INSTITUTE FOR MARINE AND ANTARCTIC STUDIES
UNIVERSITY OF TASMANIA
Penny Beaver | Masters by Research | October 2018
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Research Objectives

This research is investigating the foraging areas of a pelagic seabird know as a Wedge-tailed shearwater (*Ardenna pacifica*) throughout the year across two distinct breeding colonies located 750 kilometres apart. The project commenced after anecdotal evidence was suggesting that a colony located on the subtropical mid North coast of New South Wales (NSW) was not performing as well as other well-studied colonies that inhabit temperate regions of NSW (NPWS, 2009). The aim of the research was to compare the foraging and habitat use of a subtropical colony with the southernmost colony of this species in temperate NSW to determine if birds from the two colonies were foraging in similar or different areas and whether this was impacting the success of the subtropical colony.

A significant component of the research is to quantify the habitat ranges of *A. pacifica* during the breeding and the non-breeding periods to identify important marine areas throughout

the year and to determine if there were significant habitat range variations between individuals from the two colonies with the use of archival light geolocators (Figure 1).

The funding from **Birdlife Australia Conservation Grant Scheme (ABEF)** was used to purchase 26 (C65 Migrate Technology) archival light geolocators (GLS) which are well suited to smaller shearwater (*Procellariiform*) species due to their small size and weight (14 x 8 x 6 mm, 1.0g) and are relatively inexpensive (Figure 1). GLS devices record light levels to determine longitude and latitude at dawn and dusk each day. The loggers are archival, with the data not transmitted via satellite requiring the devices to be recovered and removed the following breeding season in order to access data and are only accurate between 202 ±171 kilometres (Shaffer et al., 2005).

Figure 1 - Light Geolocator attached to an individual Coffs Harbour

SPECIES

Wedge-tail shearwaters are a migratory marine shearwater found throughout tropical and subtropical ranges in the Pacific and Indian Oceans (Marchant & Higgins, 2007). They breed annually typically with the same partner on offshore islands during the Australian summer (Swanson & Merritt, 1974). They form large aggregations referred to as "rafts" just offshore from their breeding colony just on dusk and enter and leave the colony at night to avoid predators (Warham, 1996).

They lay one egg per year and incubate and raise their chicks underground in burrows to protect the chick from predators and harsh weather conditions. Both the male and female raise their chick equally which takes approximately 5.5 months from incubation through to a chick leaving its burrow on its first flight. Wedge-tailed shearwaters are listed as a migratory species under the Japan Australia Migratory Bird Agreement (JAMBA 1981) and the Australian Federal government's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Figure 2 – Adult Wedge-tail shearwater (A. pacifica) taken on Montague Island at night

LOCATION

Both colonies are located and managed by NSW National Parks and Wildlife Service, Office of Environment and Heritage, NSW Department of Premier and Cabinet. Muttonbird Island Nature Reserve is located on the mid north NSW coast at 30°18´ S. 153°09´E. and is joined to the mainland at Coffs Harbour by a rocky breakwater (Figure 3). The reserve covers 9 hectares with an estimated 12,400 ± 6,127 breeding pairs of *A. pacifica* (Floyd & Swanson, 1982).

Montague Island Nature Reserve is located on the far south coast of NSW at 36°15´ S. 150°14´E and is accessible by boat from the township of Narooma approximately 9km offshore (Figure 3). The reserve covers an area of 82 hectares with an estimated 15,000 breeding pairs made up of three species of shearwater; Short-tailed (*Ardenna tenuirostris*), Sooty Shearwater (*Ardenna griseus*) and Wedge-tail shearwater (N. NPWS, 1995; Tiller, Klomp, Fullagar, & Heyligers, 2013). Montague Island was the southernmost known colony when this project commenced, however in 2017 breeding individuals of Wedge-tail shearwaters were discovered a couple of hundred kilometres further south on Gabo Island Lighthouse Reserve, Victoria (Carlile, Nicholas, Principal Scientist NSW NPWS, 2017, pers.comm.).

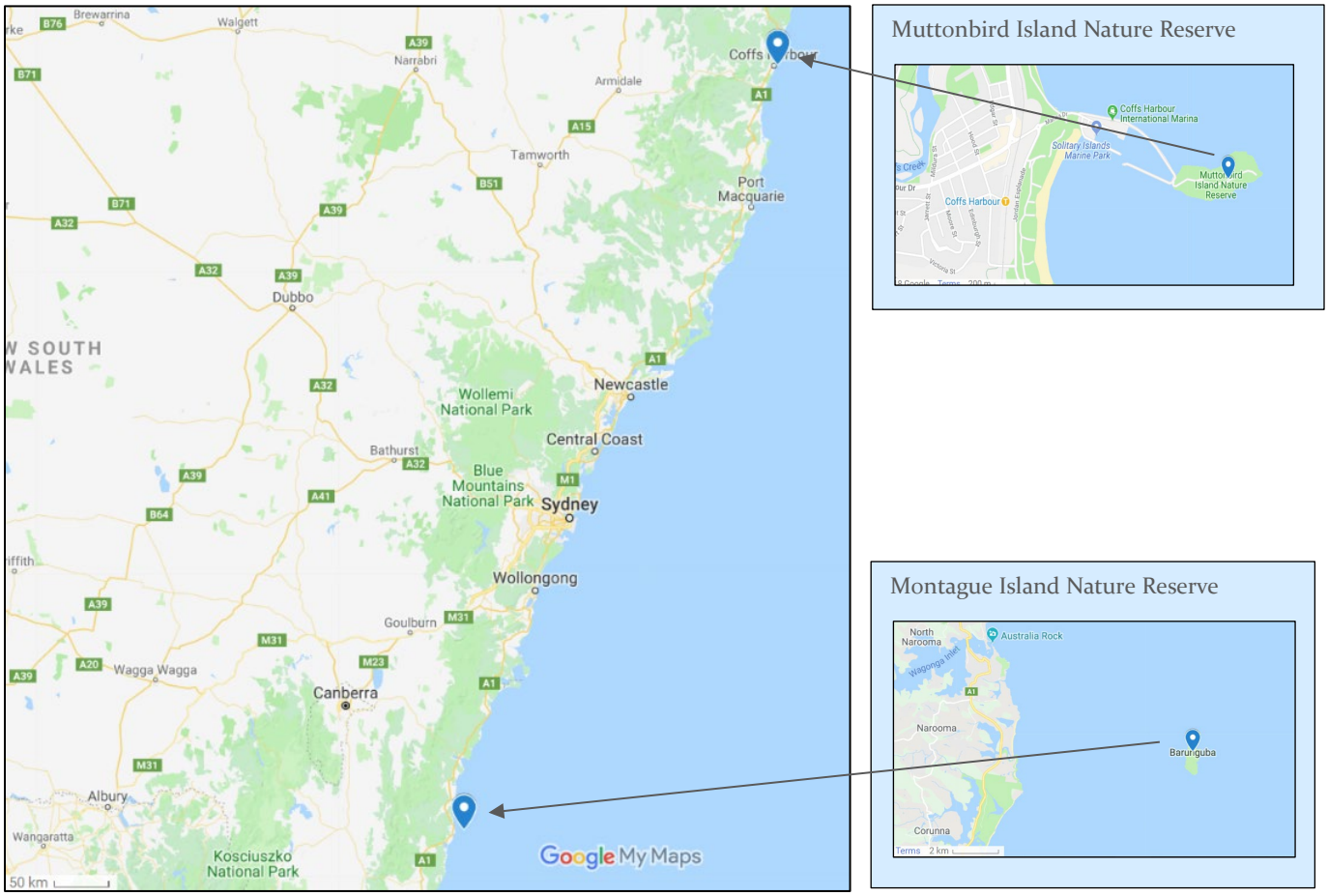

Figure 3 - Map of NSW and location of both colony's (Source: Google Maps)

Progress to Date

Of the 26 devices deployed during the 2016-17 breeding season (n = 10, were deployed on Muttonbird Island n = 16 on Montague Island) 18 have been retrieved to date (n = 16 from Montague Island and n = 2 from Muttonbird Island).

Of the 18 tags retrieved, data from four devices could not be extracted due to a failure of the devices or the data quality was too poor to process at this stage of the project (all were deployed on Montague Island and will be reassessed using a different statistical software tool).

A full years journey undertaken by two individuals (one for each colony) can be seen in Figure 4a and 4b which shows the habitats utilised via a time density map. Areas coloured in yellow are areas where individuals spent the majority of their time foraging rather than migrating.

Both remained slightly north or south of the breeding colony during the breeding season before travelling up the east coast of Australia and tracking to the north west of Papua New Guinea and onto the Philippines Sea. The individual from Muttonbird Island went as far north as Miyakojima Island Japan, whereas the individual from Montague Island took a slightly different pathway that went further east through the Solomon Islands and only going as far north as the Philippines Sea.

Interestingly, this bird undertook a southward journey in early March 2017 through to the end of April remaining in an area southeast of the Tasmanian coast before tracking past its breeding colony (Montague Island) on 20th of April just before its northward migration which could potentially indicate a failed breeding season. It may also indicate that it took such a pathway just prior to its northerly migration to feed on more productive or an enriched food source before flying past its breeding colony at about the time chicks would be leaving their burrows to take their first flight north to their wintering foraging grounds.

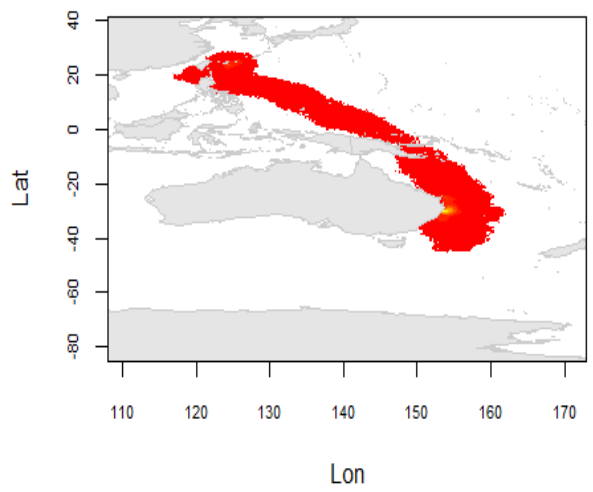

Figure 4a – Individual density map from Muttonbird Island reference ID 16244681, tracking days 424. Data set from 30/9/2016 to 28/11/2017.

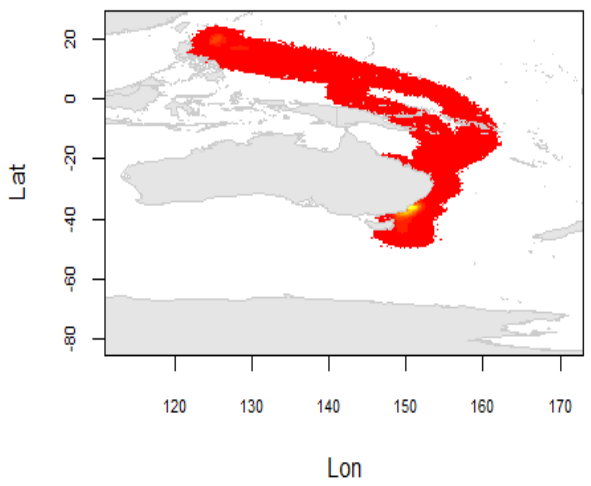

Figure 4b – Individual density map from Montague Island reference ID 16272908, tracking days 378. Data set from 26/11/2016 to 9/12/2017.

Monthly density maps of each individual's movements are shown in Appendix A, which indicate the density of time each individual spent either foraging (green areas) or migrating (orange areas). Essentially both individuals followed a similar pathway however the Montague Island individual undertook a trip south spending time south east of Tasmania before undertaking its migration north. Other datasets from Montague Island have the majority of individuals following a similar pattern.

The only other clear variation at this stage was that the Montague Island individual took a different pathway north tracking a lot further east via the Solomon Islands as opposed to the Muttonbird Island individual which took a more direct pathway along the north coast of Papua New Guinea. Based on data collected so far it appears that both are utilising the same wintering habitats once they have completed their migration north.

Next Steps

In the coming months, Penny will continue to retrieve loggers still deployed on shearwaters, particularly from Muttonbird Island which Penny has only retrieved two loggers from. Further refinement of the data from the loggers will be undertaken in conjunction with analysing other data collected over the last three years (diet analysis). The project is anticipated to continue for a further 2-3 years dependent upon how many loggers are retrieved in the 2018-19 breeding season.

Figure 5 – 1 week old chick on Montague Island

Figure 6 – 79± day old chick on Montague Island in April 2016

Appendix A

Each density map was produced using 'tripEstimation' (Sumner & Wotherspoon, 2016; Sumner, Wotherspoon, & Hindell, 2009) package in R (R Core Team, 2013). Each data set was estimated using a Bayesian framework, with the likely pathways determined using a Markov Chain-Monte Carlo method to approximate the posterior (Cleeland, Lea, & Hindell, 2014; Sumner et al., 2009). Figure 7a to 8h show the density of time each individual spent either foraging (green areas) or migrating (orange areas).

Muttonbird Island individual 16244681	**Montague Island invidual 16272908**
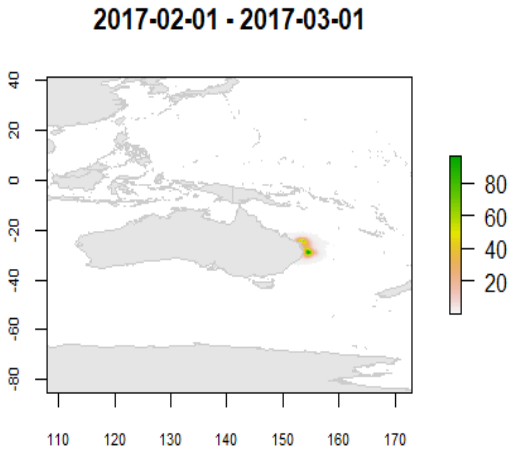	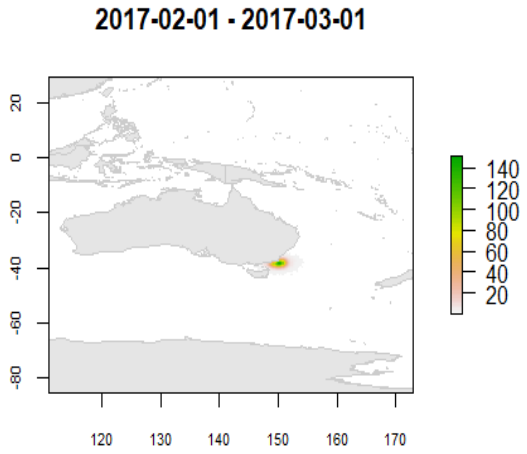
Figure 7a –1 February to 1 March 2017. Individual concentrating time slightly north of the colony.	Figure 8a –1 February to 1 March 2017. Individual concentrating time around the colony.
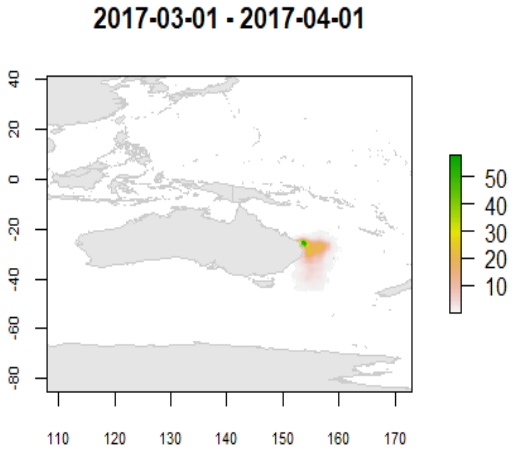	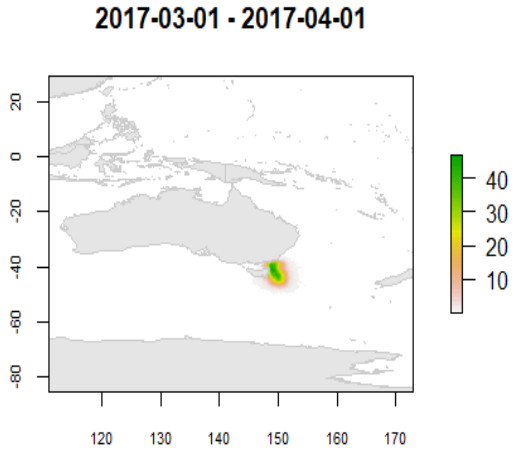
Figure 7b –1 March to 1 April 2017. Individual starting its migration north up the coast of Queensland.	Figure 8b –1 March to 1 April 2017. Individual starting a short migration south east of Tasmania.

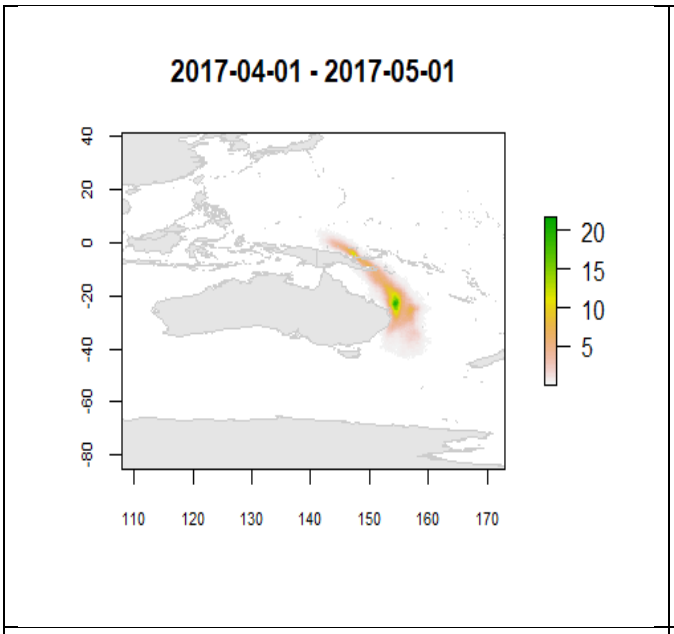

Figure 7c –1 April to 1 May 2017. Individual on its migration north, heading north east of Papua New Guinea.

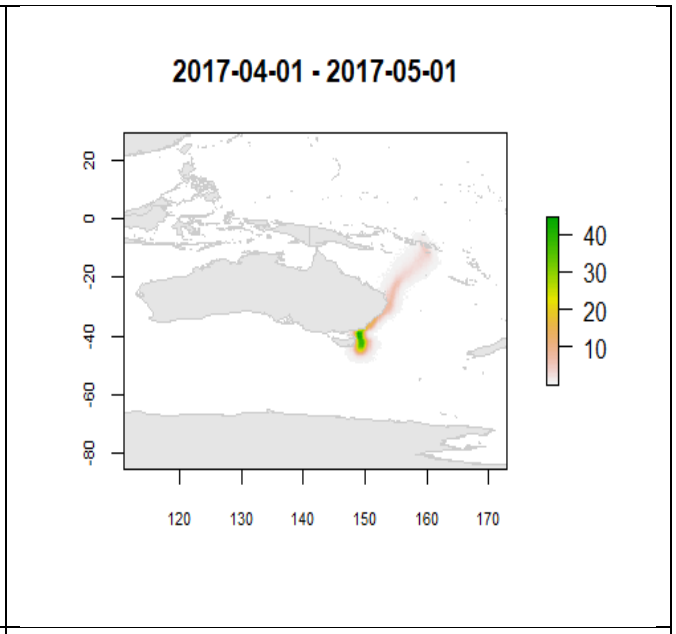

Figure 8c –1 April to 1 May 2017. Individual on its migration north past the colony and south east of the Solomon Islands.

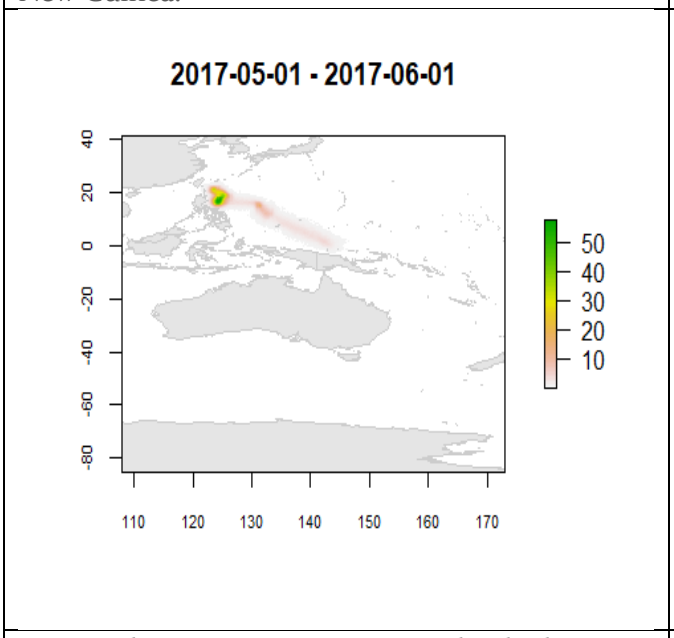

Figure 7d –1 May to 1 June 2017. Individual migrating north to its wintering grounds north east of the Philippines.

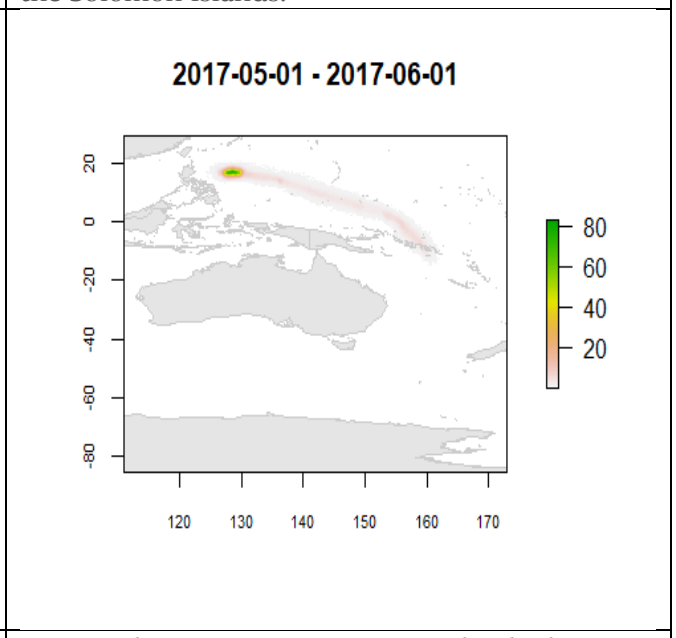

Figure 8d –1 May to 1 June 2017. Individual migrating to its wintering grounds and spending time north east of the Philippines.

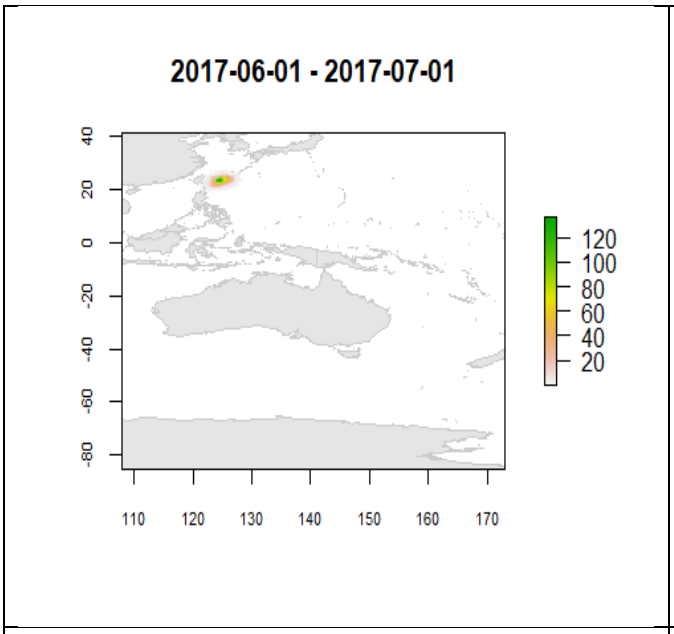

Figure 7e –1 June to 1 July 2017. Individual tracked north east of Taiwan and just south of Japan.

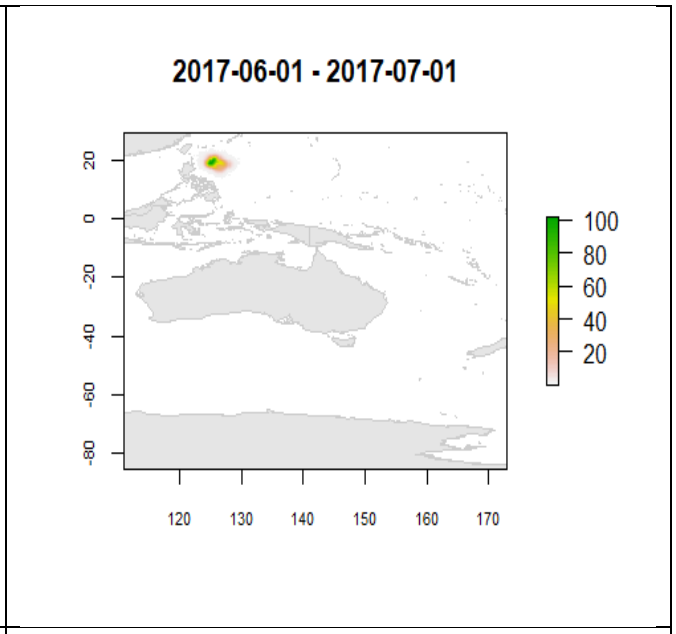

Figure8e –1 June to 1 July 2017. Individual tracked north east of Philippines.

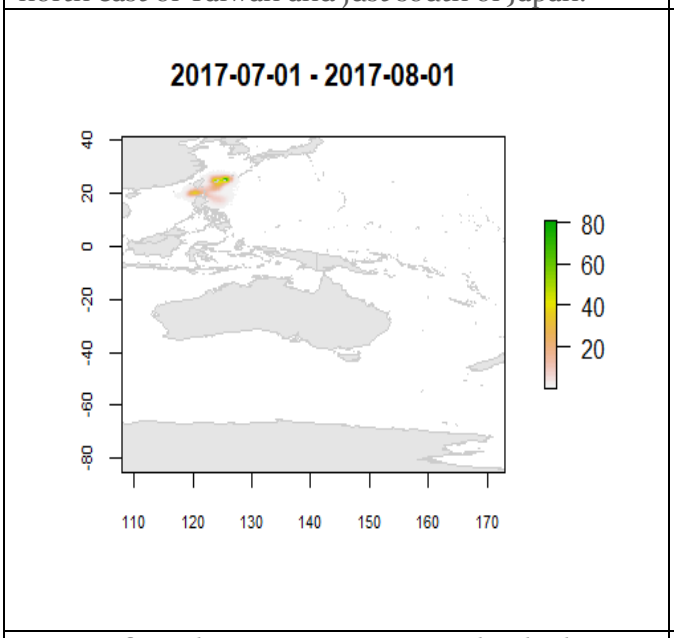

Figure 7f –1 July to 1 August 2017. Individual concentrating time south of Japan and north of Taiwan before starting its migration south.

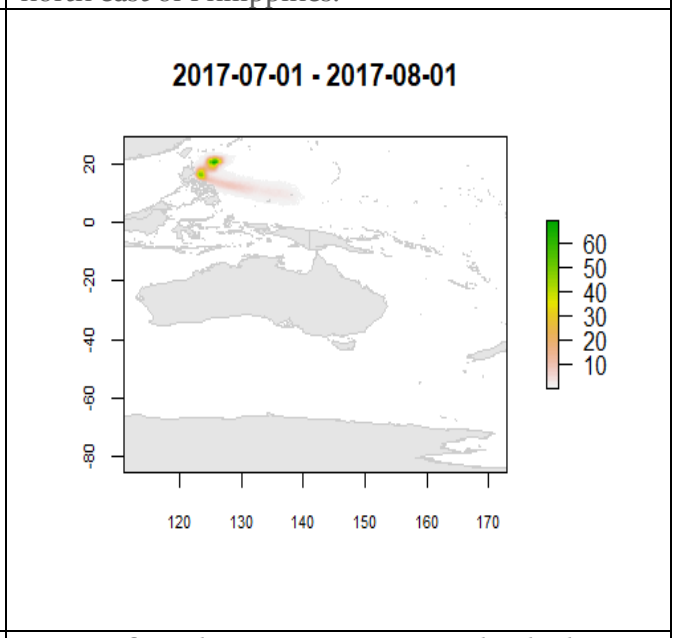

Figure 8f –1 July to 1 August 2017. Individual concentrating some time north east of the Philippines before starting its migration south.

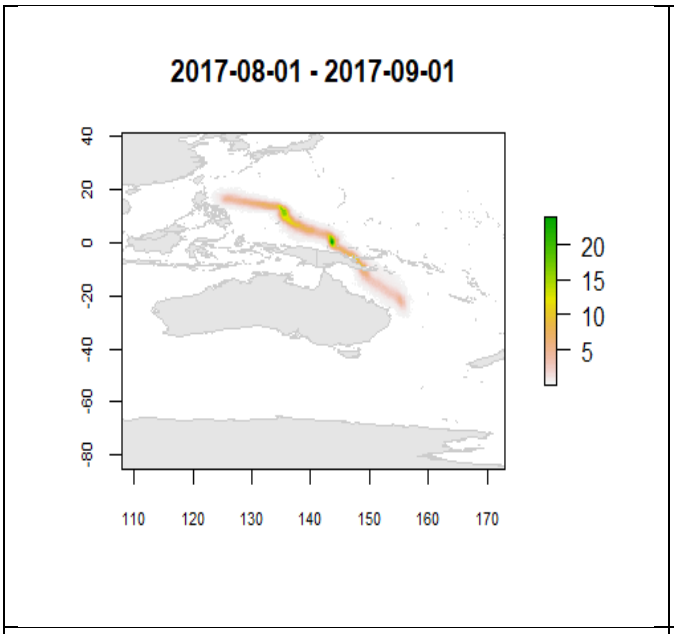

Figure 7g –1 August to 1 September 2017. Individual on its migration south whilst spending time feeding along the journey with two distinct areas of feeding occurring (green density areas).

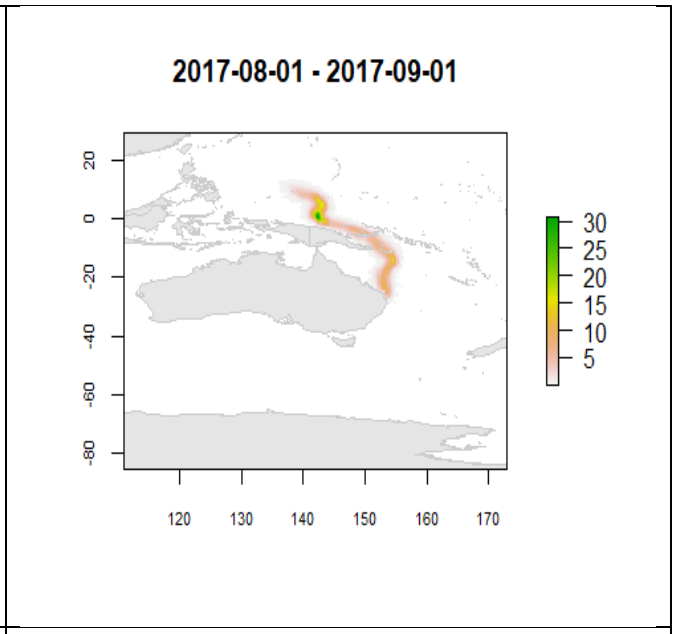

Figure 8g –1 August to 1 September 2017. Individual on its migration south whilst spending time feeding along the journey with one distinct areas of feeding occurring (green density areas).

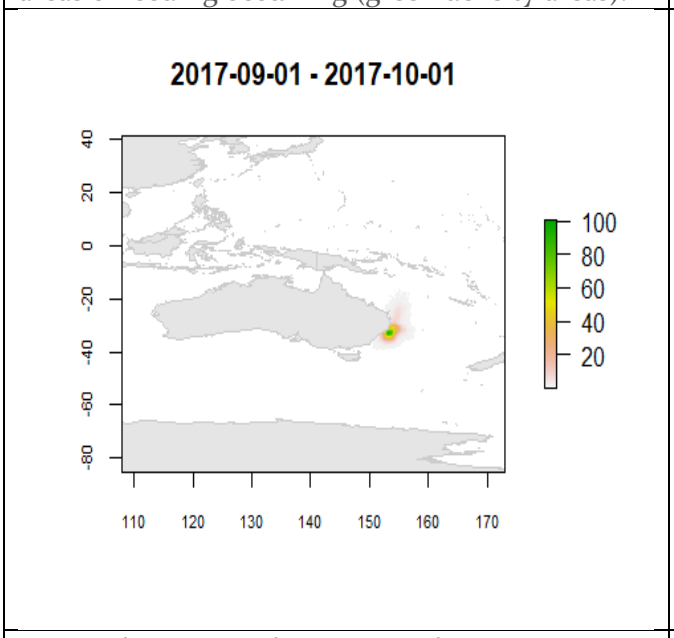

Figure 7h –1 September to 1 October 2017. Individual at the colony and feeding close by with the start of a new breeding season about to commence.

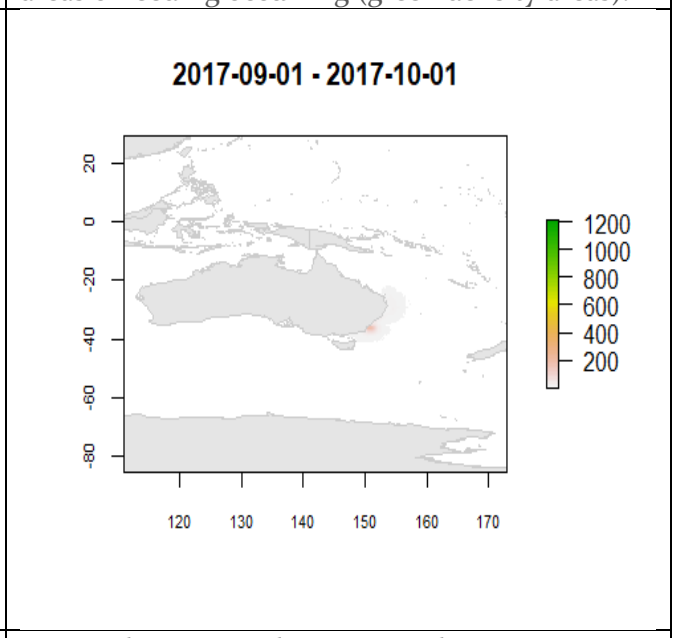

Figure 8h –1 September to 1 October 2017. Individual at the colony with the start of a new breeding season about to commence.

References

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