Draft Annual Report

A population and distributional study of white-capped albatross (Auckland Islands)
Contract Number: POP 2005/02

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Abstract

South West Cape, main Auckland Island, and Disappointment Island were visited during November-December 2008 (incubation stage) by a three-person field team to continue studies into the at-sea distribution and demography of white-capped albatross.

GPS data-loggers provided locations from an additional seven foraging tracks undertaken by white-capped albatross from the South West Cape colony during the incubation stage of the breeding season. These data revealed that birds travelled extensively, crossing the Tasman Sea to an area off south-east Australia and utilising an area from eastern Foveaux Strait northwards to the east of South Island. A total of 15 satellite transmitters (PTTs) were deployed on incubating birds at Disappointment Island, the main breeding site for white-capped albatross. These devices were expected to transmit location information for approximately 90 days, potentially covering the incubation, guard and the early part of post-guard chick rearing phases. Overall, the at-sea distribution of birds from Disappointment Island during incubation was not markedly different from that of birds at South West Cape. During the guard stage, birds travelled less far from the colony, but then expanded their foraging range during the post-guard chick rearing stage. Overlap between birds and fishing effort was most pronounced during March and April, with an area immediately to the north of the Auckland Islands being used by both birds and fishing vessels. Additionally, white-capped albatross during February (chick guard stage) in 2009 tended not to utilise an area to the east of the islands which was heavily used during the same period in 2006. We suggest this change in distribution was not due to a colony effect, but more likely reflected an environmental difference between years, supported by a corresponding shift in fishing effort away from the eastern area in 2009.

A total of ten geolocation loggers were retrieved from birds tagged as breeders in previous seasons, bringing the total retrieved to date to 23. Preliminary assessment of the location data from all 23 tags revealed that only 3 birds (13%) travelled to southern Africa during the non-breeding period, with 20 birds (87%) remaining within Australasia year-round.

Population studies continued with banding of additional breeding adults bringing the total of banded breeding birds within the study area to 119, and a total of 65 active and marked nests. Additionally, banding of potential recruits to the population within the study area continued, and ground-truthing work was undertaken in support of another aerial survey of the entire Auckland Islands population. Observations of breeding frequency, nest-site occupancy and inter-annual variation in population estimates continue to suggest that white-capped albatross is predominantly a biennially-breeding species.

Keywords

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

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). An estimate of the Auckland Islands white-capped albatross population in December 2006, 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*. 2009). In 2007 these totals were 86,080 (85,493-86,667) and 4,786 (4,648-4,924), and in 2008 were 91,694 (91,088-92,300) and 5,264 (5,119-5,409) for Disappointment Island and South West Cape, respectively (Baker *et al*. 2009). These totals represent considerable increases over previous estimates, although earlier 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 2008-09 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 are (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 November- December 2008, corresponding with the incubation stage of the breeding season. The field team comprised David Thompson (NIWA, Wellington), Paul Sagar (NIWA, Christchurch) and Leigh Torres (NIWA, Wellington).

Methods

Study site and timing of fieldwork

Following fieldwork during the guard stage in the 2005-06 breeding season, during the post-guard chick rearing stage in the 2006-07 breeding season and during the incubation stage in the 2007-08 breeding season, South West Cape, main Auckland Island, was again visited during November-December, 2008. This period corresponded with incubation, active nests being occupied by a single member of each breeding pair and a single egg. Additionally, and for a single day's visit, we were able to gain access to

Disappointment Island in order to deploy satellite transmitting tags (see below) and to collect nest occupancy data to aid in the interpretation of aerial photographs of nesting birds.

At South West Cape, fieldwork again 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 the contrary. At Disappointment Island we were able to work among nesting white-capped albatross above the north western side of Castaways Bay. This island is free of introduced mammalian pests.

A second visit to the South West Cape study area took place in early February 2009, primarily to retrieve tracking gear. Nesting activity was also recorded, but these data have not been used to estimate breeding success as many birds were still incubating or guarding small chicks – i.e. it was too early in the breeding season to determine whether a nesting attempt would have been successful or not.

Data Collection

At-sea distribution

Two different electronic devices were deployed during 2008-09 to gather at-sea distributional data for white-capped albatross.

A total of 16 Earth & Ocean Technologies (Kiel, Germany) GPS data loggers were deployed on actively incubating adults. Given the nature of this species and its response to capture and handling (see Thompson & Sagar 2007), device deployment was potentially problematic. However, we were able to deploy all GPS devices successfully although one bird subsequently deserted its nest and was not seen again during our visit. All remaining birds carrying a GPS logger continued to incubate. GPS loggers 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 (Phillips *et al*. 2003). Device attachment took less than five minutes per operation. Each GPS logger was programmed to record a fix every six minutes, a sampling frequency that would result in a 'logger lifespan' of approximately three weeks before the battery expired. Tag retrieval was necessary in order to download data as the GPS loggers were non-transmitting.

At Disappointment Island we successfully deployed 15 Sirtrack (Havelock North) KiwiSat 202 platform transmitting terminals (PTTs) which were programmed to operate continuously (no duty cycle) with a repetition rate of 90 seconds, and an operational lifespan, estimated by Sirtrack, of approximately 90 days. As for the GPS loggers described above, the 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 (Phillips *et al*. 2003). Device attachment took less than five minutes per operation. Given favourable attachment conditions and reliable device operation, we

estimated that these would provide location and tracking data from deployment during the incubation stage through to post-guard chick rearing.

No additional light-based geolocation loggers were deployed in 2008-09, but we aimed to retrieve as many of the geolocator loggers deployed during the 2005-06, 2006-07 and 2007-08 breeding seasons, and still at large, as possible.

Population parameters

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 previous visits to the colony were recorded. All breeding attempts (presence of an egg in a marked nest) were recorded.

Ground-truthing counts of breeding birds and 'loafers' (i.e. those birds within counting blocks that were not associated with active nests) were undertaken to assist with aerial photographic surveys of the Auckland Island white-capped albatross population (see Baker *et al*. 2009). On 11 December 2008, three observers made counts at hourly intervals between 12:00 and 17:00 local time of birds within three, clearly defined counting blocks. Within each block and at each count, birds were recorded as either 'sitting' (a single bird sitting down on its nest), 'standing' (a single bird standing on its nest - we did not identify whether such birds had an egg or not as we could not see into the nest cup for all nests), 'pair' (an obvious pair at a nest, one bird sitting on the nest, the partner immediately next to the nest) or 'loafer' (a bird within the count area, not obviously associated with a nest and not on a nest). Additionally, on 9 December 2008 at Disappointment Island we made counts of the proportion of nests which had a sitting (apparently incubating) adult bird with and without eggs. All of these data have been made available to the aerial survey team (Barry Baker and co-workers) and will not be discussed further here.

Results

Distributional data

GPS loggers

Of the 16 GPS tags deployed, one was lost due to the bird deserting its nest (see above), and a further five loggers were removed before incubating birds left the colony, having remained on the nest for 11 days. One additional logger was missing from the bird at recapture following a foraging trip and two devices malfunctioned and yielded no usable location data. The remaining loggers produced viable data that indicated birds travelled relatively large distances away from the Auckland Islands during the incubation stage of the breeding season (Figure 2), as was previously noted for the 2007-08 breeding season,

including areas to the south-east of Australia, to the east of Stewart Island and along the east coast of South Island.

Satellite transmitters

All 15 PTTs were successfully deployed on incubating birds at Disappointment Island, and there were no nest desertions. Overall, these tags provided location and tracking information for between 0 and 23 foraging trips per bird that extended into April 2009. We cannot rule out the possibility that some devices were removed by the birds, but it also appears likely that some devices malfunctioned relatively soon after deployment, with some failing well before the expected 90-day operating lifespan. Nevertheless, the location and tracking information supplied enabled a picture of at-sea distribution, presented here in the form of kernel density plots, to be determined across several months (Figures 3a, 3b and 3c). At a broad scale, these data revealed that birds breeding at Disappointment Island utilised marine resources over a wide area. During December and January (corresponding to the incubation stage of the breeding season) birds visited areas to the south-east of Australia and between the Auckland Islands and northwards to the south and east of South Island (Figure 3a). This distribution of birds from Disappointment Island is not dissimilar to that of birds tracked using GPS tags at South West Cape (Figures 2 and 4, see below). The at-sea distribution of Disappointment Island birds contracted during February (guard stage) and March (early post-guard chick rearing) to areas immediately to the north of the Auckland Islands extending to the east of Stewart Island (Figure 3b). During April (chick-rearing), the few PTTs/birds that continued to transmit location data revealed that areas to the south-east of Australia were again visited, but that the zone between the Auckland Islands and southern South Island were also popular (Figure 3c).

The kernel plots of PTT data from birds at Disappointment Island have been compared to similar kernel plots of fishing event start locations over corresponding temporal windows (Figures 3a, 3b and 3c). Generally, overlap with fishing effort was more notable during March and April in particular, with a key area immediately to the north of the Auckland Islands (Figures 3b and 3c). During February there was some overlap to the north of the archipelago (Figure 3b), but overlap was less distinct during December and January (Figure 3a).

At these similar, broad scales, there was little difference in the at-sea distribution of birds tracked from Disappointment Island and from South West Cape during December (Figure 4). Both groups of birds traversed the Tasman Sea to areas south-east of Australia, and areas to the south and east of South island were also favoured (Figure 4).

Geolocation loggers

A total of 10 additional geolocation loggers were successfully retrieved during 2008-09, bringing the total number of geolocation data sets to 23. Detailed filtering and processing of these data have yet to be undertaken (partly because a final analysis of these data will depend upon loggers retrieved during the final field campaign of this project scheduled for 2009-10). A preliminary plot of all locations derived from retrieved geolocation loggers is presented in Figure 5. It is clear that overall, white-capped albatross favour

New Zealand waters, particularly an area between the Auckland Islands and the south of South Island. A second area to the south-east of Australia also featured in this analysis, but despite an area off the coasts of South Africa and Namibia being used, this area was not as heavily utilised as those noted above (Figure 5). Of the 23 birds from which geolocation data have been retrieved, only three (13%) crossed the Indian Ocean to southern Africa.

Population parameters

The number of viable and active nests within the 'slope' area remains at 65, with only ten individuals breeding in the study area lacking a unique metal band.

The number of pairs with chicks in 2006-07 that returned to lay an egg in 2007-08 has been revised, based on photographs taken later during the breeding season: seven of 19 pairs (37%) attempted to breed in each of these two 'years', compared to 14 of 27 pairs (52%) with chicks in 2007-08 that attempted to breed again in 2008-09. It should be noted that these values represent upper estimates of the proportion of pairs breeding in each of two successive years as we have no definitive measure of whether a breeding attempt was actually successful – i.e. that an egg resulted in a fledged chick. In 2008-09 approximately 38% of viable nests in the 'slope' area were unused.

No further analyses of the banding data have been made, but on completion of data collection during the 2009-10 breeding season it is planned to submit these data to NIWA's SEABIRD model in order to estimate key life history parameters.

Discussion and Conclusions

The GPS tracking data acquired from breeding white-capped albatross at South West Cape during the 2008-09 breeding season augments the modest amount of data collected at the same period during 2007-08. These data reveal that birds undertake extensive foraging trips, as far afield as south-east Australia (Figure 2) for periods in excess of two weeks. Converting these data to a kernel density plot (Figure 4) revealed that birds from South West Cape and Disappointment Island travelled to largely similar destinations at this stage of the breeding season. In addition to an area to the south-east of Australia, birds from both colonies also frequented an area immediately to the east of Stewart Island and an extended area to the east of South Island (Figure 4). That birds from both colonies visited the same areas during the same stage of the breeding season is perhaps not surprising given that South West Cape and Disappointment Island are relatively close to each other.

During the incubation stage of the breeding season, there appeared to be limited overlap in space and time between foraging white-capped albatross and commercial fishing operations (Figure 3a). There was some overlap between birds and boats around New Zealand in December, particularly through Foveaux Strait and to the north of Otago Peninsula, but this overlap did not extend into January: indeed, there appeared to be no overlap between birds and a relatively important fishing area to the north east of the

Auckland Islands, even though this area would have been well within the foraging range of birds (Figure 3a). During February (corresponding to the guard stage), the birds' main foraging zones contracted to an area extending from the Auckland Islands in a north-westerly direction as far as the far south-west of South Island (Figure 3b). There appeared to be relatively little overlap with fishing boats at this time, with the main area of fishing activity (approximately half way between the Auckland Islands and Stewart Island) largely unused by birds (Figure 3b). Perhaps of most interest during February was the difference in bird distribution between 2009 and 2006, the first year of the project. In 2006, both bird and boat distributions were centred on an area to the east of the Auckland Islands – this area was important for both birds and fishing vessels and there was extensive overlap (Thompson & Sagar 2007). By contrast, in 2009 the same area was largely, but not completely, not used by both birds and fishing vessels (Figure 3b). Although the 2006 bird data were derived from the South West Cape colony and the 2009 bird data from the Disappointment Island colony, it seems likely that the differences in bird distribution between these two years reflects differences in the environment, likely resulting in a difference in fishing vessel distribution, rather than a real difference in bird behaviour between the two colonies. During March and April (Figures 3b & 3c) there was an area of marked overlap between birds and fishing boats, immediately to the north of the Auckland Islands, but birds also utilised areas in eastern Foveaux Strait (both months) and south-east Australia around Tasmania (April), the former area was not particularly important for fishing boats (Figures 3b & 3c).

Since the 2007-08 breeding season, an additional 11 geolocation loggers have been recovered: one was found on a dead bird washed ashore on a beach near Perth, Western Australia, and 10 were recovered during the 2008 field campaign. Of the latter, two were recovered from birds not seen at the South West Cape colony following their banding and deployment in the 2005-06 breeding season, but which were actively breeding in 2008-09. The location data acquired from the most recent loggers have been combined with data acquired from earlier logger retrievals to produce the preliminary plot of location distributions (Figure 5). Timing of raw data delivery from the British Antarctic Survey precluded a more detailed analysis of these data, and in any event this plot will be modified depending on data acquired from loggers still at large and due for retrieval during the 20009-10 breeding season. However, it is clear from Figure 5 that overall, white-capped albatross make extensive use of waters around New Zealand, particularly an area between the Auckland Islands and South Island, and cross the Tasman Sea to utilise an area off south-east Australia bordering Tasmania. That waters off southern Africa do not appear to be used in the main plot of Figure 5 emphasises the importance of Australasia for this species. To date, a relatively small proportion of tagged birds migrated westwards across the Indian Ocean to spend the non-breeding period off South Africa and Namibia (3 of 23 birds). As noted in an earlier report (Thompson & Sagar 2008) southern Africa appears to be an area of particular risk to white-capped albatross, with perhaps in excess of 6,000 birds killed annually in this region (Baker *et al*. 2007, Watkins *et al*. 2008). The apparent dichotomy in non-breeding period destination, with perhaps less than 20% of white-capped albatross migrating to southern Africa and the Benguela marine system, has clear implications for estimating the risk to this species from commercial fishing operations. It may well be that the relatively high levels of

fisheries mortality estimated by Baker *et al*. (2007) and Watkins *et al*. (2008) impact a relatively small component of the white-capped albatross population.

We have revised our earlier estimate of the proportion of apparently successful breeders in 2006-07 that returned and attempted to breed in 2007-08 to 37%, based on an analysis of photographs taken later in the 2007-08 breeding season which revealed that several pairs laid eggs relatively late in the season. The proportion of apparently successful birds in 2007-08 which returned to breed in 2008-09 was estimated at 52%. It should be noted that these values are upper estimates as it is entirely possible that pairs could lose their chick before fledging, but after we had noted the chick's presence, thus 'transforming' a successful pair into an unsuccessful pair and increasing the likelihood of breeding in successive seasons. Nevertheless, that at least half of apparently successful breeders from one year did not breed in the following year is atypical for an annually-breeding species. Furthermore, we again noted a relatively large proportion of usable nests (38%) on the South West Cape study slope were empty in 2008-09, although some of these were attended by birds that were actively breeding the previous year. Again, such a relatively high proportion of unused, but usable, nests is atypical of an annually-breeding albatross. Combining these observations with population counts over the most recent three breeding seasons (Baker *et al*. 2009), which have shown relatively large inter-annual fluctuations for both Disappointment Island and South West Cape, we suggest that this species is predominantly a biennial breeder.

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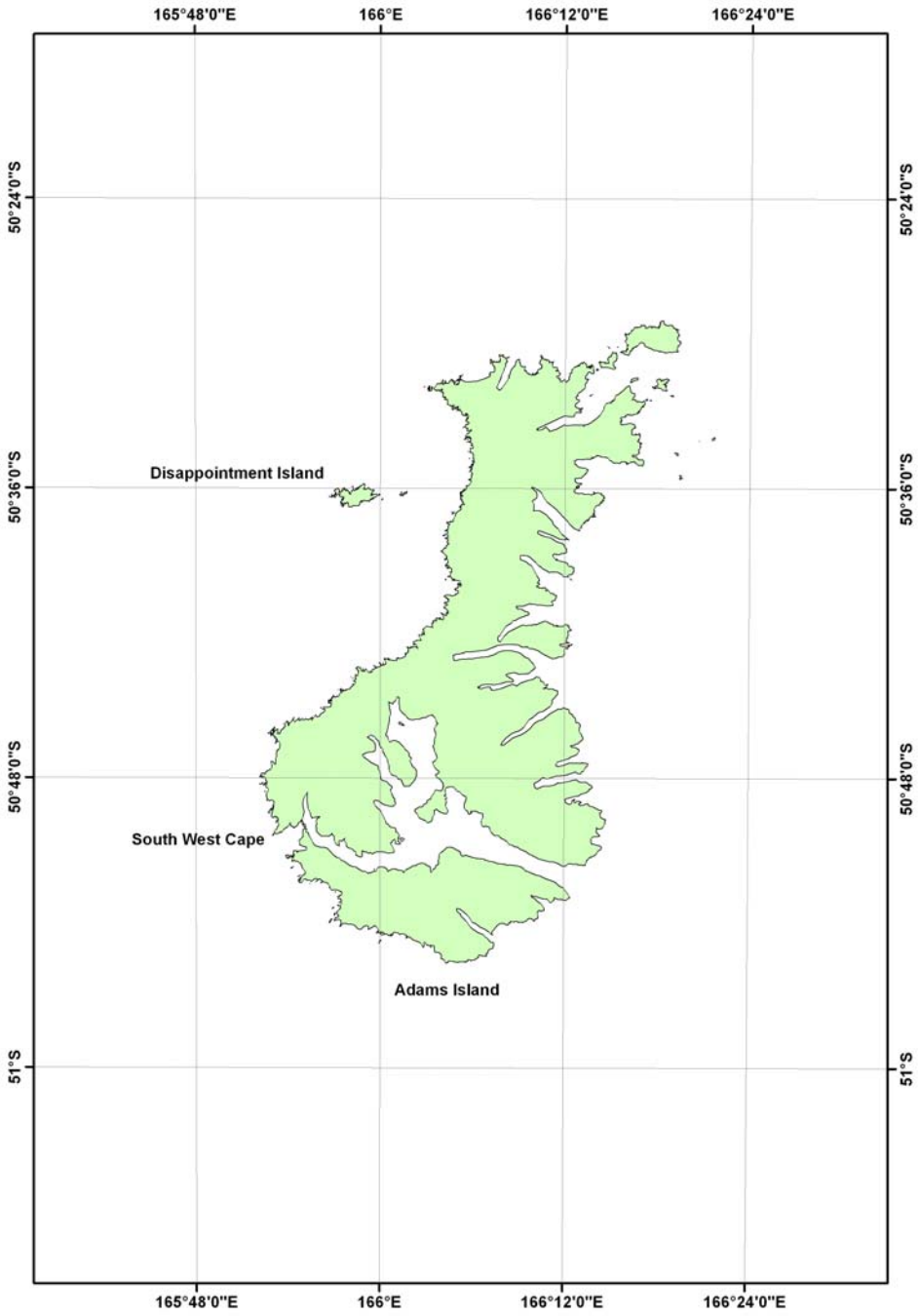

Figure 1. Map showing the locations of the three white-capped albatross breeding sites within the Auckland Islands archipelago.

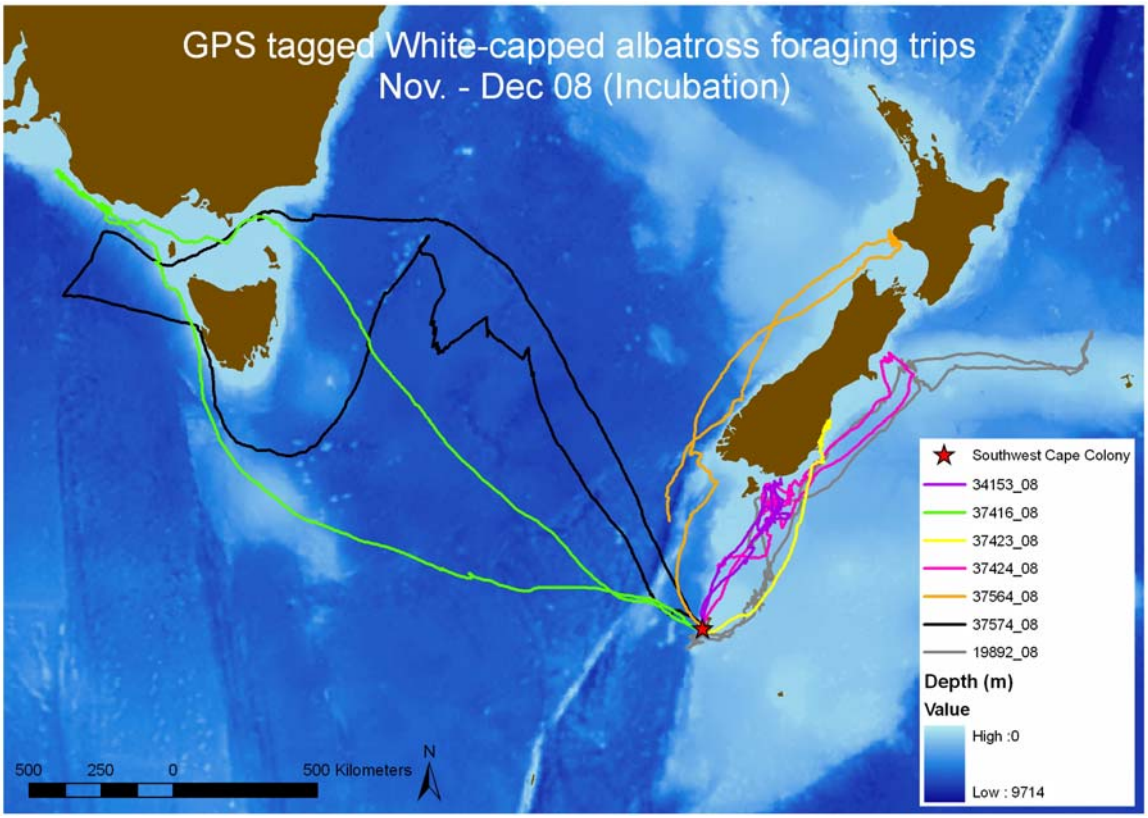

Figure 2. Plot of tracks derived from GPS tags attached to seven white-capped albatross at South West Cape, main Auckland Island.

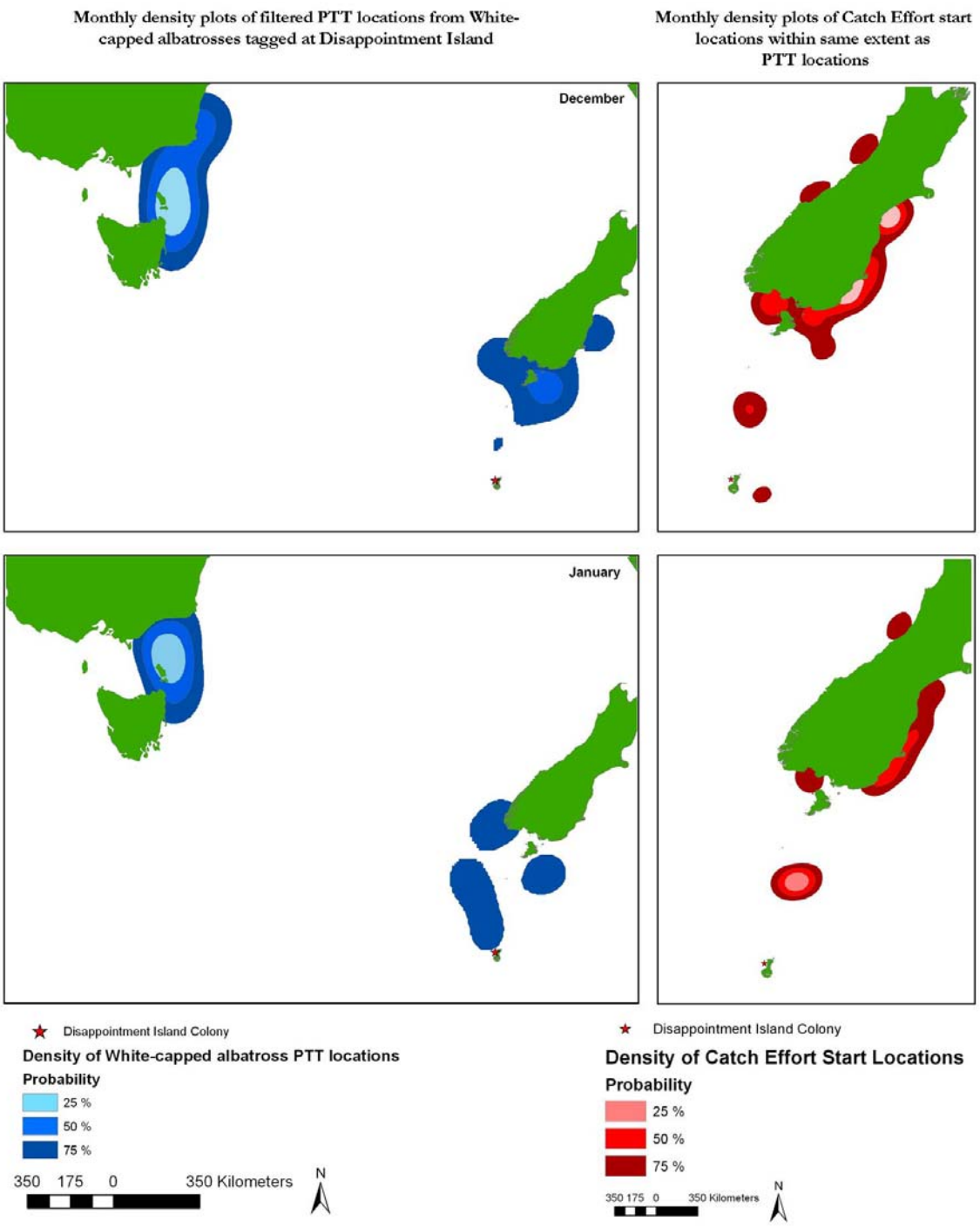

Figure 3a. Kernel density plots for PTT data derived from white-capped albatross at Disappointment Island (blue) and start locations of fishing events (red), for December 2008 and January 2009.

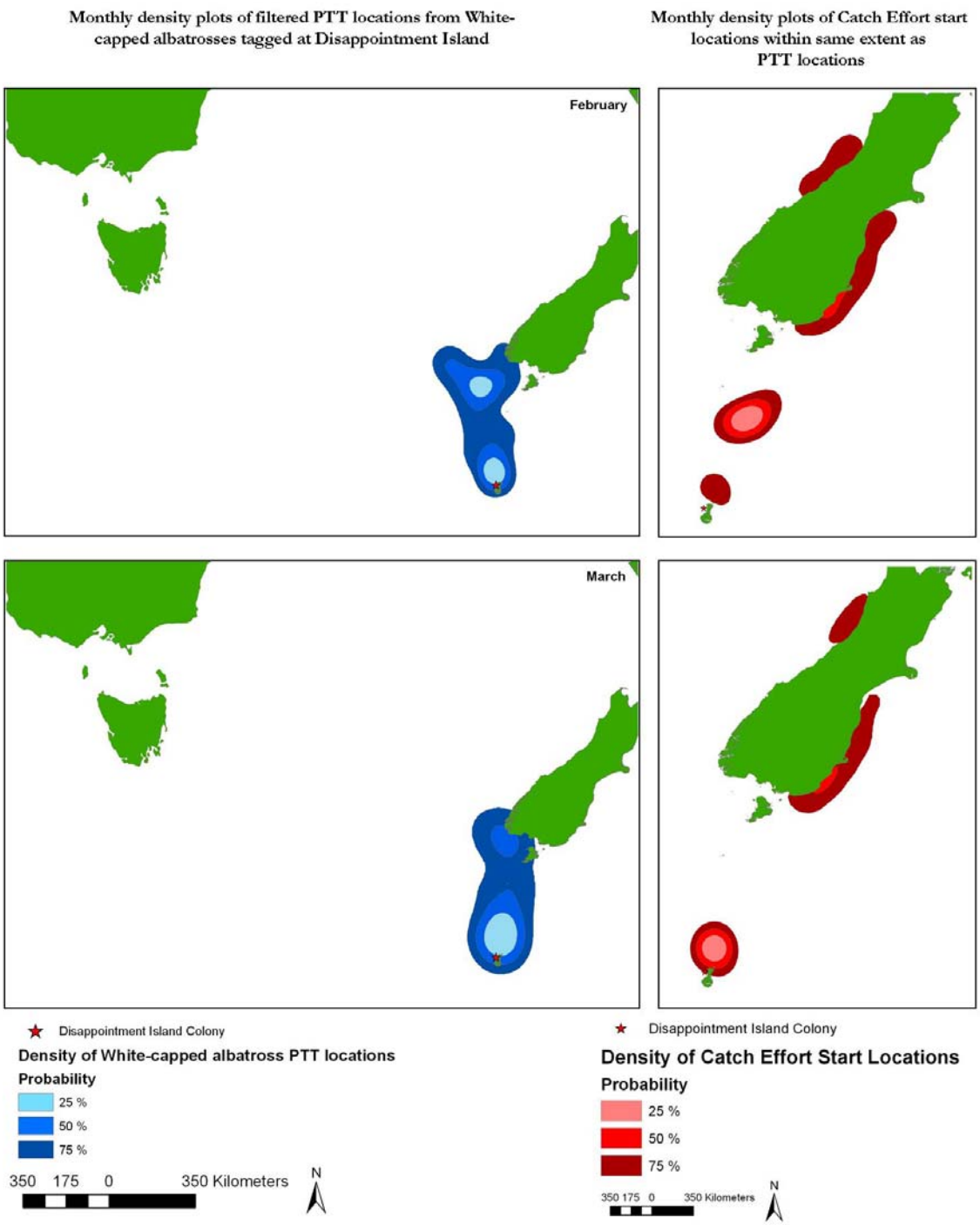

Figure 3b. Kernel density plots for PTT data derived from white-capped albatross at Disappointment Island (blue) and start locations of fishing events (red), for February 2009 and March 2009.

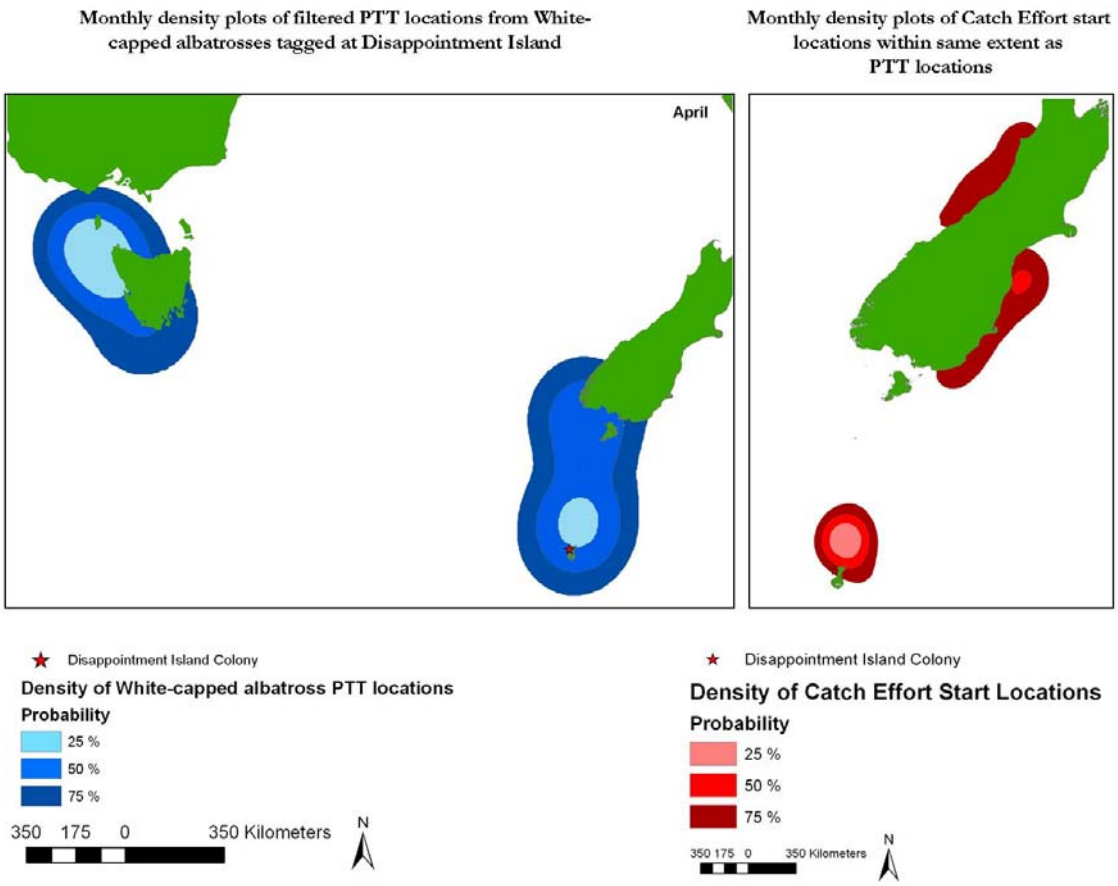

Figure 3c. Kernel density plots for PTT data derived from white-capped albatross at Disappointment Island (blue) and start locations of fishing events (red), for April 2009.

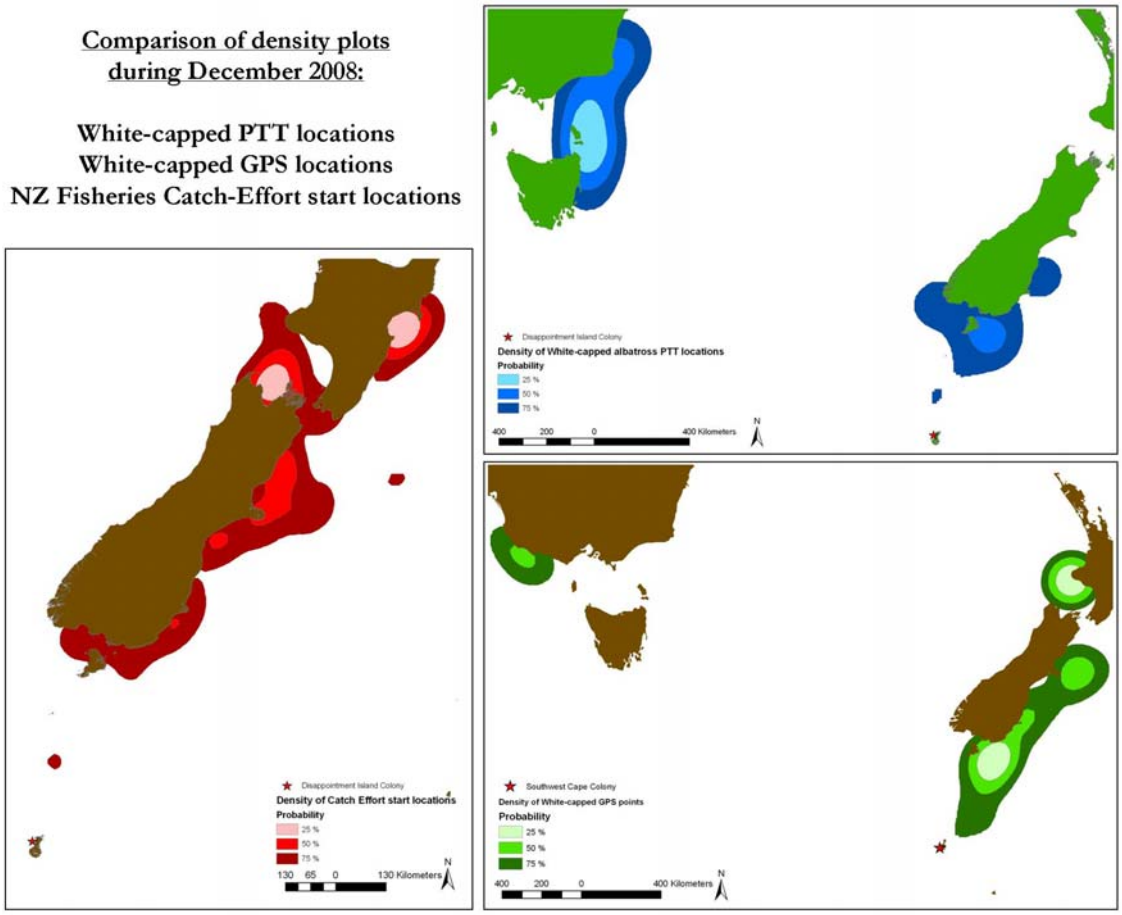

Figure 4. Kernel density plots for PTT data derived from white-capped albatross at Disappointment Island (blue), for GPS data derived from birds at South West Cape (green) and start locations of fishing events (red), December 2008.

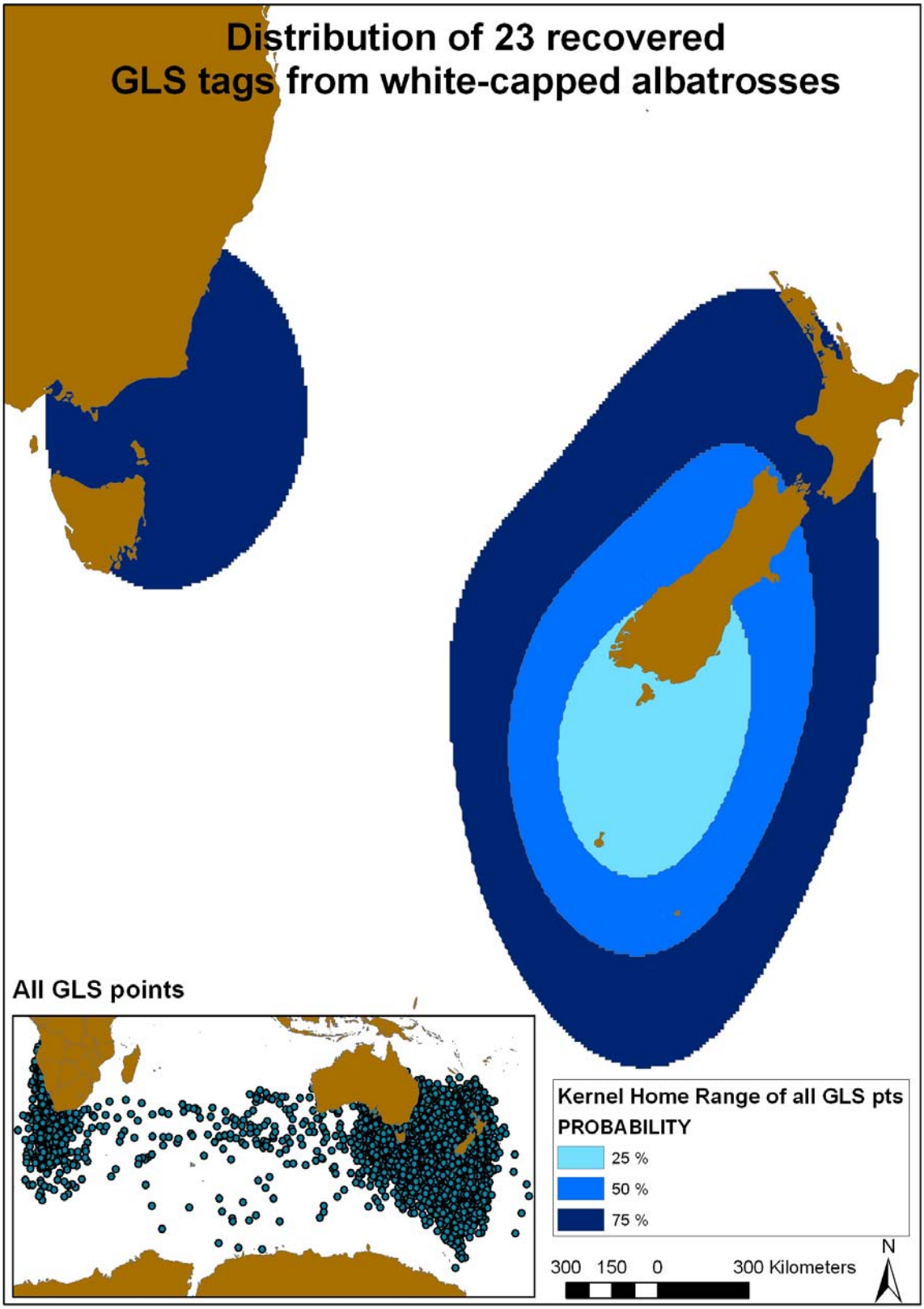

Figure 5. Plot of all geolocation points (insert) and kernel density plot of these data.