Analysis of albatross and petrel distribution within the CCSBT area: results from the Global *Procellariiform* Tracking Database

BirdLife International

ABSTRACT

This paper presents an analysis of the spatial overlap between albatross and petrel distribution and CCSBT fishing effort, using data from the Global *Procellariiform* Tracking Database and CCSBT's public domain catch and effort data.

The results highlight the importance of the CCSBT area, which overlapped with 56% of Southern Hemisphere breeding albatross distribution, and 23% of available petrel distribution data, emphasising the potential for interaction with fisheries in this area, and the importance of the area for the survival of these vulnerable species.

The area is particularly important for breeding distributions of Amsterdam, Buller's, Chatham, Indian Yellow-nosed, Northern Royal, Shy, Southern Royal and Tristan albatrosses and Westland Petrel: the distributions of all 9 of these species overlapped with the CCSBT area (1999-2003) by over 70%. Fewer non-breeding tracking data are available, but results indicate that the distributions of non-breeding Black-browed albatrosses and Grey-headed albatrosses from South Georgia overlap significantly with the CCSBT area while the distribution of breeding birds from the same site do not.

Distribution data indicate both that albatross and petrel ranges extend almost throughout the CCSBT area, particularly south of 30°S, but also that there are clusters of high densities of distribution in the area, indicating areas where there is high risk of seabird bycatch. Data from Japan's Real Time Monitoring Program bear out the fact that seabird bycatch rates vary across the CCSBT region, with higher levels in these high-density areas, and suggest that non-breeding birds make up a significant proportion of the bycatch in the region, and therefore that the degree of overlap between the CCSBT area and albatrosses and petrels is even greater than the 56% breeding albatross distribution suggests. The data from the Japanese RTMP also demonstrate the value of reporting location and date of seabird bycatch data in order to be able to obtain real insights into rates and risks of seabird bycatch through relating them to the remote-tracking distribution data held in the Global *Procellariiform* Tracking Database. There is a great need also for seabird bycatch data from Taiwanese vessels, whose distribution differ from that of Japanese vessels.

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1. INTRODUCTION

Incidental catch in fisheries, especially longline fisheries, is recognised as the principal threat to many species of albatross and petrel. Nineteen of the world's 21 albatross species are now globally threatened with extinction (IUCN 2004, BirdLife International 2004b). Effective action to reduce this mortality is possible through the use of a range of mitigation measures such as Tori lines, dyed baits and night setting. However, effective action is also greatly assisted by identification of where the threats may be occurring: greater knowledge of the spatial and temporal distributions of albatrosses and petrels, and their overlap with longline fishing effort. This paper presents analysis of data from the Global *Procellariiform* Tracking Database, a database which has been established through a unique collaboration of scientists from around the world, coordinated by BirdLife International. Results of analysis of this database have also been published in *Tracking Ocean Wanderers* (BirdLife, 2004a).

2. METHODS

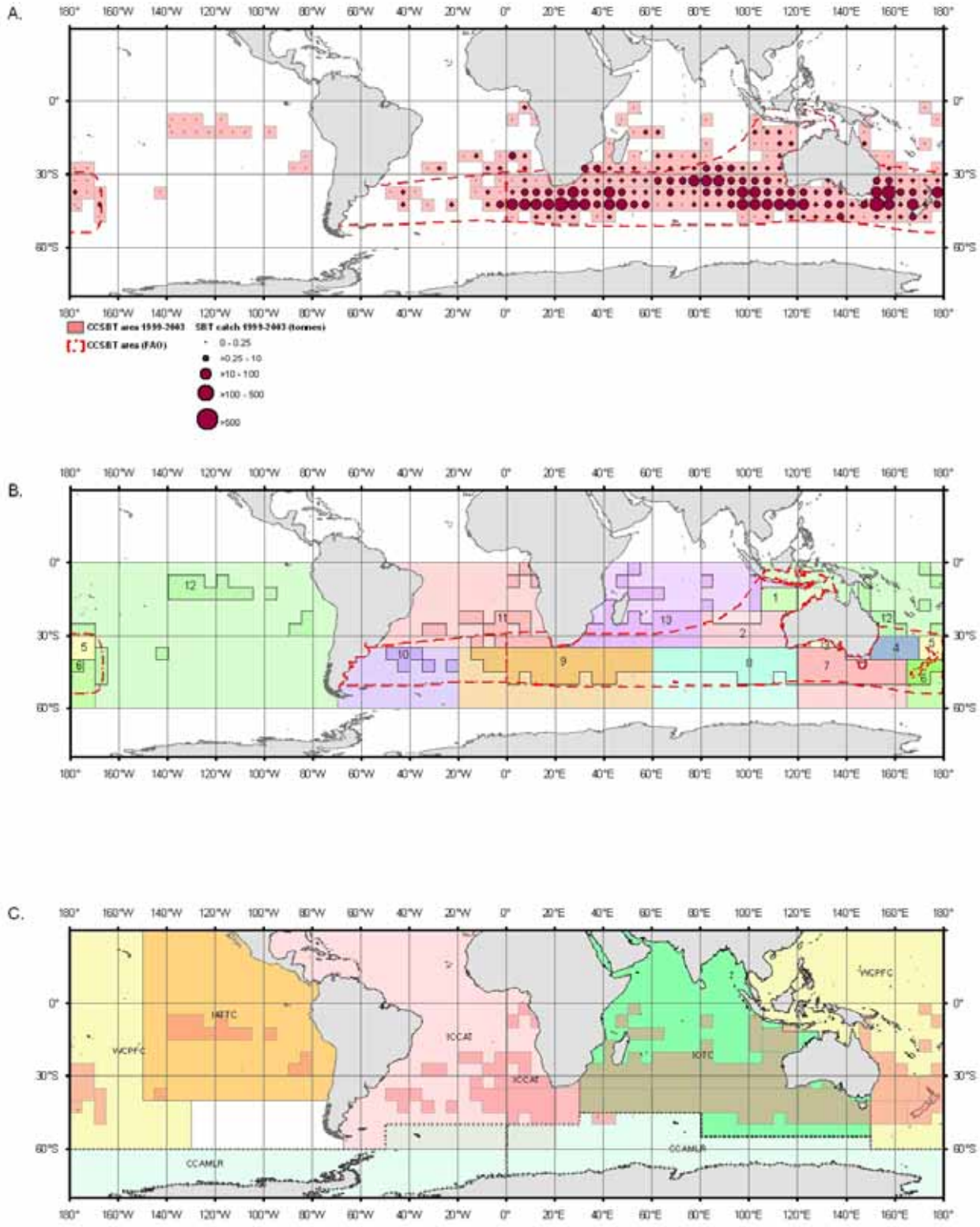
2.1 Albatross and petrel remote tracking data

Over 90% of existing albatross and petrel remote-tracking data have been submitted to the Global *Procellariiform* Tracking Database, representing 19 of the 21 species of albatross and both species of giant-petrel, as well as tracking data for White-chinned petrel, Westland petrel and Short-tailed shearwater (**Table 1**). Data contributors are listed on page (ii) of this report. **Appendix 1** lists species names used in the text.

The satellite tracking (PTT) data and geolocator (GLS) data contributed to the database were processed using standardised methods agreed among the data-holders, and procedures were agreed for transforming location data into density distributions. Density distributions were standardised to allow addition across species to create multi-species maps. Population sizes of albatross species vary greatly: there are over 500,000 annual breeding pairs of Black-browed Albatrosses and Laysan Albatrosses, whereas three albatross species have less than 1000 annual breeding pairs. For this reason, the multi-species maps were calculated with all species weighted equally, to avoid domination of the maps by the few species with large populations. The density distributions are represented on maps by the 50%, 75% and 95% utility distributions (UDs), which are probability contours that indicate the areas within which birds spend 50%, 75% and 95% of their time. The maps also indicate the full range of distribution (100% UD). For full details on methods for data validation and derivation of density distributions, see *Tracking Ocean Wanderers (*BirdLife International, 2004a). In this paper, data are only presented for the 17 species of albatross which breed in the Southern Hemisphere (tracking data were available for 15 of these species).

The database contains fewer non-breeding data (data for only 8 of the 20 Southern Hemisphere albatross and petrel species), in part due to practical difficulties related to retrieving data from non-breeding birds: data and/or tracking devices are often collected from breeding birds as they return to their nest during breeding. Moreover, a full understanding of non-breeding distribution requires data from a number of life-cycle stages (e.g. post-fledging chicks, juveniles, failed breeders, post-breeding migration, inter-breeding period), all of which may have different distributions. Many of the non-breeding data in the database are tracks of failed breeders and of post-breeding migration, leaving many gaps particularly for distribution of juveniles and distribution of adults during the inter-breeding period. For this reason, this paper restricts itself predominantly to assessment of the distribution of breeding albatrosses and petrels. Some non-breeding distribution data are presented, but the results must be considered as provisional.

Figure 1. CCSBT area as defined by catch data 1999-2003. A. CCSBT area as defined by distribution of average catch of Southern Bluefin Tuna 1999-2003 and comparison to the CCSBT area identified by FAO. B. CCSBT area as defined by distribution of average catch of Southern Bluefin Tuna 1999-2003, divided by CCSBT statistical areas. C. Relationship between CCSBT area and areas managed by other Regional Fisheries Management Organisations (RFMOs).



2.2 Overlap with CCSBT fishing areas

The area managed by CCSBT is defined as areas in which Southern Bluefin Tuna (SBT) are caught, rather than a delimited geographical area. For the purposes of this paper, the overall CCSBT fishing area (hereafter 'CCSBT area') was defined as the 5x5 degree grid squares in which SBT were caught between 1999-2003, the most recent 5-year period for which full catch data are available within the CCSBT public-domain databases. **Figure 1** illustrates this area and compares it to the generic map of CCSBT area that is used, for example, on the FAO website. For the analysis, the CCSBT area was also divided by CCSBT statistical area, as defined under CCSBT's Trade Information Scheme (CCSBT, 2003) (**Figure 1b**). **Figure 1c** shows the CCSBT area in relation to the areas managed by neighbouring Regional Fisheries Management Organisations (RFMOs).

Average longline catch of SBT (tonnes) and longline fishing effort (million hooks) were summarised for each of the 5x5 degree grid squares for the period 1999-2003. Fishing effort data in the CCSBT databases include "all fishing effort in which catches of SBT were feasible. This includes fishing that targeted SBT, fishing that targeted other tuna or tuna like species, and/or fishing conducted in strata (year/month/area) where SBT were also taken" (CCSBT, 2006). For the purposes of this paper, as advised by the CCSBT Secretariat, CCSBT longline fishing effort was defined as a subset of this overall database, limited to longline effort in strata (year, month, fleet, 5x5 degree lat/long) in which SBT were caught.

3. RESULTS

3.1 Breeding distributions

Overall, the CCSBT area overlapped with 56% of total breeding albatross distribution, and 23% of the available petrel distribution data. The breeding distributions of albatrosses and petrels within the CCSBT area are summarised by species and statistical areas in **Table 2**. **Table 3** presents the data separated by breeding populations.

The combined breeding distribution of the 20 species of albatross and petrel is shown in **Figure 2**, highlighting the concentrations of albatross and petrel distribution around New Zealand and Australia, the SW Indian Ocean, and the SE and SW Atlantic. These areas have a high degree of overlap with the CCSBT area, with the exception of the albatross and petrel concentrations in the SW Atlantic. The SW Atlantic was an area with little SBT catch between 1999-2003, although the SW Atlantic area is included within maps of CCSBT area by the FAO (Figure 1). While Figure 2 illustrates the hotspot concentrations of albatross distribution, it also shows that albatross and petrel ranges extend across the majority of the CCSBT area below 30ºS. CCSBT statistical area 6 (around New Zealand) had the highest density of breeding albatross distribution, followed by areas 7, 8 and 9 (**Table 2**).

Eight species of albatross had 70% or more of their breeding distribution within the CCSBT area: Amsterdam, Buller's, Chatham, Indian Yellow-nosed, Northern Royal, Southern Royal, Tristan and Shy albatrosses, and also Westland petrel (**Table 2, Figures 3-10)**. All nine species are mainly distributed north of 50º S. Of the nine species, the data sets for Buller's, Indian Yellow-nosed and especially Shy albatross contain data gaps for some breeding sites, as indicated in the figures, though these breeding sites are all located within or near to the CCSBT area.

Antipodean, Sooty and Wandering albatrosses have between 41-56% of their distribution within the CCSBT area (**Figures 11-13**). For Sooty albatross, the tracking data represent only

17% of the breeding population, with significant data gaps from Tristan and Gough Islands in the Atlantic and Prince Edward Islands (**Figure 12**). As such, the results should be treated as preliminary, and the actual overlap may be higher, since the remaining sites are all within the CCSBT area. The distribution of breeding Wandering albatrosses is of particular interest, since the species has a large foraging range, which extends as far north as 30ºS, and as low as 70ºS (**Figure 13**). Overlap between the CCSBT area and distributions of breeding Wanderers from South Georgia and Iles Kerguelen are fairly low, but there is a high degree of overlap between the CCSBT area and Wanderers from the Prince Edward Islands and Iles Crozet.

The breeding distributions of Black-browed, Campbell, Grey-headed, Light-mantled albatrosses and both giant-petrels have much lower overlap with the CCSBT area, with the exception of the population of Grey-headed albatrosses from Prince Edward Islands whose distribution has a high degree of overlap (64%) (**Figure 14**). In general though, the breeding distributions of all of these 5 species tend to be south of the CCSBT area, between 50-60ºS or below: many (though not all) of the populations of these species have a high degree of overlap with the CCAMLR area. Campbell Albatross (**Figure 3**) and Short-tailed shearwater (**Figure 10**) are also largely distributed south of the CCSBT area, though not overlapping with CCAMLR. Large data gaps exist for breeding distributions of Light-mantled albatross and both giant-petrels, so estimates of their overlap may change as these data gaps are filled.

For the two species for which no tracking data are yet available (Salvin's and Atlantic Yellow-nosed albatross), Atlantic Yellow-nosed albatross breeds on Tristan and Gough Islands in the SE Atlantic, which suggests that its distribution may have a high degree of overlap with the CCSBT area. Over 99% of Salvin's albatrosses breed on Bounty Island, near New Zealand, at the edge of the CCSBT area in the SW Pacific, making it difficult to predict likely overlap with the CCSBT area.

3.2 Non-breeding distributions

Northern Royal Albatrosses are the only species for which sufficient data exists in the database to calculate a reliable non-breeding density distribution (**Table 4**). Distribution maps and estimates of non-breeding distribution are also presented here for Antipodean, Buller's, Chatham, Shy, Black-browed and Grey-headed albatrosses but these results must be considered provisional due to sparseness of data.

The data for Black-browed and Grey-headed albatrosses from South Georgia indicate that their non-breeding distributions overlap to a greater extent with the CCSBT area, compared to their breeding distributions (which overlapped by less than 1%) (**Figures 15-16**). However, for these species, non-breeding data collection and analysis is still ongoing and results are still in a provisional stage.

For Antipodean, Buller's and Shy albatrosses, the provisional distribution data indicate that all three have similar levels of overlap with the CCSBT area between breeding and non-breeding seasons, though these results are based on only a few data tracks and there is some indication that non-breeders range more widely than breeding birds (**Table 4** compared to **Table 2**, and **Figures 17-19** compared to **Figures 4, 9 and 11**).

In contrast to the above, the data indicate that Northern Royal and Chatham albatrosses have a lower overlap with the CCSBT area during the non-breeding season, compared to the breeding season: in total 17% of the non-breeding distribution of Northern Royals overlapped

with the CCSBT area, compared to 92% overlap during the breeding season. This is due to their migration to the coast of South America during the non-breeding period (**Figures 20-21**).

3.3 Albatross and petrel distribution in relation to CCSBT longline fishing effort

CCSBT longline fishing effort (as defined effort in strata where SBT were caught, see Methods) has amounted to 110 million hooks per year in recent years. Japanese and Taiwanese vessels have had the largest fishing effort, with 52.3% and 33.9% of total CCSBT longline fishing effort respectively, between 1999-2003.

The distribution of CCSBT fishing effort for the period 1999-2003 is shown in **Figure 22a**, and **Figures 22b-d** compare the distribution of fishing effort by flag, indicating some differences between distributions of Japanese and Taiwanese longline fishing effort) higher concentrations of Japanese fishing effort below 40°S around between 90-170°E, and higher Taiwanese longline fishing effort north of 40ºS and west of 90°E in the SW Indian Ocean and Atlantic). **Figure 23** illustrates total longline fishing effort in the CCSBT databases compared to the SBT fishing effort, indicating the other non-CCSBT fishing effort that takes place in this region by CCSBT members.

Table 5 compares the distribution of fishing effort and the distribution of albatrosses and petrels between CCSBT statistical areas. CCSBT statistical areas 6 to 9, which included almost all (94%) of the albatross distribution within the CCSBT area, had 76% of the SBT catch between1999-2003.

4. DISCUSSION

This analysis has highlighted the high degree of overlap between the CCSBT area and albatross distribution, emphasising the potential for interaction with fisheries in this area, and the importance of the area for the survival of these species. The CCSBT area in 1999-2003 overlapped with 56% of the total breeding distribution of Southern Hemisphere albatrosses, and also with petrel species, especially Westland Petrel. Overlap was greatest between 30-50°S from the SE Atlantic to beyond New Zealand, corresponding to CCSBT statistical areas 6-9, which had 76% of the SBT catch between 1999-2003. These areas include the hotspots of albatross distribution around SE Australia, New Zealand, the South African Prince Edward Islands, the French territories of Iles Crozet and Ile Amsterdam, and the UK territories of Tristan de Cunha and Gough Island. The exception in terms of overlap was in the SW Atlantic, where there was little CCSBT fishing effort between 1999-2003.

In some species, non-breeding birds disperse much more widely than breeding birds, which may bring albatrosses and petrels into even greater contact with fishing vessels, including CCSBT vessels. Provisional results from the Global *Procellariiform* Tracking Database show that the distributions of non-breeding Black-browed albatrosses from South Georgia have a higher overlap with the CCSBT area compared to breeding birds (which have <1% overlap). The liability of non-breeding birds to be caught as bycatch in addition to breeding birds is borne out by data from Japan's Real Time Monitoring Program (RTMP), which records that Black-browed Albatross is the second most commonly caught as seabird bycatch by Japanese vessels (Kiyota & Minami, 2004) (the tracking data indicate that overlap of breeding Black-browed Albatross and the CCSBT area is <1%).

The most commonly caught species of albatross recorded by Japan's RTMP is Grey-headed Albatross. At first glance this appears surprising based on the results from the remote-tracking

distribution data, which have found that only 6% of the breeding distribution of Grey-headed albatross overlaps with the CCSBT area. However, within this, there is a high degree of overlap (64%) for Grey-headed Albatross from the Prince Edward Islands, and there are data gaps from Iles Crozet and Iles Kerguelen. In addition, it is likely that some of the Grey-headed albatrosses caught are non-breeding birds from sites such as South Georgia, for which the Southern Indian Ocean forms a staging post on their circumpolar navigations, and concentrations are highest between October and February, corresponding to the 4th and 1st quarters of the year (BirdLife, 2004a).

The Japanese Real Time Monitoring Program has also provided data on variations in rates of seabird bycatch across the region (**Table 6**), and these can be compared to the albatross and petrel distribution data presented in this paper. As might be expected from the clustered distribution of albatrosses and petrels, bycatch rates vary significantly between regions, from 0.026 to 0.31 birds/1000 hooks. Seabird bycatch rates in 2001 and 2002 were relatively low in Strata 1, corresponding to CCSBT statistical areas 4 and 5, which have been shown in this paper to have low distributions of breeding albatrosses and petrels.

The highest seabird bycatch rates reported by Japan's RTMP for 2001 and 2002 were in Stratum 3, corresponding to CCSBT statistical area 9, below South Africa, in the 2nd and 3rd quarters of each year. The analysis presented in this paper also found that area 9 contained some of the highest densities of breeding albatrosses and petrels (the Japanese RTMP program data for 2001 and 2002 does not contain data on bycatch in CCSBT area 6). In the 2nd and 3rd quarters, high densities of breeding birds in CCSBT statistical area 9 are augmented with non-breeding birds, including Black-browed Albatrosses from South Georgia, whose journey north to South Africa is concentrated between April and July, corresponding to the 2nd and 3rd quarters of each year (BirdLife, 2004a).

Seabird bycatch rates were also high in Strata 2 and 4, corresponding to observer data from CCSBT statistical areas 7-8, which have been also shown in this paper to have some of the highest densities of breeding albatrosses. Seabird bycatch rates were higher in the 1st and 4th quarters of the year (Stratum 4), compared to the 2nd and 3rd quarters (Stratum 2). As shown in **Figure 22**, Japanese fishing effort in areas 7 and 8 was mostly east of the main breeding distributions of albatrosses. Without species-specific bycatch data for the strata and greater knowledge of non-breeding distributions, one cannot conclude which species are being caught in this region, but, other than allowing for breeding data gaps such as those for Grey-heads from Iles Crozet and Iles Kerguelen described above, it may be that non-breeding birds are being caught as bycatch in the region, especially in the 1st and 4th quarters, when, for example, non-breeding Grey-headed Albatrosses from South Georgia would be passing through the region.

These data therefore suggest that non-breeding birds make up a significant proportion of the bycatch in this region, and therefore that the degree of overlap between the CCSBT area and albatrosses and petrels is even greater than the 56% breeding albatross distribution suggests. The data from the Japanese RTMP also demonstrate not only the high variability in seabird bycatch rates in the region, but the importance of reporting the location and date that such seabird bycatch data were collected (and also the mitigation measures being used on the observer vessel) in order to be able to obtain real insights into rates and risks of seabird bycatch. There is a great need also for seabird bycatch data from Taiwanese vessels: the distribution of the Taiwanese fishing effort differs from that of Japan (**Figure 22b, c**), while

the albatross and petrel distribution data indicate a high degree of overlap with the Taiwanese fleet.

Finally, as indicated in **Figure 23,** there is other non-CCSBT longline fishing effort conducted in the region by CCSBT members, undertaken under the management of other RFMOs such as ICCAT and IOTC. In addition, the distributions of many of the albatross and petrel species breeding and foraging within the CCSBT area also overlap with neighbouring RFMOs. This indicates the importance of coordinating CCSBT's seabird bycatch mitigation measures with neighbouring RFMOs such as CCAMLR, ICCAT, WCPFC and IOTC.

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Appendix 1. Key to species names used in the text

Common	Scientific	Status[1]
Amsterdam Albatross	*Diomedea amsterdamensis*	Critically Endangered
Antipodean Albatross[2]	*Diomedea antipodensis*	Vulnerable
Black-browed Albatross	*Thalassarche melanophrys*	Endangered
Buller's Albatross	*Thalassarche bulleri*	Vulnerable
Campbell Albatross	*Thalassarche impavida*	Vulnerable
Chatham Albatross	*Thalassarche eremita*	Critically Endangered
Grey-headed Albatross	*Thalassarche chrysostoma*	Vulnerable
Light-mantled Albatross	*Phoebetria palpebrata*	Near Threatened
Laysan Albatoss	*Phoebastria immutabilis*	Vulnerable
Northern Royal Albatross	*Diomedea sanfordi*	Endangered
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable
Salvin's Albatross	*Thalassarche salvini*	Vulnerable
Shy Albatross	*Thalassarche cauta*	Near Threatened
Sooty Albatross	*Phoebetria fusca*	Endangered
Tristan Albatross	*Diomedea dabbenena*	Endangered
Wandering Albatross	*Diomedea exulans*	Vulnerable
Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	Endangered
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Endangered
Northern Giant Petrel	*Macronectes halli*	Near Threatened
Southern Giant Petrel	*Macronectes giganteus*	Vulnerable
Westland Petrel	*Procellaria westlandica*	Vulnerable
White-chinned Petrel	*Procellaria aequinoctialis*	Vulnerable
Short-tailed Shearwater	*Puffinus tenuirostris*	Least Concern

1 Source IUCN 2004, BirdLife International 2004b

2 Including Gibson's Albatross *D. (antipodensis) gibsoni*

Table 1. Remote tracking data of Southern Hemisphere species of albatross and petrel held in the Global *Procellariiform* Tracking Database. * = new data added since the publication of Tracking Ocean Wanderers.

Species	Site	Annual No. Breeding Pairs	% Global Popn	PTT datasets submitted to the Global *Procellariiform* Tracking Database (blank cells indicate no tracking data)
Amsterdam	Ile Amsterdam	17	100%	Breeding
Antipodean	Antipodes Is	5,148	100%	Failed/migratory and non-breeding, resident
	Campbell Island	6	0%	
Antipodean (Gibson's)	Auckland Is	7,319	100%	Breeding and non-breeding
Atlantic Yellow-nosed	Gough Island	7,500	23%	
	Tristan da Cunha Is	25,750	77%	
Black-browed	Antipodes Is	115	0%	
	Campbell Island	16	0%	
	Chile	122,870	18%	Breeding+
	Falkland Is (Malvinas)	380,000	62%	Breeding, and single failed migratory track, plus non-breeding geolocator data
	Heard & McDonald Is	729	0%	
	Iles Crozet	880	0%	
	Iles Kerguelen	4,270	1%	Breeding
	Macquarie Island	182	0%	Breeding
	Snares Is	1	0%	
	South Georgia*	100,332	16%	Breeding, and single failed migratory track plus non-breeding geolocator data
Buller's	Chatham Is	18,150	58%	
	Three Kings	20	0%	
	Snares Is	8,465	27%	Breeding, failed and non-breeding resident and migratory, also juveniles
	Solander Is	4,800	15%	Breeding, failed, migratory
Campbell	Campbell Island*	26,000	100%	Breeding
Chatham	Chatham Is	4,000	100%	Breeding, failed and non-breeding resident and migratory, also juveniles
Grey-headed	Campbell Island	6,400	6%	Breeding
	Chile	16,408	15%	Breeding, and single failed migratory track
	Iles Crozet	5,940	6%	
	Iles Kerguelen	7,905	7%	
	Macquarie Island	84	0%	Breeding
	Prince Edward Is	7,717	7%	Breeding
	South Georgia*	61,582	58%	Breeding, and single failed migratory track plus non-breeding geolocator data
Indian Yellow-nosed	Ile Amsterdam	25,000	70%	Breeding
	Ile St. Paul	12	0%	
	Iles Crozet	4,430	12%	
	Iles Kerguelen	50	0%	
	Prince Edward Is	6,000	17%	
Light-mantled	Antipodes Is	169	1%	
	Auckland Is	5,000	23%	
	Campbell Island	1,600	7%	
	Heard & McDonald Is	350	2%	
	Iles Crozet	2,421	11%	
	Iles Kerguelen	4,000	18%	
	Macquarie Island	2,000	9%	Breeding
	Prince Edward Is	241	1%	
	South Georgia*	6,250	28%	Breeding
Northern Royal	Chatham Is	2,060	99%	Breeding, failed/migratory, non-breeding
	Taiaroa Head	18	1%	Breeding, failed and non-breeding resident and migratory, also juveniles
Salvin's	Bounty Is	76,352	99%	
	Iles Crozet	4	0%	
	Snares Is	587	1%	

Table 1 continued.

Species	Site	Annual No. Breeding Pairs	% Global Popn	PTT datasets submitted to the Global *Procellariiform* Tracking Database (blank cells indicate no tracking data)
Shy	Antipodes Is	18	0%	
	Auckland Is	72,233	85%	
	Chatham Is	1	0%	
	Tasmania	12,250	14%	Breeding, failed/migratory, also juveniles
Sooty	Gough Island	5,000	38%	
	Ile Amsterdam	350	3%	
	Ile St. Paul	20	0%	
	Iles Crozet	2,248	17%	Breeding
	Iles Kerguelen	4	0%	
	Prince Edward Is	2,755	21%	
	Tristan da Cunha Is	2,747	21%	
Southern Royal	Auckland Is	72	1%	
	Campbell Island	7,800	99%	Breeding
Tristan	Gough Island	798	100%	Breeding
	Tristan da Cunha Is	3	0%	
Wandering	Iles Crozet	2,062	26%	Breeding &single non-breeding migratory track
	Iles Kerguelen	1,094	14%	Breeding
	Macquarie Island	10	0%	
	Prince Edward Is	2,707	34%	Breeding, failed/migratory, non-breeding
	South Georgia	2,001	25%	Breeding and failed migratory
	Unknown			Non-breeding, migratory
Northern Giant Petrel	Antipodes Is	300	3%	
	Auckland Is	100	1%	
	Campbell Island	240	2%	
	Chatham Is	2,150	19%	
	Iles Crozet	1,060	9%	
	Iles Kerguelen	1,400	12%	
	Macquarie Island	1,110	10%	
	Prince Edward Is	540	5%	
	South Georgia	4,310	38%	Breeding
Southern Giant Petrel	Antarctic Continent	290	1%	
	Antarctic Peninsula	6,500	21%	
	Argentina*	1,350	4%	Breeding
	Chile	290	1%	
	Falkland Is(Malvinas)	3,100	10%	
	Gough Island	50	0%	
	Heard & McDonald Is	4,400	14%	
	Iles Crozet	1,060	3%	
	Iles Kerguelen	4	0%	
	Macquarie Island	2,300	7%	
	Prince Edward Is	1,790	6%	
	South Georgia	4,650	15%	Breeding
	South Orkney Is	3,400	11%	
	South Sandwich Is	1,550	5%	
White-chinned petrel	Antipodes Is	50,000	?%	
	Auckland Is	50,000	?%	
	Campbell Island	?	?%	
	Iles Crozet	50,000	?%	Breeding
	Iles Kerguelen	200,000	?%	
	Falkland Is(Malvinas)	?	?%	
	Macquarie Island	?	?%	
	Prince Edward Is	?	?%	
	South Georgia*	2,000,000	?%	Breeding
Westland petrel	Punakaiki	2,000	100%	Breeding
Short-tailed shearwater	SE Australia (French, Montague.)	?	?%	Breeding, and single post-breeding track

Table 2. At-sea breeding distribution of 20 Southern Hemisphere albatross and petrel species within the CCSBT statistical areas (% time). The overall CCSBT area is defined by 5x5 degree grids in which SBT were caught, 1999-2003). Data are based on available tracking data: tracking data are not available for all colonies of every species (see Table 1).

CCSBT statistical area	Amsterdam albatross	Antipodean albatross	Black-browed albatross	Buller's albatross	Campbell albatross	Chatham albatross	Grey-headed albatross	Indian Yellow-nosed albatross	Light-mantled albatross	Northern Royal albatross	Shy albatross	Sooty albatross	Southern Royal albatross	Tristan albatross	Wandering albatross	Northern giant-petrel	Southern giant-petrel	Westland petrel	White-chinned petrel	Short-tailed shearwater	TOTAL ALBATROSS	TOTAL PETREL*
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6	0	9	0	86	14	70	0	0	0	91	0	0	68	0	0	0	0	100	0	0	23	20
7	0	42	0	10	2	0	0	0	0	0	73	0	4	0	0	0	0	0	0	11	9	2
8	90	0	0	0	0	0	1	72	0	0	0	1	0	0	3	0	0	0	0	0	11	0
9	1	0	0	0	0	0	4	17	0	0	0	39	0	53	38	0	0	0	1	0	10	0
10	0	0	0	0	0	0	1	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	1	0
12	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	6	0	0	0	0	0	0	9	0	0	0	1	0	0	1	0	0	0	0	0	1	0
Total inside CCSBT	**100**	**56**	**0**	**97**	**18**	**71**	**6**	**100**	**0**	**92**	**73**	**41**	**72**	**69**	**45**	**0**	**0**	**100**	**1**	**12**	**56**	**23**
Total outside CCSBT	**0**	**44**	**100**	**3**	**82**	**29**	**94**	**0**	**100**	**8**	**27**	**59**	**28**	**31**	**55**	**100**	**100**	**0**	**99**	**88**	**44**	**77**

Table 3. At-sea breeding distribution of 20 Southern Hemisphere albatross and petrel species within the CCSBT area, divided by breeding population (% time). The overall CCSBT area is defined by 5x5 degree grids in which SBT were caught, 1999-2003). Data are based on available tracking data: tracking data are not available for all colonies of every species (see Table 1).

	Amsterdam	**Antipodean (Gibson's)**	**Black-browed**	**Black-browed**	**Black-browed**	**Black-browed**	**Black-browed**	**Buller's**	**Buller's**	**Campbell**	**Chatham**	**Grey-headed**	**Grey-headed**	**Grey-headed**	**Grey-headed**	**Grey-headed**	**Indian Yellow-nosed**	**Light-mantled**
CCSBT statistical area	Ile Amsterdam	Auckland Islands	Chile	Falkland Islands (Malvinas)	Iles Kerguelen	Macquarie Island	South Georgia	Solander Islands	Snares Islands	Campbell Island	Chatham Islands	Campbell Island	Chile	Macquarie Island	Prince Edward Islands	South Georgia	Ile Amsterdam	Macquarie Island
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	5	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	9	0	0	0	0	0	84	86	14	70	0	0	0	0	0	0	0
7	0	42	0	0	0	3	0	9	11	2	0	0	0	0	0	0	0	0
8	90	0	0	0	4	0	0	0	0	0	0	0	0	0	12	0	72	0
9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0	17	0
10	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0
13	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0
Total inside CCSBT	**100**	**56**	**0**	**0**	**4**	**3**	**1**	**95**	**99**	**18**	**71**	**1**	**0**	**0**	**64**	**1**	**100**	**0**
Total outside CCSBT	**0**	**44**	**100**	**100**	**96**	**97**	**99**	**5**	**1**	**82**	**29**	**99**	**100**	**100**	**36**	**99**	**0**	**100**

Table 3 continued.

CCSBT statistical area	Northern Royal	Northern Royal	Shy	Sooty	Southern Royal	Tristan	Wandering	Wandering	Wandering	Wandering	Northern giant-petrel	Southern giant-petrel	Southern giant-petrel	Westland petrel	White-chinned petrel	White-chinned petrel	Short-tailed shearwater
	Chatham Islands	Taiaroa Head	Tasmania	Iles Crozet	Campbell Island	Gough Island	Iles Crozet	Iles Kerguelen	Prince Edward Islands	South Georgia	South Georgia	Argentina	South Georgia	Punakaiki	Iles Crozet	South Georgia	Australia
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	91	100	0	0	68	0	0	0	0	0	0	0	0	100	0	0	0
7	0	0	73	0	4	0	0	0	0	0	0	0	0	0	0	0	11
8	0	0	0	1	0	0	3	3	5	0	0	0	0	0	6	0	0
9	0	0	0	39	0	53	32	12	80	0	0	0	0	0	24	0	0
10	0	0	0	0	0	4	0	0	0	9	0	0	0	0	0	0	0
11	0	0	0	0	0	12	0	0	0	0	0	0	0	0	2	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	1	0	0	3	0	2	0	0	0	0	0	5	0	0
Total inside CCSBT	**92**	**100**	**73**	**41**	**72**	**69**	**38**	**15**	**88**	**10**	**0**	**0**	**0**	**100**	**36**	**0**	**12**
Total outside CCSBT	**8**	**0**	**27**	**59**	**28**	**31**	**62**	**85**	**12**	**90**	**100**	**100**	**100**	**0**	**64**	**100**	**88**

Table 4. At-sea non-breeding distribution of species within the CCSBT area (% time).

CCSBT statistical area	Antipodean albatross	Buller's albatross	Chatham albatross	Northern Royal albatross	Shy albatross (Tasmania)
1	0	0	0	0	0
2	0	0	0	0	9
3	0	0	0	0	4
4	17	0	0	0	0
5	3	0	3	0	0
6	13	71	24	13	0
7	23	22	0	1	61
8	0	0	0	1	4
9	0	0	0	1	0
10	0	0	0	0	0
11	0	0	0	0	0
12	4	0	1	0	0
13	0	0	0	0	0
Total inside CCSBT	**60**	**95**	**28**	**17**	**78**
Total outside CCSBT	**40**	**5**	**72**	**83**	**22**

Table 5. Comparison of distribution of CCSBT longline fishing effort, SBT longline catch and breeding albatrosses and petrels within CCSBT statistical areas.

	Albatross and petrel breeding distribution		CCSBT longline fishing effort 1999-2003		CCSBT longline SBT catch 1999-2003	
CCSBTArea	% total	Rank	% total	Rank	% total	Rank
1	0.0	12	1.2	11	0.1	10
2	0.3	9	16.0	2	6.1	6
3	0.0	13	0.0	13	0.0	13
4	0.4	8	6.7	6	9.6	4
5	0.1	11	5.0	7	1.8	8
6	22.5	1	1.8	10	2.9	7
7	8.7	4	9.7	5	13.7	3
8	11.1	2	13.2	4	19.4	2
9	10.1	3	24.0	1	39.8	1
10	0.5	7	0.4	12	0.0	12
11	0.8	6	2.8	9	0.3	9
12	0.2	10	3.5	8	0.0	11
13	1.1	5	15.8	3	6.3	5

Table 6. Bycatch data from Japan's Real Time Monitoring Programme (Kiyota & Minami, 2004; Kiyota & Takeuchi, 2004). The seabird bycatch rates in the table are back-calculations from total hooks and estimated total number of seabirds caught**.**

Strata	CCSBT area	Year quarter	Longline fishing effort 2001	Longline fishing effort 2002	Seabirds estimated caught 2001	Seabirds estimated caught 2002	Estimated seabird catch rate 2001	Estimated seabird catch rate 2001
1	Area 4-5	2, 3	3,341,830	4,957,369	88	272	0.026	0.055
2	Area 6, 7, 8	2, 3	15,256,418	13,193,207	808	1147	0.053	0.087
3	Area 9, 10	2, 3	20,040,732	14,937,086	3847	4655	0.192	0.312
4	Area 7, 8,	1, 4	8,174,806	4,887,149	1722	795	0.211	0.163

Figure 1. CCSBT area as defined by catch data 1999-2003. A. CCSBT area as defined by distribution of average catch of Southern Bluefin Tuna 1999-2003 and comparison to the CCSBT area identified by FAO. B. CCSBT area as defined by distribution of average catch of Southern Bluefin Tuna 1999-2003, divided by CCSBT statistical areas. C. Relationship between CCSBT area and areas managed by other Regional Fisheries Management Organisations (RFMOs).

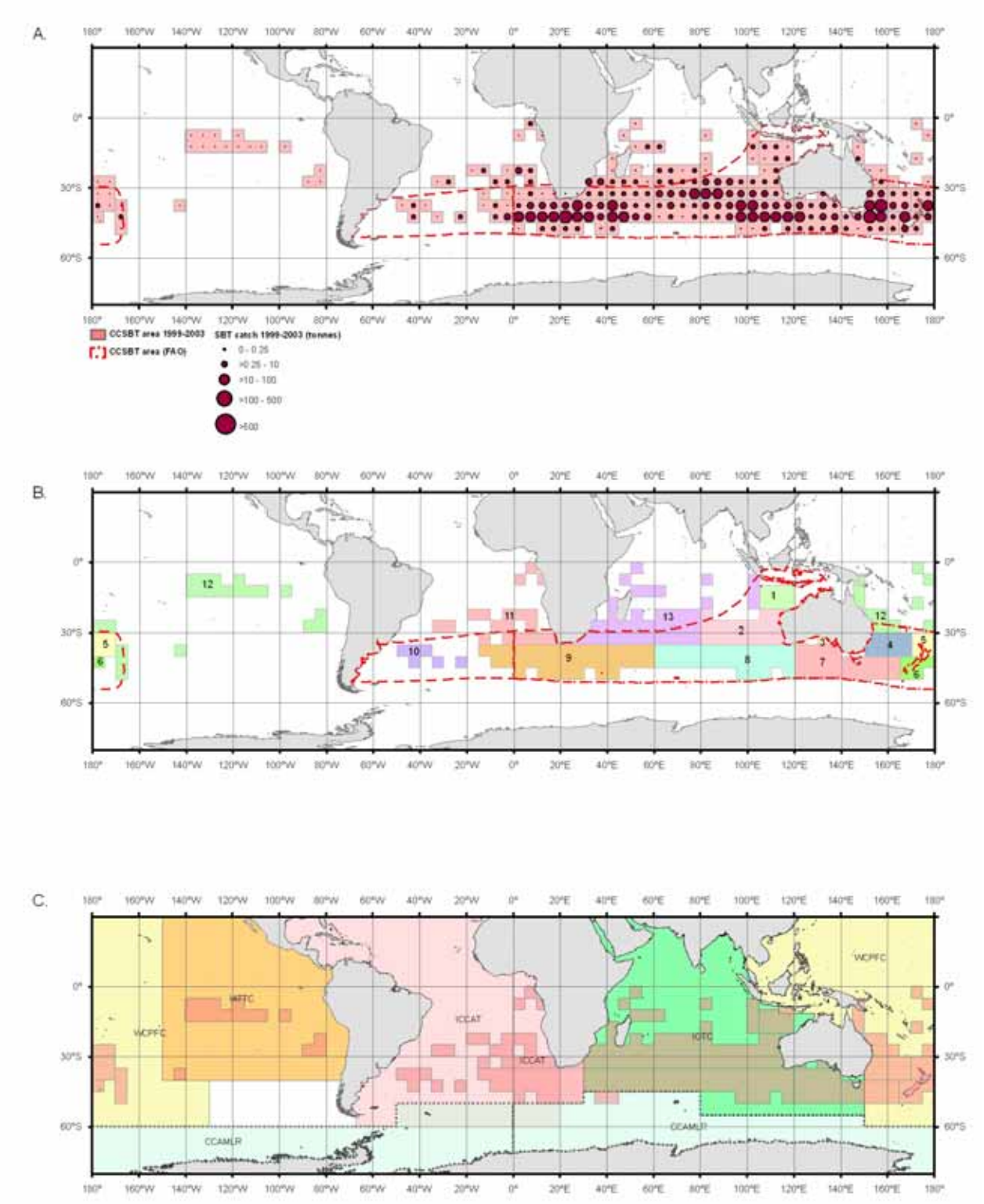


Figure 2. Combined utilisation distribution map for the breeding distribution of 20 southern-hemisphere species represented in the BirdLife International Global *Procellariiform* Tracking Database, and the overlap with the CCSBT area (1999-2003). Each species has been given equal weighting.

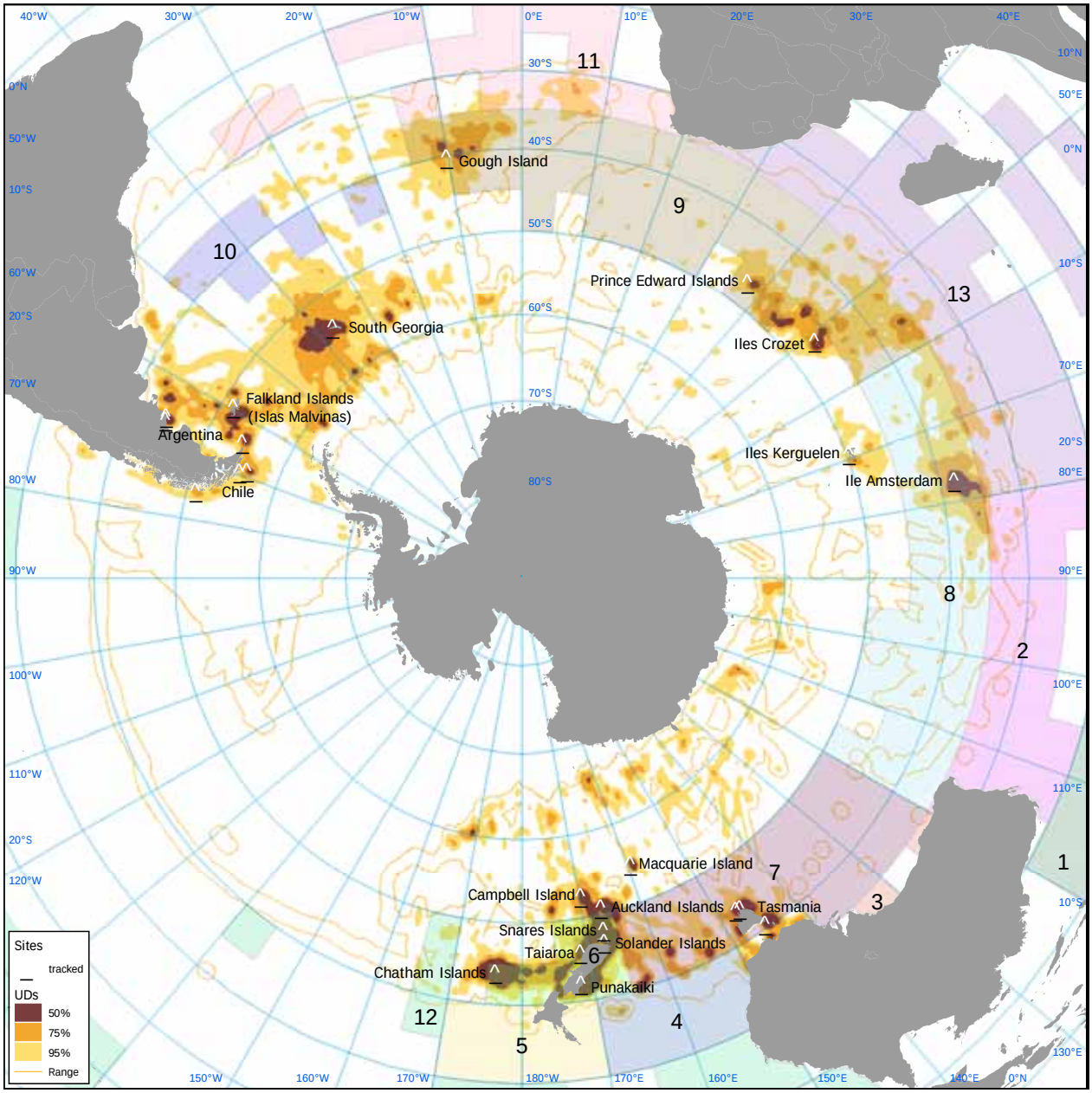


Figure 3. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Amsterdam (AMA) and Campbell (CAA) Albatrosses, both of which have a single breeding site.

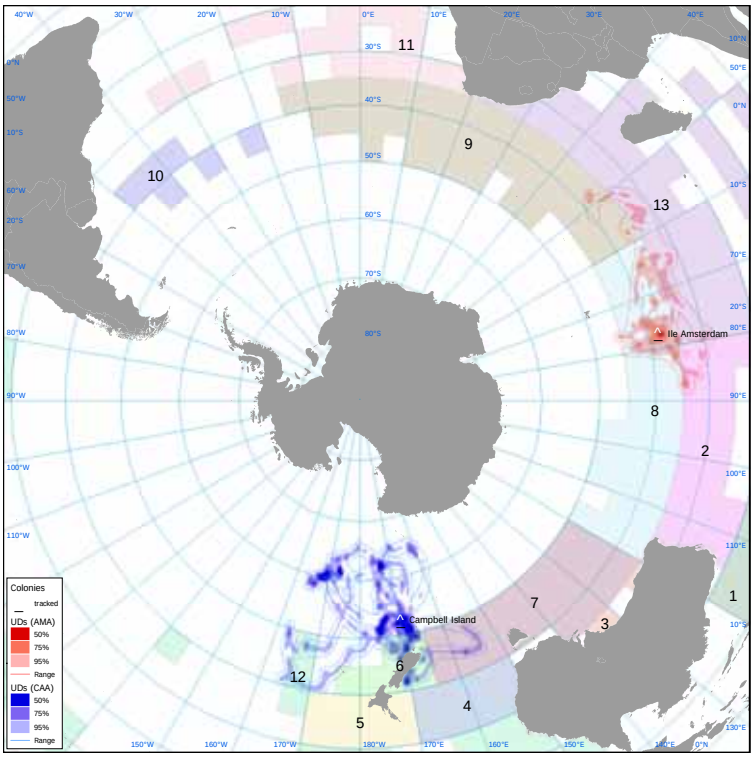


Figure 4. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Buller's Albatross tracked from sites representing 42% of the breeding population. Data gaps remain for Chatham Is. (58% breeding population) and Three Kings (<1% breeding population).

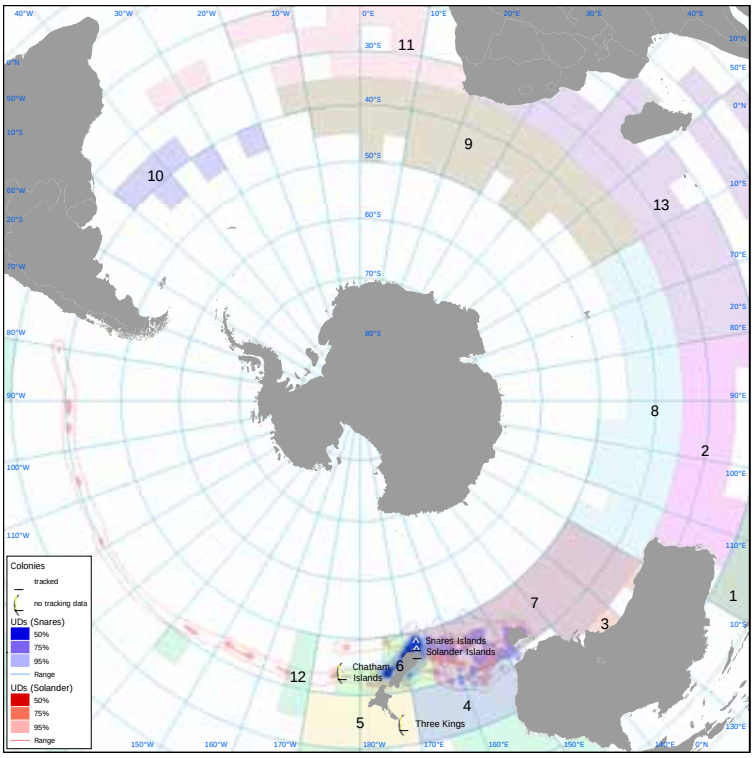


Figure 5. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Chatham Albatross, which has a single breeding site.

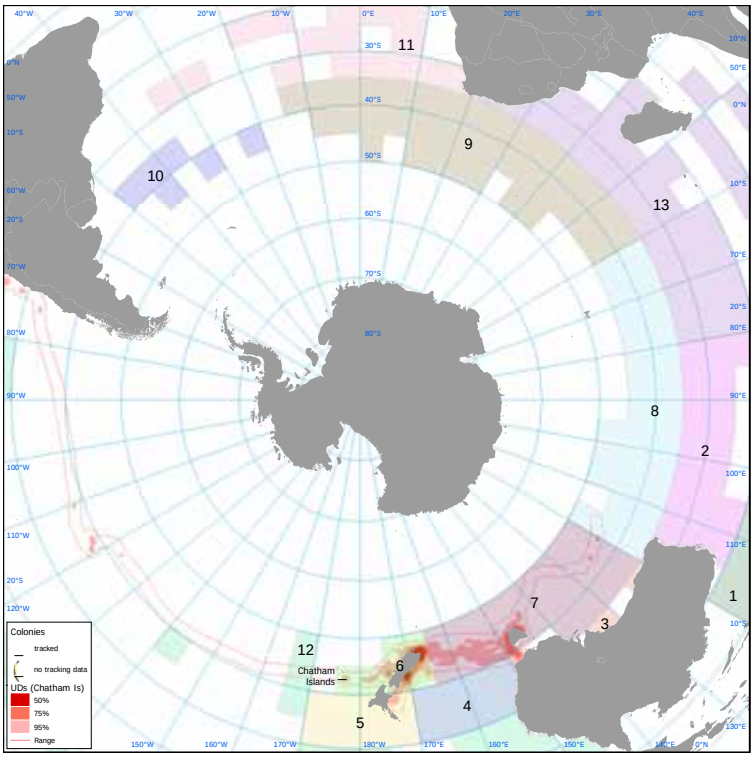


Figure 6. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Indian Yellow-nosed Albatross, tracked from sites representing 70% of the breeding population. Gaps remain for Prince Edward Is. (17% breeding population), Iles Crozet (12% breeding population), Iles Kerguelen and Ile St Paul (both <1% breeding population).

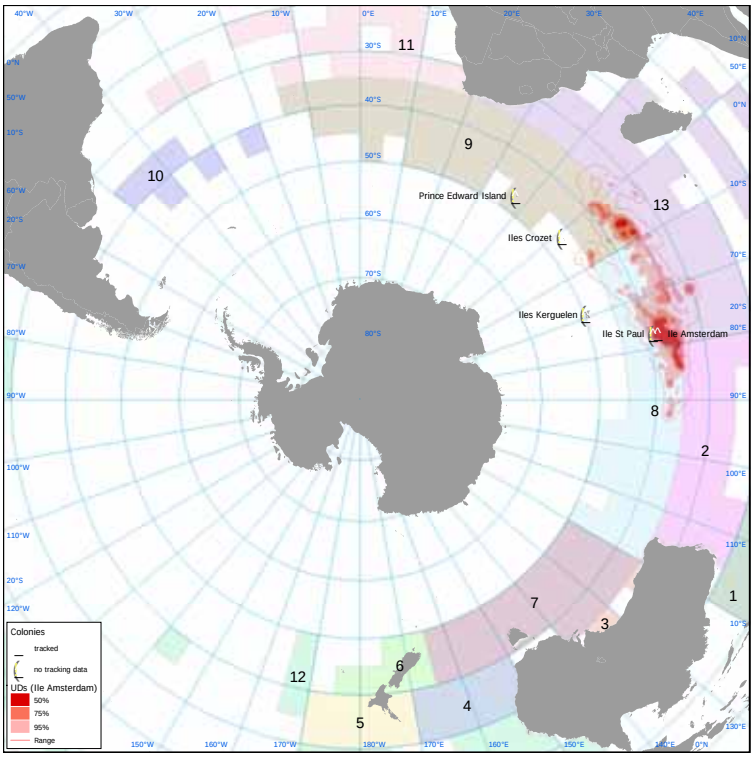


Figure 7. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Northern Royal Albatross, tracked from both of the breeding populations (Chatham Is. >99% breeding population, Taiaroa Head <1% breeding population).

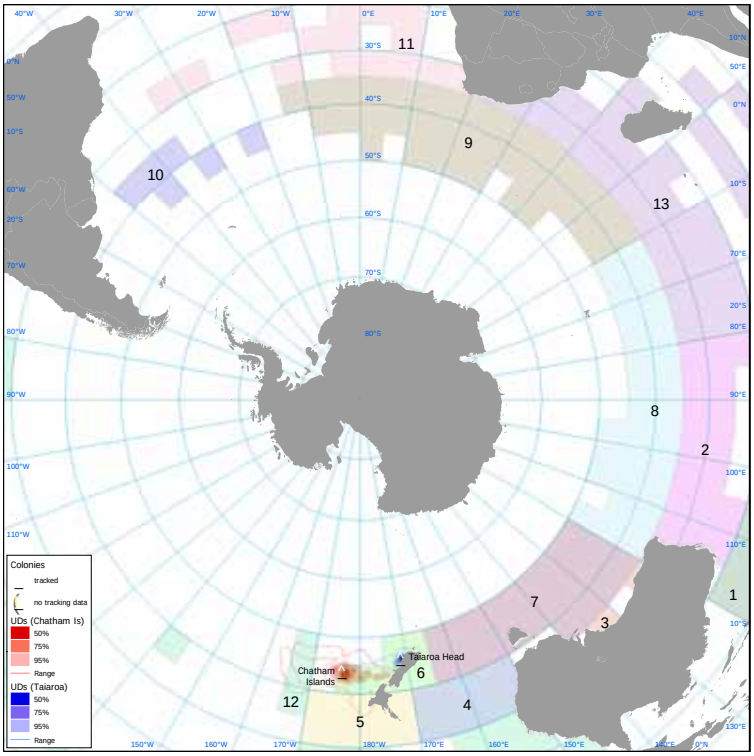


Figure 8. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Tristan (TRA) and Southern Royal (RAS) Albatrosses. For both species, tracks are from sites representing >99% of the breeding population.

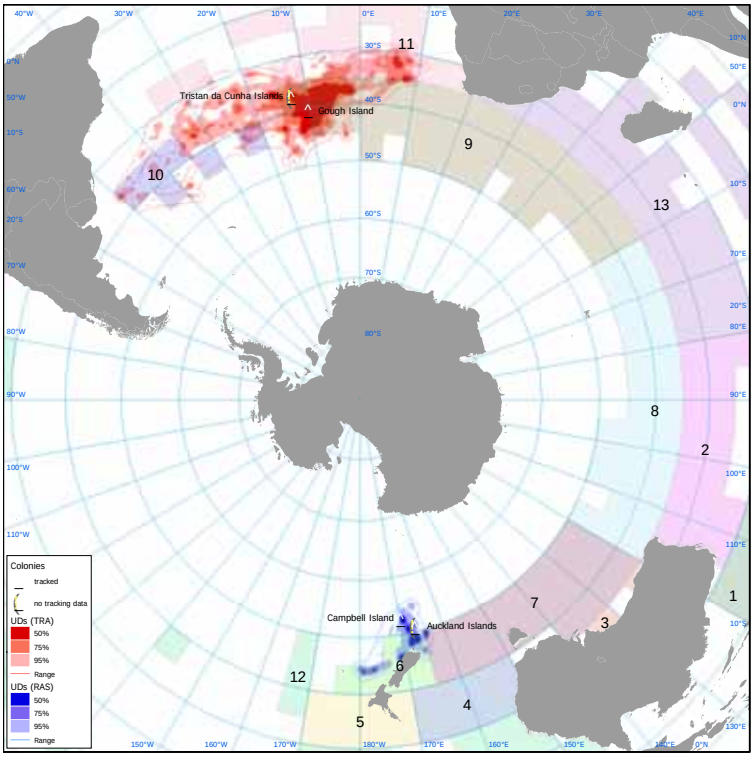


Figure 9. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Shy Albatross. Tracks represent only 14% of the breeding population. Gaps remain from Auckland Is. (85% breeding population), Chatham Is. and Antipodes (both <1% breeding population).

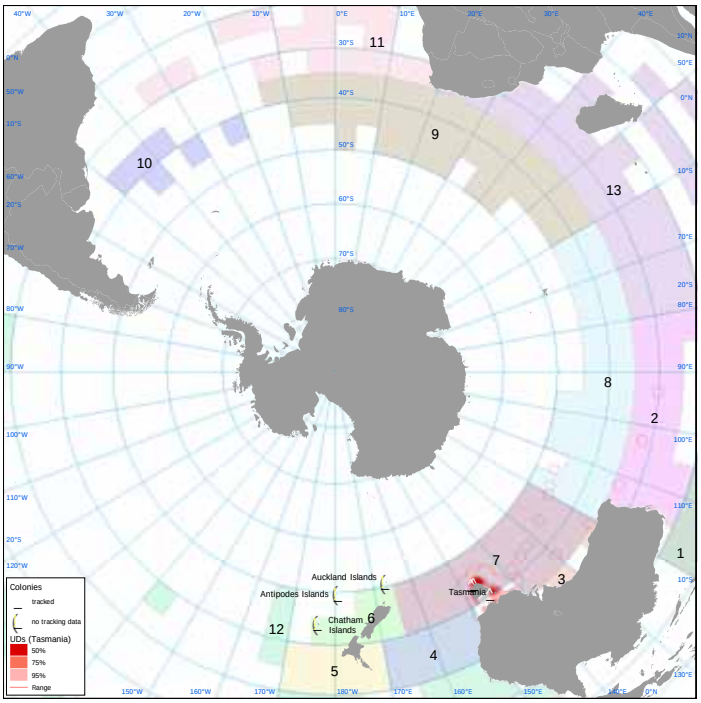


Figure 10. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Westland Petrels (WEP), tracked from the single breeding site, and Short-tailed Shearwaters (STS), tracked from 2 of approximately 160 breeding populations.

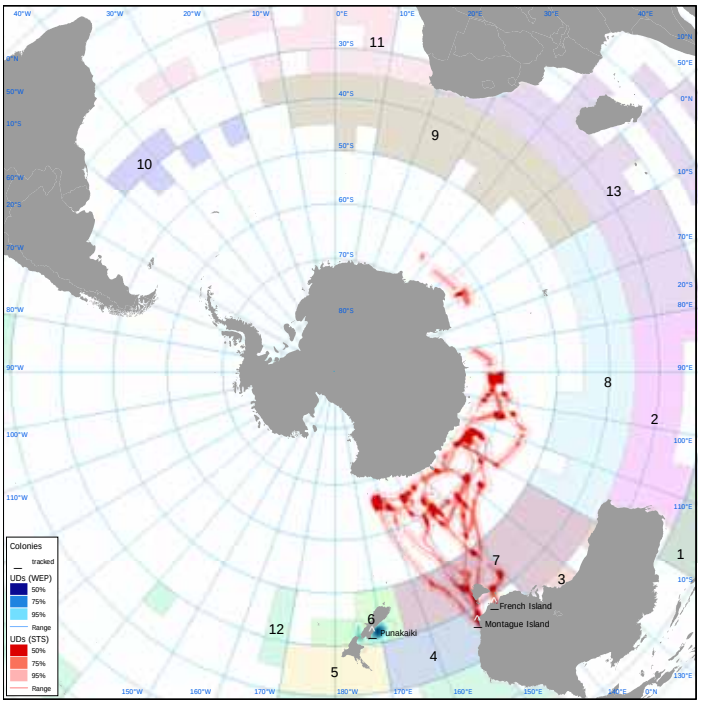


Figure 11. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Antipodean (including Gibson's) Albatross. Tracks represent 59% breeding population (100% of D. (antipodensis)gibsoni). Data gaps remain for the Antipodes (41% breeding population), and Campbell Is. (<1% breeding population).

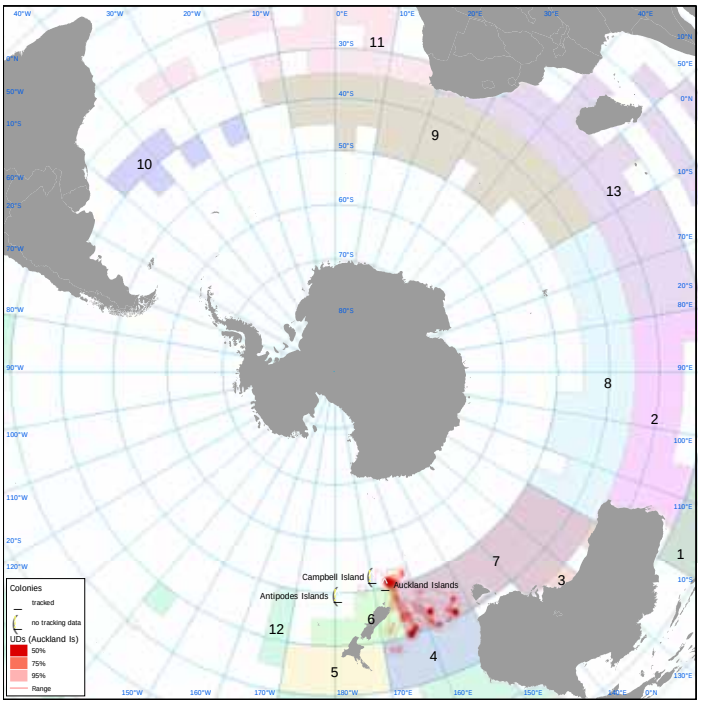


Figure 12. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Sooty Albatross. Tracks are from sites representing 17% of the breeding population. Data gaps remain for Tristan de Cunha and Gough Is. (59% breeding population), Prince Edward Is. (21% breeding population), Ile St Paul and Iles Kerguelen (both <1% breeding population).

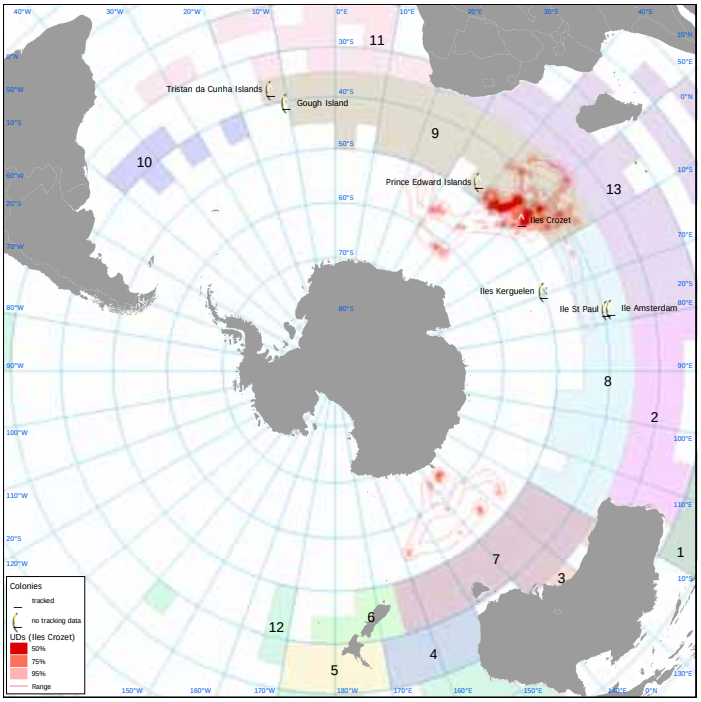


Figure 13. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Wandering Albatross tracked from four populations. Tracks are from sites representing >99% breeding population.

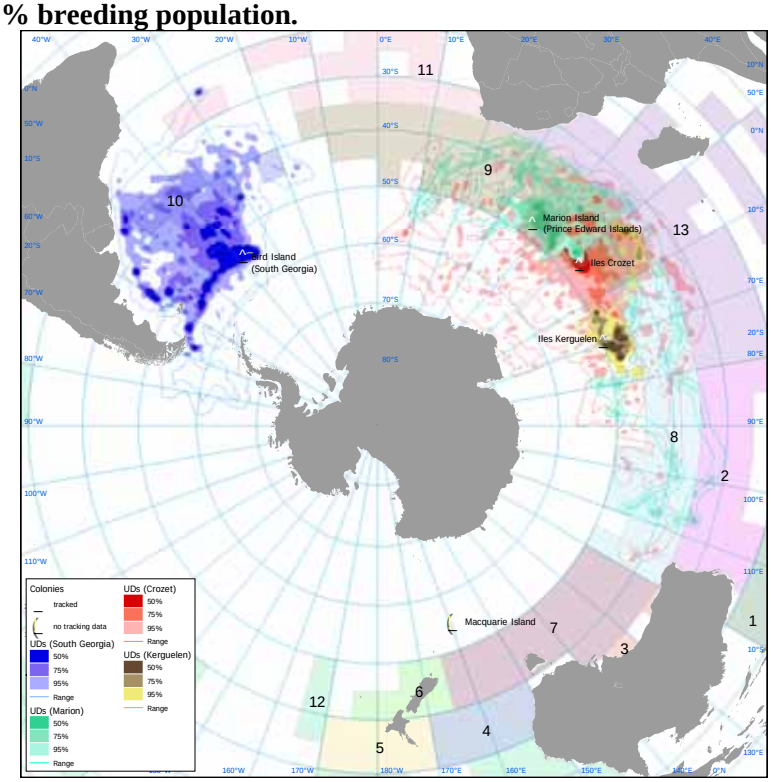


Figure 14. Overlap between the CCSBT area (1999-2003) and utilisation distributions of breeding Grey-headed Albatross. Tracks are from sites representing 87% of the breeding population. Gaps remain for Iles Kerguelen (7%) and Iles Crozet (6%).

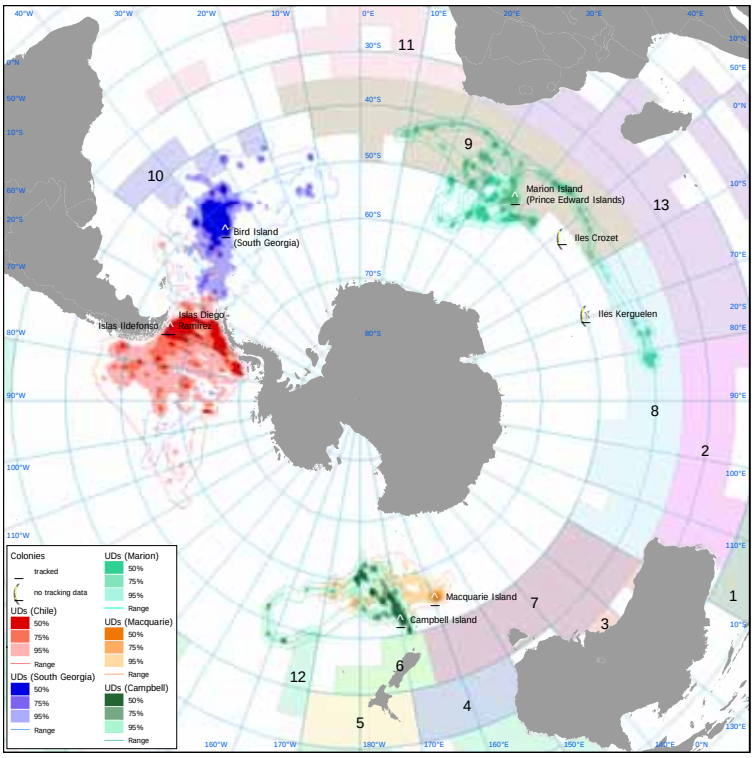


Figure 15. Overlap between the CCSBT area (1999-2003) and utilisation distributions of Grey-headed Albatross tracked from South Georgia in the 18 months between breeding attempts. Reproduced from Figure 3.30, *Tracking Ocean Wanderers*, BirdLife 2004a. A. Overall distribution, B. South Atlantic, C. Southern Indian Ocean, D. Breeding distribution of Black-browed Albatross

from South Georgia, for comparison. ***Note that non-breeding distributions are based on sparse data, so are provisional (more data are currently being processed).***

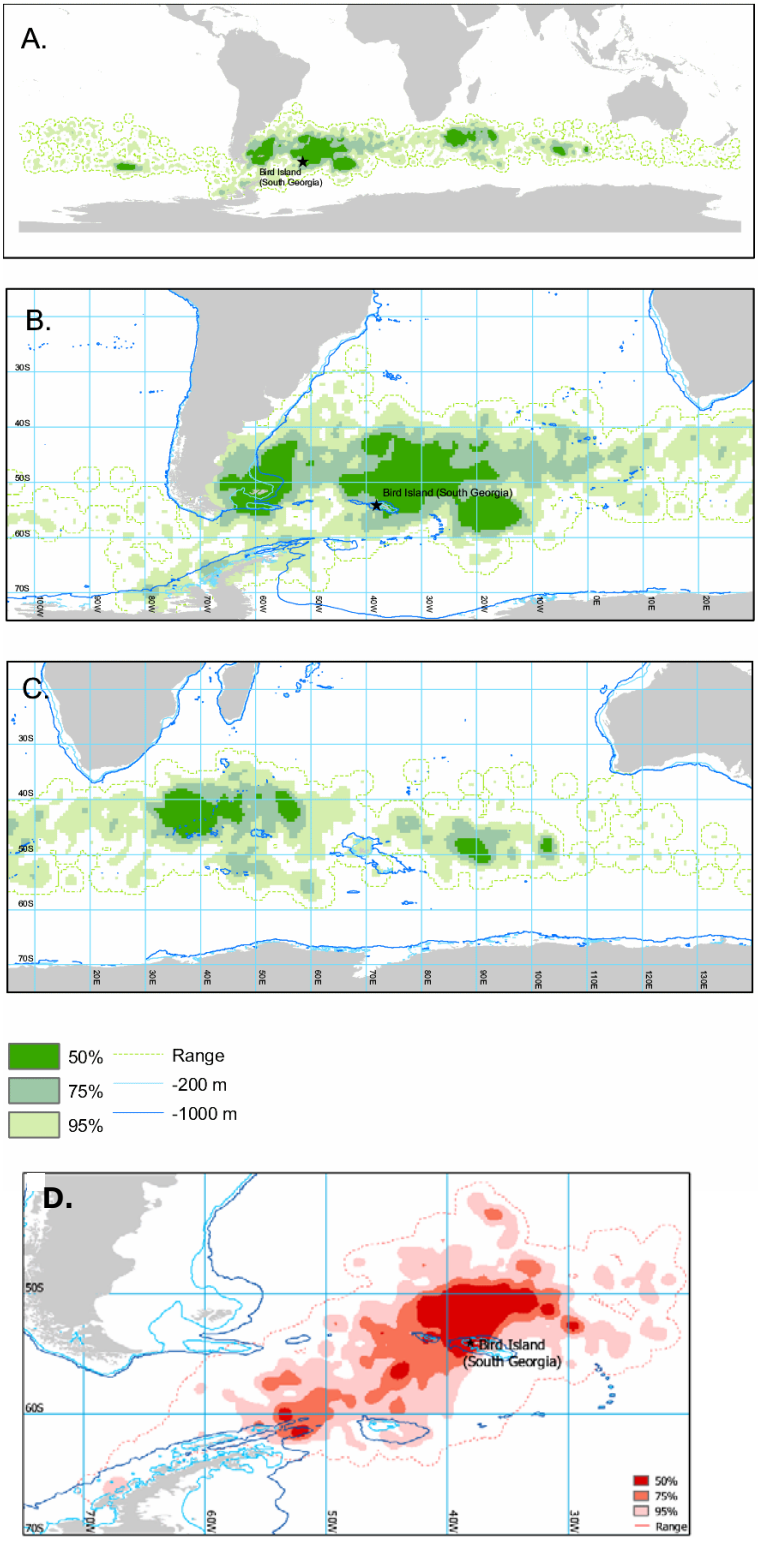


Figure 16. Overlap between the CCSBT area (1999-2003) and utilisation distributions of Black-browed Albatross tracked from Bird Island, South Georgia during the non-breeding season (Reproduced from Figure 3.27, *Tracking Ocean Wanderers*, BirdLife 2004a). N*ote that non-breeding distributions are based on sparse data, so are provisional (more data are currently being processed).*

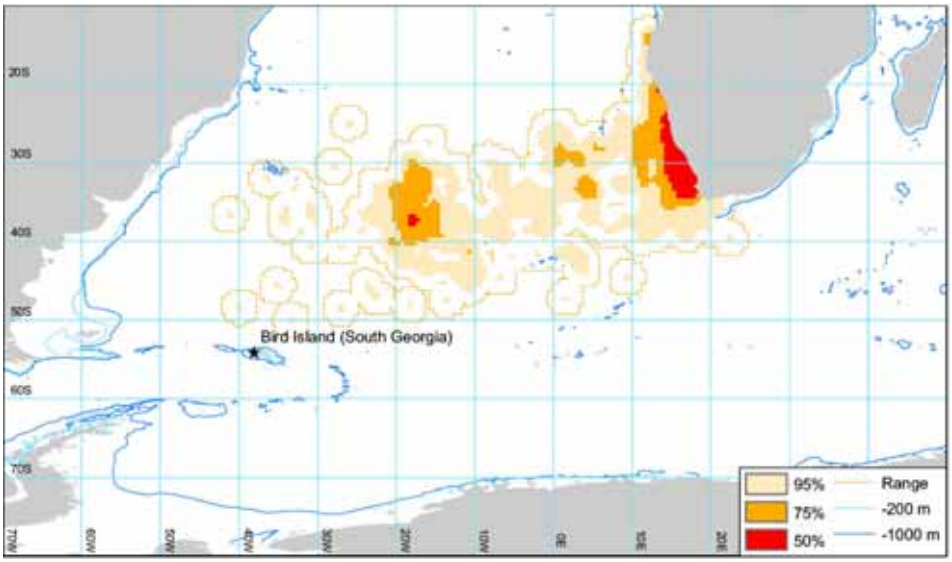


Figure 17. Overlap between the CCSBT area (1999-2003) and utilisation distributions of non-breeding Antipodean (Gibson's) Albatross. Tracks are from sites representing >99% population, *but note that non-breeding distributions are based on sparse data, so are provisional.*

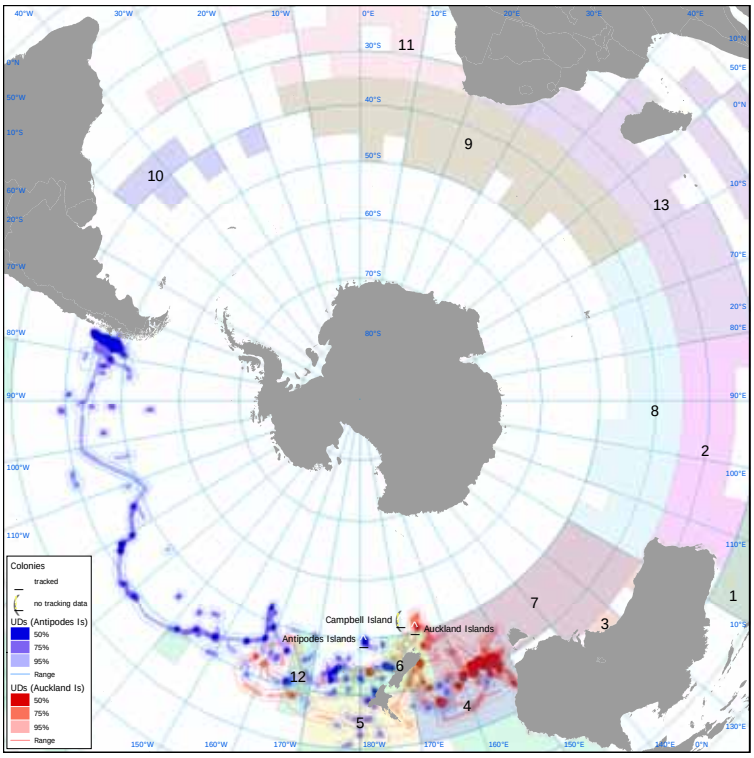


Figure 18. Overlap between the CCSBT area (1999-2003) and utilisation distribution of non-breeding Buller's Albatross. Tracks are from sites representing 42% of the breeding population. Gaps remain for Chatham Is. (58% breeding population), also Three Kings (<1% breeding population). ***Also note that non-breeding distributions are based on sparse data, so are provisional.***

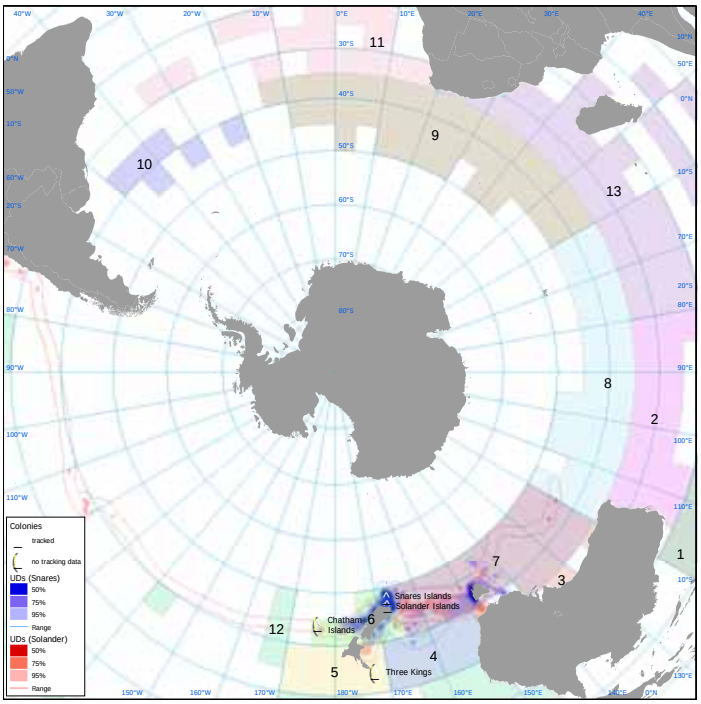


Figure 19. Overlap between the CCSBT area (1999-2003) and utilisation distribution of non-breeding Shy Albatross tracked from Tasmania (site representing 14% of the breeding population). ***Also note that non-breeding distributions are based on sparse data, so are provisional.***

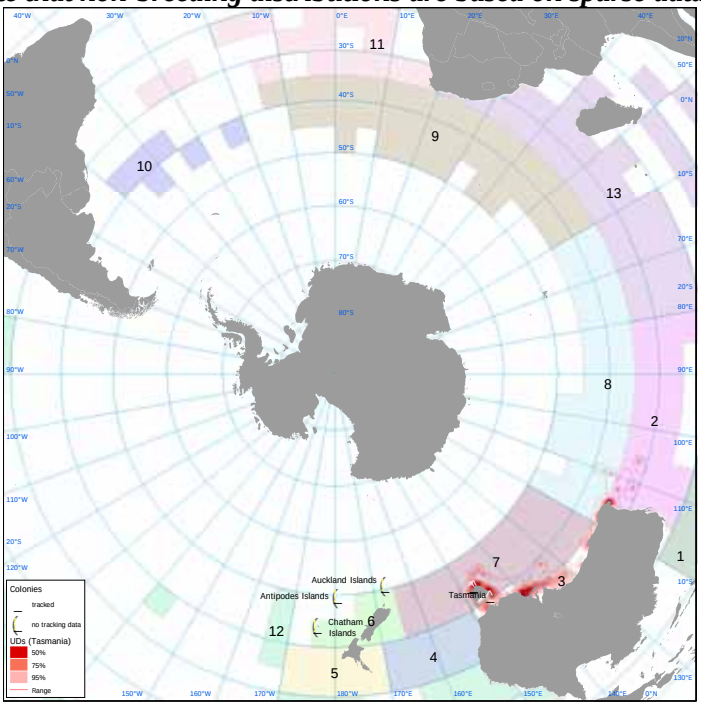


Figure 20. Overlap between the CCSBT area (1999-2003) and utilisation distributions of non-breeding Northern Royal Albatross, tracked from both of the breeding sites (Chatham Is. >99% breeding population, Taiaroa Head <1% breeding population). Data based on 7 tracks.

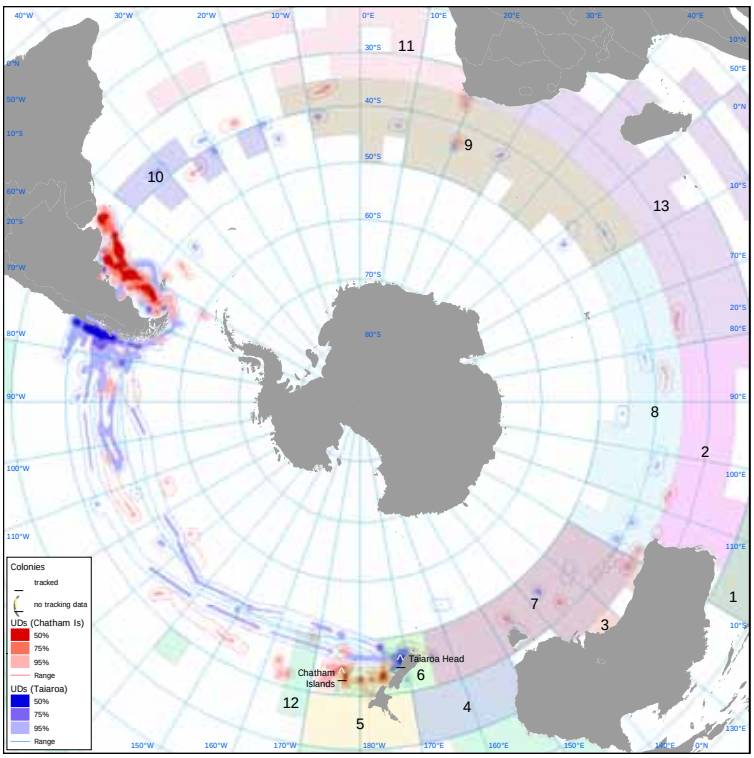


Figure 21. Overlap between the CCSBT area (1999-2003) and utilisation distribution of non-breeding Chatham Albatross, tracked from both the single breeding site, *but note that non-breeding distribution is based on sparse data, so results are provisional.*

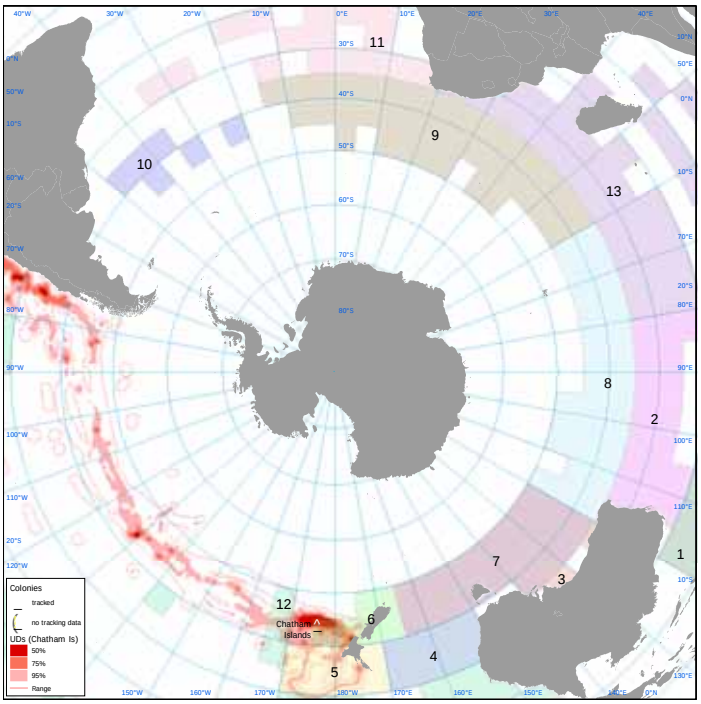
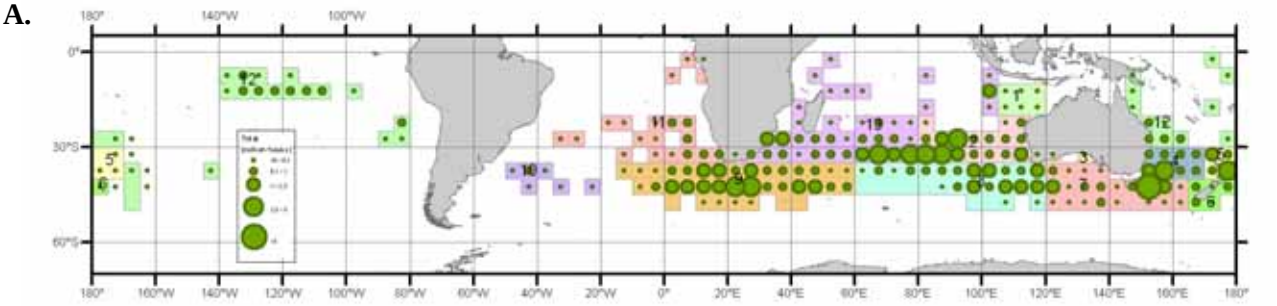
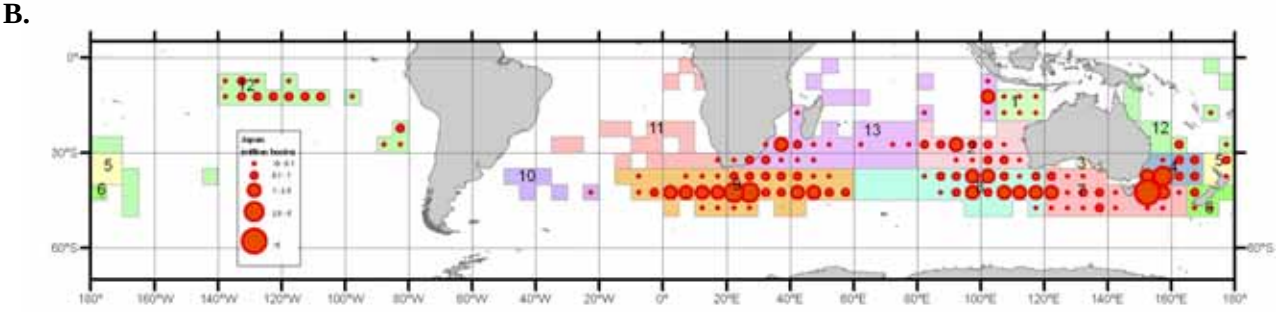


Figure 22. CCSBT Southern Blue-fin Tuna longline fishing effort by fleet averaged from 1999 to 2003, overlaid on the combined utilisation distribution map for the breeding distribution of 20 southern-hemisphere species in the Global *Procellariiform* Tracking Database*. A. Total, B. Japan, C. Taiwan, D. Korea, Australia and New Zealand.

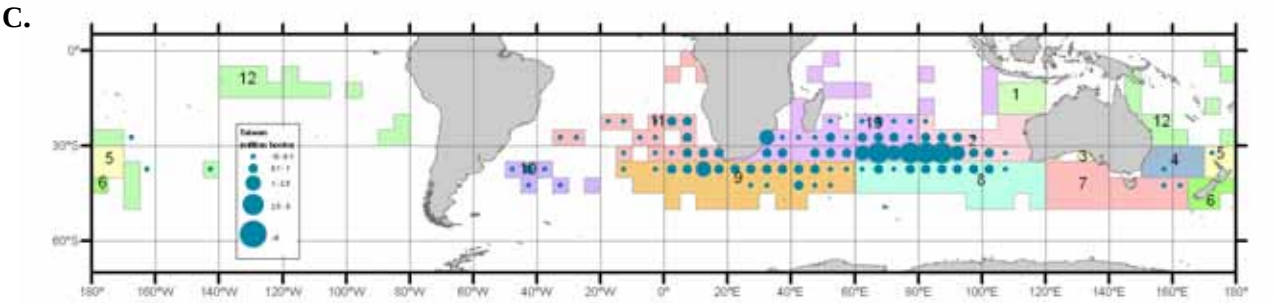
A.



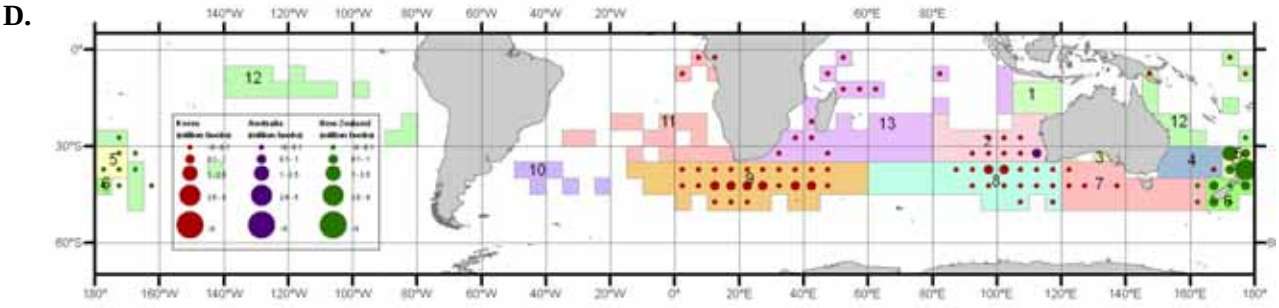
B.



C.



D.



* Close to 170ºW, the effort data do not match entirely with the CCSBT area, due to differences between the CCSBT catch and effort databases, which may be the result of data-processing methods used to defined catch estimates (CCSBT).

Figure 23. Distribution of all longline fishing effort contained in the CCSBT databases, comparing distribution of fishing effort in strata where Southern Blue-fin Tuna were caught (SBT) (which were defined as 'CCSBT longline fishing effort' in this paper), and longline fishing effort where no SBT were caught (non-SBT), which have not been included elsewhere in this paper. Data represent average effort 1999 – 2003 (million hooks).