Project Update: June 2019

My project underwent amendments to include historical datasets to make the project more robust. To date, I have completed four data chapters investigating different proximate factors ultimately affecting the migratory behaviour of *M. natalensis*. These four chapters are entitled:

1) *Increased body mass supports energy compensation theory in the breeding female Natal long-fingered bat Miniopterus natalensis.* This chapter investigated the effects of lactation on female *M. natalensis*. Lactation is one of the most energetically demanding periods in the life cycle of a small mammal. Classified as income breeders, hibernating small colonial insectivorous bats are hypothesised to compensate for the energetic demand of lactation by increasing daily food intake, which increases body mass. Lactating females were shown to be 6% heavier than non-reproductive females, and also showed the biggest mass increase between evening and morning samples. These results suggest female M. natalensis were heavier, on average, during lactation and support the energy compensation hypothesis. This chapter has been published in Acta Chiropterologica as:
Pretorius, M., Kearney, T., Keith, M., Markotter, W., Seamark, E., & Broders, H. (2018). Increased body mass supports energy compensation hypothesis in the breeding female Natal long-fingered bat Miniopterus natalensis. Acta Chiropterologica, 20(2), 319-328.

2) *Climatic correlates of migrant Miniopterus natalensis phenology in north-eastern South Africa.* Environmental change alters the availability and abundance of resources. For migratory animals, changing weather patterns may cause a mismatch between periods of expected and actual resource availability. Here, echolocation data from a maternity site in Limpopo, South Africa were used to investigate the phenology of the migratory Natal long-fingered bat *Miniopterus natalensis* in relation to climate. Results indicated that photoperiod and the associated temperature fluctuations appear to cue migration for this species. This chapter underwent peer review in the Journal of Climate Research and is currently being amended for publication elsewhere.

3) *Duration and intensity of lunar light does not affect the activity of Miniopterus natalensis.* The activity of nocturnal animals is often governed by the lunar cycle. In this chapter I investigated the temporal variation in activity of the Natal long-fingered bat, *Miniopterus natalensis* in relation to seasons and moonlight intensity. Using 6 years of echolocation data from the Madimatle Cave maternity colony in north-eastern South Africa, I described distinct differences in activity among seasons. Activity was highest during summer and lowest during winter, illustrating the migratory nature of this bat species. There was no evidence that percentage lunar illumination or duration of moonlight affected the magnitude of *M. natalensis* activity. This chapter is currently being formatted for submission to Mammal Research.

4) *Sex-specific seasonal fattening patterns in migrant hibernator Miniopterus natalensis*. Migration and hibernation require preceding physiological preparation through fattening. Bats employ both strategies and sex-biased migration is common without the expected sex-dimorphic basis. I investigated seasonal body mass (BM) differences between different demographic groups of *M.* natalensis to determine if this species show fattening in preparation for migration/hibernation. Data on

emerging bats trapped systematically from December 2011 - August 2018 at a maternity cave were used in this study. *Miniopterus natalensis* is not sexually dimorphic, but BM differed significantly between reproductive phases within sex and age groups during four seasons. My results indicate that male and female *M. natalensis* employ different fattening strategies to prepare for migration and hibernation, related to reproductive investment by the different sexes. This chapter is currently being formatted for journal submission.

My next investigations will involve isotope analysis of bat hair and looking at the wing morphology between male and female bats.

A *M. natalensis* individual being processed for age, sex and mass data ©Mariëtte Pretorius

Taking hair clippings from an a *M. natalensis* individual for isotope sample analysis ©Mariëtte Pretorius