SPECTACLED FLYING-FOXES OF PORT DOUGLAS

An observational report, 2022-2023

An observational study of Spectacled Flying-foxes, Pteropus c. conspicillatus (Listed Endangered- EPBC Act 2019), and other species of the Pteropus genus, in the Port Douglas area, far north Queensland.

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I acknowledge the Traditional Custodians of the land on which I work and live and observe many natural wonders each day. I pay my respect to the Elders, past and present. The colonial town of Port Douglas was established on lands with connection to the Yidindji, Yirrganydji, Kuku Yalanji, and Djabugay people.

Abstract

The research conducted throughout this one-month observational period shows that there are significant numbers of endangered Spectacled Flying-foxes (SFFs) roosting, foraging and fluctuating across various camps within the locations shown in **Figure 1.** and some additional smaller locations towards the north-west of the Port Douglas township.

The premise of this study is to provide observational information to those working with wildlife in the local area, and to contribute to a broader understanding of the unique demands of supporting a flying-fox colony of endangered status in a semi-urban environment through their birthing season.

Through working on site each day, the study expanded naturally to accommodate the pervasive and significant voice of community, council and local businesses and the identified active threats to the species in this urban environment. This report therefore reflects the work that went beyond addressing the original guiding questions below to also include general species information, discussion surrounding the social landscape in Port Douglas as a habitat chosen by this endangered species, pup rescue data and associated key findings and author recommendations. It is hoped, this report may contribute to assisting a broad range of stakeholders in the work of supporting the Spectacled Flying-foxes of this region.

Observations demonstrate Spectacled Flying-foxes are experiencing significant challenges as a result of human actions in the area. These actions appear inconsistent and out of touch with the current status of the species, its current inclusion as a priority species in the Australian Government's *Threatened Species Action Plan 2022-2032*, and community expectations regarding wildlife. The inadequacy of protection lies with an outdated Code of Practice and Flying-fox Roost Management Guideline which refer back to the *Nature Conservation Act 1992*; now over 30 years old.

Guiding Questions:

How do we attempt to determine if human intervention or interaction is needed or appropriate in the rescue of Spectacled Flying-foxes and other flying-fox species?

What are the circumstances and ethical considerations we must take into account when rescuing a lone flying-fox pup of an endangered species?

Does the Endangered status of a species place greater responsibility on the surrounding human community and all stakeholders to ensure protections are upheld to a higher standard?

Observational Period: 8-11am each day, 29th October to 29th of November 2022

Contents

1. Species Information

The Spectacled Flying-fox (Pteropus c. conspicillatus) is a large dark bodied flying-fox with a dark head contrasting with pale yellowish "spectacle" markings around the eyes and a bright ruff of golden yellow or blonde fur on the neck. Some individuals have quite dark brown fur around eyes and back of neck giving them an appearance similar to Black Flying-foxes (*Pteropus Alecto*).

In Australia the SFF is found Feeding in a wide range of ecosystems including rainforest, wet and dry sclerophyll, mangrove and wetlands, suburbia and occasional orchards, with the majority of its Australian population being found in the wet tropical regions of far north Queensland. A small population, on the order of hundreds of individuals, occurring also in the Iron and McIlwraith Ranges of Cape York (Westcott, Heersink, McKeown & Caley, 2015, pp. 3). They have also been associated with areas as far south as Ingham and Charters Towers, and as far west as Chillagoe (Threatened Species Scientific Committee, 2017. pp. 2).

The Little Red Flying-fox (*Pteropus scapulatus*) is included with the species and distribution information below as for a short period of time during the study they were also present at two camp locations. This led to an observable change in the social dynamics and camp occupation by the Spectacled Flying-foxes.

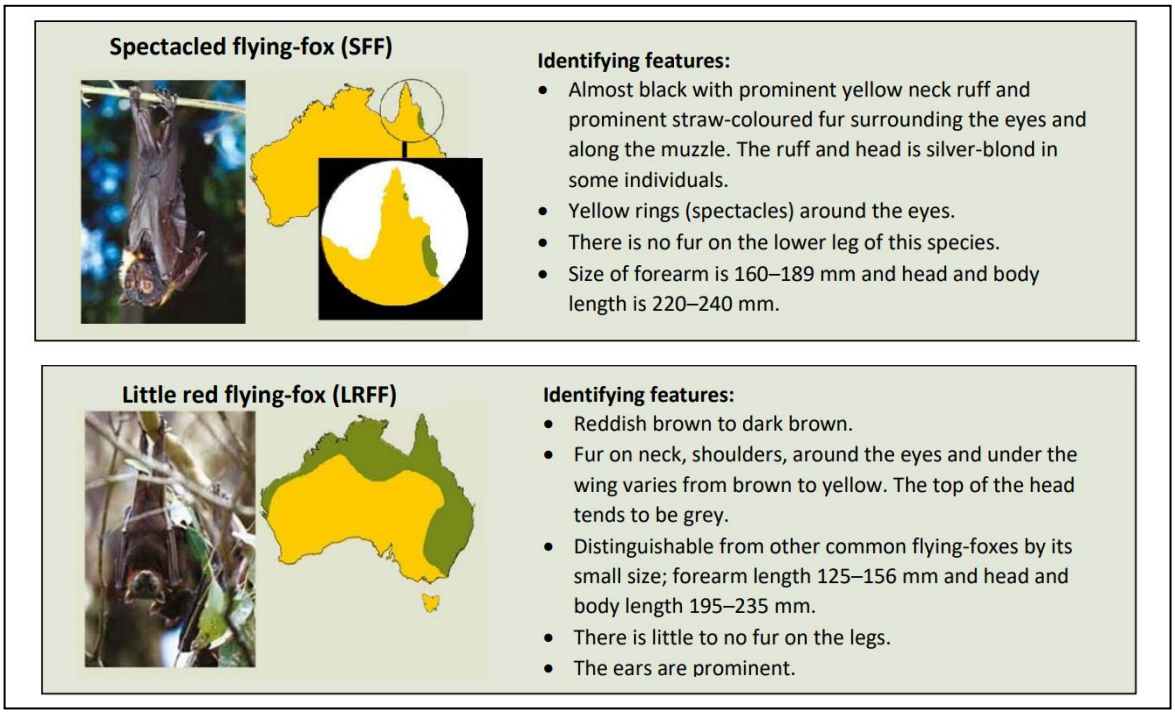

Figure 1: Flying-fox identification and distribution map (Wildlife and Threatened Species Operations, Department of Environment and Science. 2020, pp. 43).

2. Conservation Status

Spectacled Flying-foxes are listed as endangered (22/02/2019) under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2019). They are protected in Queensland under the Nature Conservation Act 1992 (Department of Environment and Science (DES). 1992), and are listed as endangered on the International Union for Conservation of Nature (IUCN) Red List as of the 27th of August 2019 (Roberts, B., Eby, P. & Westcott, D. 2020). Most recently they have been listed among 110 priority species in the Australian Government's *Threatened Species Action Plan 2022-2032*. This highlights the need for increased recovery efforts to prevent extinction. The species selected in this plan were done "carefully and strategically" acknowledging that "improving the trajectories of these priority species should also benefit many other threatened species, ecological communities and native wildlife that share the same range or have similar threats." (Commonwealth of Australia. 2022. pp. 20). Their inclusion in this federal government Plan should highlight the need for greater protective measures in all actions regarding the species.

Environmental stressors, in the form of cyclones and high temperature extremes, have impacted the population of SFFs in the past and are likely to occur again in the future. Increasing global warming will see increases in the frequency and intensity of hot extremes and an increase in the number of intense tropical cyclones (IPCC. 2022. pp.15). Cyclones result in direct mortality during the event (Shilton et al, as cited in Westcott et al. 2015. pp. 22), and also have longer term effects on major canopy loss and the loss of both flower and fruit resources that the species depends on. Population decline of the Spectacled Flying-foxes has been attributed to two major events: Cyclone Larry (March 2006) and Cyclone Yasi (February 2011). Both cyclones caused dramatic population decline and monitoring between April 2005 -January 2015 indicated a 57% loss from 214,750 to 92,880 (Westcott et al. 2015. pp. 22).

In recent years heat events have had a staggering impact on the remaining population. In November of 2018 approximately 23,000 Spectacled Flying-foxes perished when temperatures reached above 42℃. This number equates to close to a third of the entire species (Welbergen, J. as cited in Kim, Stephen. 2018). Following this event in 2018, the national conservation status of the SFF moved from vulnerable to endangered. This transition has been described as happening "too slowly". When declared endangered in February 2019, the species "already qualified as critically endangered according to official guidelines" (Welbergen, J. Preece, N., Oosterzee, P. 2020).

In addition to these large-scale environmental stress events, Spectacled Flying-foxes face a range of other ongoing threats as listed in the Australian Government's Species Profile and Threats (SPRAT) Database. These include habitat loss, tick paralysis, disturbance of maternity camps, competition for habitat, environmental stress leading to a lack of natural food sources and malnutrition, man-made obstacles, human activities including conflict with fruit growers, use of dangerous netting, and cleft palate syndrome (DCCEEW. 2019). A number of these threats have been observed to directly impact the Spectacled Flying-fox colony in Port Douglas.

3. Aboriginal Cultural Connection

Prior to colonisation, the area extending from Port Douglas to Cooktown has been used by First Nations People for thousands of years. Nation groups identified as inhabiting this area include, but are not limited to: Kuku Yalanji, Djabuganjdji, Yidinjgji, Yirrganydji, Guugu-Yimidhirr and Kokowarra. The Kuku Yalanji people have a history dating back 50,000 years (Mossman Gorge Cultural Centre. 2023), and for them the Spectacled Flying-fox was an important traditional food source (Threatened Species Scientific Committee. 2017. pp. 2). The Gimuy Walubara Yidinji People, as Custodians of wet tropics land and sea have long cared for and protected the Spectacled Flying-foxes. (Environmental Defenders Office (EDO), Cairns and Far North Environment Centre (CAFNEC). 2021. pp. 8).

> Jiritju Fourmile, a Gimuy Walubara man from the Yidinji Nation shares:
>
> *"the Flying-fox is a big part of our Aboriginal community. Our mobs eat Flying-foxes and have throughout history. They have been important medicine for us as they help people with respiratory problems like asthma. Now, we don't really eat Flying-fox anymore. At this rate, their populations are struggling so much that it wouldn't be sustainable. That is a loss for the animals and a loss for the black community as well…One of the most magical things about Gimuy used to be watching the Flying-foxes cover the evening with a curtain of black. Now, we barely see any. Soon, we will probably see none. I expect that we are probably going to see another mass die-off of the species in the very near future. I suspect that there won't be any Flying foxes in Gimuy within five years. This will mean another connection to Country gone. What else will then keep us connected to the land? One less animal means one less Goopi, one less spirit. When we are losing spirits, our storylines are changing. We have stories about the fish, the crabs, the prawns, the reefs and the Flying-foxes too. We will always tell stories, but as the animal's lives are changing, so must the stories"* (EDO, CAFNEC. 2021. pp.9).

Two 'First Nations targets' are included in the *2022-2032 Threatened Species Action Plan*. The importance of these targets is their acknowledgement that for more than 65,000 years Aboriginal and Torres Strait Islander people employed intricate, detailed and practical knowledge systems to care for land, seas and the environment. The Plan recognises that European colonisation has had negative consequences for Australian species, contributing to them becoming threatened. (DCCEEW. 2022. pp. 28). Aboriginal led recovery actions are seen as crucial for threatened species and ecological communities and partnership should be sought in the management of flying-foxes in Port Douglas. Juan Walker, a Kuku Yalanji man describes: "*the entire Wet Tropics region relies on the Flying fox as an integral part of the eco-systems just as much as the cassowary and tree kangaroos, and more work should be done to protect them, and their habitats."*

4. Urbanisation of Spectacled Flying-foxes

Results of the November 2019 National Flying-fox Monitoring Program showed there were 66,000 SFFs recorded from 12 active camps. Large camps were noted in Port Douglas and Gordonvale (CSIRO, 2019. pp. 1). The Douglas Shire Council (DSC) also acknowledges that several long-term roost sites are located throughout Port Douglas and Wonga (Logan, 2017. pp.180). In this 2017 report, DSC roosts are described as semi-permanent, sometimes dispersing seasonally, or being overtaken by the impacts of development. This mirrors the anecdotal stories shared by community members indicating flying-foxes, non-species specific, had at times of the year occupied the Melaleuca tract near Barrier St from as long as eighty years ago, while others maintained they had only been present in that area for the past 2-3 years **(Appendix 3)**.

Authors of the publication, *Are Flying-Foxes Coming to Town? Urbanisation of the Spectacled Flying-fox (Pteropus conspicillatus) in Australia*, examined monitoring data across a fifteen-year period, finding that Spectacled Flying-foxes commonly roost near humans, and that the proportion of the counted population documented in urban camps increased across the period of their study (Tait, Perotto-Baldivieso, McKeown, Westcott. 2014. pp. 1). There are several proposed urban 'benefits' for flying-foxes, including: night lighting to improve navigation, climatic suitability of urban areas, and a mixture of native and exotic plant species providing reliable nectar year round (Vardon, Tideman. 1999. McDonald-Madden et al. (2005). As cited in Timmiss et al. 2020. pp.2).

Combined with the protections afforded to them by the *EPBC Act*, the *Nature Conservation Act 1992*, and with new commitments made under the *Threatened Species Action Plan 2022-2032*, efforts towards species recovery in and around Port Douglas requires urgent, visible and continuing attention and resources from all levels of government, and relevant local stakeholders. It is important to acknowledge that each urban locations encountering a flying-fox population will experience a unique set of circumstances in both the tangible impact to residents and in its management. While there will be similarities across jurisdictions, the nuances of the human dimension calls for a need to explore new management options. For local governments, management of the human side of the conflict is identified as likely to prove more cost effective and successful. (Tait, Perotto-Baldivieso, McKeown, Westcott. 2014. pp. 1).

It is worth noting briefly that issues of human conflict associated with increased noise disturbance of the SFFs in urban areas may be heightened at certain times of the year. From September to February/March, Mothers with young pups are in constant communication with each other and pups are calling throughout the night. Additionally, throughout this period juvenile pups are learning to socialise and are vocalising with other young flying-foxes. From January/February and through to March/April males are forming their territories for breeding season and can be highly vocal as dominant males fight for prominent positions. In contrast, on days with mild weather conditions (26º-29ºC) and/or rain, flying-foxes were observed roosting quietly and could be considered to have little or no noise impact on houses and buildings close by.

5. Camp Locations, Maternity Sites and known Creche Sites

Figure 2: Camp, Maternity and Creche Site Locations

This map in **Figure 2**. reflects the camps favoured by the Spectacled Flying-foxes throughout the study period. Other known camps exist in Port Douglas but were unoccupied or used infrequently by small groups of Spectacled Flying-foxes.

Key

Orange areas represent approximate area of SFFs roosts most consistently occupied throughout the day across the course of the study period.
Light blue areas represent maternity sites, where females with pups were observed in large numbers.
Pink lines indicate where pups were heard communicating in the evening, having been left temporarily while mothers move out to forage for food. This behaviour is known as crèching.

Camp Locations by number

Camp 1-Large camp in tall melaleucas following creek bed. Access from Barrier St. Significant maternity site. Population counts include four tall melaleucas on Barrier St, corner of Tropic Court and Barrier St, corner of TiTree Villas. Some areas able to be accessed for purpose of colony check.
Google Maps: https://goo.gl/maps/6RCZmjHqnF7tnKjD8
Camp 2-Northern end of Camp 1 on opposite side of road. Backs onto Tropic Court units. Maternity site. Able to access all areas for purpose of colony check.
Google Maps: https://goo.gl/maps/32V7XeVeHMgQr3ob9
Camp 3-Dense forested area to the west of Ti Tree accommodation. Maternity site. Perimeter only able to be monitored for purpose of colony check.
Google Maps: https://goo.gl/maps/4Ca5FbQANXv9L3Qz6

Camp 4-Frequently used crèche site. Able to walk under on footpath for purpose of site check.
Google Maps: https://goo.gl/maps/bBzdJRuDC1QJdf5L9
Camp 5-Council managed land, remnant rainforest, large colony. Significant maternity site. Perimeter only able to be checked for purpose of colony check. Access down driveway ok.
Google Maps: https://goo.gl/maps/gVAC7CM1oKFWGjzE7
Camp 6-Tall melaleuca camp, highly changeable. Maternity site. Able to access all areas for purpose of colony check.
Google Maps: https://goo.gl/maps/92E44bN2W7u4ckqN9
Camp 7-Includes the mangrove area at the rear of Niramaya resort, and towards St Crispins Ave. Only able to observe from a distance across lake for the purpose of a colony check.
Google Maps: https://goo.gl/maps/EnJMsomvgqLxafc58
Camp 7 South- Remnant rainforest accessed by footpath on Port Douglas Rd. Able to walk under on footpath for purpose of site check.
Google Maps: https://goo.gl/maps/ExmjdA7YR5a5M4Hm9
Camp 8-Camp often vacant camp at Wildlife Habitat Port Douglas. Observed from outside grounds for the purpose of a colony check.
Google Maps: https://goo.gl/maps/8dkyXtb6vni485SU8

6. Population Observations

Ground-counts were used to monitor abundance at the site at different times during this study. Ground-counts are found to perform well and offer advantages in terms of labour and resourcing (Wescott, et al. 2011. pp. 24). Other methods used to count bats include fly-out counts, thermal imaging and radar imaging, and more recently the highly precise use of drone-based thermal remote sensing (McCarthy et al. 2021). Use of these methods would greatly benefit documentation of the colony in Port Douglas at different times of the year.

Estimating population of identified camps in Port Douglas is challenging, with many areas not visible or easily accessible. The counting tool represented in **Figure 4.** was developed in situ to assist in efficiently documenting approximate totals. Mothers with pups underwing were considered as one and only visible SFFs were counted. Population monitoring was not included in the original area of focus for this study and camp specific counts were collected randomly, rather than accurately and precisely as would be needed if specifically documenting population trends. See **Figure 3.** for small data set.

Figure 3: Camp 5 counts include only those Spectacled Flying-foxes visible from the perimeter only. It is the author's estimation that at all times there has been a minimum of 3000 Spectacled Flying-foxes roosting in this area. This number was determined by observing multiple evening fly-outs, accuracy should however be considered low due to the volume of animals in the fly-out stream. A similar rationale has been applied to Camp 7.
The 12/11/2022 (Figure 3.) counts show low abundance at Camps 1 and 2.
This is believed to be the direct result of Little Red Flying-foxes taking up roost at the same site across a period of three days causing unsettled behaviours in the Spectacled Flying-foxes of this camp location. Further data is included in **Appendix 4.**

	Camp 1	Camp 2	Camp3	Camp 5	Camp 6	Camp 7	Camp 7 South	Camp 8	Total
29/10/2022	4000	800	300	300 perimeter	300	1000+	-	-	6700
12/11/2022	400	150	200	400 perimeter	300	1000+	-	-	2450
19/11/2022	4000	700	300	-	160	30	-	-	5190
27/11/2022	2700	400	300	400 perimeter	150	3000	250	500	7700
28/11/2022	2700	400	300	500	200	3000	300	-	7400
29/11/2022	2200	350	300	600 perimeter	300	3000	300	-	7050

Figure 3: Population estimates by camp location.

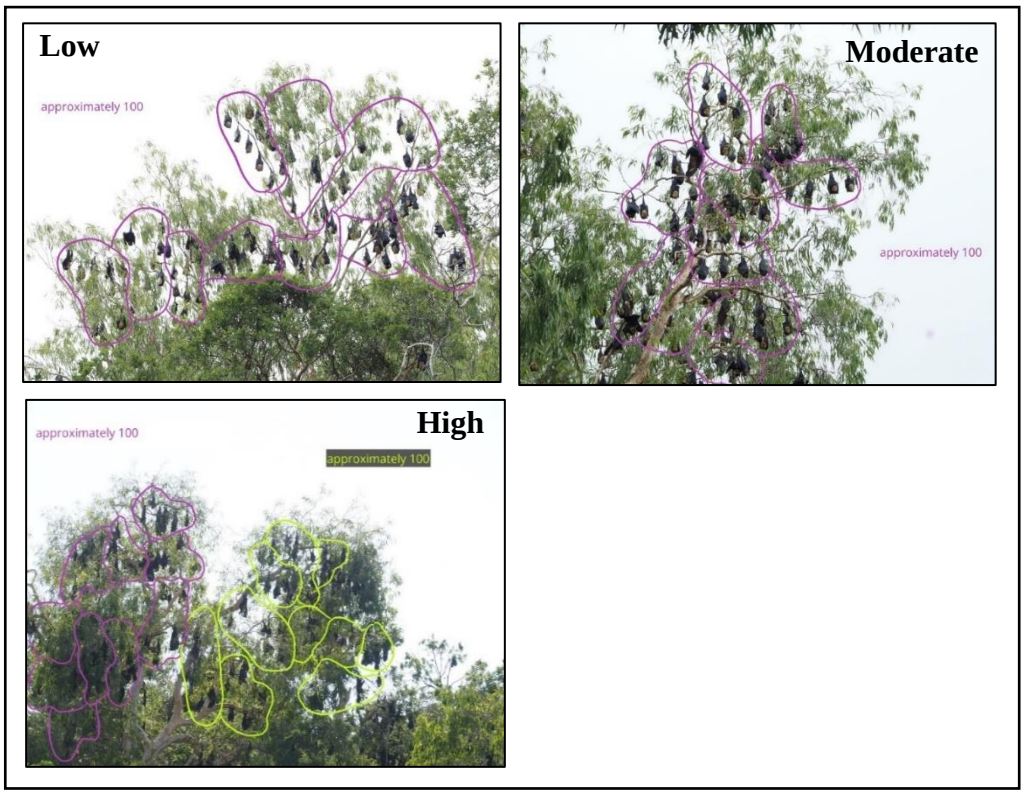

Figure 4. Population Count Tool. Low, Moderate, High Density.

7. Pup Rescue Background and Breeding Calendar Recommendation

Pups can become orphaned for a range of reasons. They may be dropped or become separated from their mothers during foraging forays (Mo et al. 2020. pp. 4), or their mothers can be killed through car strike, barbed wire, fruit netting and fishing line entanglements, powerline electrocution, and tick paralysis. Seasonal malnutrition and acute human disturbance may also cause distress leading mothers to abandon their young.

Extensive efforts across Australia to rescue and release flying-foxes of all species are largely dependent on the individual capacity of wildlife carers who are often self-funded volunteers. The broad objectives of the *Code of Practice for the Care of Sick, Injured or Orphaned Protected Animals in Queensland* are to relieve suffering and contribute to the conservation of nature (Wildlife and Threatened Species Operations Branch. 2020. pp. 6,7). The release rates of flying-fox pups and juveniles were found to be high at 76% in a NSW study which utilised wildlife carer records (Mo et al. 2020. pp.4). This data demonstrated to authors the potential conservation value of flying-fox rehabilitation which could be interpreted as especially significant in a species recognised as being "pivotal to forest ecosystems" (Welbergen et al. 2020. pp.6).

Heavily pregnant Spectacled Flying-foxes were observed in Port Douglas from mid-September and prior to the study period commencing on the 29th of October 16 live pups had already been rescued and taken into care. This timing aligns with the Flying-fox Breeding Calendar provided in the *Flying-fox Roost Management Guideline* (Wildlife and Threatened Species Operations, Department of Environment and Science (DES). 2020. Pp. 15) (**Appendix 1**).

It is evident to those working on the ground in Port Douglas that the Spectacled Flying-fox colony here needs greater support through the birthing season. A research grant awarded by The Tolga Bat Hospital allowed for more dedicated time and consultation to focus efforts and address some concerns framed in the guiding questions of this study. Resources to provide ongoing rehabilitation for rescued pups in the Port Douglas area are currently extremely limited and recognising this low capacity early in the 2022 birthing season meant co-operation was needed from many individuals and groups.

My thanks go to the Tolga Bat Hospital, Port Douglas Wildlife Rescue, and various other groups, organisations, and individuals who gave their time and energy to assist the flying-foxes and myself across this period of time.

It is recommended that the current Flying-fox Breeding Calendar **(Appendix 1.)** be updated to extend the Red criteria from September and Yellow through to March. It is highly likely heavily pregnant SFFs and dependent young are present in this region in September and SFF mothers carrying pups and roosting with pups underwing have been observed throughout March 2023. This necessary change will assist population recovery and provide greater awareness and protection across a time of increased vulnerability. It will also provide more accurate direction to those accessing information via *The Flying-fox Roost Management Guideline* which outlines all activities around camps should be avoided when flying-foxes are in late stages of pregnancy or rearing their dependent young (Wildlife and Threatened Species Operations, DES. 2020. pp. 16).

8. Pup Rescue Data and Associated Key Findings

Guiding Questions:

How do we attempt to determine if human intervention or interaction is needed or appropriate in the rescue of Spectacled Flying-foxes and other flying-fox species?

What are the circumstances and ethical considerations we must take into account when rescuing a lone flying-fox pup of an endangered species?

Does the Endangered status of a species place greater responsibility on the surrounding human community and all stakeholders to ensure protections are upheld to a higher standard?

The aim is to use data collected this season to develop a best practice approach for rescue and reunification where possible to ensure: 1) pups are not being taken into care that would otherwise be collected by their mother, 2) to gather data of the locations at which lone pups were found, and 3) to document the types of rescues needed across SFF Camp locations.

Rescue Data

Two forms of rescue were prevalent across the study period. These were rescues of lone pups hanging in foliage close to the ground at a reachable height, or lone pups at heights where the assistance of equipment would be needed. This meant, with limited resources, that some pups at heights of over 15m were monitored, some for multiple days, before dying. Many pups were found dead on arrival, either on the ground or after falling lower in the tree having possibly died of starvation or exposure at height.

An ethical concern was raised for consideration when rescuing at height. By bringing these pups into care, were we as rescuers of wildlife intervening in a harmful way by preventing the possibility of the mother returning to collect the pup later (as was anecdotally suggested). Experienced wildlife rescue personnel working with flying-foxes report mothers returning for up to four days to search for lost pups. This led to a change in rescue methodology. If a pup was at height and not in any immediate harm, it would be monitored for a 24-hour period before a rescue was attempted. This posed an additional ethical dilemma as pups left on their own are vulnerable to predation, heat exposure, dehydration and starvation. Importantly it was also very difficult to know how long a pup had been alone before being spotted by rescuers or members of the public.

On the 5th of November a lone pup was observed at height in the morning and monitored throughout the day. The pup was found deceased the following morning. This led rescuers to quickly adapt their approach again. It was decided that all pups that could be reached would be brought into care for a thorough assessment. If determined to be of good health, an attempt to reunite with a mother that evening or the following morning would take place. There were limitations to all rescue and reunification efforts including risk of personal injury and time constraints of carers.

The data collated below in **Figure 5.** lists findings between the 29th of October until the 29th of November only. For further information on individual rescues see **Appendix 2**.

Rescue Category	**Total by category**	
Low to ground, within reach	5	
At height, equipment needed	4	
At height, unable to rescue, later disappeared	2	
At height, unable to rescue, deceased	8	Alive:13
Found deceased on ground	17	Deceased:29
Found alive on ground	4	Unknown:2
Deceased in tree	4	**Total:44**

Figure 5: Pup rescue by category

Key Findings

Locations Pups Were Found

Pup rescues were prevalent in two locations. One area around the large Barrier St colony, Camps 1 and 2, the other area straddling Port Douglas Rd at Camp 6 and Camp 7 South (See **Figure 6**.). An explanation for the majority of rescues taking place here could be ease of access to find lone pups because access by foot is possible around and under the roosting Spectacled Flying-foxes without causing disturbance.

These sites experience higher levels of disturbance associated with close proximity to built-up residential areas and permitted dispersal actions by adjacent businesses. The roosting Spectacled Flying-foxes at these two identified camps should be considered particularly vulnerable as the flying-foxes are currently subject to disturbance under active Flying-fox Roost Management Permits (FFRMP)
granted by the Queensland Government Department of Environment and Science. Significant disturbance to a settled camp at one of these sites was observed and documented between 5am and 6am on three occasions throughout the period of this study.

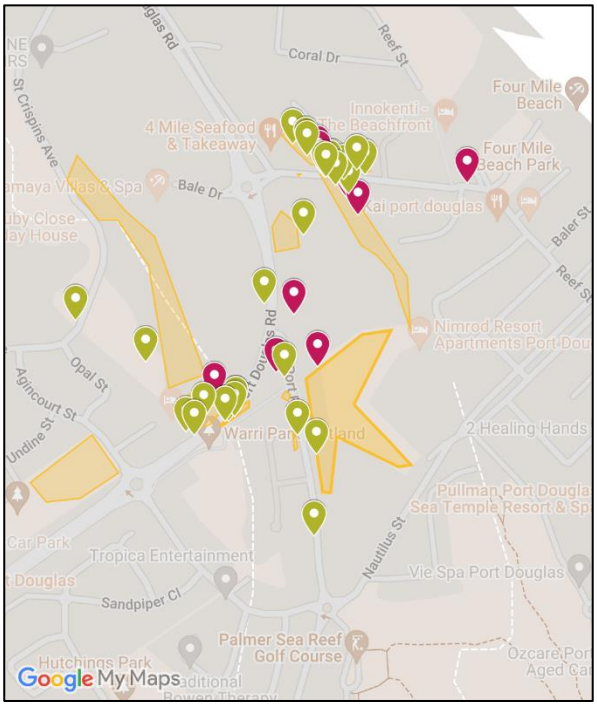

Figure 6. Location pups were found.

The use of repeated loud stimulus was employed to disperse the animals from the trees causing observable stress; more than 30% of the flying-foxes taking flight at one time (Wildlife and Threatened Species Operations, DES. 2020. Pp. 16). Two of these occasions led to the recorded separation of mothers and pups, with lone pups remaining uncollected for the duration of the day. Other behaviours observed to indicate animals were stressed, included: mothers circling repeatedly while calling loudly to try to find young, confusion when attempting to collect pups, pups calling to mothers without being picked up, movements that appear frantic and atypical, and rapid and clumsy travel around branches. There is no reason not to believe that these dispersal actions have been occurring at this location during the 2022 birthing and pup rearing season.

In addition to the Flying-fox Roost Management Guidelines (FFRMG) stating that "particular consideration should be given to avoiding major activities at flying-fox roosts during flying-fox breeding and rearing seasons" (Wildlife and Threatened Species Operations, DES. 2020. Pp. 16), it seems clear that the disturbance of pregnant or lactating females with dependent young at maternity camps may cause reduced juvenile survival (Hall, L. as cited in Queensland Department of Environment and Resource Management. 2020. pp. 23). Key threats to the survival of Spectacled Flying-foxes include the loss of critical habitat and disturbance at camps (Roberts et al. 2021. pp. 266). Camp dispersal may also be a cause of negative flow on effects for human-wildlife management elsewhere in Port Douglas, as

dispersal attempts frequently have the unintended effect of increasing rather than reducing conflict amongst local residents. The SFFs in Port Douglas demonstrate a preference for tall melaleuca tracts in low density housing areas. Any disturbances could lead to camps moving to higher urban density, economically important tourist accommodation areas.

It is the hope of this author that future permits granted by the DES in relation to this endangered species not be approved under the current application process. The FFRM Guidelines state that permit holders must only "consider" the flying-fox breeding calendar (Wildlife and Threatened Species Operations, DES. 2020. pp. 12), arguably providing inadequate protection against observable harm to the population. In its place it is recommended that a separate management process be developed in the management of flying-fox species and other species listed as vulnerable, endangered or critically endangered. This would then constrain private and local government flying-fox roost management actions against SFFs as an endangered species. Given that the SFFs are now listed in the Federal Government's *Threatened Species Action Plan 2022-2032* (Commonwealth of Australia. 2022. pp. 20), it follows that any actions which have the potential to impact this priority species be managed to the highest standard by the appropriate body at a national level. Failing this proactive, conservation minded approach, DES approved management actions must only occur under the greatest scrutiny, and only outside the birthing and pup rearing season.

The current DES approved management actions refer to the *Nature Conservation Act 1992* (Department of Environment and Science (DES). 1992). This Act was written before climate change was mainstream and before this species was listed as endangered. It is the hope of this author that this Act is updated or amended to reflect the urgent need of threatened and endangered species.

Weight of pups

Of pups that came into care only two were assessed as suitable for a reunite attempt. This meant that their overall health and temperament were determined to be good and if mum was to return to the area there would be a possibility she would find her pup. The two attempts were unsuccessful. One attempt was hindered as Little Red Flying-foxes had heavily populated the area making the environment chaotic (See *Leaf* in **Appendix 2**). A tall perch was constructed for use with the second pup to position them in a suitable location (See *Toby* in **Appendix 2**). Again, unfortunately no reunite occurred (a successful reunite is here considered witnessing the mother physically unite with the pup).

All remaining pups that came into care varied in weight and age, all exhibited signs of dehydration and were consistently 20-30% underweight. Pup weight was calculated using the age, forearm and weight benchmark guide of the BIOLAC chart for Grey-headed and Black Flying foxes (BIOLAC, 2018). This standard feeding schedule gives carers a benchmark for expected postnatal growth rates and is based on the length of the forearm (FA; radius bone) (Mclean et al., 2018. pp 2). Unfortunately at present there is not an SFF specific benchmark guide available, however use of the BIOLAC chart noted above is widely accepted as standard practice with this species.

It is a possibility pups become abandoned due to mothers being undernourished themselves. The increasing impact of foraging habitat destruction on food shortages likely causes nutritional stress in flying-foxes (Mo et al. 2021. pp. 136). Flying-fox females of all

species are considered dedicated mothers however changes in the environment, fewer flowering eucalypts and fruiting trees in combination with deforestation, can mean that without enough food mothers stop lactating and are unable to raise their young (Standford, S. 2016. WIRES).

Observing Lone/Abandoned Pups

Observation of lone pups allowed the rescue team to document a diversity of wild Spectacled Flying-fox behaviours that helped to inform rescue attempts. Key to each rescue is the understanding that all scenarios are different and each pup may present unique challenges. Analysing the small data set in **Figure 5**, only 40% of at pups spotted at height were able to be rescued. Another 40% remained out of reach in tall trees and died between a 24–72-hour period. Two pups could not be reached but were no longer there at later checks (See **Appendix 2.** 26/11/2022). It is possible these pups were collected by their mother or suffered predation. Both Brahminy Kites (*Haliastur indus)* and Eastern Ospreys (*Pandion haliaetus*) have been sighted in this area. Footage is on file (October, 2022) of a Brahminy Kite predating on a Spectacled Flying-fox.

Close observations of pups at height led to the raising of a question: can Spectacled Flying-fox pups, or broadly flying-fox pups of the *Pteropus* genus, induce a torpor state when conservation of energy is vital for survival? On several occasions lone pups at height were observed, with the aid of a zoom lens, to show no signs of life and were initially recorded as deceased. Later these same pups were found to have changed position or were seen moving and climbing. Hibernation and daily torpor (energy conservation) are widespread strategies in insectivorous bats (Fjelldal et al. 2021. pp. 1), and a range of tropical and subtropical bat species with a body mass from 4 to 74g (Geiser et al. 2011. pp.345). It would be an interesting area of study to know if this is something *Pteropus* pups can also do. While many pups died at height in trees, there were also examples of pups no longer being there after a 24-48-hour period, indicating the possibility that their mother had returned for them up to two days after the first sighting.

Green Tree Ants

Green Tree Ants (*Oecophylla smaragdina*) were common on pups who were found alone or had fallen low in trees. Green Tree Ants likely were not the initial reason a pup was abandoned, but they can lead to mortality sooner if enough swarm and bite- injecting venom. (see **Figure 8**.) This would be a painful death for the small pups. Risk of Green Tree Ant bites adds strong weight to the need for daily camp checks during the birthing season as many pups were found deceased or highly compromised with Green Tree Ants present.

Figure 8. Pups with Green Tree Ants present.

Prevalence of Tick Paralysis

Spectacled Flying-foxes show low resistance to Paralysis Tick (*Ixodes holocyclus)* toxin, and single ticks are capable of causing paralysis (DCCEEW. 2019). A rescue on the 07/11/22 (See **Appendix 2**.) was of a pup approximately 5 weeks of age found on its deceased mother. The small pup (Shown in **Figure 9.)** had a tick approximately 4mms in size on the left shoulder, but was otherwise uninjured. The tick was promptly removed in full, and the pup was showed no signs of paralysis. Tick Serum was administered as a precaution. This pup went on to be raised in care at the Tolga Bat Hospital

Figure 9. Pup found on deceased mother, and the tick found on her left shoulder.

9. Known Camp Disturbance Events

Throughout the study period all SFFs at camp locations were observed to respond to various human-related disturbances. These have been considered on a spectrum according to observable impact.

Minimal	Moderate	Significant
Pedestrians approaching causing a small lift in isolated area. SFFs resettle in same location within 5-10 minutes.	Delivery Truck idling in carpark underneath newly occupied area of Camp 2 causing lift of approximately 50 SFFs who did not resettle in that area that day.	All SFFs in the area lifted and prevented from returning due to ongoing disturbance. Eg. Noise disturbance, implementation of FFRMP, use of chainsaw/tree pruning equipment in close proximity to SFFs for extended period of time.

Figure 10. Table identifying broad levels of disturbance to roosting SFFs.

Two significant disturbance events were observed during the study period and are discussed in greater detail below.

Significant Event: Implementation of FFRMP Observed

Significant disturbance to a settled camp was observed and documented by the author of this report between 5am and 6am on three occasions throughout the period of this study. The use of repeated loud stimulus was employed to disperse approximately 400 Spectacled Flying-foxes causing observable stress and on two of these occasions led to the recorded separation of mothers and pups, with lone pups remaining uncollected for the duration of the day.

Other behaviours observed to indicate animals were stressed included mothers circling repeatedly while calling loudly to try to find young, observed confusion when attempting to collect pups where two or more pups were on the same branch, pups calling to mothers without being picked up, rapid and clumsy climbing around tree limbs and canopy, and frantic and uncoordinated movements of mothers carrying pups prior to flight.

Significant Event: Vegetation Management Observed

Scheduled vegetation management around powerlines at Camp 5 and 6 by a contracted business led to the prolonged disturbance of two known maternity locations (area predominantly populated by pregnant females or mothers rearing pups). The separation of mothers and pups was observed and documented and reunification was made difficult due to ongoing tree works. At one location three pups remained alone with mothers not returning to collect them. Conditions for rescue were not possible and each pup subsequently died at various times in the following 72 hours. The disturbed area of Camp 5 remained vacant of SFFs for the following 48 hours.

10. Community Conversations, Sentiment and Areas for Positive Change

Prior to commencing this study, anecdotally the community of Port Douglas appeared to experience flying-foxes in a generally negative way. On reflection and through collating conversational notes (**Appendix 3.)**, it is now believed the human relationship toward flying-foxes in Port Douglas should be understood to be far more diverse in line with a human-wildlife interaction continuum which ranges from positive and neutral through to negative, varying in intensity from minor to severe, and varying in frequency from rare to common (Soulsbury, White. 2015. pp. 5). Notes indicated knowledge of this species is minimal, but discourse was overall positive (82%). While there were examples of individuals expressing great negativity toward the flying-foxes and threatening harm, others spoke of them fondly. Positive accounts were perhaps more prevalent as individuals may have felt more eager to share these experiences.

Two accounts from long term residents living near Camp 1 on Barrier Street, stood out as memorable. They each described a "sadness" and "sorrow" when the Spectacled Flying-foxes left this particular location at certain times of each year. They shared their differing experiences of watching and listening to the SFFs from the unique vantage points their homes offered. Each resident was over 60 and living alone. This perspective offers a possible area of study in examining the social/emotional bond some may form to this often transient species.

To create a general positive/negative frame for the attitudinal positions encountered notes from these two conversations may assist:

Date	**Location**	**Positive/ Negative**	**Age/Gender**	**Details**
15/11/2022	Tropic Court	Negative	60+ Male	-approached by resident of units on Tropic Court. Units back onto Camp 2 ***"Are you taking photos of the bats?" - Resident*** *"I am, I'm doing research around this species. They're the Spectacled Flying-fox and they're endangered." - Kate* ***"They would be if I had a gun." -Resident*** -explained they are a protected species -male 60+
26/11/2022	Barrier St Unit, near occupied Melaleucas	Positive	70+ Female	-permanent resident -spends a lot of time at home -watches the SFFs in melaleuca across the road -loves watching the mums with pups -feels quite protective of them -shared a story of a time one was on the ground crawling, she called Wildlife Habitat for help -used the word **"sorrow"** to describe the feeling she has when they leave -she misses them -wanted to know why they leave for periods of time -female 70+

Figure 10. Two examples taken from Appendix 3. Community conversations transferred from notes

While conversations proved to be largely positive, this does not discount the acutely inconvenient impacts reported by residents when living directly adjacent to a camp of Spectacled Flying-foxes in Port Douglas. Some of the identified negative impacts include sleep deprivation in connection to early morning fly-in to camps, defecation on external living areas and property requiring frequent cleaning, possible contamination of pools and a perceived risk to personal health and safety. Most of these negatives can be mitigated and financial support in this area is encouraged to facilitate and encourage a landscape of coexistence both physically and attitudinally. Future intervention strategies could facilitate the installation of double glazed windows to assist with noise management, shade sails, pergolas or awnings, pressure cleaning equipment, and greater ongoing community education and adaptation when living near flying-foxes.

Recorded conversation #27 of **Appendix 3**, highlights the potential to create a walking trail or map designed to allow wildlife photographers and visitors to view the Spectacled Flying-foxes in their regular camp locations. On this particular occasion a photographer was shooting from outside the fence near Wildlife Habitat Port Douglas and was grateful to learn that there were other locations he could visit within walking distance. Tour companies were also witnessed frequently stopping roadside near Camp 5 to allow guests to exit the car, take photos and view the flying-foxes up close. There is great potential for the creation of a positive eco-tourism experience in the area by local council. With minimum financial outlay such an attraction may lead to financial gains for local businesses with additional educational outcomes for community and greater appreciation and protection for the Spectacled Flying-foxes.

11. Wildlife Observations

Observing other wildlife in the area was an informal part of this study but has demonstrated, in particular, the abundance of birdlife located in Port Douglas. Sightings were documented by location and conservation status and can be viewed in **Appendix 4**. Spectacled Flying-foxes are known prey of several animals in the area including the Brahminy Kite as can be seen in **Figure 11**.

Figure 11. A Brahminy Kite (*Haliastur indus*) feeds on a Spectacled Flying-fox at its nest site in close proximity to Camp 5.

Anecdotally, local residents report predation from Australian Estuarine Crocodiles (Crocodylus porosus) at the lakes near Warri Park and rear of St Crispin's Avenue.

Spectacled-Flying Foxes were at times observed sharing roosting sites with Sulphur-crested Cockatoos (*Cacatua galerita*), Torresian Imperial-pigeons (*Ducula spilorrhoa*) and Magpie Geese (*Anseranas semipalmat*).

12. Plant Species Identification by Camp Location

Across identified camps and in adjacent overflow locations, Spectacled Flying-foxes appear to prefer tall Melaleuca species; *leucadendra, cajaputi* and a*rgentea*. Each camp offers a great diversity of plant species some of which were present at all locations. Young trees growing up underneath roost trees were identified as species likely dispersed by flying-foxes. See **Appendix 5.** and **Appendix 6.** for further vegetation information. As identified by Broad Vegetation Groups mapping, the remnant Melaleuca Open Woodland possibly includes endangered Palustrine Wetland (The Department of Environment and Science. 2023) and should receive assessment by a qualified botanist or dendrologist.

13. Recommendations for the Conservation of Spectacled Flying-foxes in Port Douglas

Community Conservation Approach

There are a range of stakeholders with varying interests in the protection and/or management of the Spectacled Flying-fox colony in Port Douglas. Some associated issues of the present population are acknowledged to be multifaceted and complex and any response or action should consider the broad context surrounding this endangered species. For development of an effective landscape of co-existence between humans and the Spectacled Flying-foxes, council, businesses, schools, organisations, and community members should endeavour to adopt a likeminded conservationist approach to the species.

Future development of Lot 3 and 4, and Lot 906, Port Douglas

Lots 3 and 4 on the corner of Old Port Road and Port Douglas Road are bordered by SFF occupied Camps 1, 3, 4, and 5 and is considered a significant site. This location, or rather the future development of this location has the potential to either increase conflict with this species or alternatively progress by adopting best practice approaches to consider mitigation elements and species protection. The same should be applied to Lot 906 adjacent to the Niramaya Day Spa. This undeveloped site is bordered by a significant, long term SFF camp and is currently listed for sale. As an endangered species with a Federally recognised priority recovery status, all applications and approvals should proceed with this species at the centre of design.

Education Program: Schools, Community, Visitors

As has been found in many locations Australia wide, taking a positive approach to this species is favourable both financially and for the conservation of the species. If it chooses, the Douglas Shire Council has an opportunity in this region to develop positive educational experiences at a school, community and tourism level. Independent organisations and

businesses should also be seeking to capitalise on the unique opportunities available by supporting and tapping into SFF experiences.

As a teacher of both primary and high school students I have experienced the wonderful journeys and outcomes that eventuate from education. It is my hope to see the development and implementation of a school based education program around the SFFs reaching Douglas, Cook, and Tablelands schools.

Further areas of research

Ongoing monitoring of the colony in Port Douglas would benefit greatly from accurate population data throughout the seasons. As one of the known remaining large colonies of this species, being able to accurately document this information is vital. The use of thermal imaging drones, used appropriately, at the right time is recommended to record approximate counts from locations unable to be accessed on foot, such as Camps 5 and 7, which are believed to support upwards of 3000 SFFs at each location.

Wildlife cameras could be trialled to monitor the movements and behaviours of lone/abandoned pups during an observational period. This may assist (although difficult at height) in answering the question of what happens to those pups who appear to disappear (reunited/predation/abandonment).

Conflict associated with living alongside flying-foxes is increasing. A trial of mitigation strategies, supported by federal government funding, could provide a template for local jurisdictions Australia wide to improve the experience of community members when a nomadic species such as the flying-fox establishes a roost site near an urbanised area.

Greater investment in food tree corridors, vegetation easements and appropriately planned housing and infrastructure in areas known to have flying-foxes should be considered the norm. The DSC could become a leader in this approach, placing the protection of wildlife who occupy space within its shire, alongside well considered development and growth in the globally significant Wet Tropics.

Increased Rescue/Carer Recruitment

The sustainability of ongoing population recovery efforts by rescue/carers in Port Douglas and elsewhere for the Spectacled Flying-foxes is largely based on the growth of a stable team. This is not only a personally expensive endeavour initially to cover the cost of necessary Australian Bat Lyssa Virus vaccinations, but has many ongoing associated husbandry costs. Raising Spectacled Flying-fox pups for release is a long term, intensive endeavour and while there are some personal benefits to carers in the sense of joy and value in their efforts, their investment of time, money and the emotional toll care can take is largely unseen. Supporting population recovery of endangered species such as the SFF, a keystone species, should be valued as an ecosystem service and should attract coordinated, ongoing support.

Development of a Douglas Shire Heat Event Emergency Plan

The high likelihood of a heat event affecting colonies within the DSC jurisdiction in the future would be best managed with the cooperation of numerous teams within the area. The

development of a local Emergency Plan would assist by monitoring and supporting resilient roosting sites year-round, communicating with relevant stakeholders, preparing communities, and responding to the acute needs of animals in distress, dying or deceased when temperatures approach an identified point of concern when the ambient temperature exceeds 38ºC (Wildlife and Threatened Species Operations, DES. 2020. pp. 17).

Conclusion

All field work, research, evidence, recommendations and discussions offered in this report largely support what is known about this species. Their survival and the performance of their vital role in our ecosystem hangs on our ability as a community of people to adapt and positively strengthen the ways we live alongside them. Continuing and increasing conflict via the use of reactive strategies such as nudging and dispersal adds further pressure to a population already threatened in a multitude of compounding ways.

The Federal Government's goal to halt the extinction crisis by identifying 110 priority species with clear recovery targets in its *Threatened Species Action Plan* appears to be a significant and positive step towards approaching things differently. The inclusion of the Spectacled Flying-fox in this plan is cause for hope for this species and all who advocate tirelessly for their acceptance and protection. The flow on effects to other flora and fauna by protecting this one species are demonstratable.

At the time of writing this conclusion, the DSC has passed a motion to take "nudging" action against a small, fluctuating roost of SFFs in a location in Port Douglas. This is in response to persistent complaints from a small number of residents, who according to council minutes have advised DSC of its (council's) As-of-right authority to manage flying-fox roosts on council land. This information was provided to residents by a private contractor who "provides roost management services under permit in other areas of Port Douglas" (Douglas Shire Council. 2023. pp. 53). While there is a conflict of interest apparent in the communication by someone who seeks to gain financially from these ongoing actions, this series of events sheds light on a greater issue.

What the recent threats to the Spectacled Flying-fox camps in Port Douglas demonstrate is a devastating failure of collaboration for the protection of this species, and wildlife in general, across all levels of government. At the highest level of government in our country we have a staggeringly positive pledge being made to prevent any new extinctions. While at local council level, decisions may be driven by a handful of disgruntled residents, small businesses with vested interests, and local council members, some of whom, demonstrate minimal knowledge of the species they are making decisions on behalf of. It is patently obvious that a local government's 'As-of right' authority under the *Nature Conservation Act 1992* to take unilateral actions against an endangered species must be immediately removed. This approach is outdated and dangerous and will hasten the extinction of not only the Spectacled Flying-fox, but the myriad of other plants and animals that coexist within their range and habitat.

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Appendix 1: Flying-fox Breeding Calendar (Wildlife and Threatened Species Operations, Department of Environment and Science. (2020). pp. 15)

*Figure 11. Flying-fox breeding calendar to assist in determining best times to manage roosts**

	January	February	March	April	May	June	July	August	September	October	November	December
BFF	Young flying on their own	Mating territories formed	Conception		Gestation period - Nomadic movement related to food source				Birth – Young carried for 4-5wks			Most young left at camp (crèched)
GHFF	Young flying on their own	Mating territories formed	Conception		Gestation period - Nomadic movement related to food source				Birth – Young carried for 4-5wks			Most young left at camp (crèched)
SFF	Most young left at camp (crèched)	Young flying on their own	Mating territories formed	Conception		Gestation period - Nomadic movement related to food source				Birth – Young carried for 4-5wks		
LRFF	Gestation period - Nomadic movement related to food source			Birth – Young carried for 4-5wks			Most young left at camp (crèched)	Young flying on their own	Mating territories formed	Conception		Gestation

Key:

- Lower likelihood of heavily pregnant or dependant young being present
- Some likelihood of heavily pregnant or dependant young being present
- High likelihood of heavily pregnant or dependant young being present
- Seasonally lower risk of heat stress events
- Seasonally higher risk of heat stress events

*this is for general information only and timing of behaviours may differ depending on region and climatic conditions. Flying-fox behaviour should be confirmed by a site visit.

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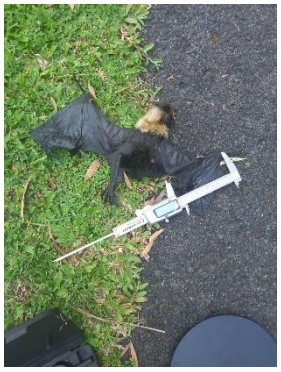
Appendix 2. Rescue Data & Observations

Date	Time	Location	Alive/ Dead	Measurements FA Weight/approx. Sex	Observations	Rescue	Reunite	Assistance/ Notification
Prior to Research Project	Lower Daintree carer-3 Wildlife Habitat/Daintree carer-6 Cairns carer-3 Tolga Bat Hospital-4 Total=16							
30/10/22 **File #01** **Siva**	08:00	Barrier St, opposite the Beach Shack 	Alive	FA101mm 115g (159g) 28% underweight Female	Hanging 2m off ground, pup calling, no response. Taken into care as they were in a very public space. No reunite considered due to weight.	Yes	No	Kate PDWR TBH
30/11/22 **File #02** **No Medical File**	08:56	Camp 2, rear, below colony height, 16m approx.	Alive, later died	Unknown, body in tree	-pup sighted hanging below small group -Small vocalisation -Indian minor watching nearby -No parent vocalisations in response	No -notified deceased in tree 14:29 by PDWR	No	Kate PDWR

					-Pup dropped from 2 thumb grip to one -indian minor left 08:06 -very little signs of life -09:24 pup vocalising and moving now -09:30 approx. Pup climbed higher and calling. Some recall from female (s) -Simon take over obs 10:12			
31/10/22 **File #03** **Morta**	08:26	Camp 2, rear towards residential. 3m approx. 	Alive, later died	FA109mm 129g (192g) 33% underweight Female	-Morta came into care at 09:30am and was deceased at 09:40 -She was 33% underweight -received 6.5ml subcut at 09:30, another 6ml at 09:35	Yes	No	Kate PDWR
31/10/22 **File #04** **Leaf**	08:58	Camp 1, mid way down units, near first car park space.	Alive	FA88mm 113g (119g) 5% underweight Male	-Leaf was found hanging near a car park in the units, just above the fence line on the creek bed side	Yes	No Reunite attempt was made at 6pm, unsuccessful	Kate PDWR TBH

					Leaf was taken into care at 10:00am and received sub-cut -At the time of this rescue and reunite the camp had become unstable with Little Reds present			
31/11/22	08:17		Dead	-	-found on grass next to first car park of units	-	-	Kate
01/11/22 **File #05 Della**	09:43		Alive	FA110mm 177g (198g) 11% Underweight Male	-found roadside beneath tall Melaleucas Camp 1 -Della ended up having a broken shoulder bone Renamed Sylvester at Tolga	Yes	No	Kate PDWR TBH

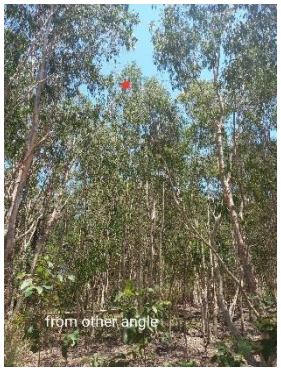
01/11/22	07:00		Dead	FA112mm 119g (209g) 43% underweight	-found below trees on Barrier St near Camp1	-	-	Kate
02/11/22	08:45		Dead	-	-found on grass next to first car park of units	-	-	Kate
02/11/22			Dead	FA102mm 117g (166g) 30% underweight Male	-found on the ground towards the rear driveway near Camp 3	-	-	Kate
02/11/22 **File #06** **Brad**	08:49		Alive	FA117mm 168g (232g) 28% underweight Male	-found along fence side, rear units camp 1 -hanging until 11:30 when brought in for weigh and hydration	Yes	No	Kate PDWR TBH

					-Brad stayed in care 27% underweight			
04/11/22 **File #07** **Corrie**	10:18		Alive	FA109mm 123g (193g) 36% underweight Female	-Corrie was first observed on the morning of the 3/11, seen again on the morning of 4/11 -rescue was via tree climb and lowering of branch -rescuers name, Corrie -Corrie (pup) had a thigh wound, see medical chart for details	Yes	No	Kate PDWR MPDT TBH
06/11/22	08:05		Dead	-	-palm tree up, across the road from creche location. Camp 4. -spotted 05/11, too high to rescue. -appeared well, checked last at 3pm. We decided to rescue AM of the 6/11. Pup was deceased when I arrived.	No	-	Kate PDWR

06/11/22	09:22		Died soon after rescue	-	-Pup first sighted on the 4/11 -Too high to rescue, was near to Rear Camp 7 -eating blossoms, too high to rescue -6/11 had fallen lower -ladder on car+9m pole -knocked pup down -gave small subcut -pup died shortly after	No	-	Kate PDWR
06/11/22	11:39		Dead	-	-near post boxes of units Barrier St, Camp 1	No	-	Kate
07/11/22	08:56		Dead	-	-Camp 1, high	No	-	Kate

07/11/22	09:34		Dead	-	-Camp 6, Western end, green ants	No		Kate
07/11/22	09:36		Dead	-	-remains of wings	No	-	Kate
07/11/22 **File #08** **Acacia**	10:30		Alive	FA109m 150g (192g) 22% underweight Male	-Acacia was first heard on the 06/11. Too high for rescue and was the weekend so unable to ask for assistance from MPDT -Acacia was checked on after the below rescue and found to have fallen to a height of 3m approx. so was retrieved by pole and taken into care.	Yes	-	Kate PDWR TBH

07/11/22 **File #09** **Daisy**	10:24		Dead adult Female Live Pup	FA97mm 118g (147g) 20% underweight Female	-Daisy was found at Camp 5 amongst the Singapore Daisies on her deceased Mother -she had a paralysis tick on her left shoulder that was carefully removed head and all shortly after found -Daisy also had maggots under her wings, in her eyes and on other parts of her body	Yes	No	Kate PDWR TBH
07/11/22	14:34		Dead	-	-Camp 1, high towards road	No	-	Kate
08/11/22 **File #10** **Alix**	09:50		Alive	FA110mm 133g (198) 33% underweight Male	-Alix was found hanging low at rear Camp 7 accessed by Port Douglas rd walkway -32% underweight	Yes	No	Kate PDWR TBH

08/11/22	09:22		Dead	-	-found west end Camp 6, down low -rigamortis, but not deceased long -covered in green ants	-	-	Kate
09/11/22 **File #11** **Stihl**	11:00		Alive	FA95mm 100g (140g) 29% underweight Male	-Stihl was high up away from camps in melaleucas near lake on St Crispins -appeared to be very small -rescuers used ladder, and chainsaw to bring a limb to ground level -high risk was evaluated before taking any actions	Yes	No	Kate PDWR
09/11/22 **File #12** **Toby**	13:00 approx.		Alive	FA 120mm 214g (252g) 15% underweight Male	-Toby was first spotted in the morning at 08:26 -adults were still active in the area and rescuer believed there was a good chance of collection -Toby looked in good health -Rescue of Toby happened later in	Yes	Unsuccessful Attempt Click to see notes.	Kate PDWR

					the day, delayed by the above rescue -Reunite was attempted, but was unsuccessful			
10/11/22	08.21		Dead	-	-high in Melaleuca Camp 1	No	-	Kate
10/11/22	10:51		Dead	-	-high in Melaleuca Camp 6	No	-	Kate
10/11/22	11:06		Dead	-	-near large tower between Camp 5 & 6	-	-	Kate
10/11/22	11:07		Dead	-	-near large tower between Camp 5 & 6	-	-	Kate

10/11/22	08:48		Dead	-	-roadside under Camp 6	-	-	Kate
12/11/22 **File #13** **Died in Care**	09:26		Alive	FA 122mm 194g (263g) 26% underweight Male	-pup found on ground in leaves, west end of Camp 6 -pup had laboured breathing, some blood visible near neck, and green ants -rushed home into care with PDWR -died 10:10 -see medical chart	Yes	No	Kate PDWR
14/11/22 **File #14**			Alive	Didg FA125mm 222g (283g) 22% underweight Male	-came into Simon via MOP call to PDWR -MOP had described the pup dragging his leg as he dragged himself along the ground -pup was hanging at the time of rescue -X-rays done at Ulysses on the	Yes	No	Simon PDWR

					16/11/22 reveal trauma to the upper femur of the right leg			
15/11/22	0830		Dead	Adult female, teets pronounced	-approached by MOP, Kenny, who took me to adult female near roadside camp 5. -determined from examination it was a carstrike as there was trauma to one side of body	-	-	MOP-Kenny Kate
16/11/22	0901		Dead	FA119mm No cleft palate	-	-	-	Kate
17/11/22	-		Dead	-	-pup was left abandoned after ETS disturbance on Monday the 14th -Have been observing for three days, but unable to rescue	-	-	Kate

17/11/22	-		Dead	-	-pup was left abandoned after ETS disturbance on Monday the 14th -Have been observing for three days, but unable to rescue	-	-	Kate
17/11/22			Dead	FA123mm	-pup was found on the ground below a newly established roost tree -pup was covered in green ants, but perhaps only been dead for a couple of hours	-	-	Kate
20/11/22	1029		Dead	-	-found beneath Barrier ST Camp 2 -decayed	-	-	Kate
20/11/22	1033		Dead	-	-found beneath Barrier ST Camp 2 -decayed	-	-	Kate

20/11/22	0900		Dead	-	-hanging high in tree near Camp 7 rear/south	-	-	Kate
21/11/22	0956		Dead	FA 109mm	-found beneath rear Camp 7 -long decayed			
22/11/22			Dead		-found on the footpath, underneath tall melaleuca on Barrier St			
25/11/2022	0755		Dead	Male FA 135mm	-found on the footpath, underneath tall melaleuca on Barrier St -suspect not long dead, no obvious injuries	-	-	Kate

Reported 22/11/2022 Found 26/11/2022			Dead	Unknown FA130mm	-Old Port Rd, 100m up from driveway spot -reported earlier in the week by Clare and Simon from PDWR	-	-	-PDWR -Kate
26/11/2022	0913		-	-	-sighted during checks -15m approx, before entering rainforested area on footpath walking towards Habitat -27/11/2022 -checked this pup again at 0900am, realised the pup is alive. -approximately 16m high 28/11/2022 -checked on pup, they are no longer there 0820	-	-	-Kate

26/11/2022	1300		Alive 0939	-	-Camp 4 -tall melaleuca, 16m approx -sighted on morning checks, small amount of climbing -looked to not be doing very well -called MPDT just before 1pm, no return call. -Pup appears to be deceased at 1pm. No movement of eyes or ears. -Pup was not there Sunday AM 0817. Checked surrounding tree area thoroughly.	-	-	Kate

Appendix 3. Community Conversations Transferred from Notes

#	Date	Location	Positive/Negative	Details
#1	29/10/2022	Ti Tree Unit	Positive	RESCUE -holidaying family -woke up to a lot of SFF noise -pup hanging from guttering -relocated pup to a nearby tree, was able to show the family the pup and have positive conversations -they were fascinated by the SFFs -happy staying in accommodation nearby to them
#2	01/11/2022	Camp 1	Positive	- local resident near colony, discussed growth of the colony in the area (Barrier St creek bed). SFFs present 2+ years -male 50+ -minimal knowledge of species
#3	01/11/2022	Coles service station, Craiglie	Positive	-positive conversation, discussed colony on Fraser Island. -male 30+ -some knowledge of SFF
#4	01/11/2022	Camp 1	Negative	-Ti Tree villas resident, highly put-out by AM noise -female 60+
#5	02/11/2022	Camp 1, units Southern side	Positive	-came out during low pup rescue. -positive conversation, noted the bats are noisy and messy -female 20+
#6	04/11/2022	Camp 4, Creche location	Positive	-MPDT cherry picker rescue of “Corrie” -interested and helpful conversations with three staff who assisted -males 20-30
#7	05/11/2022	Niramaya Visit	Positive	-allowed to walk around the grounds -happy to have flyers made up to have at the service desk
#8	08/11/2022	Ti Tree Villas	Negative	-pressure cleaning of external unit walls adjacent to Camp 1 -disturbance to nearby area of SFFs -two males, 20+, 40+
#9	09/11/2022	Camp 1	Positive	-spoke to a council worker who was around the colony, clearing drains, residents worried about flooding coming into wet season -positive attitude towards the flying-foxes -discussed the difficulties in managing residents expectations of council works -stated they don’t go underneath with machinery -some SFF knowledge
#10	09/11/2022	Camp 1, units Southern side	Positive	-positive conversation with resident -gave contact for wet season as they have found them in the past after the heavy rain -guided me through unit complex to where I can walk to view SFFs further along the creek
#11	09/11/2022	Barrier St, Camp 2 Rescue	Positive	-assisted in ladder rescue by local -very positive about the SFFs -photographer -male 30+
#12	11/11/2022	Ti Tree Villas	Positive	-met and chatted with two seasonal visitors who have a unit and come every year -minimal species knowledge

				-very much enjoy seeing the flying-foxes -long, friendly chat about the SFFs -male, female 50+
#13	14/11/2022	ETS Vegetation Management Crew	Negative	-clearing around the flying-foxes -dismissive, negative language -very low knowledge of the species, stated flying-foxes are bad for the rainforest -two males 30+
#14	15/11/2022	Old Port Rd, near Camp 5	Positive	-headed towards Camp 5 -male 40+ pulled over in his car and showed me where a deceased female adult was
#15	15/11/2022	Tropic Court	Negative	-approached by resident of units on Tropic Court. Units back onto Camp 2 "Are you taking photos of the bats?" - Resident “I am, I'm doing research around this species. They're the spectacled flying fox and they're endangered.” - Kate "They would be if I had a gun" -Resident -explained they are a protected species -male 60+
#16	21/11/2022	Camp 1, units Southern side	Positive	-great chat with a mum, baby and her partner -living in the units -they asked lots of questions -looked up into the trees at all the mums with pups, talked about birthing and how the pups grow up -female, male 30+
#17	23/11/2022	Barrier St, near Camp 1	Positive	-positive conversation with a couple who pulled over, they are bird watchers and have a property nearby -minimal knowledge of the flying-foxes -50+
#18	24/11/2022	Ti Tree Villas	Positive	-spoke to a gardner -awesome chat -said the SFFs have been at Barrier St constantly for the last 2 years, before that, very on and off. -happy to chat more anytime. -female 40+
#19	24/11/2022	Phone call	Positive	-report of SFF of powerlines -MOP had my contact from a friend at Barrier St Units
#20	24/11/2022	Camp 7 South, rainforest path	Positive	-amazing conversation with tourists, mother and son -Spanish speaking, were afraid the bats would come and attack them -they were looking for birds -showed them photos, had a long conversation -they walked away very positive
#21	25/11/2022	Tropic Court Units	Positive	-huge chat with resident -says people are very divided on them here -huge problem with mess in peoples backyards -lives here part time -SFFs been here the two years he has -male 60+
#22	25/11/2022	Tropic Court Units	Negative	-resident, her back terrace almost right underneath trees -doesn’t use her outside areas -no shade cover, tiles visibly messy

				-uses a Karcher most days -female 50+
#23	25/11/2022	Tropic Court Units	Positive	-resident -likes the SFFs -talked about finding pups -call Wildlife Habitat for help -female 40+
#24	25/11/2022	Tropic Court Units	Positive	-roofers working right below the colony -chatted to them on the ground -communicated lots of incorrect information about the SFFs -but, very friendly, like the flying foxes -were on the roof calling out how awesome it is to almost be at eye level with them -two males 40+, 20+
#25	26/11/2022	Barrier St Unit, near occupied Melaleucas	Positive	-permanent resident -spends a lot of time at home -watches the SFFs -loves watching the mums with pups -feels quite protective of them -shared a story of a time one was on the ground crawling, she called Wildlife Habitat for help -used the word "sorrow" to describe the feeling she has when they leave. She misses them. -wanted to know why they move on -female 70+
#26	27/11/2022	Warri Park Pathway	Positive	-father and son on holiday -looking at birds -big chat about the SFFs visible in Camp 6 -very interested -70+, 30+
#27	28/11/2022	Port Douglas Rd, near Wildlife Habitat	Positive	-wildlife photographer -works with a local tourism business -getting some close up shots from outside WH -aware of what species they were -told him where else he could see them in Port Douglas -some SFF knowledge
#28	29/11/2022	Ti Tree Units	Positive	-permanent resident on Camp 3 side -loves watching the SFFs from his balcony -loves when it rains and the water fills up and it becomes a little ecosystem outside his home -talked about a sadness when they move on -male 60+

Appendix 4. Observed Wildlife

Conservation Status (CS): Least Concern (LC)

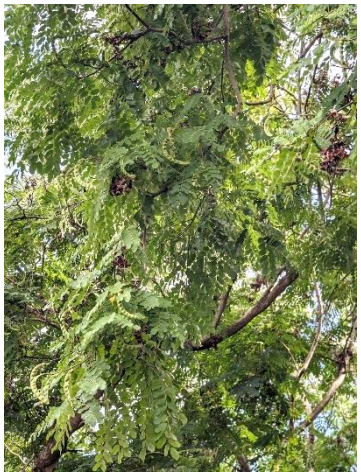
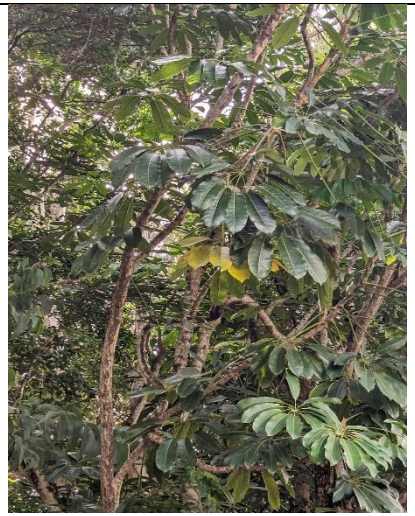
Images of each bird species can be found at: www.ebird.org

Personal photographs used for all other species.

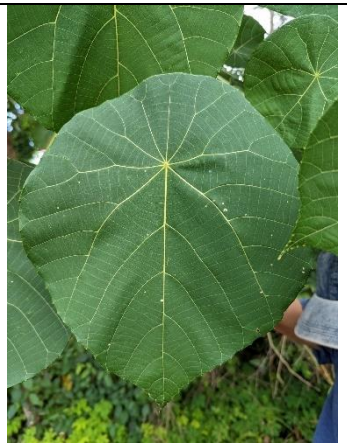
Species	**CS**	**Location**	**Species**	**CS**	**Location**
Brahminy Kite *Haliastur indus*	LC	Tall Melaleuca's near Creche site 4	Blue-winged Kookaburra *Dacelo leachii*	LC	Powerlines Camp 5, 6
Torresian Imperial-pigeon *Ducula spilorrhoa*	LC	Across locations	Orange Footed Megapode *Megapodius reinwardt*	LC	Camps 1,6,7
Helmeted Friar Bird *Philemon buceroides*	LC	Camp 1	Rainbow Bee Eater *Merops ornatus*	LC	Powerlines Camp 3,4,5
Radjah Shelduck *Radjah radjah*	LC	Rear Camp 1 creek	Little Egret *Egretta garzetta*	LC	Lake near Camp 7
Osprey *Pandion haliaetus*	LC	Nesting pair, feeding atop tower between Camp 5&6	Magpie Geese *Anseranas semipalmat*	LC	Across locations
Australiasian Swamphen *Porphyrio melanotus*	LC	Camp 6 surrounds	Masked Lapwing *Vanellus miles*	LC	East Camp 6
Bush Stone-curlew *Burhinus grallarius*	LC	Camp 5, 6 surrounds	Peaceful Dove *Geopelia placida*	LC	Camp 5
Bar-shouldered Dove *Geopelia humeralis*	LC	Camp 5,6	Rainbow Lorikeet *Trichoglossus moluccanus*	LC	Camp 2
Spangled Drongo *Dicrurus bracteatus*	LC	Camp 1,6,3	Willie Wagtail *Rhipidura leucophrys*	LC	All locations

Eclectus Parrot *Eclectus roratus*	LC	Camp 4, 5	Magpie Lark *Grallina cyanoleuca*	LC	All locations
Australasian Figbird *Sphecotheres vieilloti*	LC	Camp 1,2	Olive-backed Oriole Oriolus sagittatus	LC	Camp 1,7
Black Butcherbird *Cracticus quoyi*	LC	Camp 1,2	Common Myna *Acridotheres tristis*	LC	Camp 1,2
Olive-backed Sunbird *Cinnyris jugularis*	LC	Camp 6	Welcome Swallow *Hirundo neoxena*	LC	Camp 3,4,5
Sulphur-crested Cockatoo *Cacatua galerita*	LC	Camp 3,6,7,8	Little Red Flying-fox Pteropus scapulatus 	LC	Camp 1,5
Golden Orb-weaver *Nephila* 	LC	Camp 1,2,5,6,7	Garden Orb-weaver *Hortophora transmarina* 	LC	Camp 5
Common Lynx Spider *Oxyopes quadrifasciatus* 	LC	Camp 5,7	Closed-litter Rainbow skink *Carlia Longpipes* 	LC	All locations

Appendix 5. Plant Identification

Name	Image	Name	Image	Name	Image
Red Bead Tree *Adenanthera pavonina*		**Umbrella Tree** *Schefflera actinophylla*		**Red Leaved Fig** *Ficus congesta*	
Northern Wattle * *Acacia crossicarpa*		**Ribbonwood** *Euroschinus falcatus*		**Sweet Sarsparilla** *Smilax australis*	

Flame Tree *Brachychiton acerifolius*		*Sapindaceae* Family Unconfirmed sapling ID.		**Alexandra Palm** *Archontophoenix alexandrae*	
Beach Calophyllum *Callophyllum inophyllum*		**Northern Olive** *Chionanthus ramiflorus*		**Swamp Mahogany** *lophostemon suaveolens*	

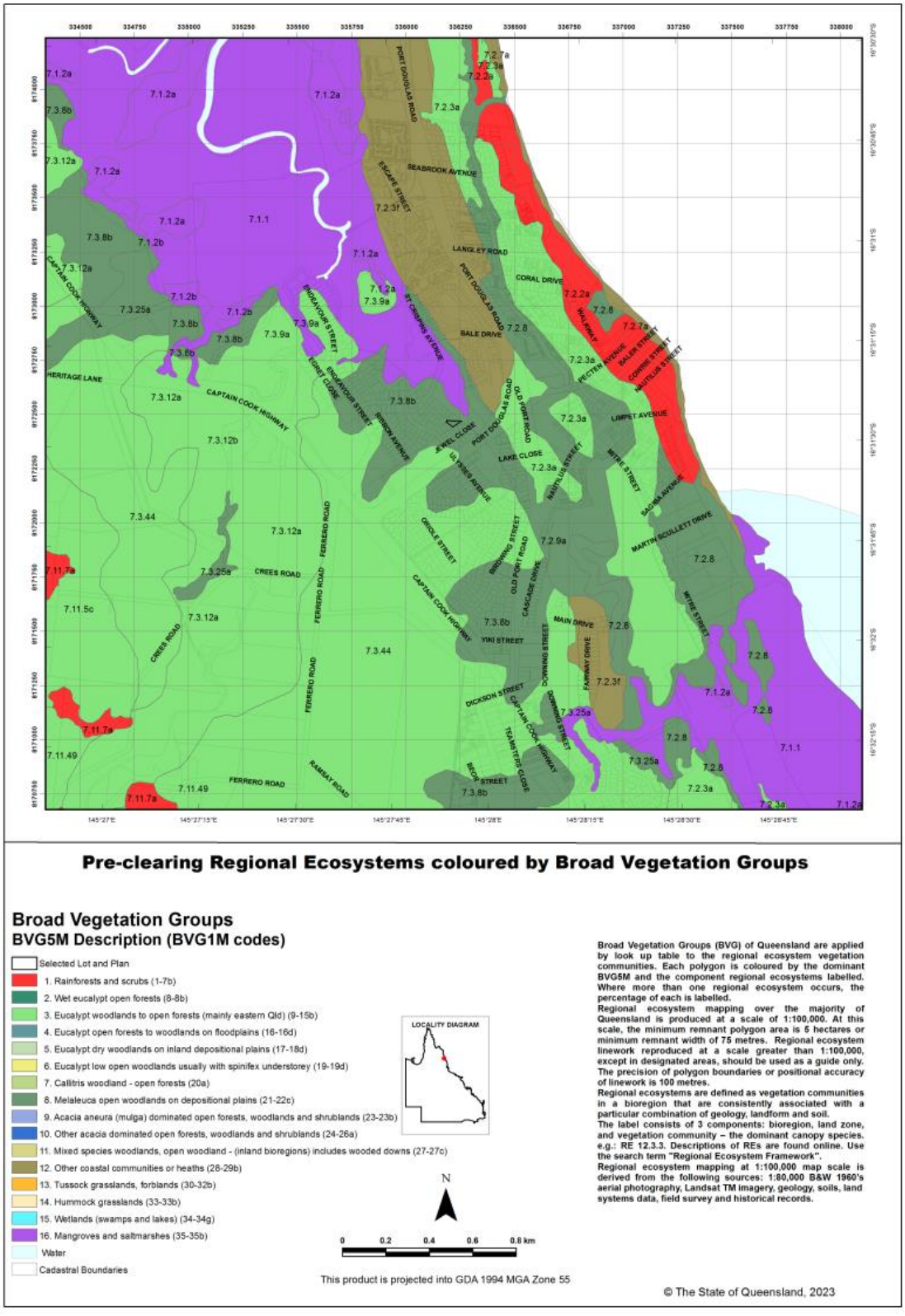
Red Beech *Dillenia aluta*		**Corky Bark** *Carallia brachiata*		**Blush Macaranga** *Macaranga tanarius*	
Grewia Weed *Grewia asiatica*		**Tree Peach** *Trema orientalis*		**Brown Macaranga** *Macaranga involucrata*	

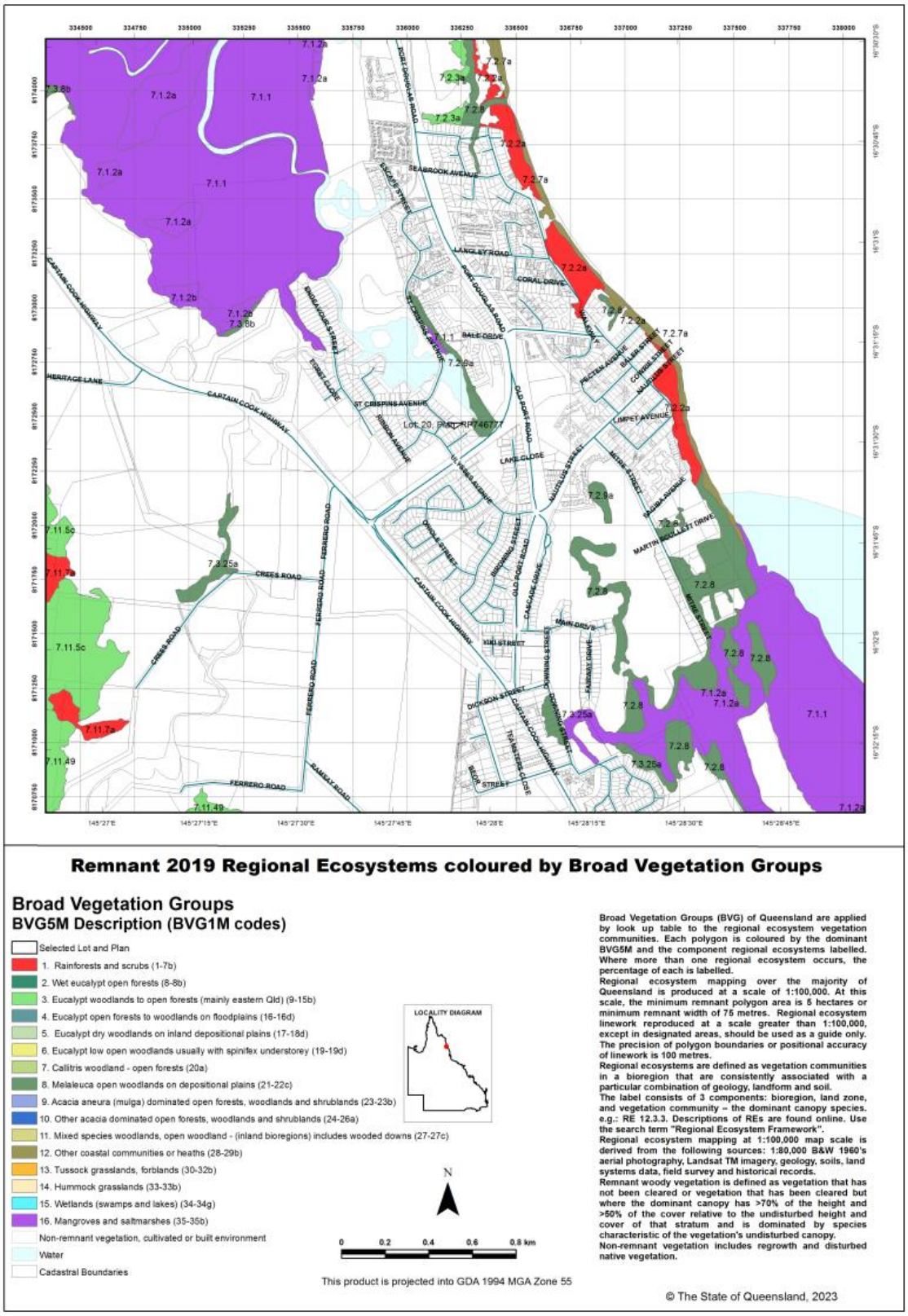
White Beech *Canarium australiense*		**Native Yam** *Dioscorea transversa*		**Dalrymple's White Beech** *Gmelina dalrympleana*	
Fishtail Palm *Caryota mitis*		**Weeping Paperbark** *Melaleuca leucadendra*		**Tim Tim** *Timonius timon*	

Glossy Laurel *Cryptocarya Laevigata*		**Native Gardenia** *Atractocarpus fitzlanii*		**White Cedar** *Melia azedarach*	
Tulipwood *Harpulia* arboresense		**Beach Calophyllum** *Calophyllum inophyllum*		**Benjamina Fig** *Ficus benjamina*	
Paper Bark Tree *Melaleuca cajuputi*		**Silver Leaved Paperbark** *Melaleuca argentea*			

Appendix 6. Pre Clearing and Remnant Broad Vegetation Groups, Queensland Government

26/02/2023 10:42:27
Lot: 20 Plan: RP746777





Remnant 2019 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- Selected Lot and Plan
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries

LOCALITY DIAGRAM

N

0 0.2 0.4 0.6 0.8 km

This product is projected into GDA 1994 MGA Zone 55

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.
Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Non-remnant vegetation includes regrowth and disturbed native vegetation.

Appendix 7. Population Counts by Camp Location

	08:00am approx.									
	°C	Camp 1	Camp 2	Camp 3	Camp 4	Camp 5	Camp 6	Camp 7	Camp 7 So	Camp 8
29-Oct-22	-	4000	800	300	-	300	300	1000	-	-
02-Nov-22	28.5	-	-	-	-	-	500	2000	200	-
03-Nov-22	-	150	50	200	1 pup	-	400	2000	-	-
04-Nov-22	-	0	0	-	1 pup	400	0	3000	-	-
05-Nov-22	26.1	0	0	0	-	400		3000	-	-
06-Nov-22	25.9	2000	2000	-	0	500	300	2000	300	-
07-Nov-22	26.7	1000	0	200	-	-	300	3000	300	-
08-Nov-22	26.5	-	-	150	-	-	400	-	-	-
09-Nov-22	27.2	500	-	-	-	-	-	3000	-	-
10-Nov-22	-	300	0	-	-	500	200	3000	400	-
11-Nov-22	26.3	400	50	-	-	500	200	3000	100	
12-Nov-22	-	400	150	200	-	500	300	1000	-	-
13-Nov-22	27.4	200	50	200	-	-	-	-	-	-
16-Nov-22	27.9	3000	300	200	-	600	-	1000	0	-
17-Nov-22	26.2	-	300	200	-	200	100	-	30	-
19-Nov-22	-	4000	700	300	-	-	150	-	30	-
20-Nov-22	27.9	3000	500	300	-	300	500	3000	100	300
22-Nov-22	27.2	3000	600	400	-	-	500	4000	200	-
23-Nov-22	29.5	3000	500	200	-	200	400	4000	-	-
24-Nov-22	26.2	3000	300	-	-	-	0	-	200	-
25-Nov-22	26.3	2300	300	200	-	300	-	3000	200	-
26-Nov-22	28.8	2700	400	300	-	300	80	3000	-	-
27-Nov-22	26.8	2700	400	300	-	400	150	3000	250	500
28-Nov-22	27.5	2700	400	300	-	500	200	3000	300	-
29-Nov-22	-	2200	350	300	-	600	300	3000	300	-
30-Nov-22	27.4	1500	-	-	-	-	200	3000	200	-
02-Dec-22	27.5	400	80	200	-	1000	200	2000	200	500
04-Dec-22	-	1500	200	300	-	1000	-	2000	-	-
05-Dec-22	26.6	1500	300	300	-	1000	300	-	-	-
09-Dec-22	26.1	2500	300	400	-	1000	300	-	-	-
10-Dec-22	28.4	4000	400	300	-	1000	300	2000	200	
14-Dec-22	28.4	400	500	-	-	800	700	2000	250	100
15-Dec-22	35.6	900	500	200	-	800	400	2000	250	300
22-Dec-22	28.1	1200	180	150	-	1000	300	2000	200	300
24-Dec-22	27.2	900	100	-	-	1000	200	2000	200	300
28-Dec-22	26.7	1000	100	200	-	-	-	-	-	-
02-Jan-23	27.5	400	-	200	-	1000	200	2000	200	500
03-Jan-23	26.5	600	80	200	-	1000	60	-	50	300
06-Jan-23	29	550	100	200	-	1000	200	2000	100	300
07-Jan-23	25.4	400	100	150	40	1000	150	3000	100	400
12-Jan-23	28.5	1500	200	200	40	1000	150	3000	100	400
23-Jan-23	30.7	1000	100	200	-	1000	-	-	-	500
08-Feb-23	-	170	30	150	60	1000	60	-	100	800
10-Feb-23	-	empty	empty	-	-	-	100	-	-	-
26-Feb-23	-	empty	empty	60	250	600	150	4000	300	800
28-Feb-23	-	empty	empty	-	250	200	300	-	400	800
14-Mar-23	-	empty	empty	50	50	50	300	3000	400	800
15-Mar-23	28.7	500	100	50	empty	30	300	3000	400	800

Location Notes:

Camp 1
-Camp 1 count also includes three tall melaleucas close to the area and included in the same footprint

Camp 4
-Used as a creche site September-December
-Later hosts its own intermittent populations

Camp 5 Count
-Taken of the perimeter, which can be observed by foot. -Includes 5 trees within the camp footprint along Old Port Rd

Camp 8
-based largely on flyout estimates