

WE ARE WHAT WE EAT: ARE NUTRITIONAL DISEASES CONTRIBUTING TO THE DECLINE OF THE ENDANGERED CHRISTMAS ISLAND FLYING-FOX (*PTEROPUS MELANOTUS NATALIS*)?

Laura Ann Pulscher, MSc¹, Ellen Dierenfeld, MS, PhD^{2,3}, Karrie Rose, DVM, DVSc⁴, Justin Welbergen, PhD⁵, and David Phalen, DVM, PhD¹*

¹*Sydney School of Veterinary Science, University of Sydney, 425 Werombi Road, Camden NSW 2570, Australia.*

²*Ellen S. Dierenfeld, LLC, Animal Nutrition Consulting, 4736 Gatesbury Dr, St. Louis, MO 63128, USA*

³*School of Agriculture, Rural & Environmental Sciences, Nottingham Trent University, Brackenhurst Campus, Brackenhurst Ln, Southwell NG25 0QF, UK.*

⁴*Taronga Conservation Society, Taronga Zoo, Bradleys Head Road, Mosman NSW 2088, Australia.*

⁵*Hawkesbury Institute for the Environment, Western Sydney University, Hawkesbury Campus, Bourke Street, Richmond NSW 2753, Australia.*

Abstract

The Christmas Island Flying-fox (CIFF, *Pteropus melanotus natalis*) is the last endemic mammal on Christmas Island and is classified as critically endangered. While the causes for its decline are uncertain, it is theorized that nutritional imbalances stemming from preferential foraging on introduced plants may be a contributing factor. This study aims to identify the nutritional content of food plants that comprise the CIFF diet and determine if nutritional imbalances are contributing to CIFF decline. Common food plants used by the CIFF were collected during both the wet and dry seasons from May 2018 to February 2019. Plants were dried, milled, and sent to a commercial laboratory to quantify crude protein and non-fiber carbohydrates (NFC) as well as select minerals (sodium, potassium, calcium, phosphorous, iron, copper, magnesium, and manganese). Sixteen species of introduced fruit, eight species of native fruit, and five species of leaves, petioles or flower petals were sampled. Compared to native fruits, introduced fruits contained higher percentages of moisture, NFC, and zinc but significantly lower percentages of crude protein, calcium, magnesium, sodium, copper, iron and manganese. Leaves on the other hand contained higher concentrations of crude protein, calcium, magnesium, sodium, iron, and manganese but lower levels of NFC and zinc. This study suggests that if CIFFs preferentially forage on introduced plants they may develop mineral deficiencies or imbalances. Introduced fruit has lower percentages of essential minerals, including those that are necessary for reproduction, such as calcium. CIFF's peak mating season occurs during the dry season when less fruit is available which may therefore lead to calcium deficiency in females. However, CIFFs may supplement these mineral deficiencies with leaves that contain higher percentages of essential minerals. Introduced fruits also contain higher percentages of NFC but lower percentages of crude protein. Therefore, if CIFFs are preferentially foraging on introduced plants and eating until they obtain their protein requirements, they could be consuming excess carbohydrates with resultant obesity. This research has implications for frugivorous and nectarivorous species worldwide, particularly in urban areas

where flying-foxes may be more likely to forage on agricultural fruits in comparison to native fruits.