2006-07 Annual Report

A population and distributional study of white-capped albatross (Auckland Islands)

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Abstract

South West Cape, main Auckland Island, was visited during March-April 2007 (post-guard chick-rearing stage) by a two-person field team to continue studies into the at-sea distribution and demography of white-capped albatross.

At-sea distributional studies were again successful. Seven actively breeding adults were tracked over 55 foraging trips during March to May 2007, with an additional migration track, to South Africa, by a bird during June and July 2007. Foraging birds exploited a wide range of zones throughout southern New Zealand, and at a site to the north-east of Tasmania, not all of which overlapped with commercial trawl activity. Birds overlapped most convincingly with commercial trawl activity targeting squid at three general areas – an area immediately to the east and north of the Auckland Islands, a second area extending north-east from the Auckland-Snares shelf to the south-east of South Island, and a third area to the south of Banks Peninsula. Additionally, birds foraged in several areas where there was minimal or no commercial fishing activity. One geolocation tag was retrieved, preliminary data from which revealed that the bird remained within New Zealand waters throughout the non-breeding period.

Population studies were limited to banding of additional breeding adults, and marking of their nests, together with banding of potential recruits to the population within the study area, and an estimation of breeding success.

A further 13 breeding birds were tagged with light-based geolocators, with the aim of recording post-breeding movements over relatively large temporal and spatial scales.

Keywords

White-capped albatross, distribution, population, fishing activity, satellite telemetry, GPS

Introduction

In New Zealand, white-capped albatross *Thalassarche steadi* breed primarily at the Auckland Islands archipelago (Auckland, Adams and Disappointment Islands: Figure 1), with relatively small numbers breeding at Bollons Island, Antipodes group, and at the Forty-Fours, Chatham group (Robertson *et al*. 1997, Tennyson *et al*. 1998, Taylor 2000). A recent estimate of the white-capped albatross population, based on aerial photography, found 110,649 (95%CI 110,040-111,258) breeding pairs at Disappointment Island and 6,548 (6,400-6,695) at South West Cape (Baker *et al*. 2007). These totals represent considerable increases over previous estimates, although methodologies were not comparable. Despite being New Zealand's most numerous breeding albatross, very little is known of breeding biology, population characteristics and demography, and at-sea distribution of this species. Additionally, relatively large numbers of white-capped albatross have been killed and returned from observed New Zealand fisheries (e.g. Robertson *et al*. 2004). This combination of paucity of biological information and relatively high incidence of capture in commercial fisheries has resulted in white-capped albatross being classified as 'high priority' for research in the draft National Plan of Action – Seabirds Research Plan.

This report summarises work undertaken during the 2006-07 breeding season as part of the Conservation Services Programme project POP2005/02 - A population and distributional study on white-capped albatross (Auckland Islands). The objectives of the project were (1) to collect data describing the at-sea distribution of white-capped albatross, (2) to collect field data to allow estimation of white-capped albatross population size, and population parameters relevant to population viability, and (3) to analyse these data, including estimating population size, population parameters and distribution of white-capped albatross with reference to spatial and temporal fishing effort.

Fieldwork was carried out during mid March-early April 2007, corresponding with the post-guard chick-rearing stage of the breeding season, when the age of the chicks ranged from an estimated four to eight weeks. The field team comprised David Thompson (NIWA, Wellington) and Paul Sagar (NIWA, Christchurch).

Methods

Study Site and timing of fieldwork

Following an initial period of fieldwork during the 2005-06 breeding season, South West Cape, main Auckland Island, was again visited during mid March to early April, 2007. This period corresponded with chick-rearing, active nests being occupied with relatively large, unguarded chicks, which were just beginning to lose down and produce feathers. Adult birds associated with active nests were only infrequently ashore, and then for relatively short periods, to feed the chick. Due to contractual issues, fieldwork for the 2006-07 breeding season was constrained to the chick-rearing phase.

Fieldwork was focused on an area of feral pig-free sloping ground that could be accessed relatively safely with the aid of ropes and a hand-crafted rope ladder. We were confident that pigs could not gain access to this area, and there was no evidence to contradict this. It was noteworthy that by the chick-rearing phase of the breeding season, every white-capped albatross nest that we encountered, and which was clearly accessible to pigs (i.e. those nests at the base of bluffs on gently sloping ground, or otherwise those unprotected by steps, cliffs or very steeply sloping ground of at least 1 metre height), was either empty or either partly or totally destroyed. The feral pig population in the South West Cape region evidently has a considerable impact on many, if not all, accessible white-capped albatross nests. The effect on adult birds attempting to breed at these nests remains unknown.

Data Collection

At-sea distribution

Two different electronic devices were deployed during 2006-07 in order to gather at-sea distributional data for white-capped albatross. Following an initial 2-3 day assessment of likely foraging trip duration, and adult attendance at the colony, it was decided not to deploy global positioning system (GPS) tags. These are data-logging devices and require recapture of the bird, device retrieval and data downloading. The likelihood of recapturing a bird for a second time at this stage of the breeding season was determined to be not high.

A total of four KiwiSat and three Telonic platform transmitting terminals (PTTs) were deployed on actively breeding adults immediately following chick feeding. Typically a returning adult would land directly next to its nest, feed its chick and depart to sea, a process that could take a little as ten minutes. Given the nature of this species and its response to capture and handling (see Thompson & Sagar 2007), device deployment was always carried out after a bird had fed its chick when it would be naturally inclined to return to sea. PTTs were attached using water-proof Tesa tape and fixed to contour feathers along the mid-line on the dorsal surface of the bird, slightly posterior of the wings. Device attachment took less than five minutes per operation. Three of the KiwiSat PTTs were originally configured for deployment on penguins, and were programmed with a repetition rate (transmission rate) of 40 seconds and continuous operation with no duty cycle. Three of the remaining four PTTS were programmed to transmit at 90 second intervals, with continuous operation. The remaining PTT also transmitted at 90 second intervals, but was duty cycled to transmit continuously for 15 days, then switch off for 15 days, before switching back on for 15 days, off for 30 days; then 21 days on, 13 days off; before finally switching on for as long as the battery lasted. All Kiwisat PTTs were manufactured by Sirtrack Ltd. (Havelock North, New Zealand) three were ‘KiwiSat 202’, c. 34 g or c. 0.9% of body mass, and one was a 'KiwiSat 101’, c. 80 g or c. 2% of body mass. The three Telonic PTTs were ‘ST10’s, c. 70 g or c. 1.8% of body mass. The PTTs were deployed with no intention of successful retrieval, and operated until batteries failed or the tag detached from the bird. PTT data tend to be accurate to a few hundreds of

metres, at best, but more typically on the order of kilometres. All deployed PTTs successfully transmitted positional data.

A total of 13 light-based geolocators (British Antarctic Survey, Cambridge, England; 'Mk4 Micro Logger', c. 4.5 g or c. 0.1% of body mass) were also deployed, on different breeding adults to those fitted with PTTs, to augment the 18 birds carrying similar devices from the 2005-06 breeding season. For these tags, daily positions are calculated from ambient light level readings with reference to time and date – latitude from day (night) length and longitude from the time of local midday (midnight) relative to Greenwich Mean Time. Positional accuracy is much less compared to PTT devices, perhaps to within 150-200 km, but devices can log data over relatively long periods (years) and can additionally record ancillary data – proportion of time spent on the sea's surface in the case of the BAS 'Micro Logger' tags. Geolocation is the ideal approach to record relatively long-term and long-distance movements, such as migration pathways. Geolocator tags were attached to the bird's leg using a custom-designed plastic tag holder and leg strap; the attachment required no glue, tape or cable ties and was 'self-locking', each deployment taking a minute or so.

Additionally, we aimed to retrieve as many of the original 18 geolocator tags deployed during the 2005-06 breeding season as possible, download the data, and then re-deploy on a 'new' bird.

Population parameters

Given the timing of our visit it was not practicable to make a population estimate. However, in the pig-free study area we estimated breeding success (to the stage of the season close to our departure – we were unable to follow chicks through to fledging) as the number of nests that contained a live chick as a proportion of nests that showed clear evidence of being active during the 2006-07 breeding season: active nests in this sense were those that still contained a live chick plus those with broken eggshell or remains of a dead chick on or close to the nest.

All breeding birds handled were banded with uniquely numbered metal bands and their nest locations recorded and marked with metal pegs and plastic, individually-numbered tags. Additionally, non-breeding adults or failed breeders that were frequenting the pig-free slope were caught when possible and similarly banded with a uniquely numbered metal band. Band numbers of birds banded during 2005-06 were recorded.

Results

Distributional data

All nests from which adults were captured and released carrying an electronic device remained active over the course of our visit. As far as we could determine, all chicks at these nests continued to be fed, and there were no nest desertions.

The seven birds fitted with PTTs made a combined total of 55 foraging trips from South West Cape between 22 March 2007 and 24 May 2007, of which 11 were incomplete due to battery or device failure, or to duty cycling turning a device off, prior to a bird returning to South West Cape. Mean complete trip duration was 3.31 ± 2.83 days, range 0.54 to 13.97 days. There was no particular pattern in timing of trips, with departure from, and arrival at, South West Cape occurring throughout the day/night. The mean interval between successive trips by the same bird was 1.84 ± 3.23 hours, including some relatively long inter-trip periods (up to 12.33 hours) which all occurred overnight (i.e. a bird returned late in the day then remained at the colony overnight and departed the following morning). If these long inter-trip intervals are excluded, the mean interval between successive trips falls to 0.67 ± 0.63 hours.

Figure 2 shows all PTT fixes acquired for all birds, excluding improbable locations. White-capped albatross exploit a relatively wide range of locations during chick-rearing, but tracked birds tended to return to the same area over several trips. For example, two birds favoured the Auckland-Snares shelf and waters around Tasmania (Figure 3), three birds favoured the Auckland-Snares shelf and the shelf edge off the east coast of South Island (Figure 4), one bird exploited waters off the west coast of South Island and the remaining bird, despite making relatively long trips of up to almost seven days remained extremely close to the Auckland Islands (Figure 5).

A kernel density plot (Figure 6) of all PTT data highlights a relatively large, continuous area of importance for foraging white-capped albatross during chick-rearing: this area extends from immediately around the Auckland Islands out to the east of the archipelago as far as approximately 170^{o}E, and north-eastwards from north of the archipelago towards Stewart Island and the south coast of South Island. Foraging along the east coast of South Island as far north as 43^{o}S to around Banks Peninsula, to the north-west of Stewart Island, off the west coast of South Island at approximately 43^{o}S 168^{o}E, and immediately to the north-east of Tasmania at approximately 41^{o}S 149^{o}E was relatively less important (Figure 6).

In order to compare foraging zones utilised by birds during the chick-rearing stage (see Figure 6) with areas of relatively high fishing activity over the same time period, we have constructed kernel density plots based on fishing event start locations for boats operating in the same area and at the same time as we tracked birds. These plots have been constructed for all fishing activity (Figure 7), trawl activity targeting specifically squid (Figure 8), the fishery from which most white-capped albatross have been returned for autopsy (for example, Robertson *et al*. 2004), and specifically hoki (Figure 9), and a comparative plot showing all these plots combined (Figure 10).

Trawls targeting squid show two areas of particularly intense activity: an area extending to the north of the Auckland Island archipelago as far as Stewart Island and an area to the south and east of Banks Peninsula (Figure 8). For trawlers targeting hoki there are two key zones: an area extending broadly eastwards from Banks Peninsula and an area or lesser importance to the south-east of Stewart Island at c. 47.5^{o}S 169.5^{o}E (Figure 9). All fishing activity combined favoured an area extending from the Bay of Plenty northwards

to the greater Hauraki Gulf, in addition to those areas described above specifically for squid and hoki Figure 7).

One PTT, which was duty cycled, continued to transmit positional information from the beginning of June through to the middle of July, 2007. We do not know the outcome of this bird's nesting attempt, but the chick was healthy and alive at the time of our departure from South West Cape in early April 2007. In any event, after either successful fledging of the bird's chick or nesting failure prior to this, the bird clearly departed from South West Cape and migrated westwards across the southern Indian Ocean to occupy an area immediately to the south-west of South Africa at c. 34^{o}S 17^{o}E (Figure 11).

Due to many of the birds deployed with geolocation tags during the 2005-06 breeding season being absent from the South West Cape colony at the time of our visit, some gear failure issues and probably some tagged birds attending the colony at times when we were not monitoring nests (at night for example), only one geolocation tag was successfully retrieved. Data were successfully downloaded, and the tag was redeployed on a 'new' bird. Very preliminary data are presented in Figure 12. These data need further filtering and processing (by co-workers at the British Antarctic Survey), but the overall pattern of distribution is relatively clear – during the period of tag deployment on this bird (February 2006 to the end of March 2007), encompassing the end of the previous year's breeding attempt, the non-breeding period, and the first stages of the 2006-07 breeding attempt, the bird hardly moved out of New Zealand waters, in contrast to the bird tracked with a PTT above (Figure 11).

Population parameters

A total of 90 nests in the main pig-free area, and in other pig-free areas at South West Cape, have been uniquely identified. A further 28 adult birds were banded (all metal bands) in 2006-07, of which 16 were definitely breeding adults, bringing the total of breeding adults banded to 70. All birds banded during 2006-07 were done so at the 'main' pig-free slope. A total of 14 complete pairs have now been banded. No further analyses of these data have been made.

Breeding success was estimated at 53% for the pig-free slope, based on 20 live chicks at the time of our departure from 38 nests that showed signs of activity during this breeding season.

Discussion and Conclusions

The foraging data presented here for the 2006-07 chick-rearing period show some marked differences compared with similar data gathered during the guard stage in January-February 2006. Specifically, birds tended to forage much further from the colony, and trip durations were longer, during the post-guard chick-rearing stage. During the guard stage, mean trip duration was c. 1.8 days (Thompson & Sagar 2007), compared to c. 3.3 days during post-guard chick-rearing stage. Compared to the guard stage when birds

focused foraging around the Auckland Islands and at two 'hotspots' to the north of the archipelago (Figure 13), during the post-guard chick-rearing stage birds additionally tended to forage in zones off the east coast and west coasts of South Island, to the north-west of Stewart Island into Foveaux Strait and perhaps most impressively across the Tasman Sea to an area immediately north-east of Tasmania (Figure 6). Compared to the closely related shy albatross *Thalassarche cauta* breeding in Tasmania, white-capped albatross appear to travel further and for longer at comparable stages of the breeding season. In 1995/96 and 1996/97 foraging trips of shy albatross during the guard stage averaged 1.1 days (1.8 days for white-capped albatross in 2005-06), and during the post-guard chick-rearing stage 1.8 days (3.3 days for white-capped albatross in 2006-07) - all shy albatross data from Hedd *et al*. (2001). Certainly, shy albatross can be considered relatively sedentary compared to white-capped albatross, with no evidence of breeding birds undertaking trans-Tasman foraging trips, or even movements out of Tasmanian coastal waters (Hedd *et al*. 2001).

White-capped albatross appear to exploit a range of foraging zones, spread relatively widely throughout the southern New Zealand region, and as far afield as Australia (Figure 6). Importantly, not all of these zones appear to overlap with commercial trawl activity. Certainly the areas favoured by trawlers targeting squid (Figure 8) are also attractive to birds, and whilst there is some overlap between the two areas favoured by trawlers targeting hoki (Figure 9) and birds, this is less convincing. Overall, there appears to be a slightly better fit between bird and squid trawl 'hotspots', compared to other fishing activity. As noted above, there remain several areas of apparent importance to foraging birds that do not coincide with fishing activity: these are the bird areas off the west coast of South Island and the area north-east of Tasmania. White-capped albatross clearly favour a wide range of foraging zones, particularly during chick-rearing but also to a lesser extent during the guard stage, not always in association with commercial fishing boats.

During the 2006-07 breeding season, and notwithstanding the problems associated with the timing of the fieldwork and some problems with tracking gear, the at-sea distribution work proved successful. With careful capture and handling of target birds, at a time when they would naturally be leaving the colony to forage at sea, it has proved possible to gather important and revealing information about the foraging strategies of this species. Given the constraints imposed on the project relating to study site location and the associated problems with feral pigs, the demographic components of the work will necessarily be more challenging.

Nevertheless, we conclude that with care it should be possible to continue to build upon the bird banding undertaken during the two field seasons in order to estimate key population parameters, and that it should definitely be possible to expand upon the success in tracking foraging birds during the guard stage reported previously (Thompson & Sagar 2007) and during the chick-rearing stage reported here.

5. References

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6. Acknowledgements

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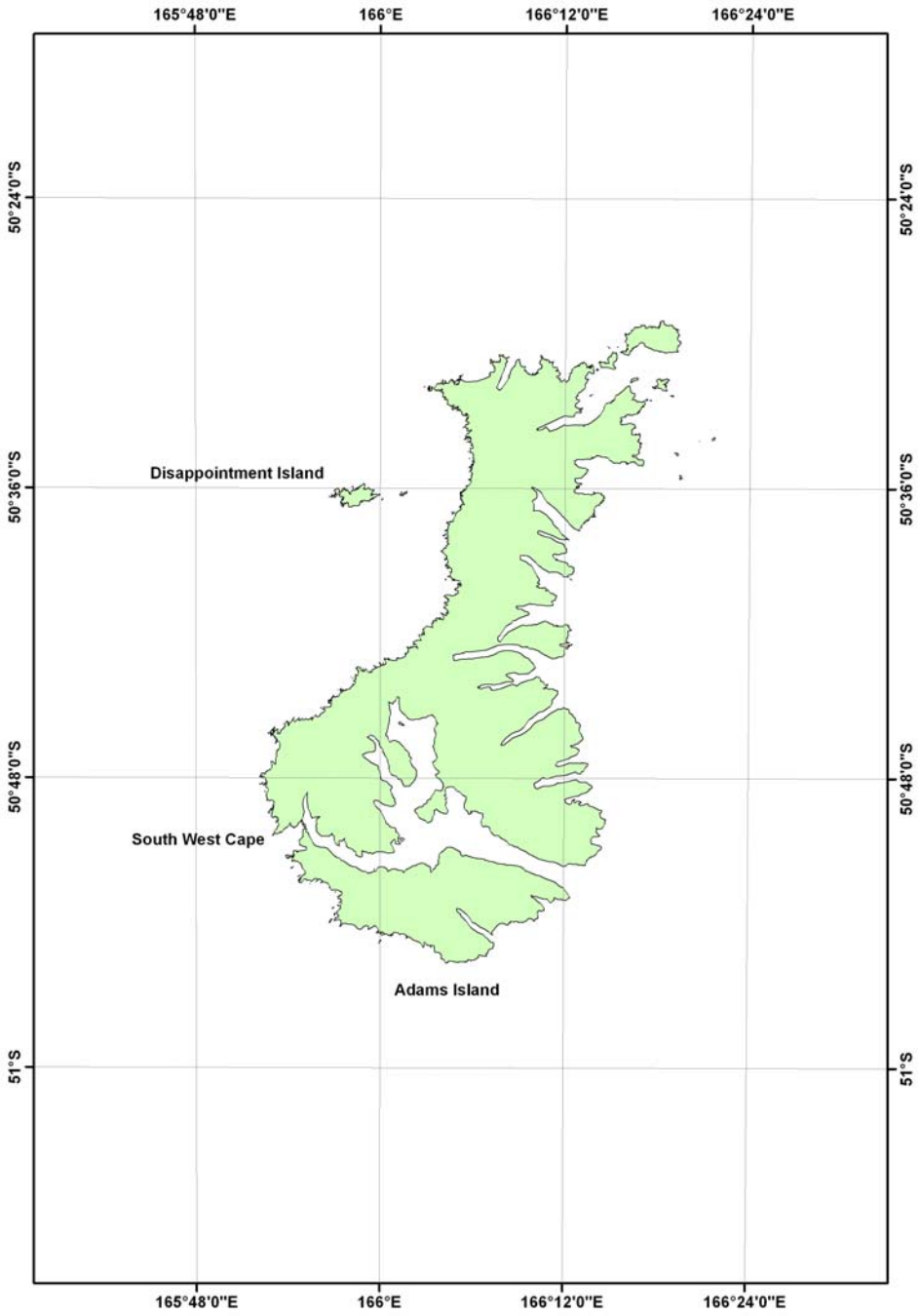

Figure 1. Map showing the locations of the three white-capped albatross breeding sites within the Auckland Islands archipelago.

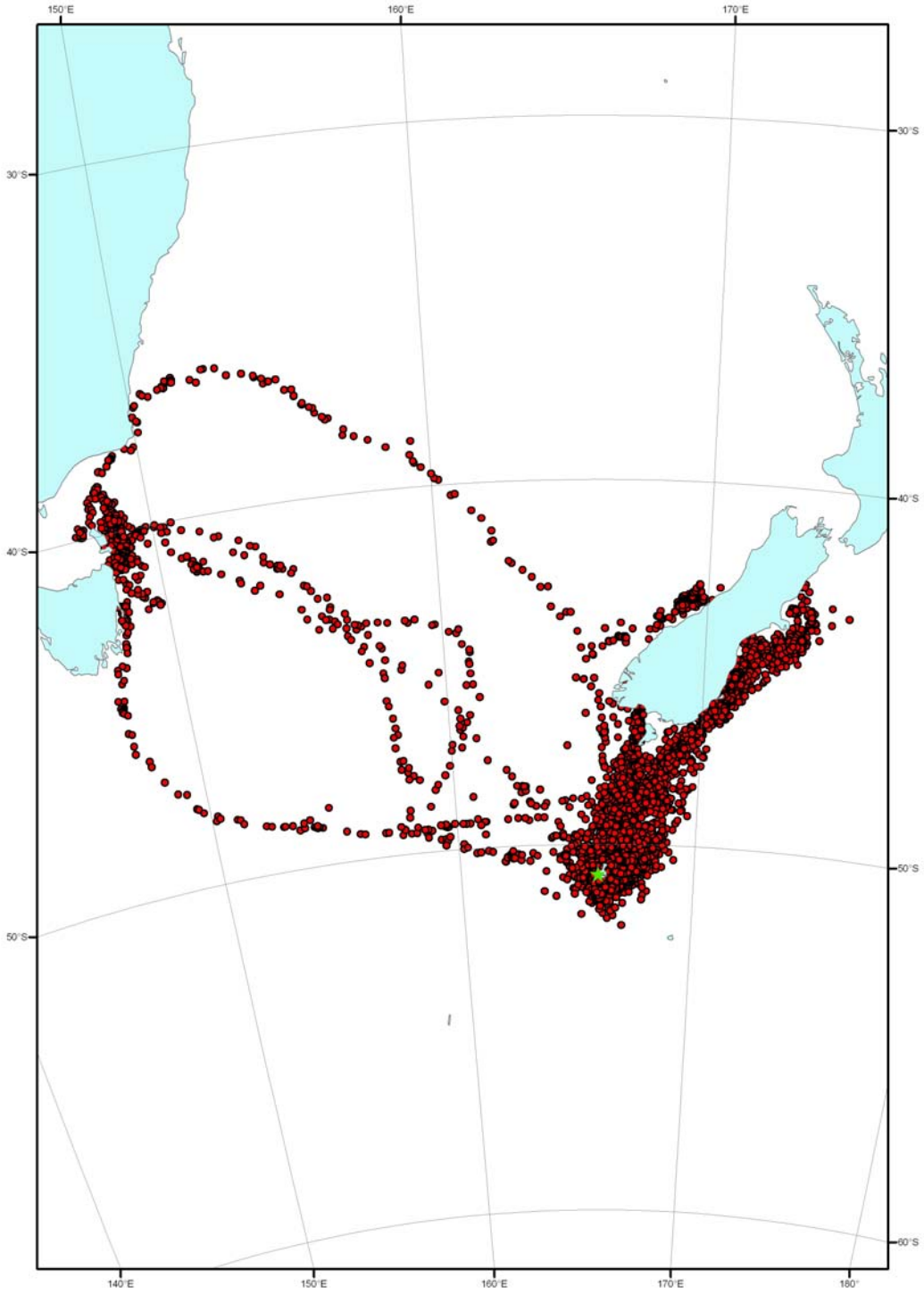

Figure 2. Map showing all PTT fixes. The green star shows the location of South West Cape.

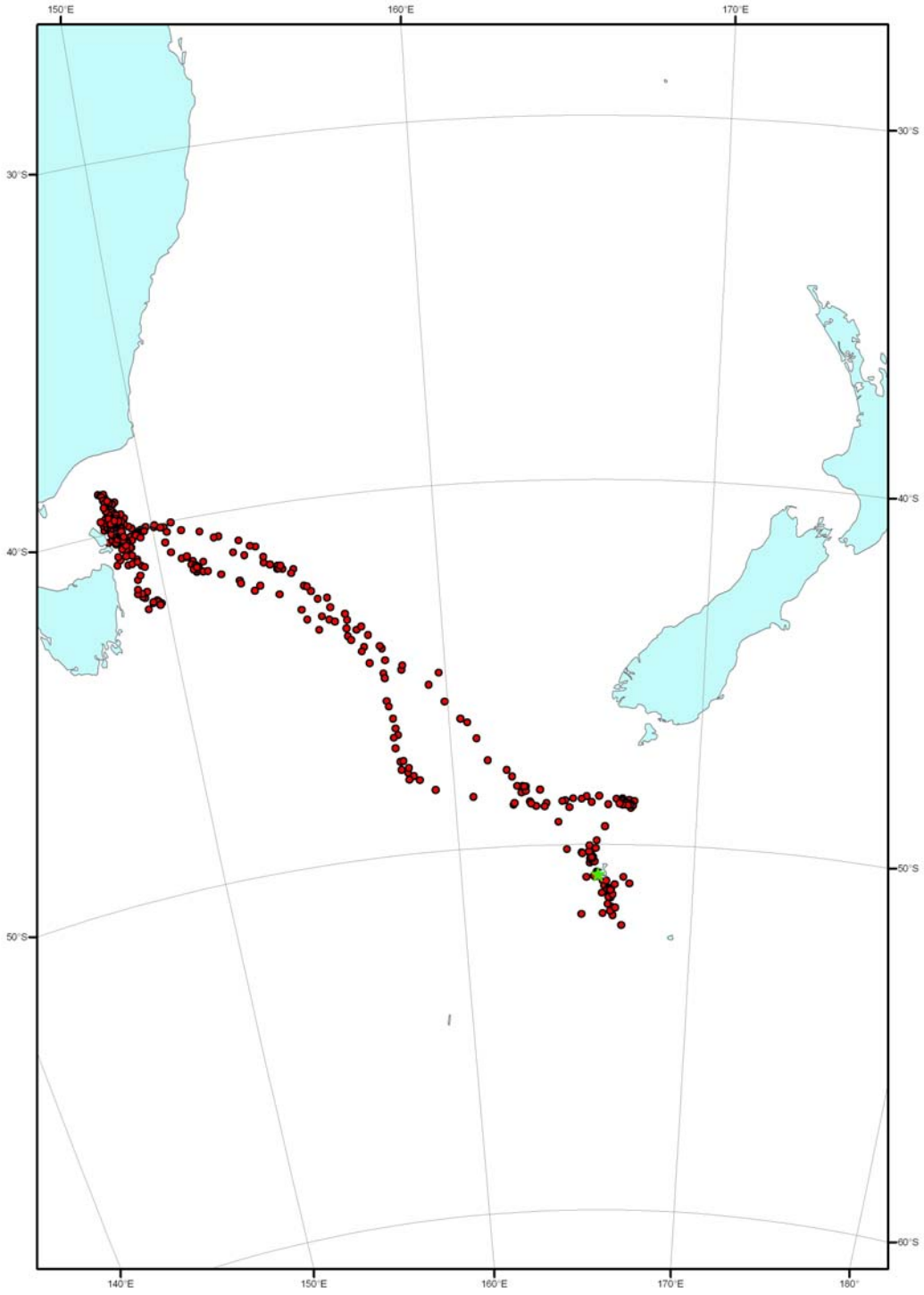

Figure 3. Map showing PTT fixes for two consecutive foraging trips made by the same bird, one to Tasmania, the second to the south-east of the Auckland Islands. The green star shows the location of South West Cape.

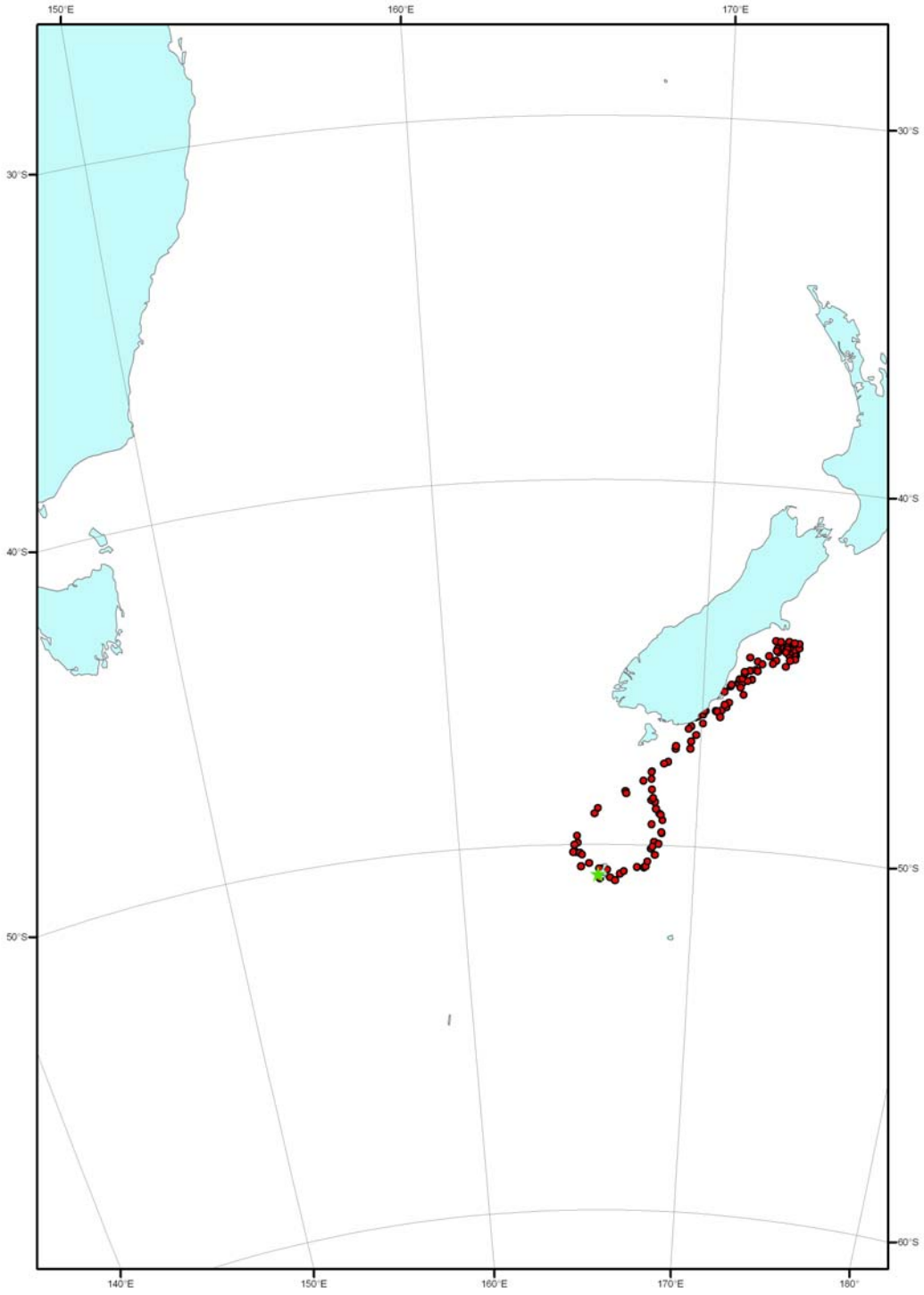

Figure 4. Map showing PTT fixes for a foraging trip towards Banks Peninsula. The green star shows the location of South West Cape.

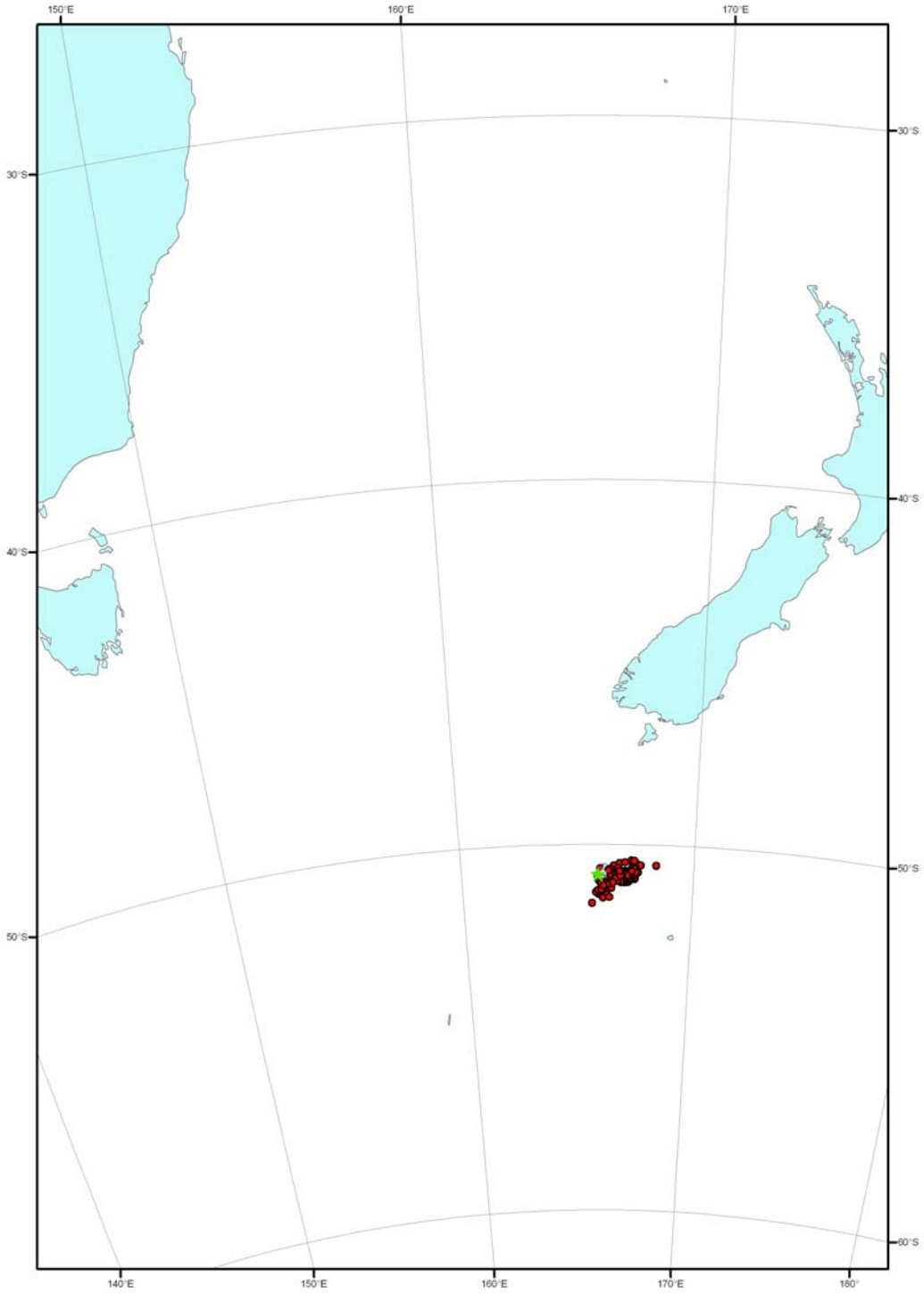

Figure 5. Map showing PTT fixes for a foraging trip relatively close to the breeding colony, typical of this particular bird. The green star shows the location of South West Cape.

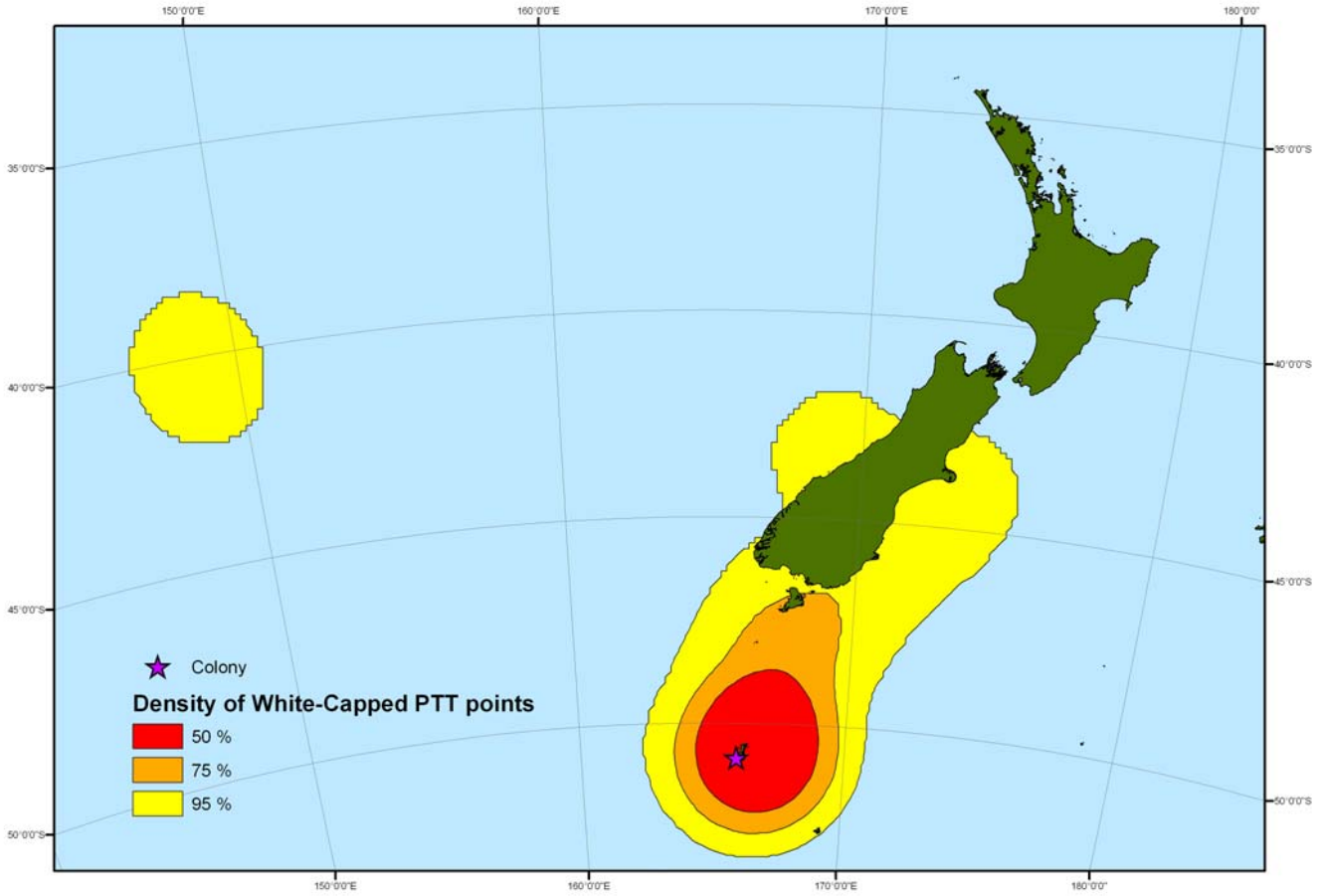

Figure 6. Kernel density plot for all PTT data from birds with active nests, March-May 2007. Density contours encompass that proportion of time spent by the study population when away from the colony at South West Cape, here marked with a purple star. The smoothing (h) parameter was 150 km and the grid size was 15 km in keeping with recommendations made by BirdLife International (2004).

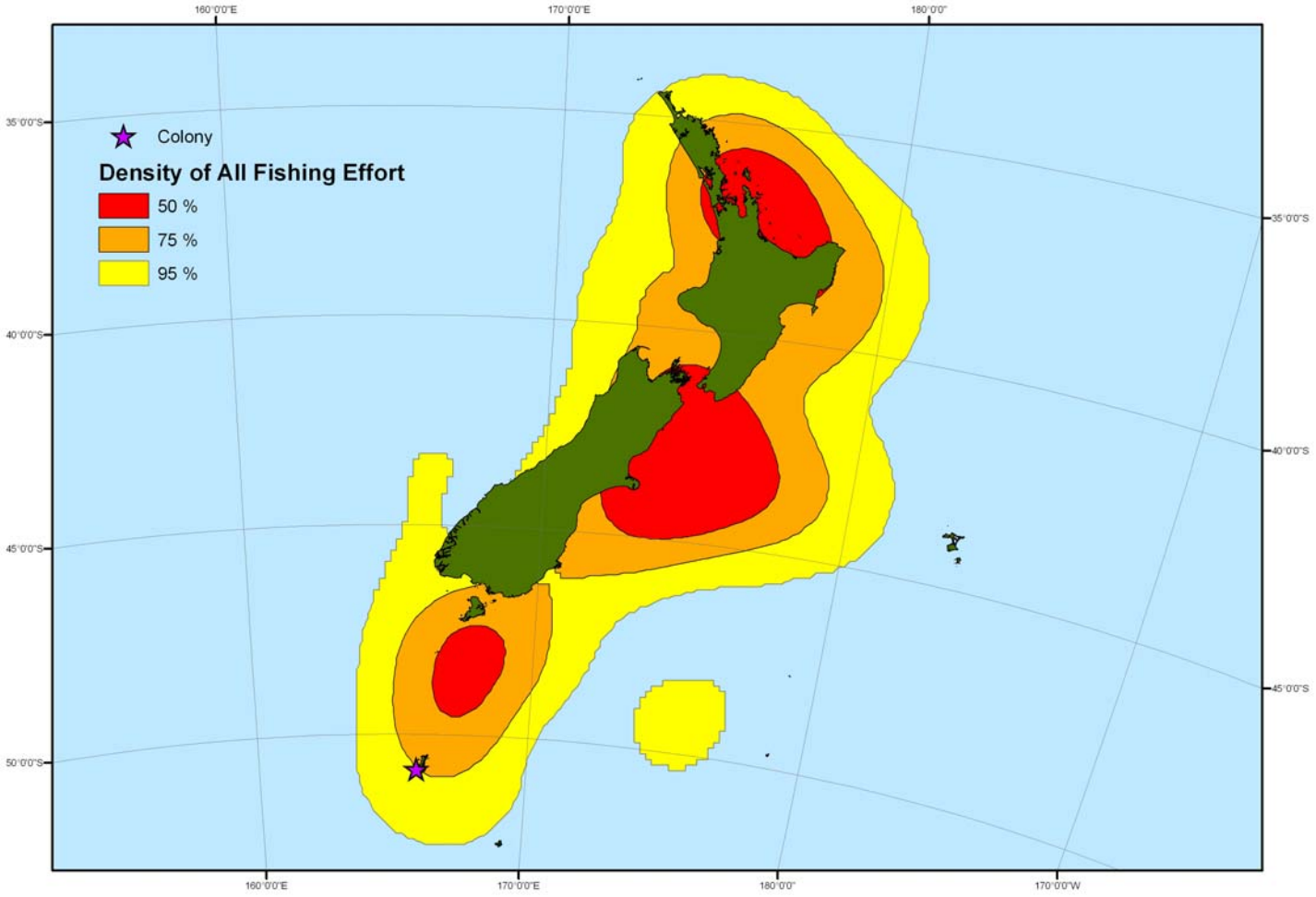

Figure 7. Kernel density plot based on start positions of all fishing events over the period 22 March-28 May 2007. Density contours encompass that proportion of all events. Other details as for Figure 6.

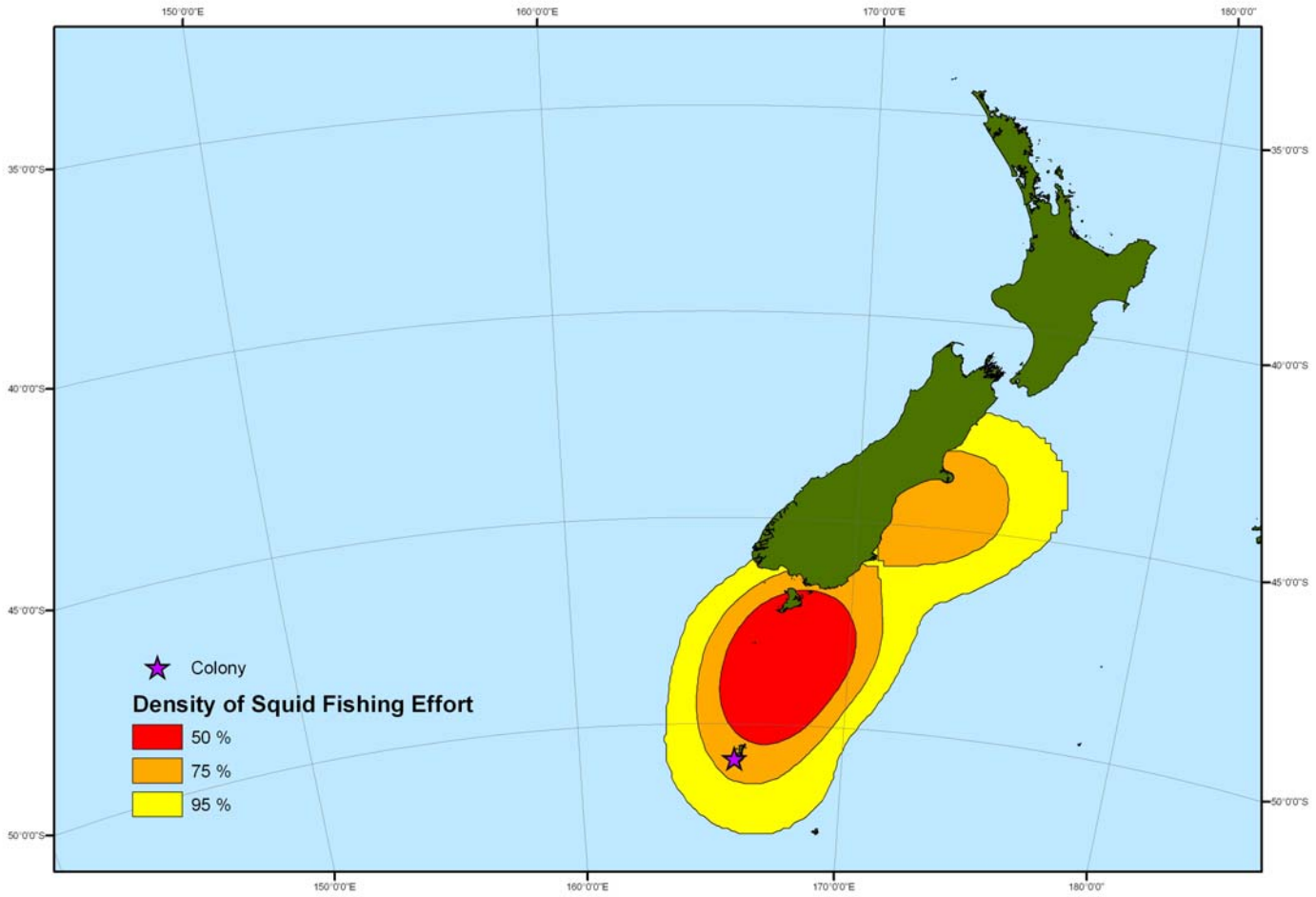

Figure 8. Kernel density plot based on start positions of trawls targeting squid over the period 22 March-28 May 2007. Density contours encompass that proportion of all trawls. Other details as for Figure 6.

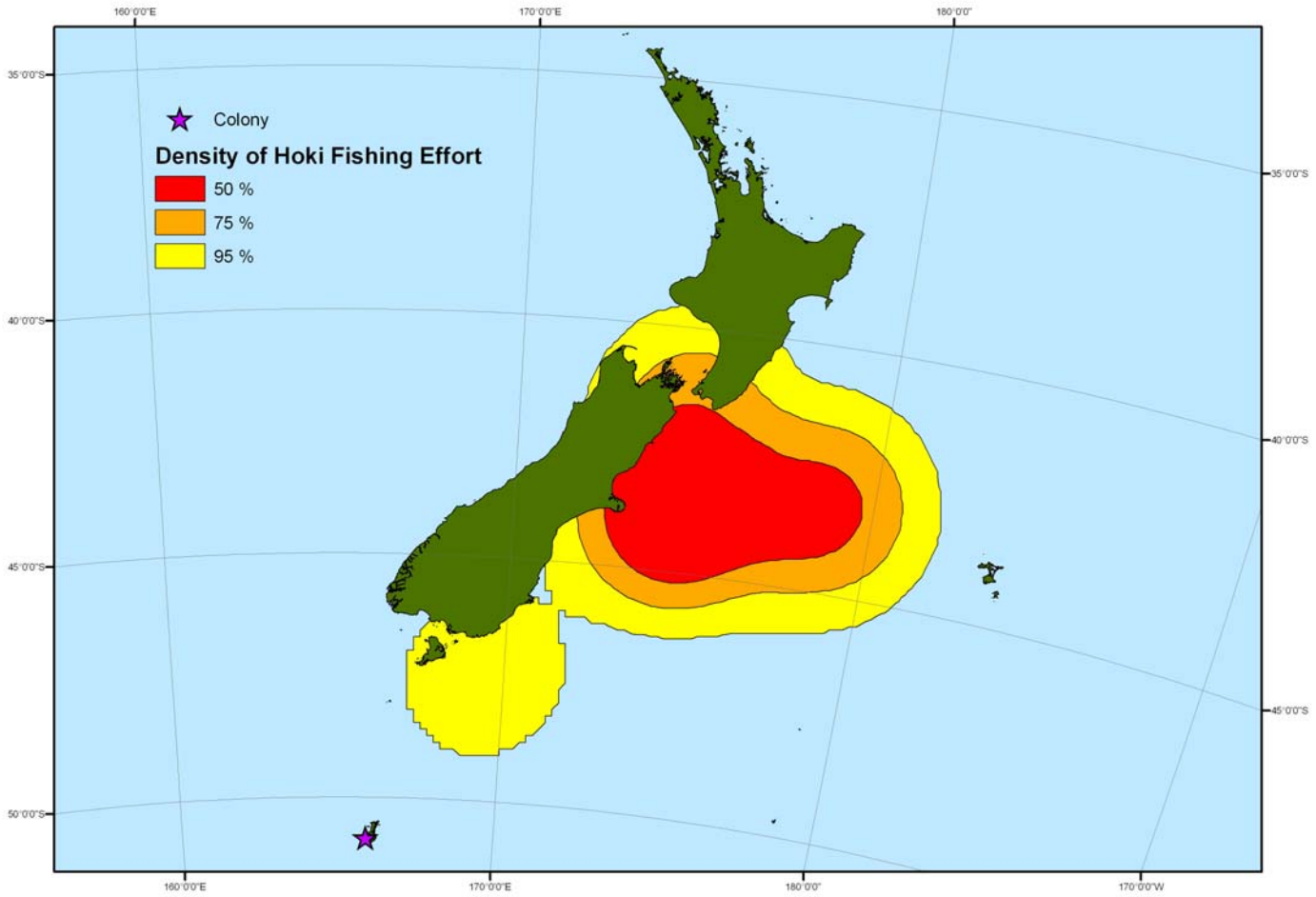

Figure 9. Kernel density plot based on start positions of trawls targeting hoki over the period 22 March-28 May 2007. Density contours encompass that proportion of all trawls. Other details as for Figure 6.

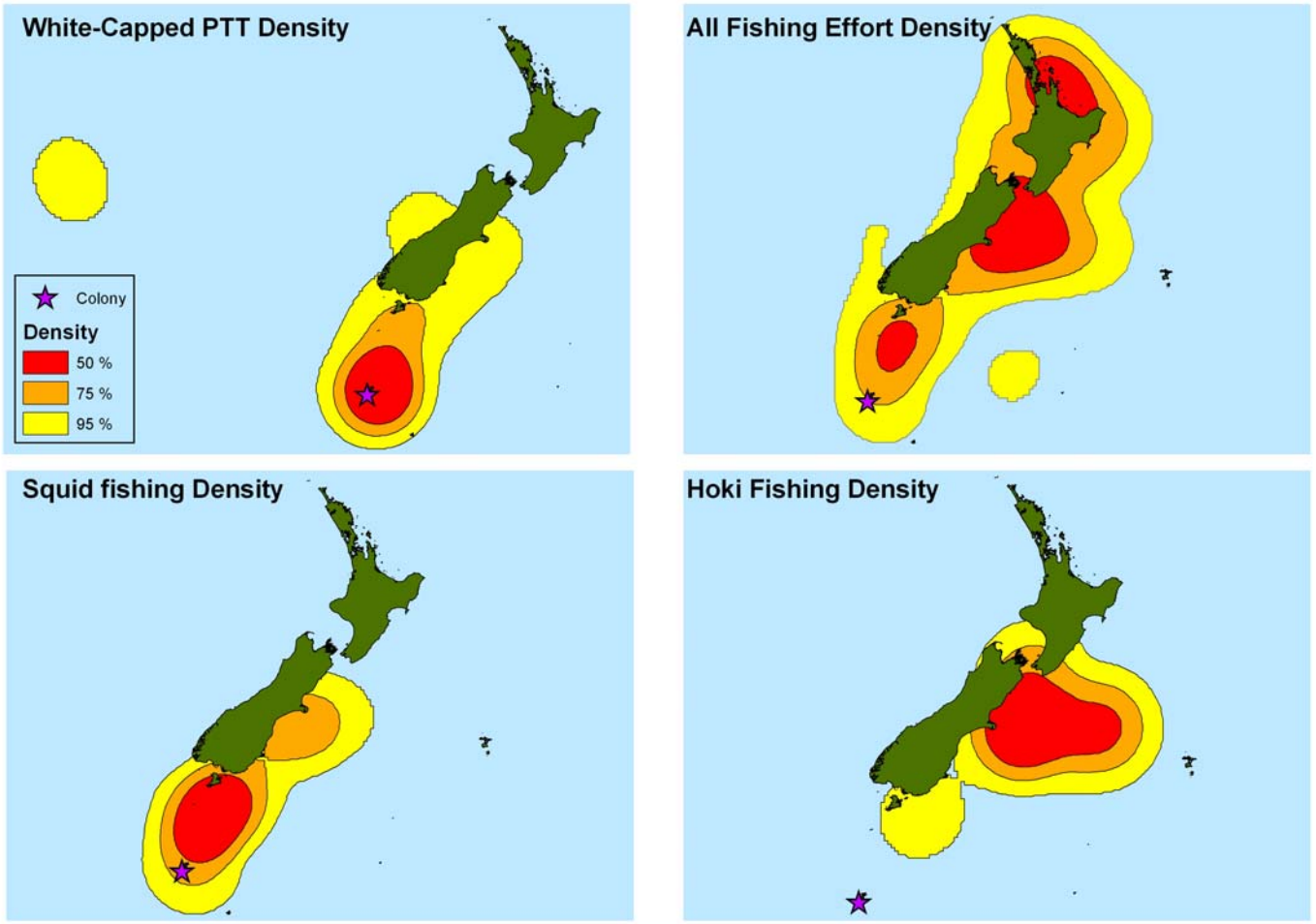

Figure 10. Kernel density plots comparing Figures 6-9 as above.

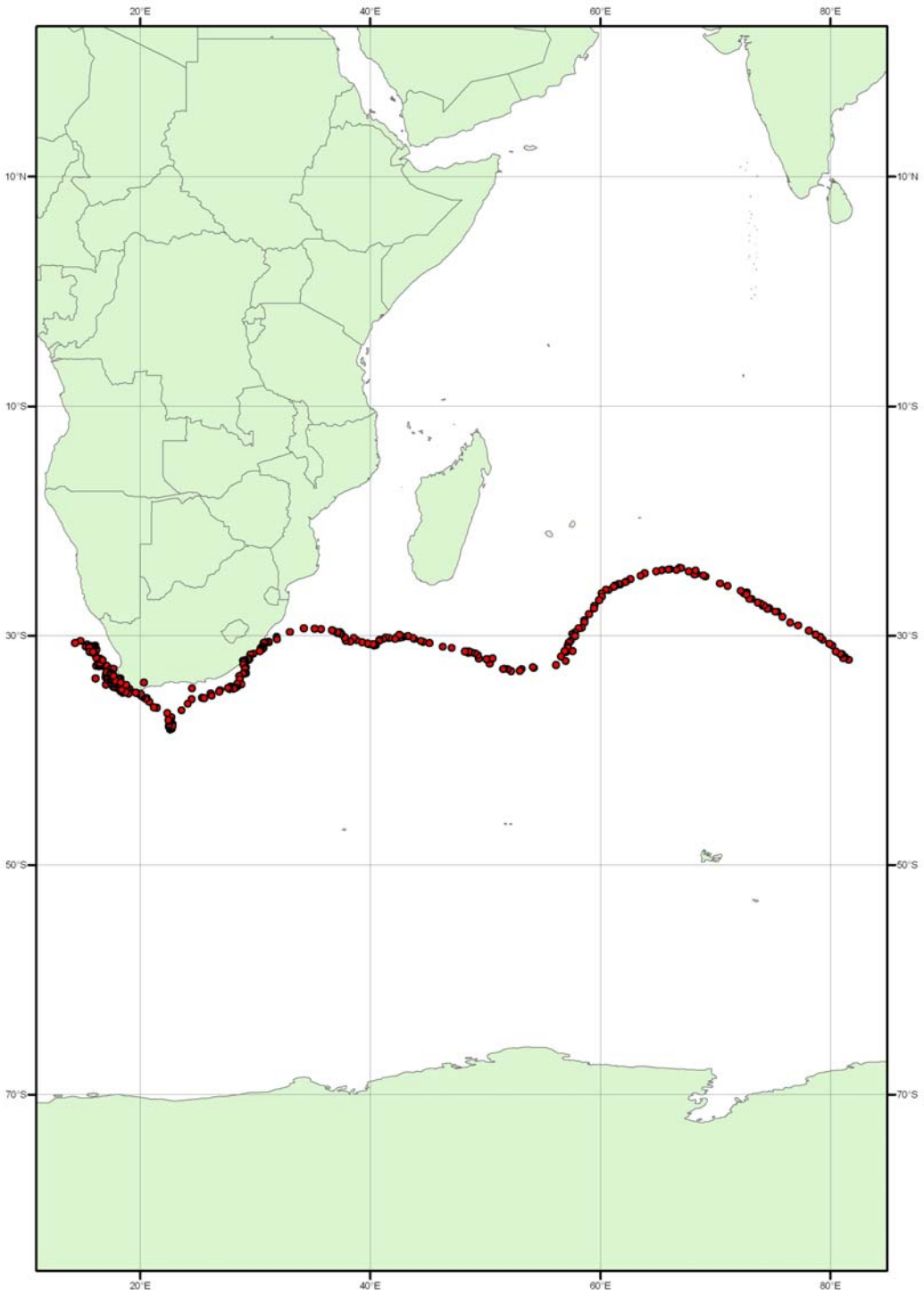

Figure 11. Map showing PTT fixes for a bird on migration between 5 June-14 July 2007.

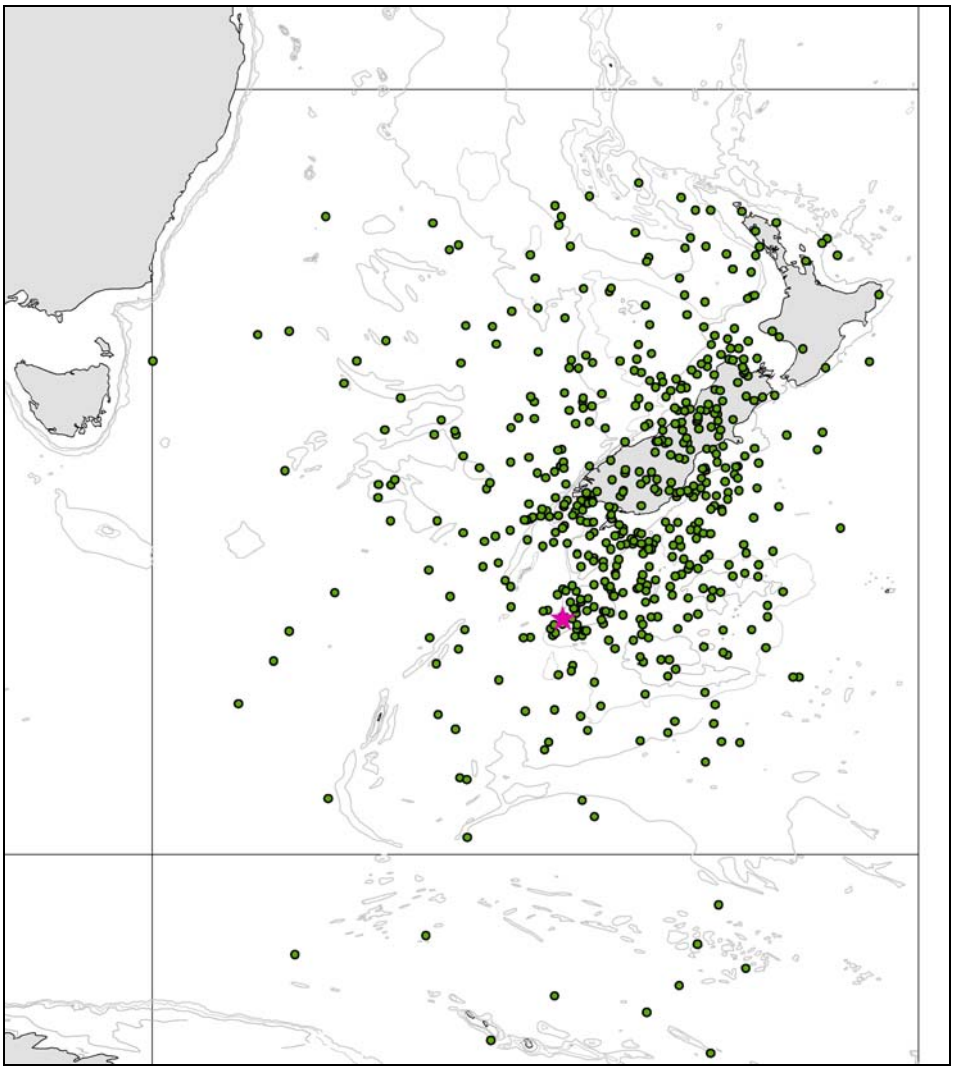

Figure 12. Map showing unfiltered and ‘raw’ geolocation fixes for a bird from February 2006 to the end of March 2007. The colony at South West Cape is shown here with a pink star.

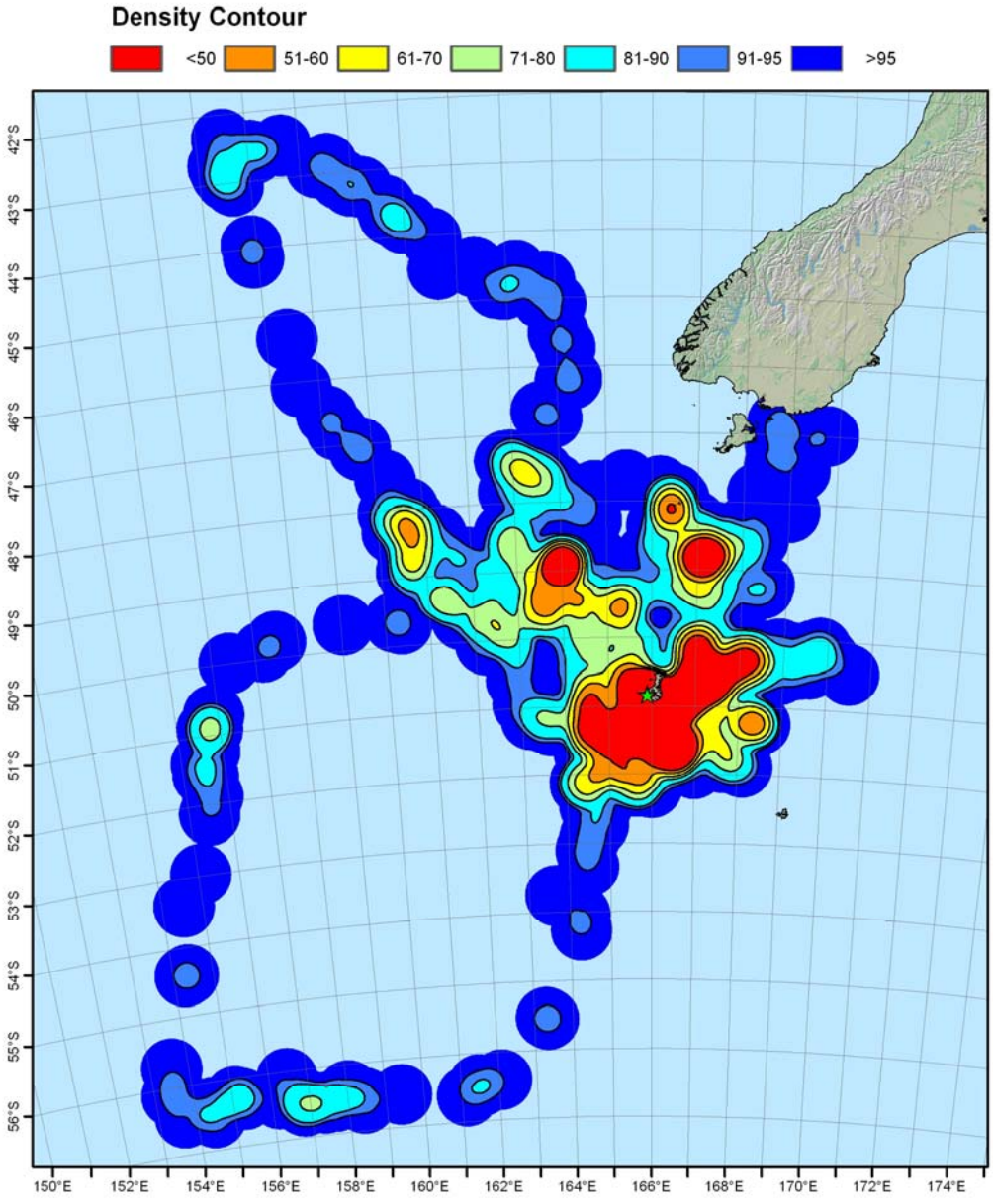

Figure 13. Kernel density plot for all PTT data from birds with active nests during the guard stage, 2005-06. Density contours encompass that proportion of time spent by the study population when away from the colony at South West Cape, here marked with a green star. The smoothing (h) parameter was 50 km and the grid size was 500 m.