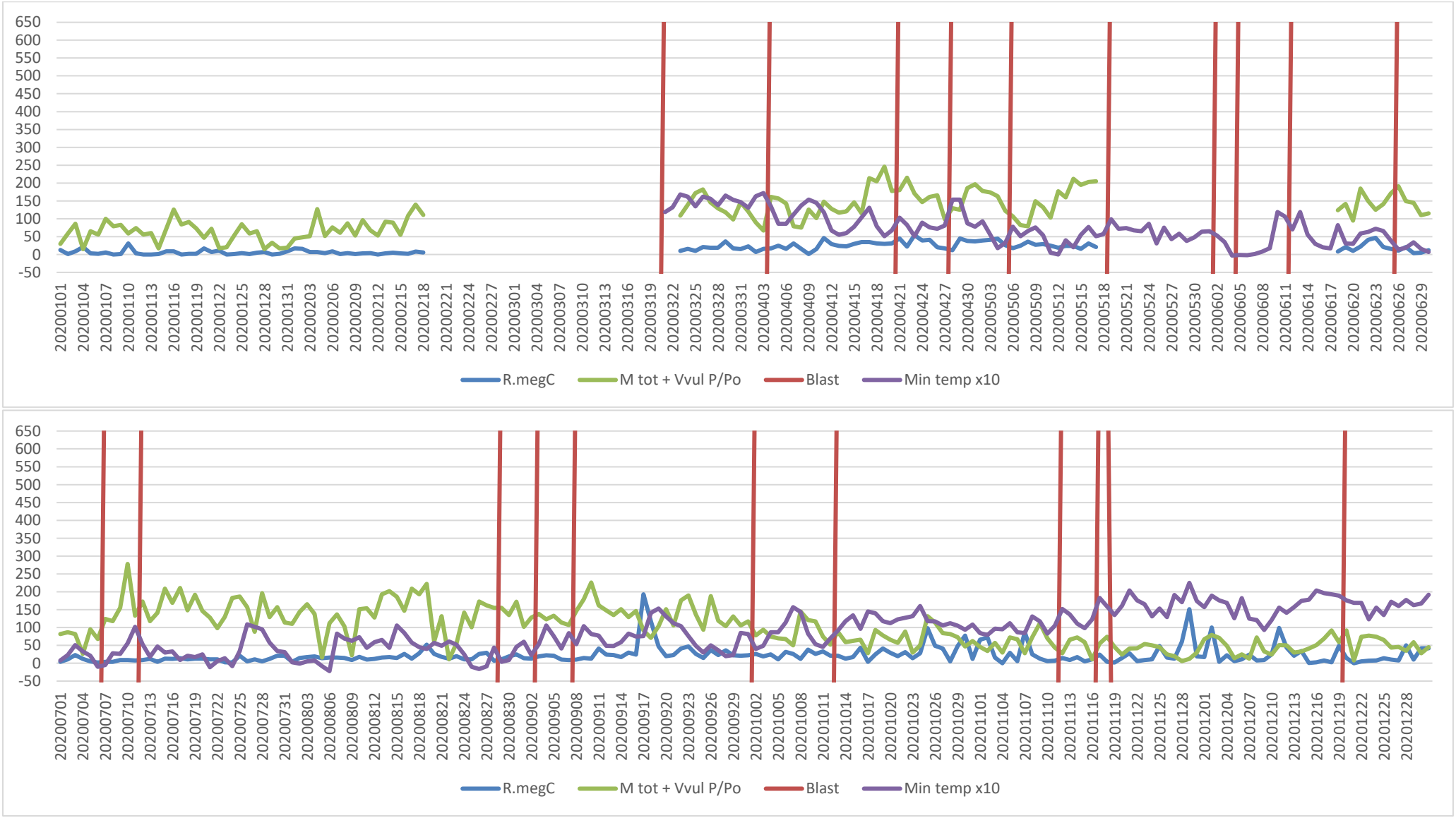


Figure 4-2g: Nightly Large Bent-winged Bat activity in 2025. *M.oceC* represent the number of confident open space Large Bent-winged Bat calls. *Pooled-Vvul(150)* represent the number of pooled confident calls for Large Bent-winged and Little Forest Bats which have similar call parameters (i.e. M.oceC + VvulC – 150). *Mtot+VvulP/Po* represent the number of total Large Bent-winged Bat calls plus calls of Little Forest Bat that were not identified confidently as Little Forest Bat.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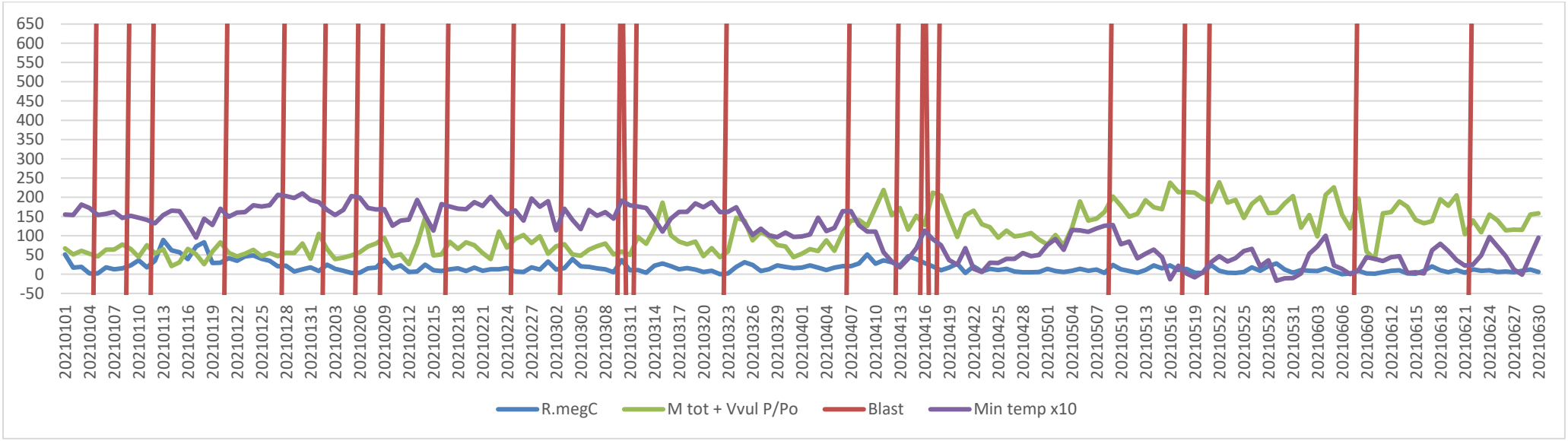
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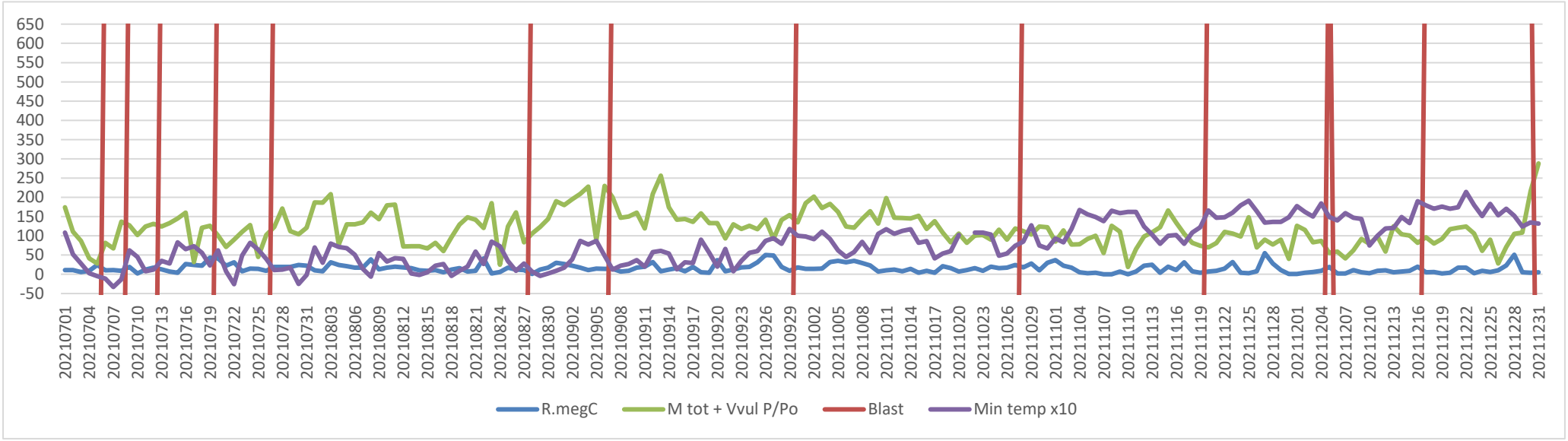
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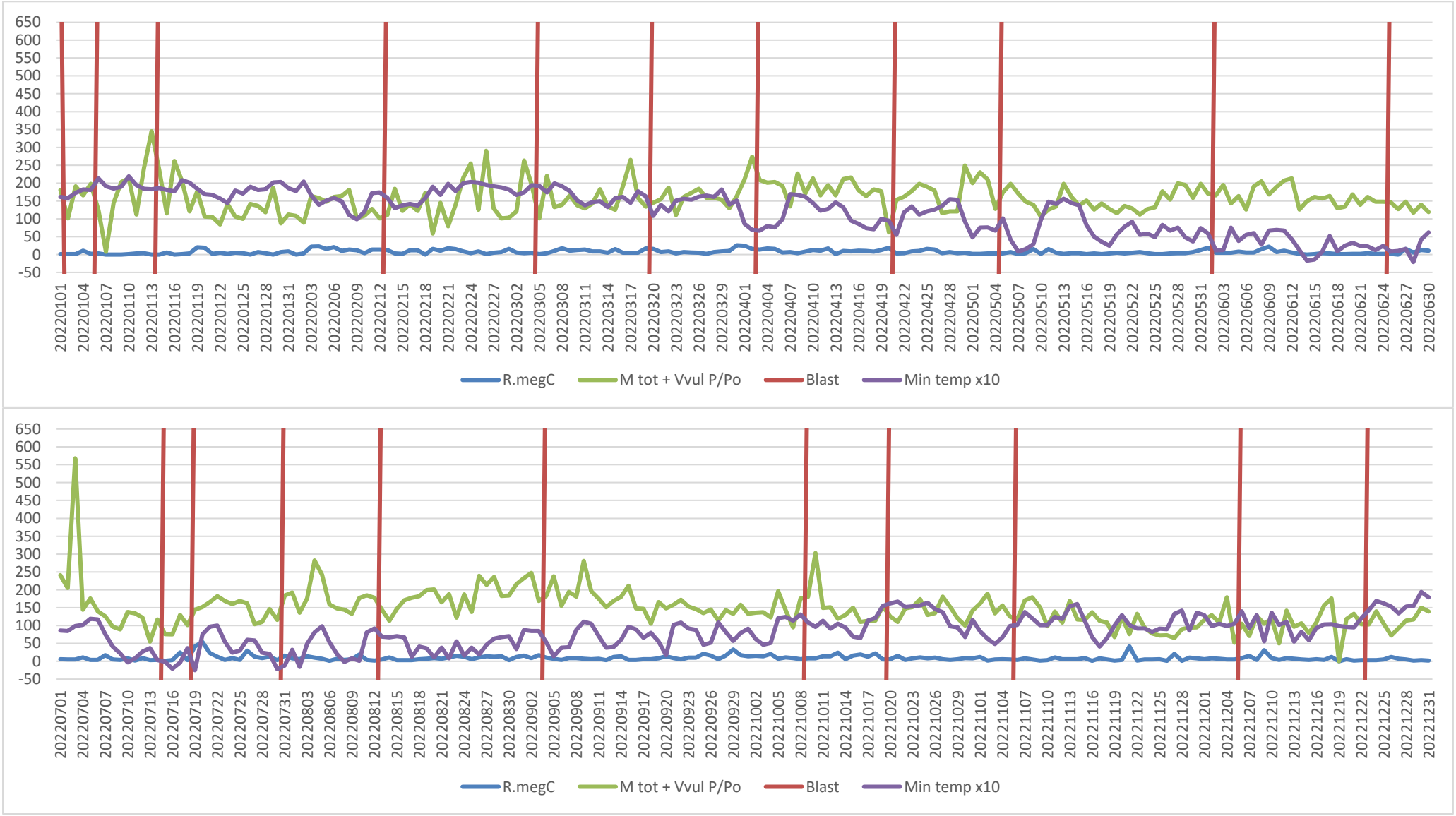
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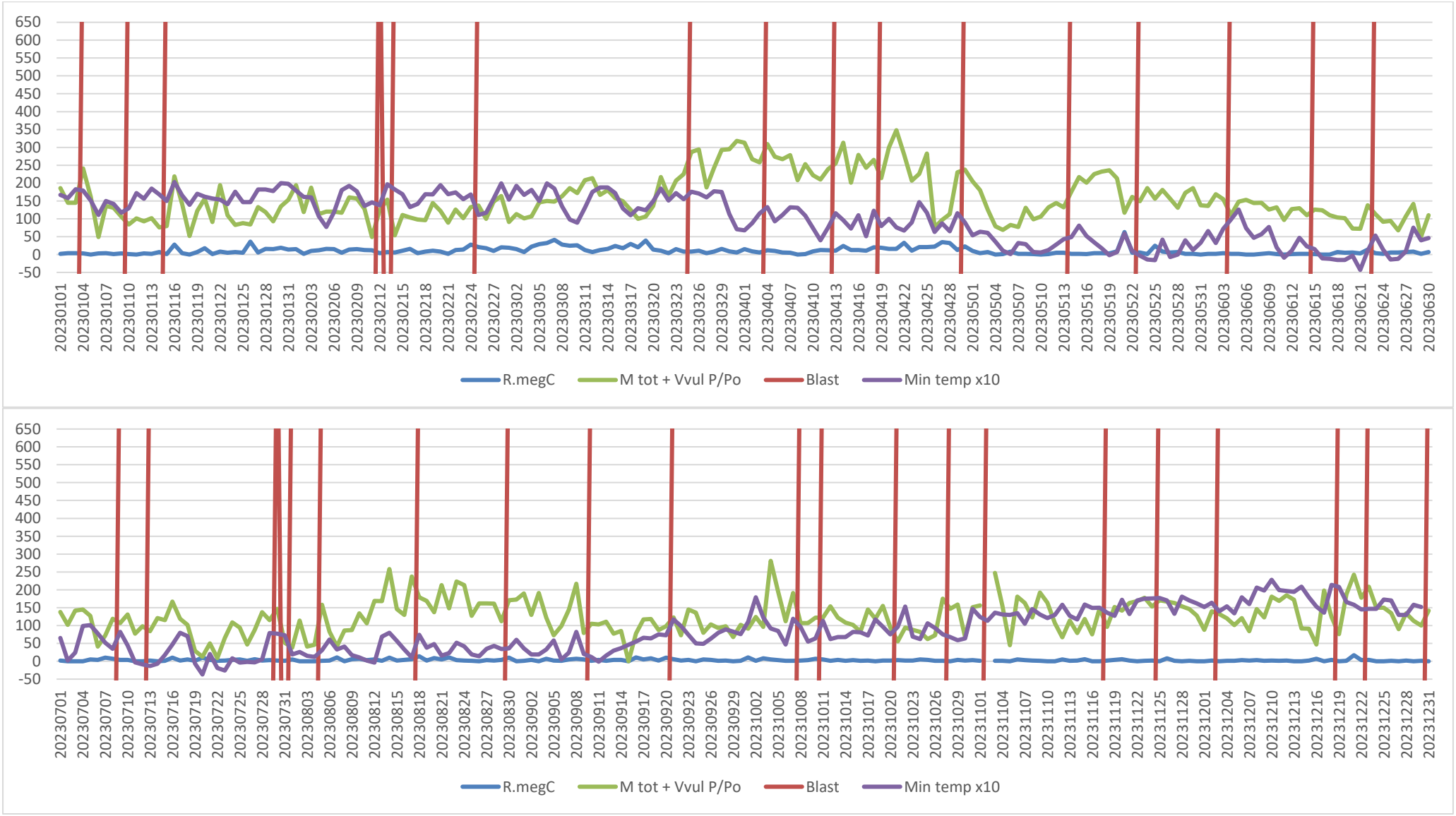
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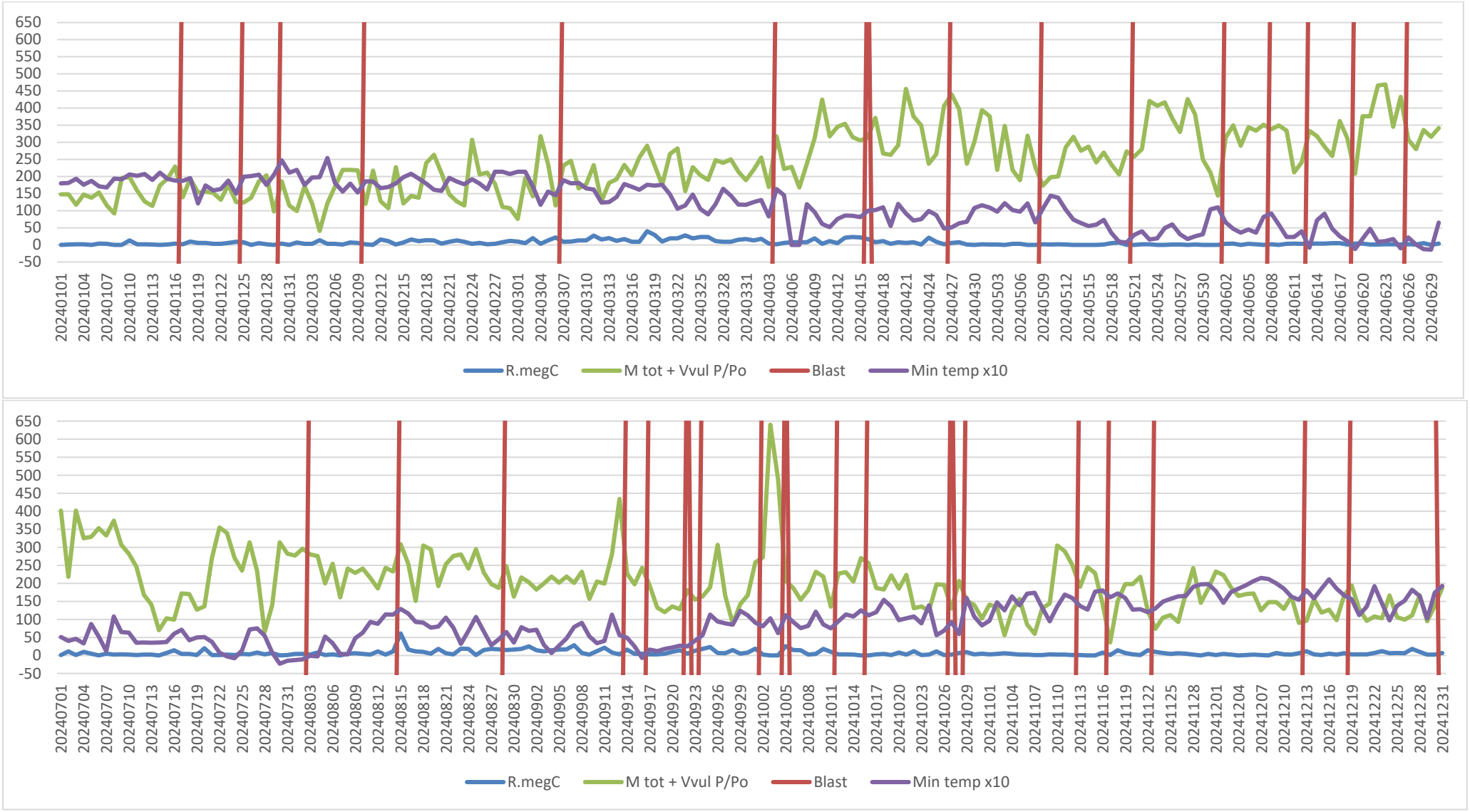
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Figure 4-3: Eastern Horseshoe-bat and Large Bent-winged Bat numbers through time with blast dates marked as vertical lines

Minimum temperatures presented as degree Celsius x10 so change in temperature is visible against change in bat activity

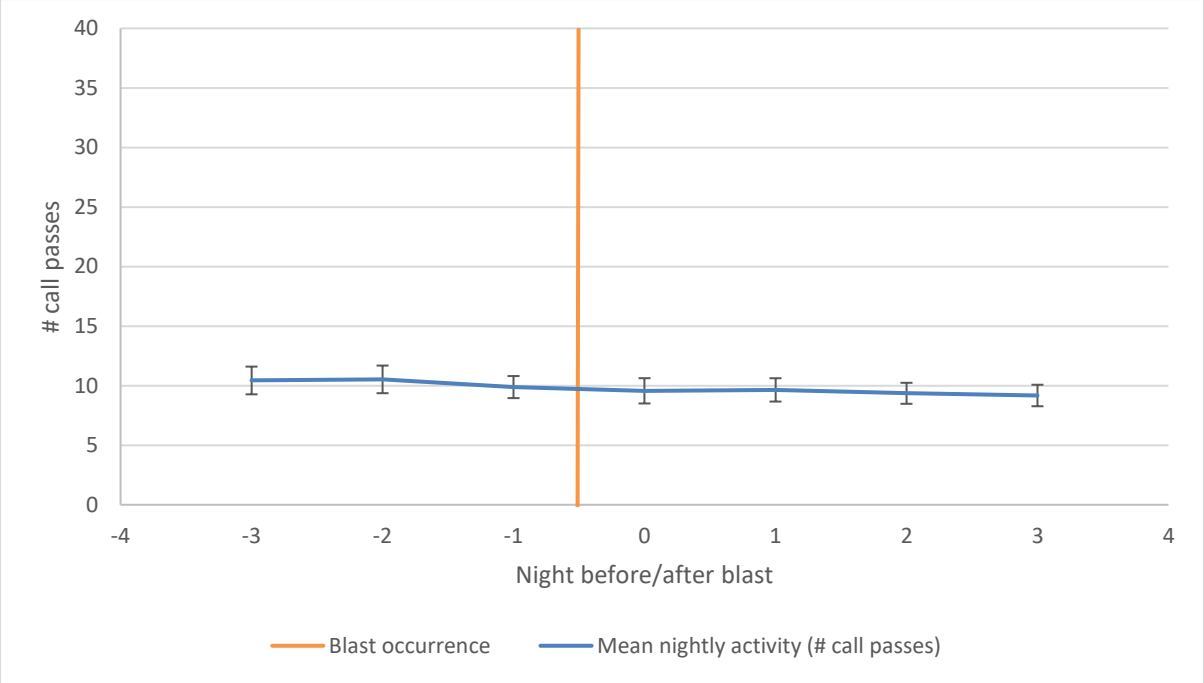

Figure 4-4: Mean short term response by Eastern Horseshoe-bat (R.megC) 2020-2025

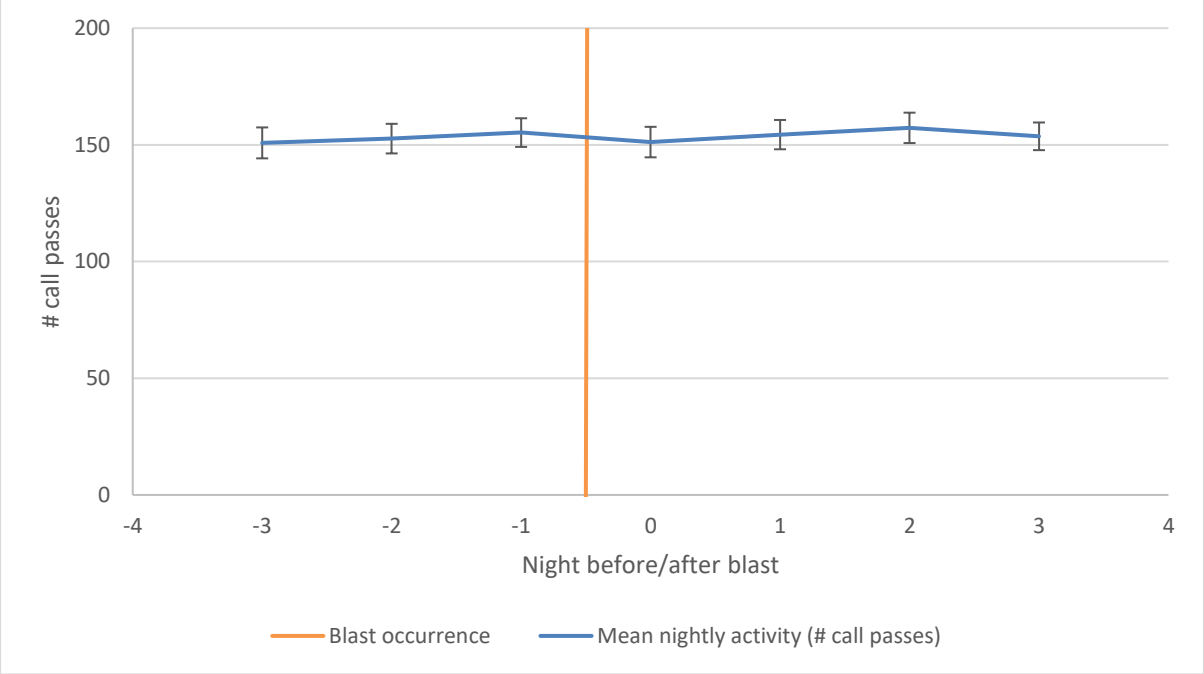

Figure 4-5: Mean short term blast response by Large Bent-winged Bat (M tot + Vvul P/Po) 2020-2025

5.0 Discussion

November 2019 saw the installation of a 900mm diameter steel pipe in the entrance of the adit. Collapsed material was removed, a 20m section of pipe pushed into the entrance, and material back filled around the pipe. The aim of this was to ensure an opening is maintained in the event of an entrance collapse. Modifications to this work were conducted in April 2020 in response to concerns raised via email in March 2020, regarding the height of the backfill material reducing the size of the adit opening. Low numbers of Large Bent-winged Bats were recorded in March 2020, after individuals were found to have returned in February. While the extreme drought and heat conditions experienced through 2019 could explain the large reduction in bat numbers, the fact that numbers had declined since the February count indicated there could be a localised issue. It was postulated that this reduction could be due to the small gap left after material was back filled over the pipe. This material was reduced, increasing the opening to approximately 1.0m in height. By June 2020 numbers were back to where they were in June 2019, and by August 2020 the number of Large Bent-winged Bats counted indicated numbers were back to levels seen in winter 2017.

On 26 April 2023, the steel pipe was removed from the adit and replaced with a larger aperture square steel box tunnel (see **Plate 5-2**). This was in response to the beginning of signs of rock fracture around the adit entrance. The rock around the adit entrance was sprayed with marking paint in September 2022 to facilitate identification of rock that had dislodged from the adit entrance. Minor rock falls (football sized) were observed in December 2022, February 2023, August 2023, September 2023 and April 2025. A larger block (esky sized) was observed to have dislodged from the right hand side of entrance in March 2023. The new tunnel (measuring 1.1m high x 1.3m wide) was constructed of steel plate with the inner surface a combination of painted and bare steel. The old pipe had a cross sectional area of approximately 0.64m^2, while the new tunnel had a sectional area of 1.43m^2. This better suits the requirements of Large Bent-winged Bat flight, with few (if any) bats ever observed using the round pipe. The April 2023 count was conducted on the night of the tunnel installation. Dirt had been piled up on top of the tunnel in an attempt to stabilise the tunnel and close the adit in (forcing bats to use the tunnel). On counting the exit, a small aperture was obviously present in the top of the dirt pile, as approximately 90% of the bats exiting the adit that night used the top rather than the tunnel. Forcing large numbers through a small aperture also meant the exit took longer than it had previously. The author proposed that the mine remove some of the dirt on top of the pipe to allow bats to use their preferred flight path, and reduce the risk of predation by a cat or fox standing in front of the small aperture. In May 2023, the space above the tunnel had been expanded to avoid funnelling bats through a tiny aperture.

From June 2023, a few different observation setups were trialled. Shining a torch out and up from the end of the tunnel allowed counting of the bats exiting the tunnel, but made it hard to pick up bats exiting via the top (or out to the side where Horseshoe-bats prefer to come and go). Lowering the light intensity still allowed counting without preventing the bats from exiting (assessed by turning the light off at the end and listening for bats exiting). This method was modified in 2025 with the torch being placed on the ground approximately 1 m in front of the adit, pointed up and out at 60 degrees from horizontal. That way, bats aren't deterred from exiting as they only cross the beam after exit. Though we miss some of the non-target species, we still pick up most of the target species over most months, and can concentrate on the non-target species over summer.

The smaller aperture of the tunnel has still resulted in slowing the emergence of the bats. Exit counts previously peaked in the 10 minute period 10-30 minutes after first exit, and most bats had exited by

40-50 minutes after first exit. With the new tunnel installed, exits were observed as a steadier stream but a peak at about 20-30 (Mar, Apr, Jun) or 30-40 (Sep, Oct) minutes after the first exit. It now takes 70-100 minutes for the colony to exit with the new setup.

Some very small rocks were observed dislodged from the roof in October 2024, but the main concern in 2024 was the widening of the crack in the wall on the right hand side (western side) of the entrance (**Plates 5-2** and **5-3**). A large acacia fell across the entrance in February 2024, but small branches were pruned so it did not obstruct exiting bats.

Looking at December counts from 2017-2023, the number of Eastern Horseshoe-bats was the lowest on record in 2023. 2024-2025 (7-12) has shown an increase, but numbers are still relatively low. The nine counted in December 2024 match the nine individuals harp trapped in July 2024 (five male, four female). The dry conditions experienced in 2023 may be partly responsible for the drop in numbers, but the removal of farm dams for the mine may also explain the reduction in counts/activity. Blast data does not indicate any obvious impact.

April 2024 counts (both species) were similar to those seen in 2022, but slightly lower than those seen between 2017 and 2019. Whilst April counts were down in 2025 from the previous year, June counts were nearly doubled in 2025 compared to 2024. June counts in 2024 were on par with the lower years, with the higher numbers not building until September 2024. Numbers peaked for 2025 in June at 739. This is the third highest June count behind 2018 and 2021. This is also lower than the peak count in September 2024 (912-1178). Though not entirely absent from the adit in December 2025, the low numbers of Large Bent-winged Bat at the adit (2 in Dec) are not indicative of breeding activity. These numbers are more indicative of non-breeding individuals remaining in the area over summer, and reconfirms the absence of maternity roost in the adit.

Automated echolocation call detection worked successfully at Slate Gully for estimating the activity of the two microbat species roosting within the disused oil shale mine workings. A fault in the detector caused loss of data over several weeks in March and June 2020, but the equipment has functioned without fail throughout 2021-25. One night in 2023 (2 November) recorded no call passes, but it is impossible to tell if this was a glitch in the detector or a genuine absence of activity over one night. The pattern of activity broadly mirrored numbers of bats recorded leaving the adit from hand counts undertaken over several years (Fly By Night 2017; Fly By Night 2018; Fly By Night 2019), with the absence of Large Bent-winged Bats in March 2020 counts the only anomaly. There are some complications with separating Large Bent-winged Bat calls from Little Forest Bat calls in the area, though the overall trends seen in the pooled data make ecological sense. With such large amounts of data to analyse from nights call recording, this is considered sufficient to monitor changes in the two cave-dwelling species utilising the adit.

The activity of the Large Bent-winged Bat recorded at the detector was broadly comparable with the hand counts undertaken simultaneously at the adit. Activity of the Eastern Horseshoe-bat recorded at the detector correlated much more poorly with the hand counts. This can be attributed to the small population of Eastern Horseshoe-bats resident in the workings throughout the year compared with that of the Large Bent-winged Bat. The activity patterns of the Eastern Horseshoe-bat (lots of coming and going) also impacts the suitability of the index for this species. From all the data collected, we estimate the population of Eastern Horseshoe-bats within the adit to be stable at 5-30 individuals. Early years have shown activity of the Eastern Horseshoe-bat peaking during the autumn and spring months, with minor activity declines over winter and summer. This species' activity was relatively

consistent over 2021 and 2022. 2023 saw consistent activity over the first half of the year and very low activity since May. 2024 -2025 saw a return to the pattern of peak activity in autumn and spring. Conversely, Large Bent-winged Bat activity fluctuated more in 2024 than during previous years. Activity peaked in April, June and August-September 2024 -2025 (April and July in 2022 and April-May and August-September in 2023). Though the usual decline in activity over summer as females migrate to select maternity roosts to give birth (Hoye and Hall 2008) was seen in summer 2023-24 it was not as evident in summer 2024-25. Activity remained relatively high through October 2024 to March 2025. Patterns of activity do not appear to coincide with noted blasts (data March 2020 to December 2025). The index tracking the number of total Large Bent-winged Bat calls added to those attributed to Little Forest Bat with low confidence (*M tot + Vvul P/Po*, **Figures 4-2a** to **4-2g**) give the best representation of Large Bent-winged Bat numbers in the adit. Looking at bat activity before and after blasts showed mixed (increase/decrease) results. The small changes relative to normal nightly variation in activity suggest no impact from blasting in Pits 3 or 8 on the two bat species.

Results suggest that monitoring of the colony at Slate Gully through nightly recording of echolocation calls provides a feasible means of monitoring use of the disused workings by the two microbat species. Mean monthly activity for the two species can be compared prior to mining taking place in adjacent areas with that post mining. As of February 2025, mining activity is approximately 190m from the adit (350m in February 2024). As the mine moved past in 2025 (topsoil stripping only), we did not detect any significant changes to occupation/activity of the two cave dwelling microbat species. Images from monthly monitoring (**Plates 5-A**, **5-B**, **5-C** and **5-D**) show the adit entrance has maintained integrity despite the nearby blasting in Pits 3 and 8 (and potentially Pit 7). However, some football sized rocks were dislodged from the entrance in the last half of 2022. One larger rock fell from the eastern side of the entrance in 2023. A crack opened up on the right hand side in 2024. Some rock collapse occurred on the right hand side of the adit in April 2025, but it has not blocked the exit over the top of the tunnel, and no further collapses were noted between May and December. Things to look out for in 2026 will be collapse of the western wall of the entrance, and maintaining access to the site for ongoing monitoring.

As a side study, a PIR camera was mounted out the front of the adit, pointed at the tunnel entrance. This was left in place between 17 December 2025 and 19 January 2026. No feral species were noted hanging around the entrance to the tunnel. The only species noted were Bare-nosed Wombat, Red-necked Wallaby, Pied Currawong and Rockwarbler. Other species noted whilst conducting counts over the years have been Rabbit, Black Rat, Fox, Fallow Deer and Common Wallaroo (not including all the birds observed/heard in the forest surrounding the adit). Rockwarblers are often observed entering and exiting the adit before dark. At this point there is nothing to suggest predators are attracted to the adit, but the camera should be redeployed in winter when the Bent-winged Bats are present.

Plate 5-A: Periodic monitoring photo of adit entrance from February 2021 (top), January 2022 (middle) and December 2022 (bottom) showing lack of substantial change

Plate 5-B: Monitoring photos of adit entrance pre culvert installation (March 2023 – top left), afternoon of installation (April 2023 – top right), nine months after installation (January 2024 – bottom left), and 20 months after installation (December 2024 – bottom right). This shows progression of pipe to tunnel with small aperture, tunnel with large aperture. Large crack forming on western side shown with red arrow.

Plate 5-C: Monitoring photos of adit entrance 15 months after installation (July 2024). Harp trapping was conducted to get an update on roost status (species present, sex ratios and recapture of banded individuals). Large crack forming on western side shown with red arrow.

Plate 5-D: Monitoring photo of adit entrance almost three years after installation (April 2025). Shows rock collapse in bottom right (western side – red arrow).

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17 February 2026

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