**Respond to examiners’ comments**

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| **Examiner Remarks** | **Thesis Author Comments** | **Page or other References** |
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| 1. Introduction - consistency presenting both common name and scientific name for all species at first mention. | All species common names and scientific names were inserted at first mentioned. | p. 1-11 |
| 1. Introduction - Numerous typos/applications of scientific name issues ‐ please check *Tadarida* (spelling and application to Australian species), *Chalinolobus, Scotorepens*, *M. schreibersii* (subspecies spelling and application to Australian species), *Mormopterus* (application to Australian species), et al. |  | p. 29 - |
| 1. Ch2 – How do you identify species during fly outs. How does this relate to the data from the recorders ‐ how are they married up? | It was stated in the second paragraph in section 2.2 Method and analysis that the species and temporal pattern of activity of bats emerging and returning the tunnel was identified using acoustic monitoring survey.  In the third paragraph it was stated that, the exit counts survey did not identify species during fly out, it was conducted to determine the timing of first emergence and first activity peak within the first hour after official sunset.  It was added to the last paragraph of the section 2.2 that “The exit counts results also assisted to determine the first emergence and used to compare the time of first emergence peak with the acoustic data.” to explain how the exit counts and acoustic recorders data were used together for analysis. | p. 29 - 31 |
| 1. Ch2 - Sometimes on flyouts many individuals exit at once ‐ how is this accounted for in the counts? | It was added to the second paragraph in section 2.2 Method and analysis that “If there were many bats exit at once, the echolocation calls of that period were zoomed into millisecond time frame looking for the number of unnatural pulses within the given pulse interval of the species provided by Reinhold et al. (2001) key to estimate the number of bat passes.” | p.30 |
| 1. Ch2 - How do you avoid missing or double counting bats that fly around in the tunnel as you disturb them on your walk‐throughs? | It was stated at pg. 31 that a red light and slow walk were applied during the walk through to minimize the disturbance to bats.  During the walk – through bats were relatively calm and remained at their roosts. As there was no bat flying around in the tunnel during the walk through, I did not address this issue in the document.  I agreed that it is difficult to avoid missing or double counting bats with observation. I acknowledged that the walk-through surveys might only provide a relatively accurate estimate on the number of bat population than other two surveys rather than showing the exact number of bats roosting in the tunnel.  Hence, I added the following in pg. 32 “Results from exit counts and walk-through surveys did not undergo statistical tests but used to compare the estimated bat population in the tunnel.” and also in pg. 60 “Although some bats may be hidden out of sight, this method provides a relatively accurate estimate of the total bat population in the tunnel than the other two surveys.” | p. 31, 32, 60 |
| 1. Ch3 - You identified twelve species ‐ how accurate is the recorder ID work for achieving this ‐ what scope is there for error? |  |  |
| 1. Ch4 - You identified 21 (of 34 SEQ) species, which is amazing in a 3km radius ‐ how accurate is the recorder ID work for achieving this ‐ what scope is there for error? |  |  |
| 1. Ch4 - Results – 3rd para. X%? | It was changed to “90%” | p.144 |
| 1. Ch4 - Fig 4.2 and 4.3 ‐ which species is which? | It was noted in the caption of both figures that the species list was sorted in descending order based on the proportion of their echolocation call passes. | p. 145-146 |
| 1. Ch5 - However, there was also some repetition in the discussion (of results) and then in the general discussion there was further repetition of discussion material (via a summary of each topic) without too much extension on the chapter material (or at least not referenced in light of literature). | The purpose of this chapter mainly was to provide major findings of this study to the Moreton Bay Regional Council for evaluate the conservation significance of the Yugar tunnel and bats.  Therefore, I summarised the major findings from each chapter and further expressed my suggestion for future research in this chapter. | p. 175 - 183 |
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| 1. It seems that *Nyctophilus Geoffroy* to be present in many fragmented patches and will spend time foraging in adjacent cleared areas with scatter trees. | It was changed to “Bat species that have low tolerances for edge effects such as *Nyctophilus gouldii* and *Vespadelus vulturnus* are likely to experience a population decline in disturbed habitats (Threlfall et al. 2013; Meyer et al. 2008; Haddock et al. 2019).” | p. 4 |
| 1. This study didn’t look at *C. gouldii* or *A. australis* | This reference was cancelled out. | p. 7 |
| 1. Though *M. schreibersii* have been recorded making further moments between overwintering roost and maternity sites in NSW. | It was inserted in pg. 11 that “*Miniopterus schreibersii* was recorded involving internal migrations from warm to cooler areas with higher temperature variability within caves (Kuipers & Dean 1970); also may involve migration over relatively long distance or in a local scale (Brown & Bernard 1994). *Miniopterus orianae oceanensis* was recorded long distance migrations between overwintering roost and maternity sites in NSW (Dwyer & Hamilton-Smith 1965; Mills 2021).“ | p. 10-11 |
| 1. What about adding some details about other artificial structures used by bats- e.g. stormwater drains, mines, bridges etc? | This was mentioned in Chapter 1 General Introduction. As chapter2 focuses on tunnel roosting bats, I think this is appropriate to keep it that way. | p. 27 |
| 1. Why these two seasons? Can you please justify the selection of these seasons? For example, was summer selected as this is season when most female bats congregate to give birth. For winter, was this season selected as some species may use tunnels for overwintering given the stable microclimate tunnels can afford bats. |  | p. 29 |
| 1. Did you do repeat counts on multiple nights in each season? This is suggested earlier in the methods when you say that counts were undertaken at the same time as acoustic surveys (which spanned 5 nights). | Yes, the exit count survey was conducted over 5 nights for replication so that can compare between summer and winter.  Hence, I inserted the following in pg. 31. “The final exit count of each night was calculated by averaging the count of bats leaving the tunnel determined by each observer, then this result was averaged over 5 nights and compared between summer and winter.” | p. 31 |
| 1. How did you determine which species were present? Please provide this detail. | The sentence was changed in pg. 31 to “The transect line was followed at a slow walk and the species were observed and identified with the assist of prepared photos of several cave roosting bat species in Queensland, and number of bats counted; their distance from the entrance and height on the tunnel wall was recorded.” | p.30-31 |
| 1. What about the acoustic and walk-through surveys? How did you analyse those datasets? Presumably you compared between seasons? | Yes, the results were compared between seasons for the datasets of the walk-through and acoustic surveys.  However, results of the exit counts and walk-through did not undergo any statistical analysis. As exit counts cannot determine activity pattern throughout the nights, and walk-through did not provide information for bats activity.  Exit counts results were used to determine the first emergence from the acoustic survey, also used to compare the time of the emergence peak during the first hour after official sunset.  Hence, I inserted the following in pg. 32 “Multiple plots were created to examine the nightly activity pattern of bats, and a peak in activity was identified by observing these plots with each change in activity from increase to decrease was classified as a peak. Results from exit counts and walk-through surveys did not undergo statistical tests but used to compare the estimated bat population in the tunnel. The exit counts results also assisted to determine the first emergence and used to compare the time of first emergence peak with the acoustic data.” | p. 31-32 |
| 1. Why was this period chosen for assessment? Why not the whole night? | I acknowledged that analysing the first 4.5 hours after sunset may not represent species activity throughout the nights. However, analysing every bat recording into number of passes and species for 5 whole nights could be very time consuming with great effort. Considering the time constraints of completing the study, I have chosen to analyse the first 4.5 hours after sunset which I think is confident to show the emergence time of the three bat species inhabiting the tunnel. | p. 34 |
| 1. Please consider whether it might be clearer to average activity levels by species over all nights of sampling and then presenting two coloured lines (winter/ summer) in four plots – one for each species. Since each species will have echolocation calls that vary in amplitude it’s difficult to make a fair comparison among species using acoustic activity data. | I do not agree with Prof. XXX comment, because the weather condition was not uniform during the sampling periods. As there were 3 days of rain during summer. It would be hard to look at the change of patterns due to different weather if using average. I think both Fig. 2-3 and Fig. 2-4 are clear enough to show the bat species activity pattern over the sampling nights. Meanwhile, Fig 2-5 compared the average of the first activity peak of each species between summer and winter, which does a similar job of what has been suggested. | p. 36-37 |
| 1. Which three species? Can you please specify? | It was inserted on pg. 34 that “In summer, all four species (*M. macropus*, *M. australis*, *M. orianae oceanesis* and *R. megaphyllus*) were first detected within 0.5 hours before sunset, but each species exhibited peak activity at different times and at different levels (Figure 2-3). | p. 34 |
| 1. I think it is also important for you to describe how you identified peaks in activity. Was this done visually? Or did activity have to be above the nightly average for this to be considered a peak in activity? | I agreed with Prof. XXX’s comment that it is important to describe how I identified activity peaks. Hence, I inserted the following in pg. 32 “Multiple plots were created to examine the nightly activity pattern of bats, and a peak in activity was identified by observing these plots with each change in activity from increase to decrease was classified as a peak.” to address this issue. | p. 34 |
| 1. This isn’t clear to me – I’m not sure what you mean here. Are you saying that differences in activity between species varied with season? | I agreed to Prof. XXX that the sentence was not very clear. It was meant to be comparing seasonal difference across different species. Hence, the sentence was changed on pg. 38 to “Comparing seasonal difference across species, it was found that seasonal interactions on the time of first activity peak (emergence) across different species were also significant (p < 0.05 — Table 2-2) except for *R. megaphyllus* in summer and *M. australis* in winter, and *M. macropus* in summer and *M. australis* in winter (p = 0.3169 & p = 0.2739, respectively — Table 2-2).” | p.36 |
| 1. It's not clear why this is a negative value. The plot seems to show a higher value for *Miniopterus australis* in summer compared to winter. If that's the case, then summer minus winter should be positive. |  | p.37 |
| 1. Shouldn't this be positive based on relative activity of Myotis in summer compared to Miniopterus australis in winter? |  | p.37 |
| 1. Seems odd that this isn't significant given the large differences in activity between both species in the respective seasons. |  | p.37 |
| 1. Again, this is not clear. Do you mean that differences between species were not influenced by season? Should this be p > 0.05? | I agree with Prof. XXX that the sentence was not very clear. It was addressed in a similar approach that sentence was changed on pg. 40 to the following “Comparing different species between the two seasons, it was found that seasonal interactions on the time of first activity peak (emergence) across different species were not significant (p > 0.05 — Table 2-3) except for the interaction between *M. australis* in summer and *R. megaphyllus* in winter (p = 0.0313, Table 2-3).” | p.38, 40 |
| 1. You might consider reporting this to fewer decimal places – e.g. p < 0.001 | It was changed to p < 0.001 | p.40, 42 |
| 1. Not according to fig 2-1. | “(Figure 2-9)” was inserted to the sentence on pg.44 | p.42, 44 |
| 1. I think before discussing these limitations, further discussion is needed about why there was a similar pattern for acoustic surveys and exit counts. For example, is this something others have found elsewhere? If there was a difference in patterns between winter and summer, it would be worth exploring this here. |  | p.46, |
| 1. What behaviour is this? | It was explained in pg. 59 that there are some bat species exhibit a light sampling behavior undertaking flights within roost before emergence and return associated with predator avoidance (Fure 2006). | p.46, 59 |
| 1. Why do you think this may be the case? If your surveys were carried out in summer (including late summer), could some activity be from juveniles that are starting to fly? | I agree with Prof. XXX that some activity could be from young bats. Since it is not known if the Yugar tunnel is a maternity site for *M. australis*, there is a potential that some activity could be from juvenile bats. Hence, I inserted on pg. 51 “However, some activity could potentially be produced by juvenile bats that were born in summer.” | p.49, 51 |
| 1. This study didn’t assess emergence for tree-roosting Myotis. | This reference has been canceled out. | p.49, 51 |
| 1. This makes sense but contradicts your previous sentence. | It was changed to “However, Reichard et al. (2009) indicated that lactating females were likely to emerge earlier than pregnant females due to higher energy demands. Contrastingly, pregnant and juvenile bats have higher energetic costs of flight due to greater wing loading or inexperience, and so they may emerge later to reduce predation risk (Kunz & Anthony 1996; Jones & Rydell 1994). | p.50, 52 |
| 1. This is important and probably should be mentioned in the method. | I agree with Prof. XXX that this should be mentioned in the method section. Hence, I inserted the following in pg. 30. “In addition, there were heavy rains over the 3 sampling nights and no pattern of bat emergence under normal weather condition was recoded in summer.” | p.51, 53 |
| 1. Insert references to support this statement | The following was inserted in pg. 57. “Studies indicated that insect abundance was positively correlated with warmer ambient temperature and dependent on immediate condition of weather (Meyer et al. 2016; Turbill 2008; Sherwin et al. 2013)” | p.55, 57 |
| 1. Or there may be some relationship with breeding condition. | I agree with Prof. XXX that breeding condition could potentially affect the return peak of *M. macropus.* Hence, I inserted the following in pg. 58. “Contrastingly, the earlier final return peak of *M. macropus* in summer might be caused by early satiation due to higher food abundance and possibly the breeding condition.” | p.56, 58 |
| 1. Are walk-through surveys really favoured? They can cause a lot of disturbance to bats, especially in winter when bats can be in deep torpor. Disturbances can also have a long-lasting | I think walk-through survey in this project is relatively favored, because walk-through was conducted after the exit count and acoustic surveys. So, disturbance was minimized during the earlier two surveys. | p.57, 59 |
| 1. Though sometimes bats may be hidden out of sight - e.g., in cracks/crevices. Walk through surveys can also disturb bats, causing them to take flight which makes it difficult to count bats. | The following has been inserted in pg. 60 “Although some bats may be hidden out of sight, this method provides a relatively accurate estimate of the total bat population in the tunnel than the other two surveys.” | p.58, 60 |
| 1. This would be unlikely for a nursery site. | I agree with Prof. XXX that *M. australis* with colonies mostly consist of adult males and females would unlikely be a nursery site. Hence, this has been canceled out and changed to the following in pg. 62 “*Miniopterus australis* migrate to their nursery site in early spring from August to September (Dwyer 1968)” | p.60, 62 |
| 1. Not sure this is accurate. Not all bats can roost in artificial structures. | It was changed to the following in pg. 78 “Degradation of natural habitats due to human activities such as deforestation, urban development and agricultural expansion have decreased the availability of natural roosts for many bat species consequently impacting on populations and causing an increase of roosting in artificial structures (O’Malley et al. 2020; Sparks et al. 2004; Gehrt & Chelsvig 2003; Park 2015; Russo & Ancillotto 2015).” | p.75, 78 |
| 1. It's not clear to me what you mean here. | It was changed to the following in pg. 77 “Thermally stable in microclimate is thought to be suitable for maternity roosting as pregnant females generally preferred limiting excessive heat loss to promote growth of the young (Neubaum et al. 2017).” | p.77, 80 |
| 1. This is important to know for chapter 2 and should be made clearer in methods for that chapter. The walk-through survey may have influenced activity patterns recorded on acoustic devices. | I think the walk through surveys did not influence the emergence pattern recorded on acoustic device as the walk through surveys were conducted after the exit counts and acoustic surveys. So that the disturbance of bats’ emergence was minimized.  However, I agree with Prof. XXX that it should be made more clear in methods. Hence, I inserted the following in pg. 30 – 31 (1st paragraph in Section 2.2) “The exit counts and acoustic surveys were conducted simultaneously in summer (15th – 19th January 2020) and winter (17th – 21st July 2020), then the walk-through surveys were conducted two days later to minimize disturbance which potentially affect the emergence pattern of the bats.”  Also inserted the following in pg. 82 “Followed by the three surveys conducted in Chapter 2, another walk-through survey was also conducted on the day of deployment (before bats emerged) to finalize the locations of each roost.” | p.78, 82, 30, 31 |
| 1. Include manufacturer details, make and model | Manufacturer details, make and model were inserted in the following at pg. 82 “HOBO loggers (manufacturer: Onset Computer Corporation; Model: HOBO U23 Pro v2 Temperature/Relative Humidity Data Logger - U23-001)” | p. 78, 82 |
| 1. Is this the east or west? | It is the east side of the wall. “(east side)” was inserted into the sentence. | p.80, 84 |
| 1. Can you specify what the W and S represent in the diagram? I'm guessing it's the number of bats observed in each hole in summer/ winter. | I inserted a compass labeling the direction of the tunnel in Figs 3-1& 3-2. | p.83, 86, 87 |
| 1. Is this differences between seasons? If so, please describe which season had greater differences. | The following was inserted in pg. 92 “Tmin and Tfluc showed winter had significantly greater differences than summer (Independent T-test, p < 0.05 – Table 3-5).” | p.88, 92 |
| 1. How is this different to what you have presented earlier? Is this looking at each individual roost vs ambient whereas the earlier results is comparing all roosts (i.e., pooled) vs ambient? | Yes, it is looking at each individual roost vs ambient. I agree that it should be more clear. Hence, I inserted the following in the first paragraph of pg. 94 “Comparing the mean daily diurnal temperature between each individual roost and each ambient, …” | p.90, 94 |
| 1. Can you describe which season had the greater difference? | It was changed to “However, maximum showed significant difference with winter greater than summer (p < 0.05).” | p.102, 106 |
| 1. How are these results different to what has been presented above? | Again, this one shows the difference between each individual roost and ambients. | p.104, 108 |
| 1. It would be good to offer up suggestions for why this happens. Is it simply that the bats generate some heat and in winter this is greater than ambient heat elsewhere in the tunnel, whereas in summer the heat generated by bats is small compared to ambient heat in the tunnel? | Suggestions were made in the next paragraphs in the Temperature – Bat roosts section. See page. 120 - 123 | p.116, 120 |
| 1. It's not clear what you mean by this. | It was changed to “Meanwhile, minimum temperature increased when roost temperature was less varied between night and day” | p.116, 120 |
| 1. So then is it clear that bats are selecting for temperature stability or high temperatures - or can this not be teased apart? | I agree with Prof. XXX that the roosting selection of bats for better thermal stability and high temperatures can be teased apart. Hence, the sentence was changed to the following in pg. 121 “In general, bats preferred to select locations with either warmer or more thermally stable or possibly both conditions in the Yugar tunnel.” | p.117, 121 |
| 1. Not necessarily. Young regrowth can be very cluttered for bats. | True, hence it was changed to the following “Cluttered habitats contain vegetations with a relatively more closed canopy which provide potential roosting sites (Ciechanowski 2015; Callahan et al. 1997; Sedgeley 2003) and favorable foraging condition for clutter adapted species (Wegiel et al. 2019; Patriquin & Barclay 2003).” | p.136, 140-141 |
| 1. But there is no way to know if the bats detected in the surrounding landscapes are the same bats that roost in the tunnel – you would need to do something like radio-tracking to achieve this. Or light tagging bats from the tunnel (a bit hit and miss). | I agree with Prof. XXX that the acoustic surveys cannot determine where the bats from the Yugar tunnel go for foraging. I acknowledge that the acoustic surveys conducted in this study cannot identified where exactly the bats from the tunnel traveled for foraging at night. Hence, I inserted the following in the Discussion pg. 155 “I also acknowledged that the surveys conducted in this project cannot show where the bats in the Yugar tunnel were foraging in the surrounding landscapes.” | p.137, 142 |
| 1. Reference | A reference for vegetation classification document was inserted “(Queensland Government 2019)” | p.137, 142 |
| 1. At what spacing | It was changed to “Each vegetation type was replicated 5 times approximately 1.5 km apart.” | p.137, 142 |
| 1. Why not the whole night? | This was addressed in the response to Prof XXX’s comments. It is because it would take a huge amount of time and great effort to sample whole night and analyse the data. Although there’s a potential that the sampling might miss recorded some species later at night, I’ve plotted the species accumulation graphs for each site (recorder) over the sampling period and assured each site has reached the asymptote. Hence, it is likely that the sampling effort is enough to represent the overall species diversity in the study area. | p.138, 143 |
| 1. Good to describe how you distinguished search phase calls in clutter from feeding buzzes. | The following was inserted in pg. 143. “Reinhold et al. (2001) key was also used to distinguished search phase calls and feeding buzzes.” | p.138, 143 |
| 1. It's not clear how species can be incorporated if the response variables are diversity and evenness indices. | No, species did not incorporate in the three-way non-parametric ANOVA. Hence, it was changed to the following in pg. 144 “A three-ways non-parametric ANOVA using a 0.05 rejection level was conducted on the Shannon-Weaver indices and evenness among seasons, habitat and vegetation types.” | p.139, 144 |
| 1. A clearer map will help to see where all the sites are. | I acknowledge that this map is somehow difficult to see where the sampling sites are. Unfortunately, this was the only vegetation map provided by Moreton Bay Regional Council through a pdf document. Hence, I can only extract this map from cropping image with a relatively low resolution. | p.140, 145 |
| 1. Did you log-transform data prior to analysis? I suspect the variability in sites might be behind the non-sig. result. Other analytical techniques such as mixed models might help to deal with this issue - i.e., including site as a random factor. Given edge and interior at each site are likely to be correlated, this needs to be accounted for in an analysis. | Yes, the data was not normally distributed even after log-transformation. Hence, the Aligned Rank ANOVA which was the non-parametric approach was undertaken. | p.143, 148 |
| 1. Can you specify whether evenness was greater in summer? | The following was inserted to pg. 149 “The two ways interactions were also not significant, and only seasons showed significant difference in evenness with winter showed greater evenness than summer (Table 4-2).” | p.144, 149 |
| 1. It's not clear how this fits in. | It was changed to “eco-morphology”. | p.150, 155 |
| 1. Can you please elaborate on this point? How does a change in season influence vegetation structure and the assemblage of bats? |  | p.151, 156 |