A preliminary assessment of tooth condition, body mass index and management options for edentulous Black Flying Foxes (*Pteropus alecto* Gould) in the Townsville District, North Queensland

Jon Luly
North Queensland Wildlife Care Inc.
pteropus@ozemail.com

Dominique Thiriet
North Queensland Wildlife Care Inc.
pteropus@ozemail.com

Emma Gyuris
Taylor Street, Belgian Gardens, Townsville

Introduction

The black flying fox (*Pteropus alecto* Gould) is the most commonly encountered pteropid bat in the Townsville district. North Queensland Wildlife Care Inc. receives approximately 180 individuals of this species each year. A number are edentulous, or have severely reduced dentition and opinions differ as to whether such individuals should be rehabilitated and released or euthanised. In this paper we examine the relationship between dental state and the body mass on receipt of black flying foxes received by North Queensland Wildlife Care between August 2008 and February 2012 with a view to determining whether bats with worn or absent teeth are at nutritional disadvantage and therefore unsuitable for rehabilitation and release. Data collection is continuing.

Animals measured for this study were acquired and held under rehabilitation permit issues by the Department of Environment and Heritage Protection (formerly the Department of Environment and Resource Management).

Methods

Animals measured in this study were brought into care as a result of injury and were released or euthanised according to the terms of the DEHP permit. All animials coming into care were screened and selected according to strict criteria intended to minimise confounding influences exerted by underlying disease and dehydration / starvation attendant upon an extended period of debility. Decision rules were:

1. Animals were adult black flying foxes. Juvenile and first-year bats, as determined by forearm measurement (forearm < 140 mm), weight (weight < 500 gm) and subjective assessment were excluded from the study population.
2. Animals selected for the study were injured, not ill.
3. Animals selected had a reliable history that demonstrated a short time interval (less than 24 hours) between injury and discovery and rescue.

Bats were weighed on receipt. Forearm measurements (made in millimetres with a vernier caliper) and assessments of tooth condition were made after the animal had been stabilised or euthanised. Animals not deemed not to meet the selection criteria were entered into the rehabilitation program or euthanised as appropriate to their circumstances.

Tooth condition was scored on a 5-point Likert scale. For the purposes of this study scored canine and molar teeth separately. Each set of teeth was scored as follows:

1. All teeth sharp and white
2. Teeth discoloured but sharp and unworn
3. Teeth white of discoloured but occlusal surfaces blunted and showing clear signs of wear
4. Canines distinctly shortened and molars worn flat
5. Teeth worn to stubs or animal edentulous.

Body condition was represented as a body mass index calculated as a ratio of forearm length (mm) to body weight (gm). The index used was that of Pinson (2009). In practice, the index generates a "preferred" weight by subtracting 100 from the forearm measurement and multiplying the result by 10. Thus for a forearm measurement of 155 mmm the "preferred" weight would be 550gm. The "preferred weight" was used to calculate a percentage deviation from that figure. Divljan et al. (2007) note that where the weight of a bat is 15% below the "preferred" weight, the bat is considered to be malnourished. Where weight is 20% below the "preferred" weight, the bat is considered to be starving (Pinson 2009). A subjective assessment based on palpation of the thorax and upper back was also made of the condition of each bat included in the study cohort.

Results

Fifty individual *P. alecto* fit the selection criteria and were included in the measured cohort. The majority of these animals (N= 19) were recovered from fruit netting or barbed wire fences, nine were found with assorted injuries including fractures, tears in the wing membrane and bilateral detachment of the retina. Five bats had been caught by dogs and three had been electrocuted. Twenty seven bats were male and 22 female so there is little obvious sex bias in the sample.

The vast majority of bats investigated have noticeable dental wear. The modal score for canine teeth is score 3 (N=11) whilst the modal score for molars is 4 (N= 25), suggesting that molars wear more rapidly than do canines. Although the sample size is small, figures 1 and 2 suggest that severely worn canines are weakly negatively associated with body condition, whether expressed as percentage of "preferred" weight or as body mass index. Figures 3 and 4 suggest that males are more disadvantaged than females by poor canine condition. The reason for this apparent difference is unknown.

Figure 1 – relationship between canine condition and “preferred” weight (all bats)

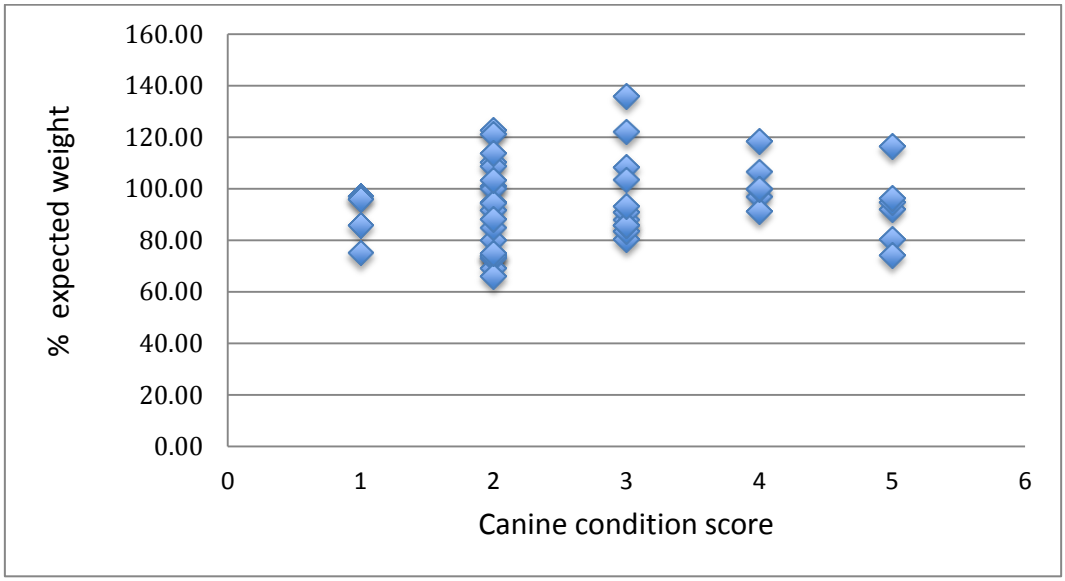


Figure 2 - relationship between canine condition and body mass index (all bats)

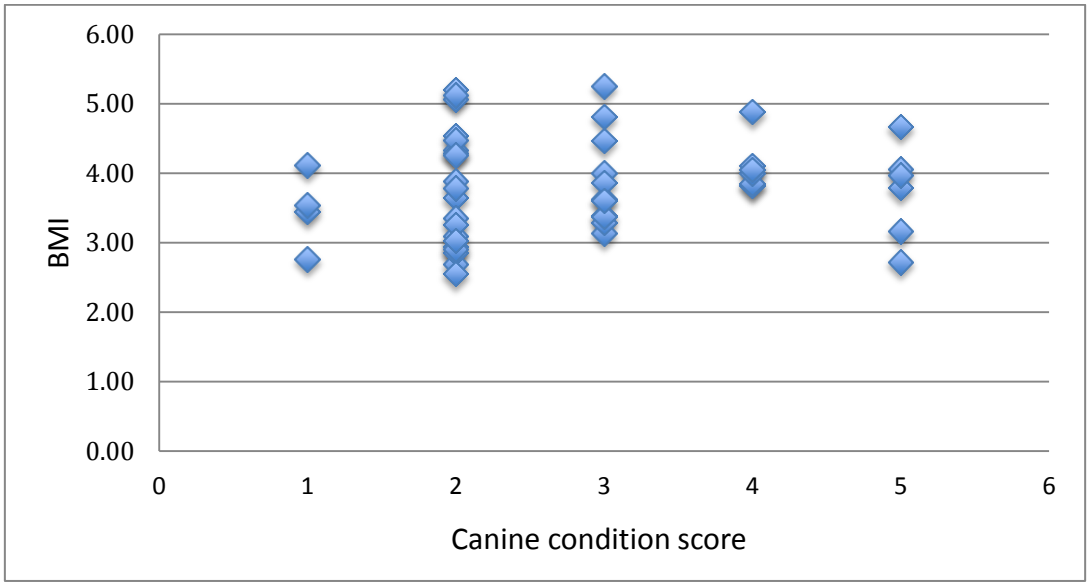


Figure 3 – relationship between canine condition and body percentage of preferred weight (males only)

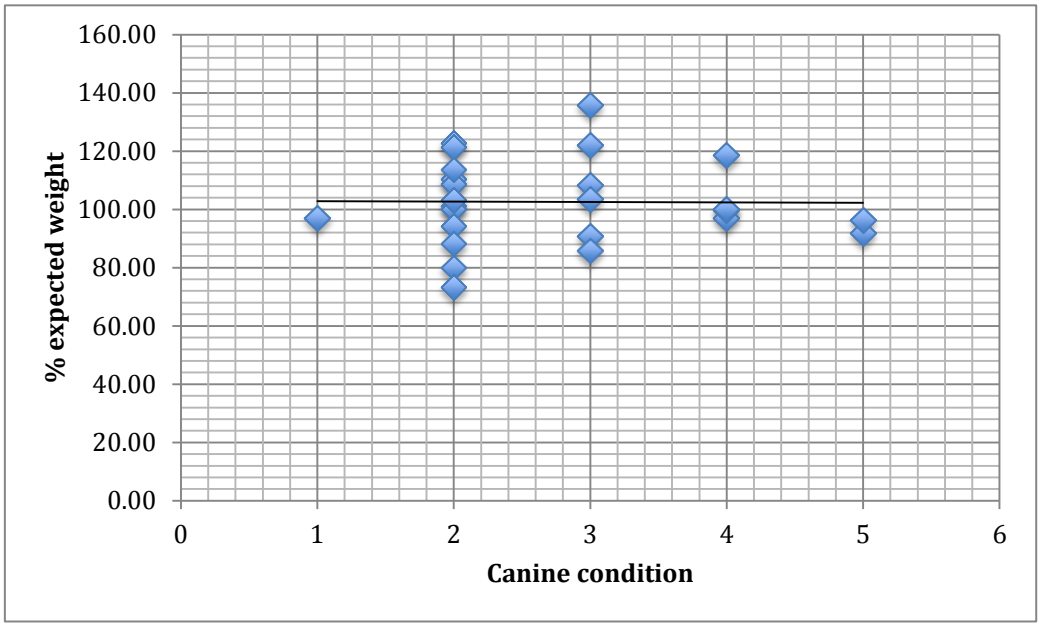
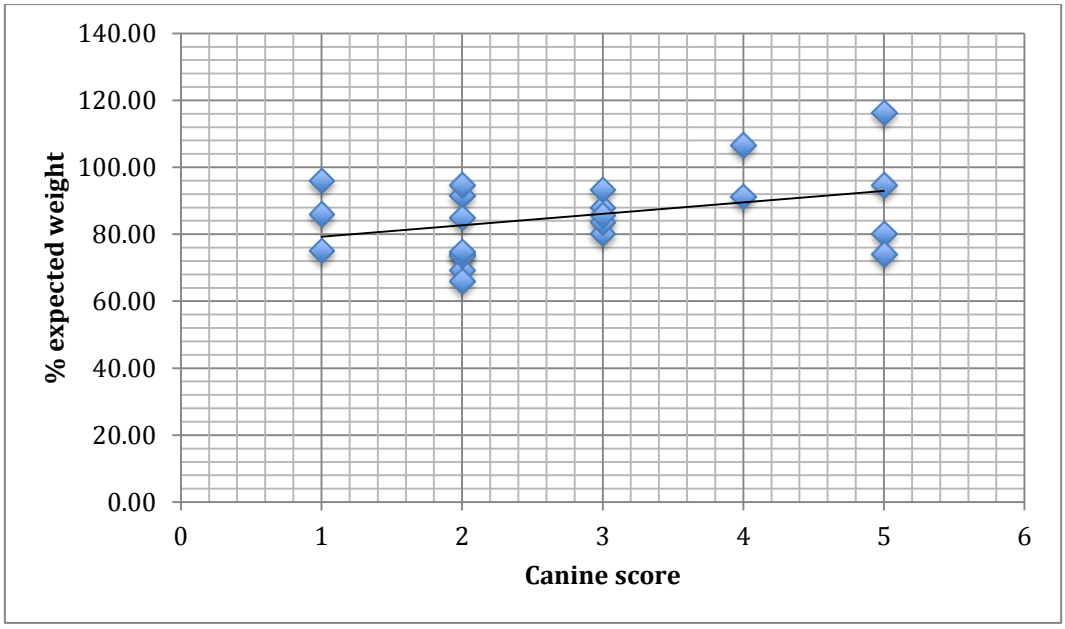


Figure 4 - relationship between canine condition and body percentage of preferred weight (females only)



Graphical representations of molar condition against body mass index and percent of preferred weight for all bats (figures 5 and 6) and by sex (figures 7 and 8) suggest that poor molar condition has no role in predicting nutritional status.

Figure 5 – relationship between molar condition and body mass index (all bats)

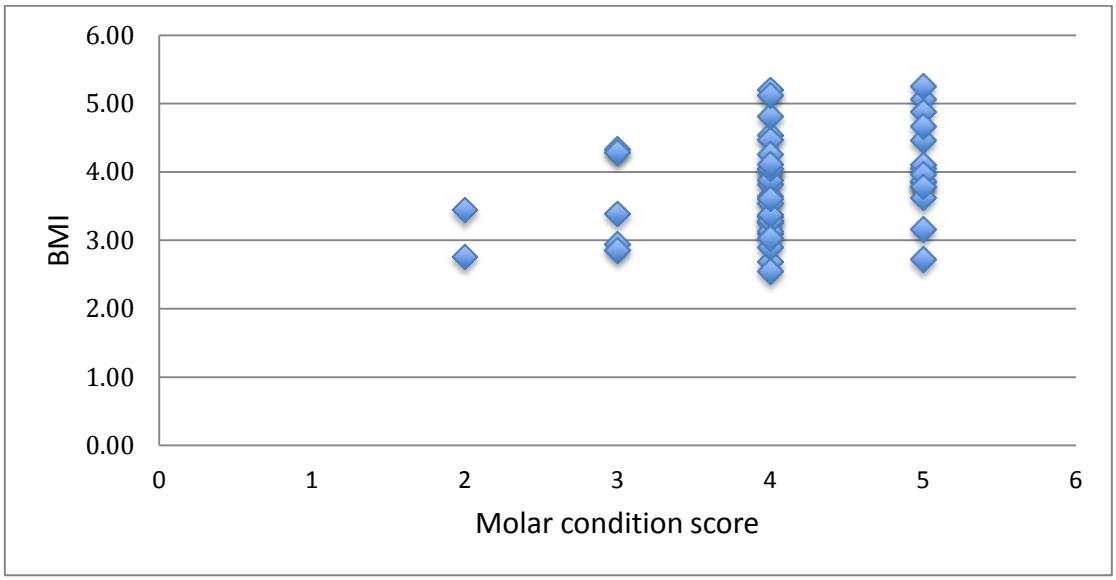


Figure 6 - relationship between molar condition and expected body weight (all bats)

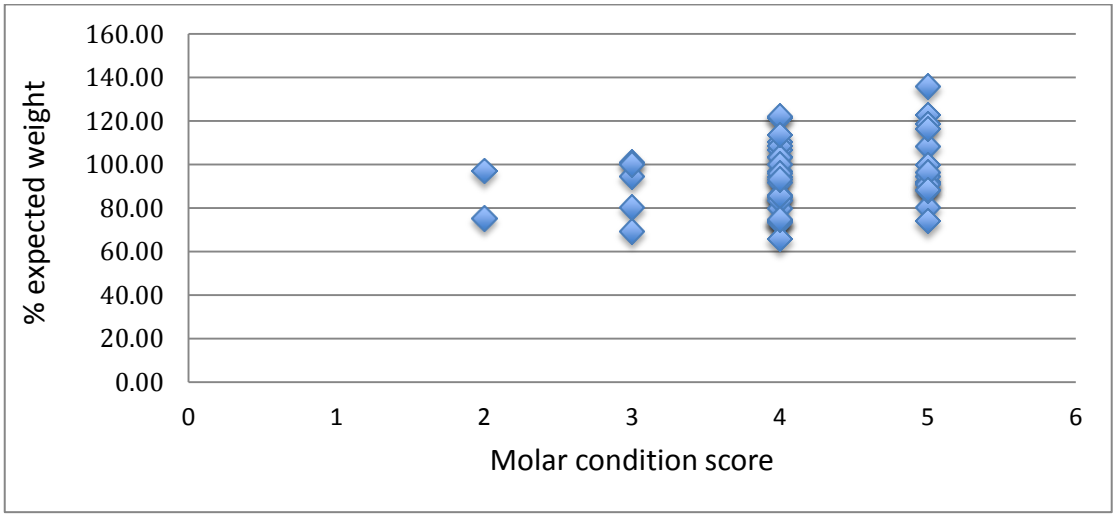


Figure 7- relationship between molar condition and expected weight (males)

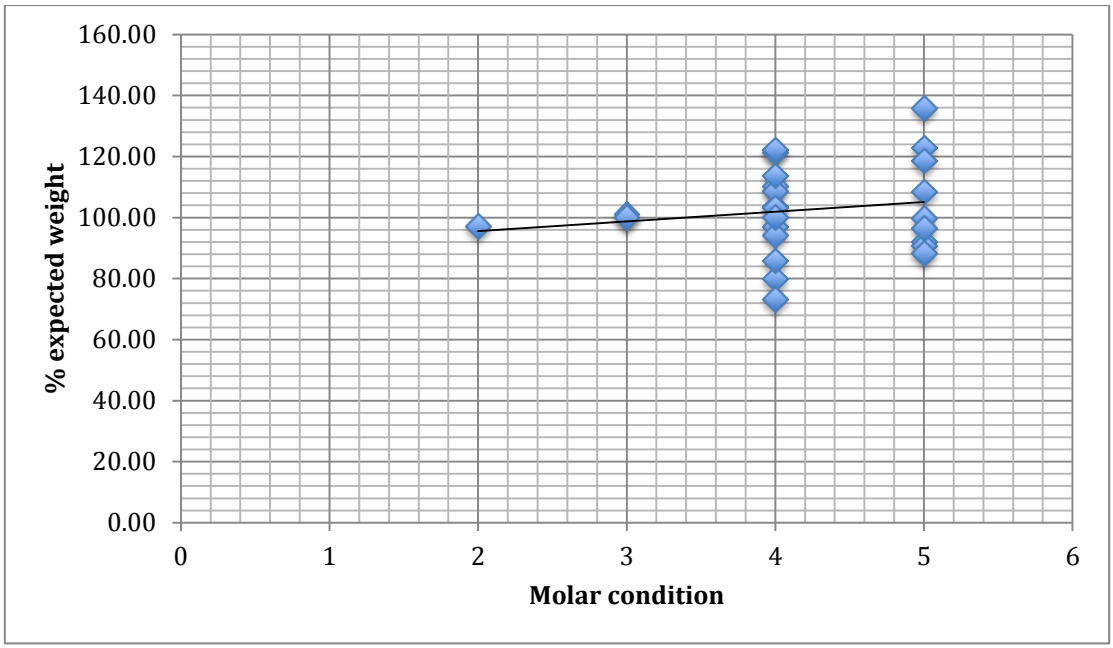
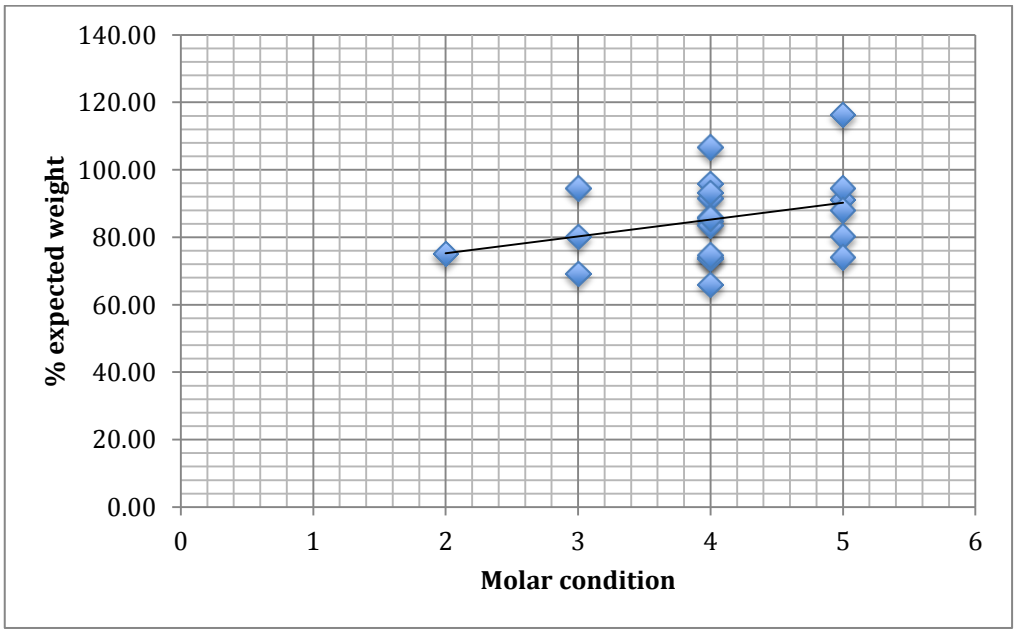


Figure 8 – relationship between molar condition and expected weight (females)



Discussion

The preliminary date presented suggest that there is little = relationship between tooth condition and nutritional status in the years for which data are available. There are intriguing differences between results for molars and canines and between sexes which require more detailed analysis using a more comprehensive data set. The results are, however, consistent with dietary preferences shown by *P. alecto* in the Townsville district.

Dietary studies carried out by Parsons (2011) indicate that *P. alecto* depends heavily on nectar flows for eucalypts and paperbarks, a conclusion which makes sense in that the landscape around the city is dominated by tropical savannas and the rainforest / vine thicket vegetation which yields the majority of fleshy fruit is scarce. Introduced plants such as palms, mangoes, paw paws are eaten, but these taxa do not appear in meaningful quantities in scat analyses. This contrasts strongly with the spectacled flying fox (*P. conspicillatus*) where figs are a prominent element in scats and numerous other fruit, native and introduced, also occur (Parsons et al. 2006). Data from Townsville suggest that for much of the year, *P. alecto* diets are similar to those recorded for pollen and nectar specialists such as the little red flying fox (*Pteropus scapulatus*) and the grey-headed flying fox (*Pteropus poliocephalus*).

The ubiquity of tooth wear in adult *P. alecto* in Townsville suggests that although they depend on nectar and pollen for a significant part of the year, abrasive materials, such as leaves and bark, must also be eaten. The difficulty of determining the age of flying foxes means it is difficult to estimate rates of tooth wear, however the presence of discoloration and wear on the teeth of many first-year individuals implies that wear begins early. Flying foxes have long potential life spans however data for *P. poliocephalus* (Divjlan et al. 2007) and *P. conspicillatus* (Fox et al. 2008) suggest that lifespans in the wild are often short. The substantial tooth wear noted illustrated by our data suggests that estimates of age based on tooth wear are attractive, but are unlikely to be useful.

Conclusions

Codes of Practice regulate the care and rehabilitation of wildlife in most States. The codes seek to ensure that cruelty to animals is avoided, suffering is minimised and the success rates of rehabilitation and release are maximised. All codes contain provisions that stipulate conditions under which animals (in this case, flying foxes) are to be euthanised. Our results suggest that although there is an intuitive requirement for flying foxes to have intact dentition to prosper in the wild, in the Townsville district, and probably also in other areas in which savanna or woodland is the dominant vegetation type, reliance on floral resources likely buffers edentulous bats against dietary stress arising from inability to eat hard fruit. Euthanasia of edentulous bats, or bats with reduced dentition is not warranted in the absence of other considerations. We believe these conclusions will apply to other species, such as grey-headed flying foxes (*P. poliocephalus*) and little red flying foxes (*P. scapulatus*) as well.

Limitations

The strict decision rules applied to the sample cohort means that the sample size is small. Data collections continue and we expect to be able to analyse a larger data set in future.

There are indications that body mass index is a relatively weak indicator of nutritional status (Divljan et al. 2012) but until a better usable index can be developed it will have to suffice.

Tropical cyclone Yasi affected the landscapes around, and to the north of, Townsville during the data collection period. Food supplies for frugivorous birds

and bats were severely affected and may have had an as yet unquantified effect on the regional scale nutritional status of flying foxes from February 2011 until vegetation had substantially recovered late in 2011. We are unable to resolve seasonal differences which might exist in body weights.

There is a need to extend sampling outside the Townsville region in order to identify the extent to which conclusions reached here have wider applicability.

References

Divljan, A., Parrry-Jones, K. and Eby, P. (2007) *Report on deaths and injuries to Grey-headed Flying- foxes, Pteropus poliocephalus shot in an orchard near Sydney, NSW*. Report to Humane Society International.

Divljan, A., Parry-Jones, K., Roberts, B., Eby, P., van der Ree, R. and Martin, J. (2012) A measure of body condition in flying-foxes: an assessment of methods based on mass and length. Australasian Bat Society Newsletter (38) 32-33

Fox, S., Luly, J., Mitchell, C., Maclean, J., Westcott, D. (2008) Demographic indications of decline in the spectacled flying fox (*Pteropus conspicillatus*) on the Atherton Tablelands of northern Queensland. *Wildlife Research* **35**(5) 417–424

Parsons, Jennifer G. (2011) ***Studying mobile species in spatially complex ecosystems: Australian flying-foxes as a case study.*** PhD thesis, James Cook University.

Parsons, J and Shilton, L. (2010) The Implications of sympatry in the spectacled and grey headed flying-fox, *Pteropus conspicillatus* and *P. poliocephalus* (Chiroptera: Pteropodidae). *Acta Chiropterologica* 12(2) 301-309. 2010

Parsons, J. G., Cairns, A., Johnson, C. N., Robson, S., Shilton, L. A. and Westcott, D. A. (2007) Dietary variation in spectacled flying foxes (*Pteropus conspicillatus*) of the Australian Wet Tropics. *Australian Journal of Zoology* **54**(6) 417–428

Pinson, D. 2009. *The Flying-fox Manual*, 2nd Edition. Murwillumbah, NSW: StickeeBatz Publishing.

Dr Jon Luly BA (Monash), PhD (ANU)
Currently Senior Lecturer, School of Earth and Environmental Sciences, JCU

Dominique Thiriet Lecturer.School of Law, James Cook University, Townsville QLD 4811

Dr Jon Luly and Dominique Thiriet have been bat carers in Townsville for 15 years and are currently co-ordinators of bat care and rescue with NQ Wildlife Care.