Ministry for Primary Industries
Manatū Ahu Matua

Risk of commercial fisheries to New Zealand seabird populations: Supplementary information

Supplement to New Zealand Aquatic Environment and Biodiversity Report No. 109

Y. Richard,
E.R. Abraham

ISSN 1179-6480 (online)
ISBN 978-0-478-40567-5 (online)

March 2013

New Zealand Government

Growing and Protecting New Zealand

Requests for further copies should be directed to:

Publications Logistics Officer
Ministry for Primary Industries
PO Box 2526
WELLINGTON 6140

Email: brand@mpi.govt.nz
Telephone: 0800 00 83 33
Facsimile: 04-894 0300

This publication is also available on the Ministry for Primary Industries websites at:
http://www.mpi.govt.nz/news-resources/publications.aspx
http://fs.fish.govt.nz go to Document library/Research reports

TABLE OF CONTENTS

1. OVERVIEW

This supplementary information presents a summary of population and distributional data for the 70 species included in the risk assessment of the impact of fishing-related mortalities on seabirds breeding in the New Zealand region. For each seabird species included in the risk assessment, the demographic parameters used were the New Zealand population size, the age at first reproduction, and the survival rate. For species for which no demographic estimates were available, values from proxy species were used, as indicated with a reference to the data source. Distributional data are presented as maps of the at-sea distribution of each species, with separate maps for the non-breeding and breeding distributions. The distribution of non-breeders was derived from existing maps published by NABIS (National Aquatic Biodiversity Information System) and Birdlife International. A single distribution map was generated when the breeding season extended throughout the year. Included in the distributional maps are data of any incidental captures in commercial trawl, longline and set-net fisheries between the 2006–2007 and 2010–2011 fishing years, recorded by fisheries observers.

A detailed description of the methods used to derive the data presented here is provided in Section 2 of the risk assessment.

2. SPECIES DATA

S.1 Gibson's albatross (*Diomedea antipodensis gibsoni*)

Population (NZ)	5831 (4826 – 7417) pairs [1997]	Walker & Elliott (1999)
Age at first reproduction	10 to 12 years	L. Brooke (2004)
Survival rate	93.8 to 98.5% [1996]	Croxall & Gales (1998)
	96 to 98% [1997]	Walker & Elliott (1999)
	95.9 $\pm$ 0.6% [2004]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)

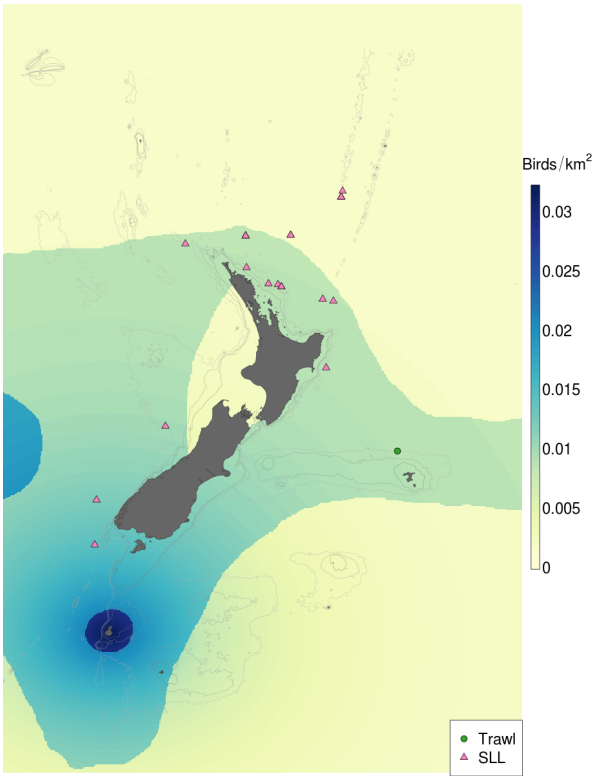


Figure S-1: Relative density of Gibson's albatross (*Diomedea antipodensis gibsoni*). The distribution base map was obtained from BirdLife telemetry global distribution maps. The breeding season runs throughout the year, hence a single distribution map was created. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.2 Antipodean albatross (*Diomedea antipodensis antipodensis*)

Population (NZ)	6292 pairs [2009]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	10 to 13 years [1997]	Walker & Elliott (2002)
Survival rate	95.7 ± 0.7% [2004]	Walker & Elliott (1999)

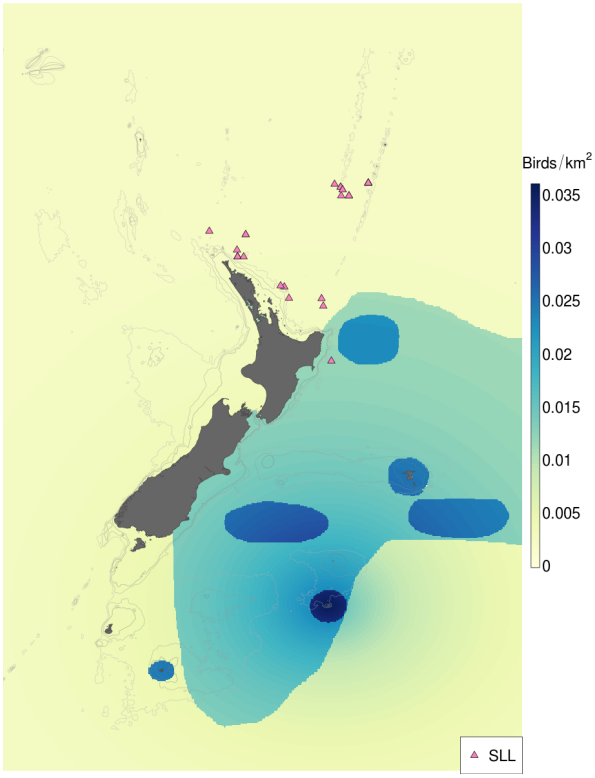


Figure S-2: Relative density of Antipodean albatross (*Diomedea antipodensis antipodensis*). The distribution base map was obtained from BirdLife telemetry global distribution maps. The breeding season runs throughout the year, hence a single distribution map was created. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.3 Southern royal albatross (*Diomedea epomophora*)

Population (NZ)	7886 pairs [2008]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	8.5 to 10.6 years	Robertson (1993)
Survival rate	94.9 $\pm$ 0.8% [2001]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)

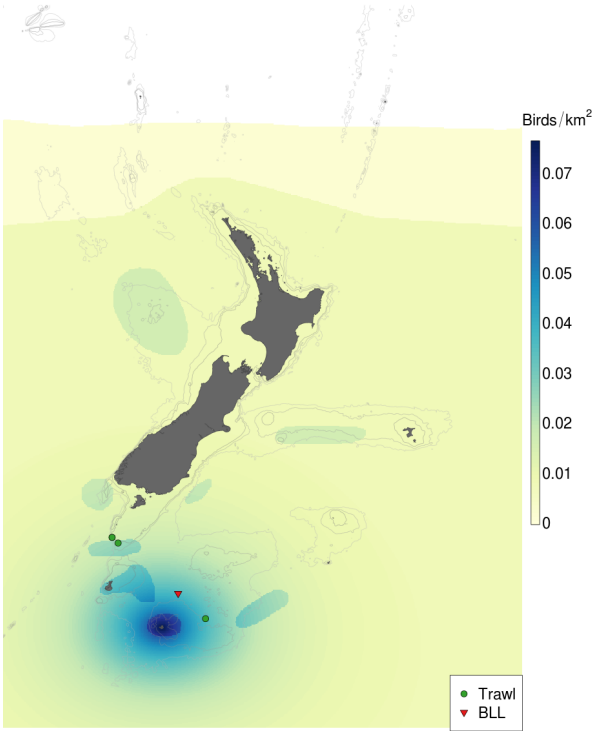


Figure S-3: Relative density of southern royal albatross (*Diomedea epomophora*). The distribution base map was obtained from BirdLife telemetry global distribution maps. The breeding season runs throughout the year, hence a single distribution map was created. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.4 Northern royal albatross (*Diomedea sanfordi*)

Population (NZ)	5832 pairs [2003]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	8.5 to 10.6 years	Robertson (1993)
Survival rate	95.2% [1993]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
	94.6 ± 1.5% [1993]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)

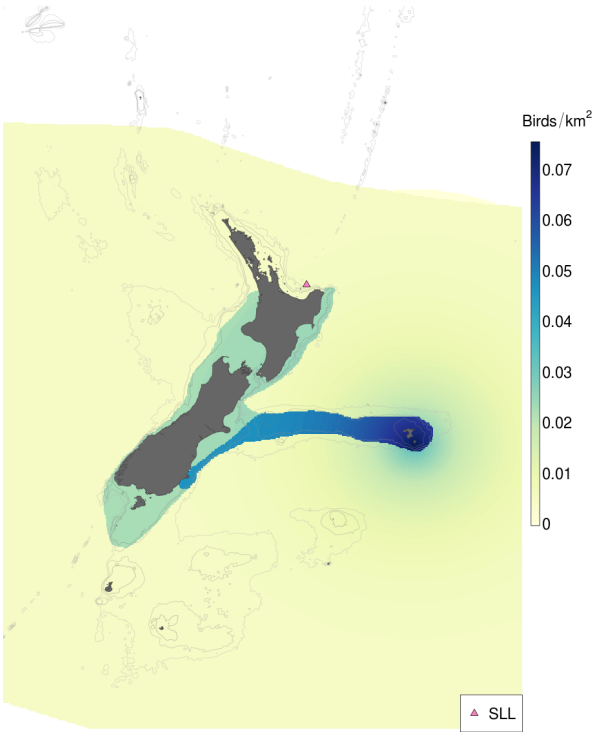
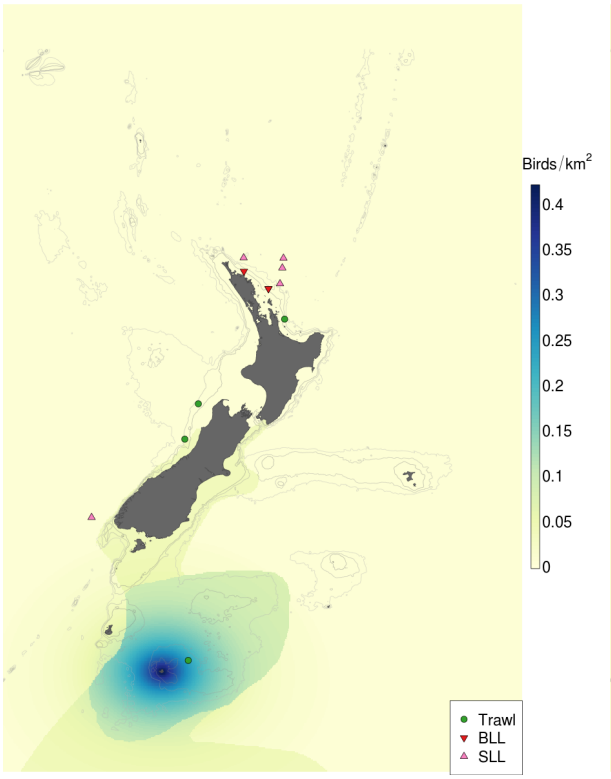


Figure S-4: Relative density of northern royal albatross (*Diomedea sanfordi*). The base map for the distribution was obtained from the NABIS database. The breeding season runs throughout the year, hence a single distribution map was created. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.5 Campbell black-browed albatross (*Thalassarche impavida*)

Population (NZ)	21 000 pairs [1998]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	10 (6 – 13) years [1995]	Waugh et al. (1999)
Survival rate	94.5% [1996]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)

(a) Breeding distribution



(b) Non-breeding distribution

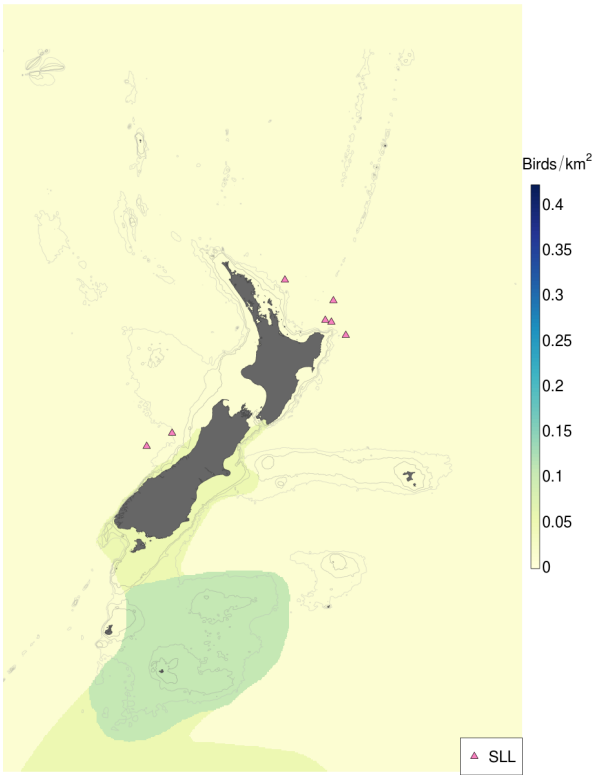


Figure S-5: Relative density of Campbell black-browed albatross (*Thalassarche impavida*). The distribution base map was obtained from BirdLife telemetry global distribution maps. The breeding season runs from August to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.6 New Zealand white-capped albatross (*Thalassarche steadi*)

Population (NZ)	77 000 pairs [2011]	Birdlife International (2012)
Age at first reproduction	12 years [2011]	Southern Buller's albatross as proxy, Francis & Sagar (2012)
Survival rate	96 (90.7 – 99.5)% [2011]	Francis (2012)

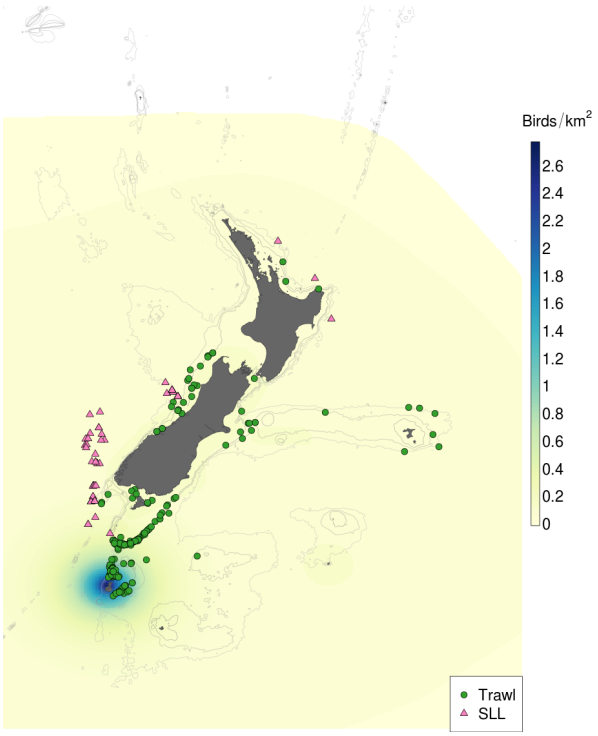


Figure S-6: Relative density of New Zealand white-capped albatross (*Thalassarche steadi*). The base map for the distribution was obtained from the NABIS database. The breeding season runs throughout the year, hence a single distribution map was created. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.7 Salvin's albatross (*Thalassarche salvini*)

Population (NZ)	31 947 pairs [1998]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	12 years [2011]	Southern Buller's albatross as proxy, Francis & Sagar (2012)
Survival rate	96.7% [2011]	Sagar et al. (2011)

(a) Breeding distribution

(b) Non-breeding distribution

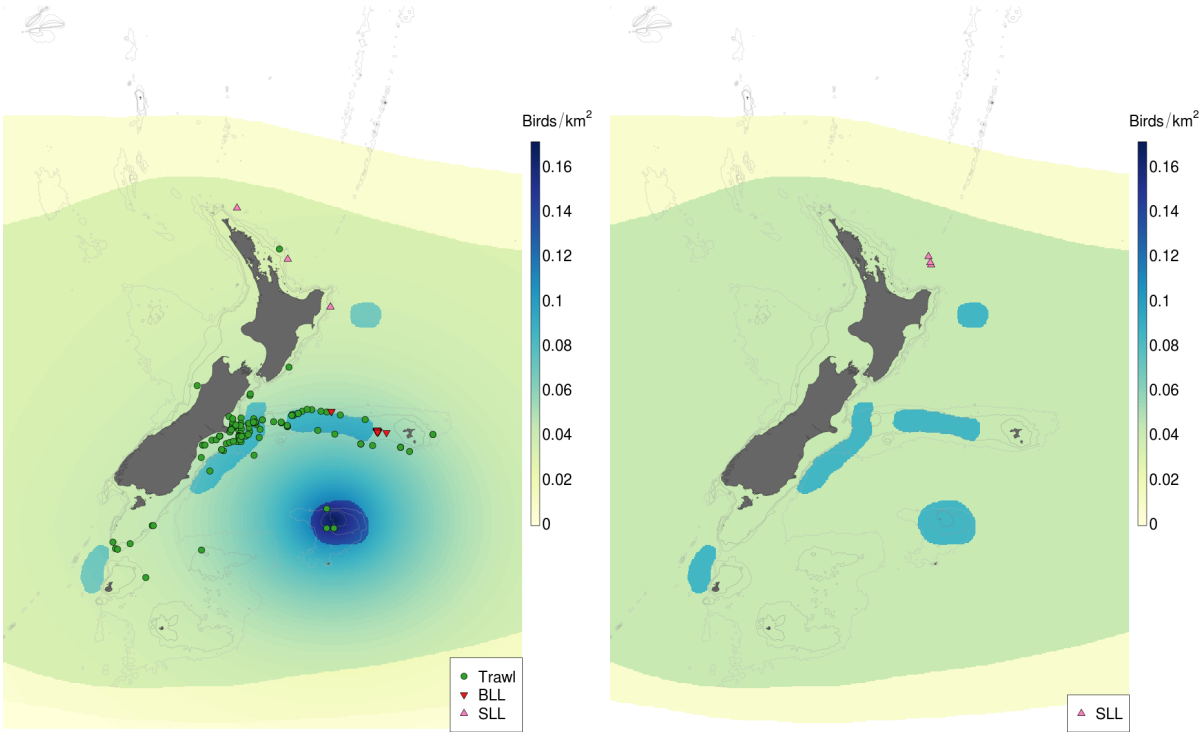


Figure S-7: Relative density of Salvin's albatross (*Thalassarche salvini*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from August to April. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.8 Chatham Island albatross (*Thalassarche eremita*)

Population (NZ)	5247 pairs [2007]	Birdlife International (2009)
Age at first reproduction	12 years [2011]	Southern Buller's albatross as proxy, Francis & Sagar (2012)
Survival rate	96.7% [2011]	Salvin's albatross as proxy, Sagar et al. (2011)

(a) Breeding distribution **(b) Non-breeding distribution**

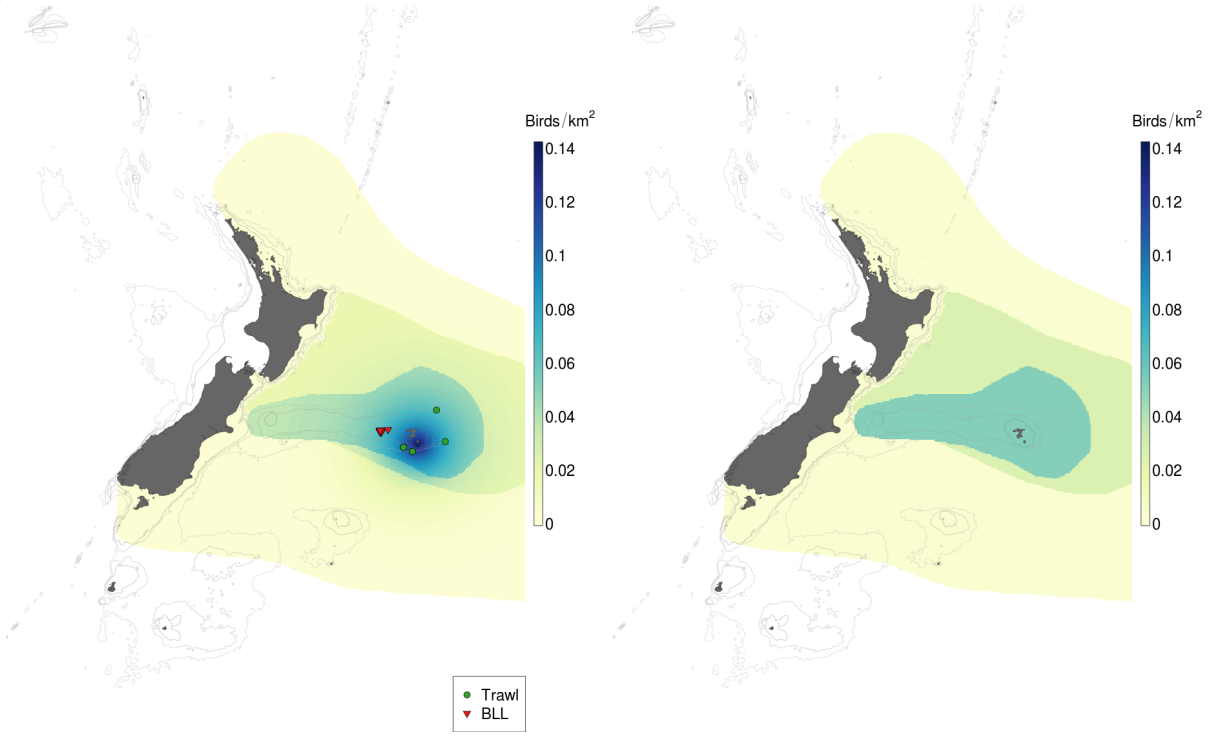


Figure S-8: Relative density of Chatham Island albatross (*Thalassarche eremita*). The distribution base map was obtained from BirdLife telemetry global distribution maps. The breeding season runs from July to April. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.9 Grey-headed albatross (*Thalassarche chrysostoma*)

Population (NZ)	6600 pairs [1997]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	7 to 13 years	Schreiber & Burger (2001)
Survival rate	$95.3 \pm 0.9\%$ ($N = 225$) [1996]	Waugh et al. (1999)

(a) Breeding distribution **(b) Non-breeding distribution**

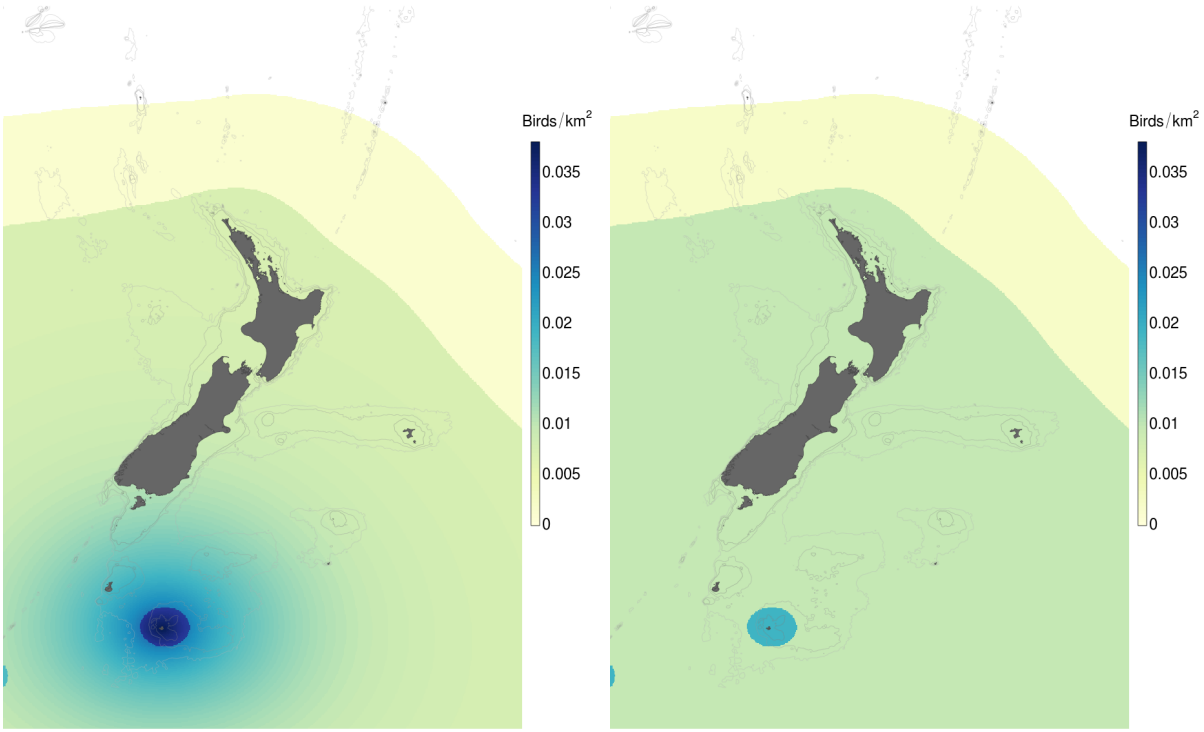


Figure S-9: Relative density of grey-headed albatross (*Thalassarche chrysostoma*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from September to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.10 Southern Buller's albatross (*Thalassarche bulleri bulleri*)

Population (NZ)	13 625 pairs [2002]	Sagar & Stahl (2005)
Age at first reproduction	12 years [2011]	Francis & Sagar (2012)
Survival rate	93 to 98% [2011]	Francis & Sagar (2012)

(a) Breeding distribution **(b) Non-breeding distribution**

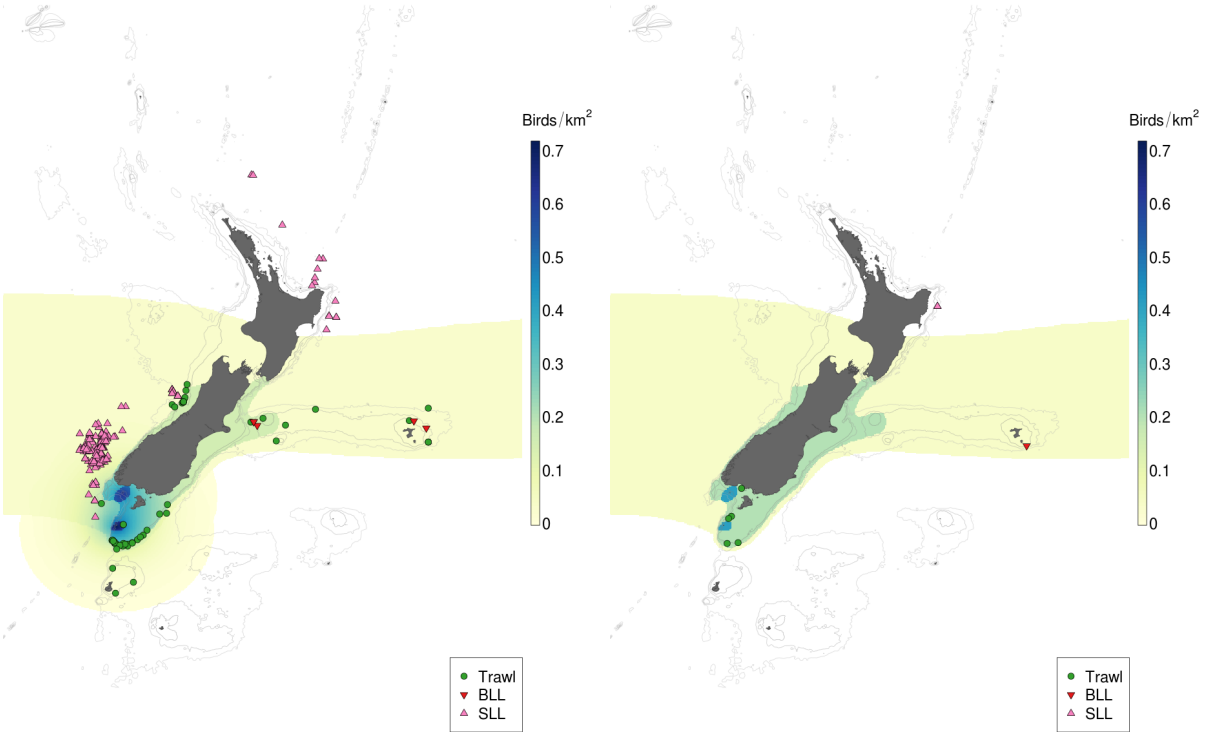


Figure S-10: Relative density of southern Buller's albatross (*Thalassarche bulleri bulleri*). The distribution base map was obtained from BirdLife telemetry global distribution maps. The breeding season runs from March to December. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.11 Northern Buller's albatross (*Thalassarche bulleri platei*)

Population (NZ)	16 346 pairs [2008]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	12 years [2011]	Southern Buller's albatross as proxy, Francis & Sagar (2012)
Survival rate	93.5 (93 – 98)% [2011]	Southern Buller's albatross as proxy, Francis & Sagar (2012)

(a) Breeding distribution **(b) Non-breeding distribution**

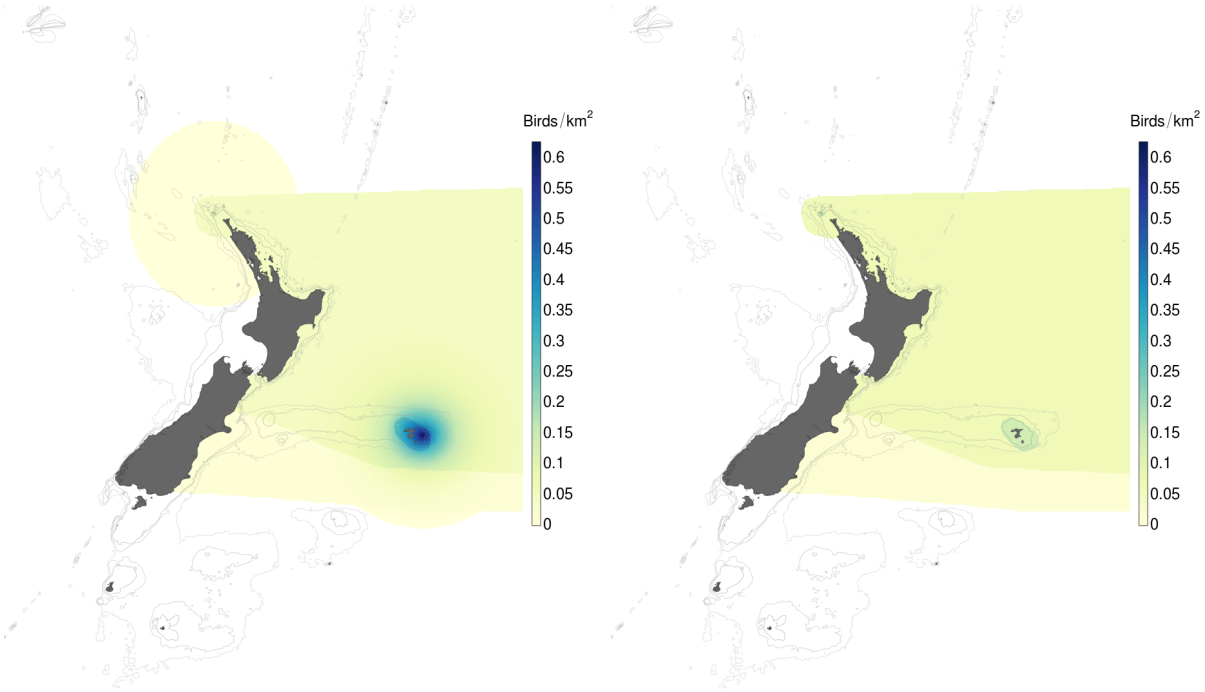
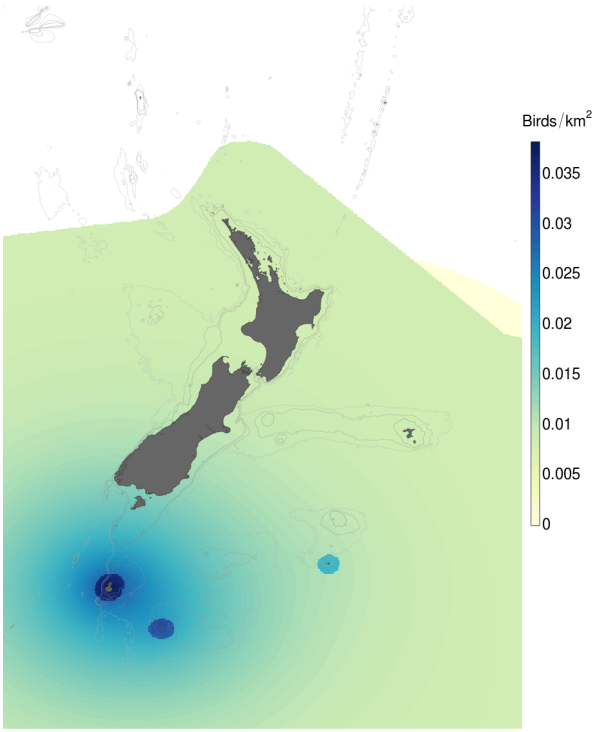


Figure S-11: Relative density of northern Buller's albatross (*Thalassarche bulleri platei*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from December to September. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.12 Light-mantled sooty albatross (*Phoebetria palpebrata*)

Population (NZ)	6770 to 6900 pairs	Taylor (2000a)
Age at first reproduction	12 years	L. Brooke (2004)
Survival rate	96 to 98% [1997]	Gibson's albatross as proxy, Walker & Elliott (1999)

(a) Breeding distribution



(b) Non-breeding distribution

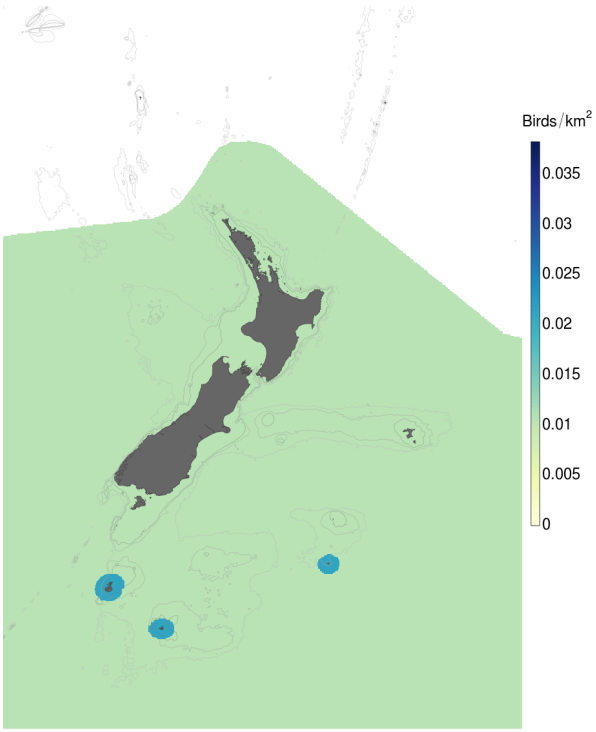


Figure S-12: Relative density of light-mantled sooty albatross (*Phoebetria palpebrata*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from September to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.13 Northern giant petrel (*Macronectes halli*)

Population (NZ)	2567 pairs [1993]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	6 to 10 years	Trivelpiece & Trivelpiece (1998)
Survival rate	92.3%	L. Brooke (2004)
	88 to 93% [1981]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
	88% [2003]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)

(a) Breeding distribution **(b) Non-breeding distribution**

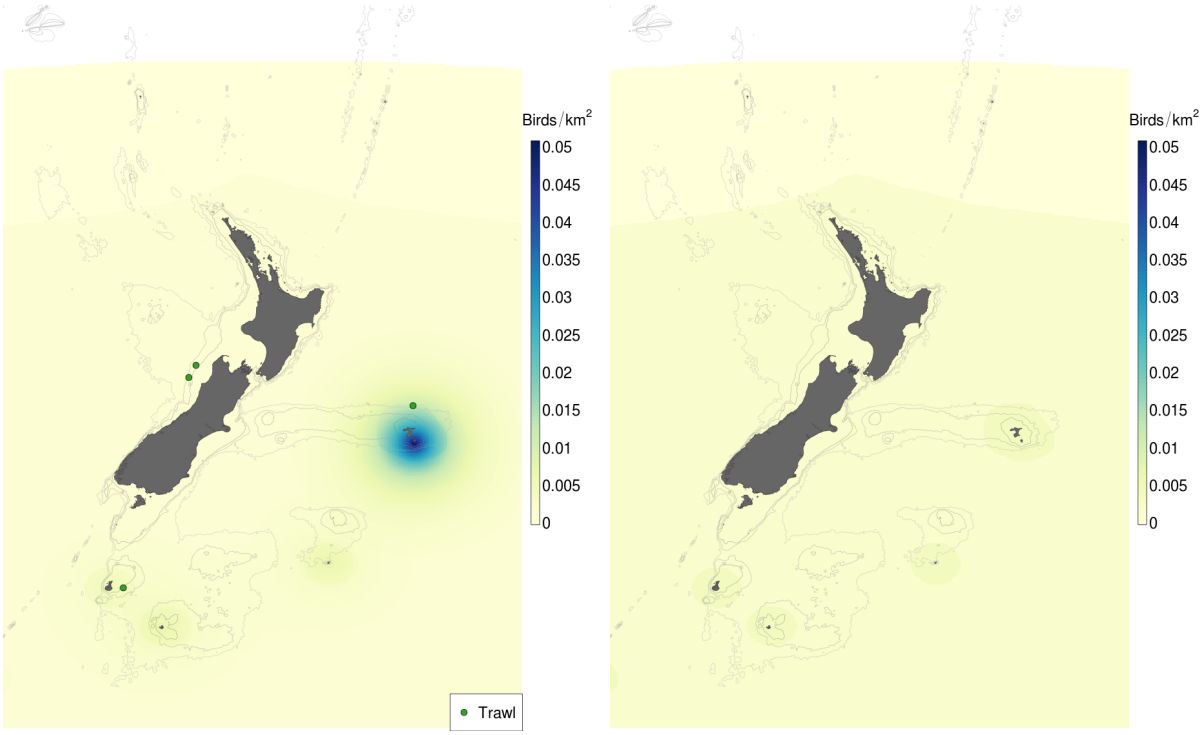


Figure S-13: Relative density of northern giant petrel (*Macronectes halli*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from August to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.14 Grey petrel (*Procellaria cinerea*)

Population (NZ)	32 000 to 73 000 pairs [2001]	Bell (2002)
Age at first reproduction	7 years	Barbraud et al. (2009)
Survival rate	90 to 97%	White-chinned petrel as proxy, Dillingham & Fletcher (2008)

(a) Breeding distribution **(b) Non-breeding distribution**

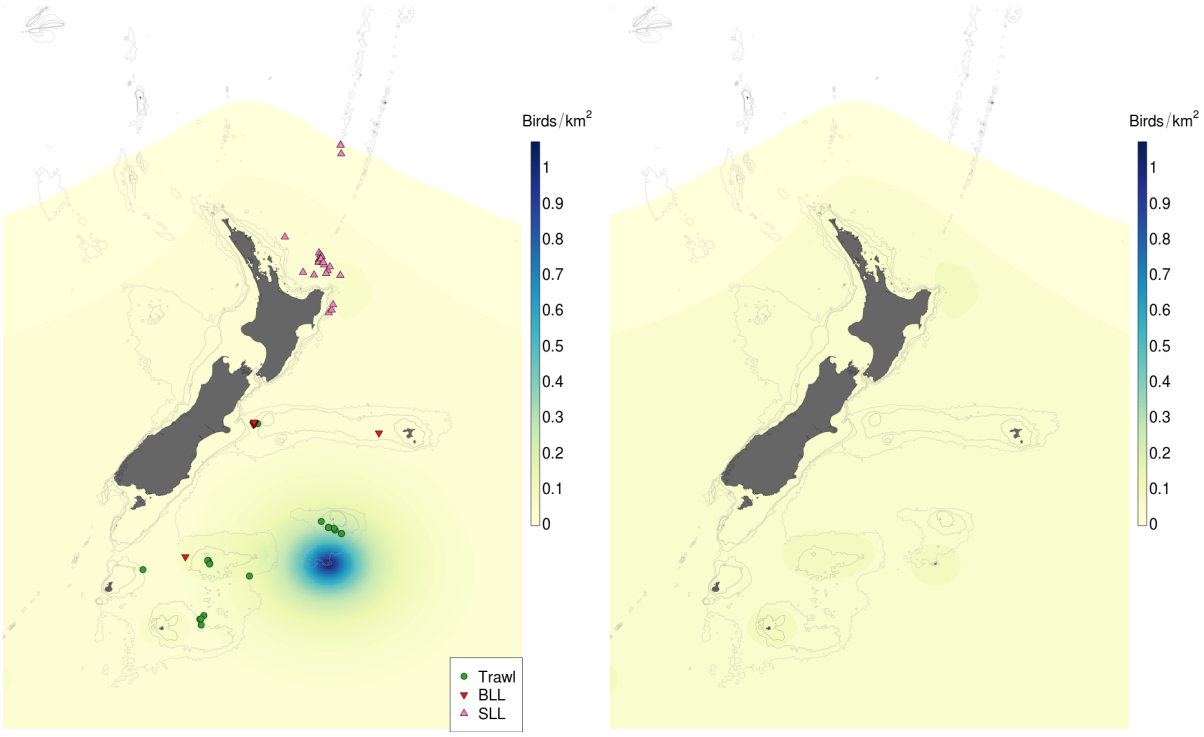


Figure S-14: Relative density of grey petrel (*Procellaria cinerea*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from February to December. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.15 Black petrel (*Procellaria parkinsoni*)

Population (NZ)	1059 pairs [2010]	Bell et al. (2011)
Age at first reproduction	6.6 ± 0.2 years [2010]	Bell et al. (2011)
Survival rate	90.32 ± 2% [2010]	Bell et al. (2011)

(a) Breeding distribution **(b) Non-breeding distribution**

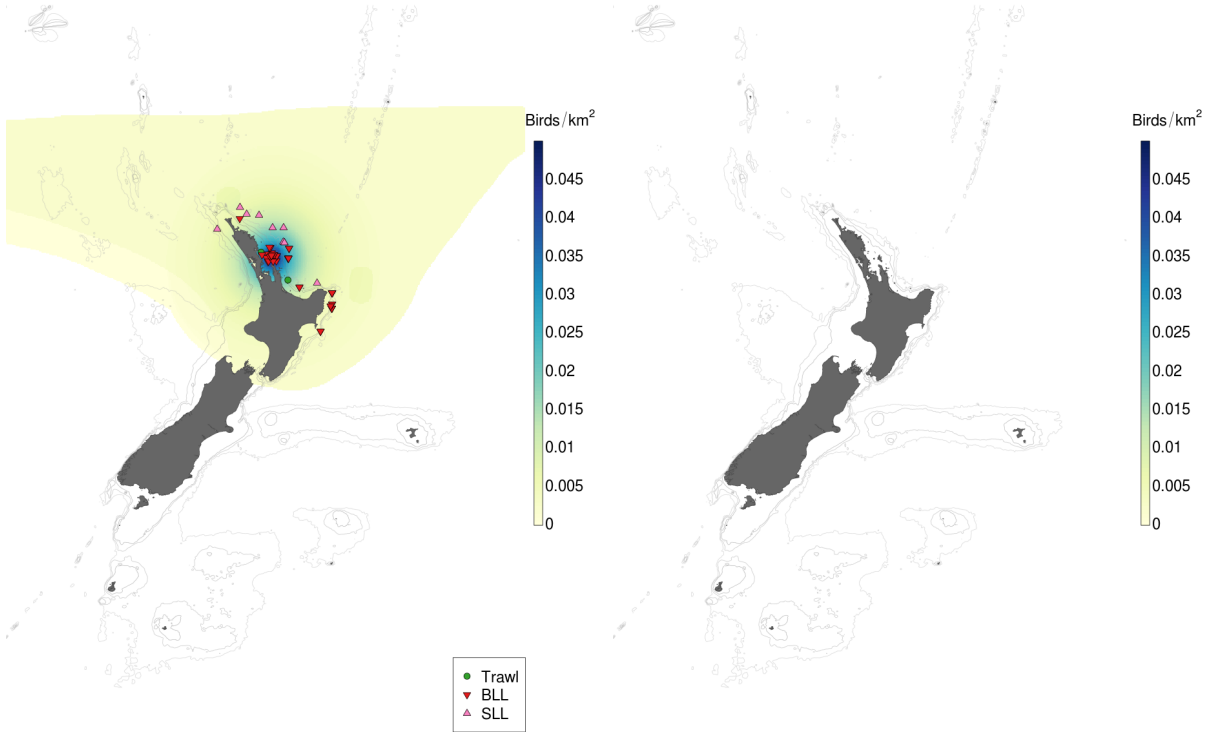


Figure S-15: Relative density of black petrel (*Procellaria parkinsoni*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from October to June. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.16 Westland petrel (*Procellaria westlandica*)

Population (NZ)	4000 pairs [2008]	Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010)
Age at first reproduction	6.5 years [2002]	Waugh et al. (2006)
Survival rate	88.4 to 93.3%	L. Brooke (2004)

(a) Breeding distribution **(b) Non-breeding distribution**

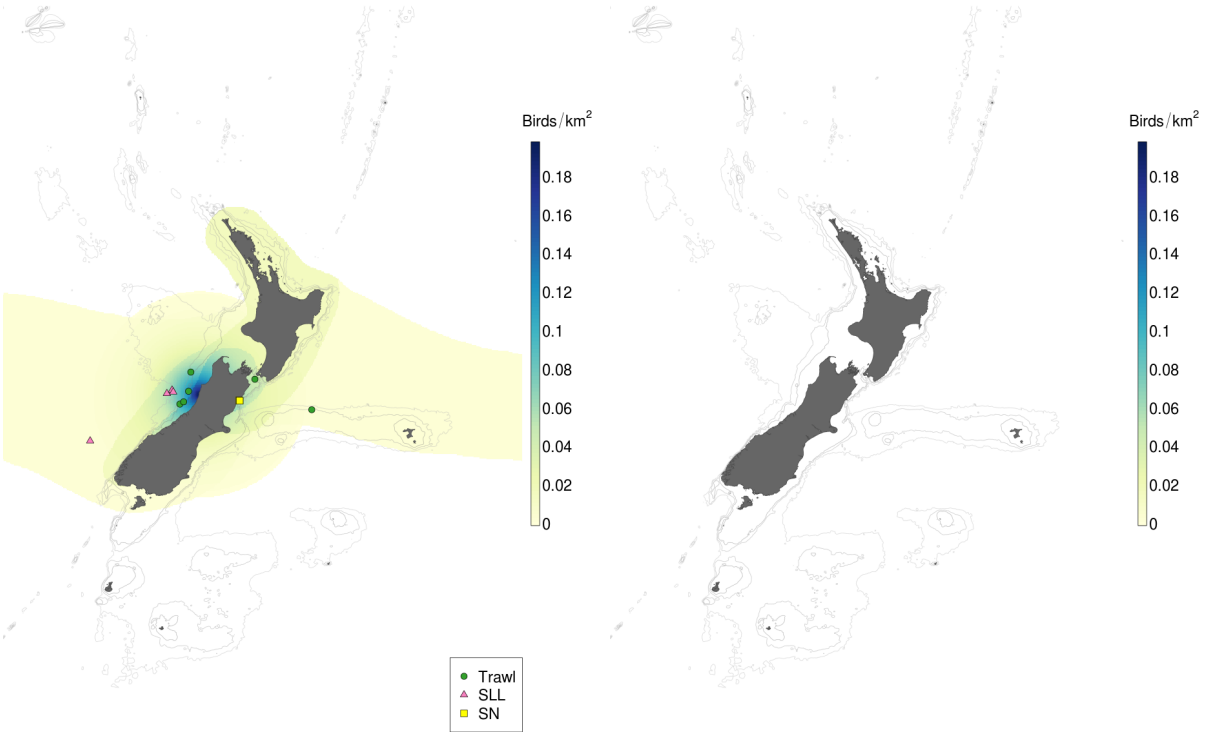
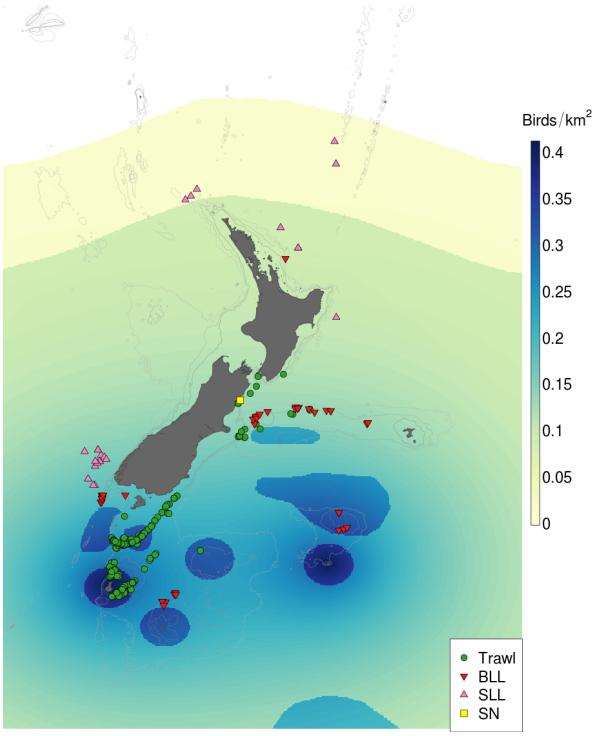


Figure S-16: Relative density of Westland petrel (*Procellaria westlandica*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from February to December. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.17 White-chinned petrel (*Procellaria aequinoctialis*)

Population (NZ)	168 725 pairs	Birdlife International (2012)
Age at first reproduction	6.5 years	Schreiber & Burger (2001)
Survival rate	90 to 97%	Dillingham & Fletcher (2008)

(a) Breeding distribution



(b) Non-breeding distribution

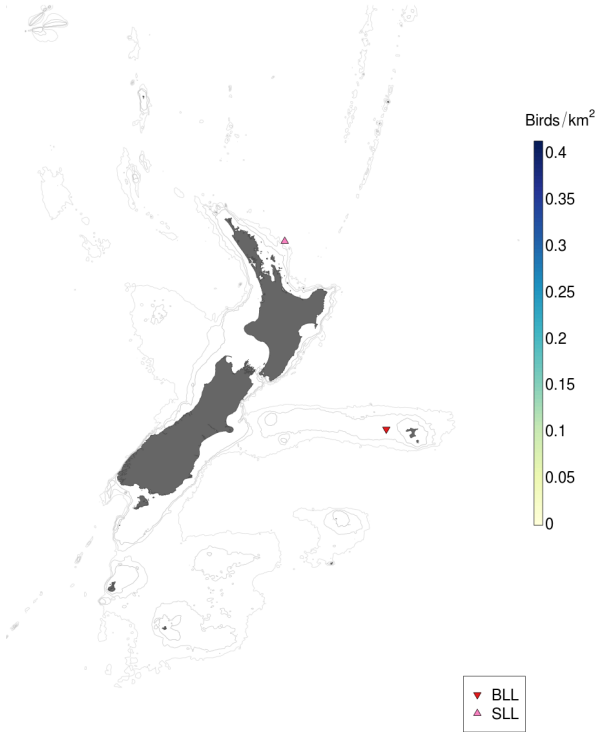


Figure S-17: Relative density of white-chinned petrel (*Procellaria aequinoctialis*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from October to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.18 Flesh-footed shearwater (*Puffinus carneipes*)

Population (NZ)	6689 to 10 540 pairs [2010]	Baker et al. (2010)
Age at first reproduction	4 to 9 years [1973]	Bradley et al. (1999)
Survival rate	92%	Short-tailed shearwater as proxy, L. Brooke (2004)

(a) Breeding distribution **(b) Non-breeding distribution**

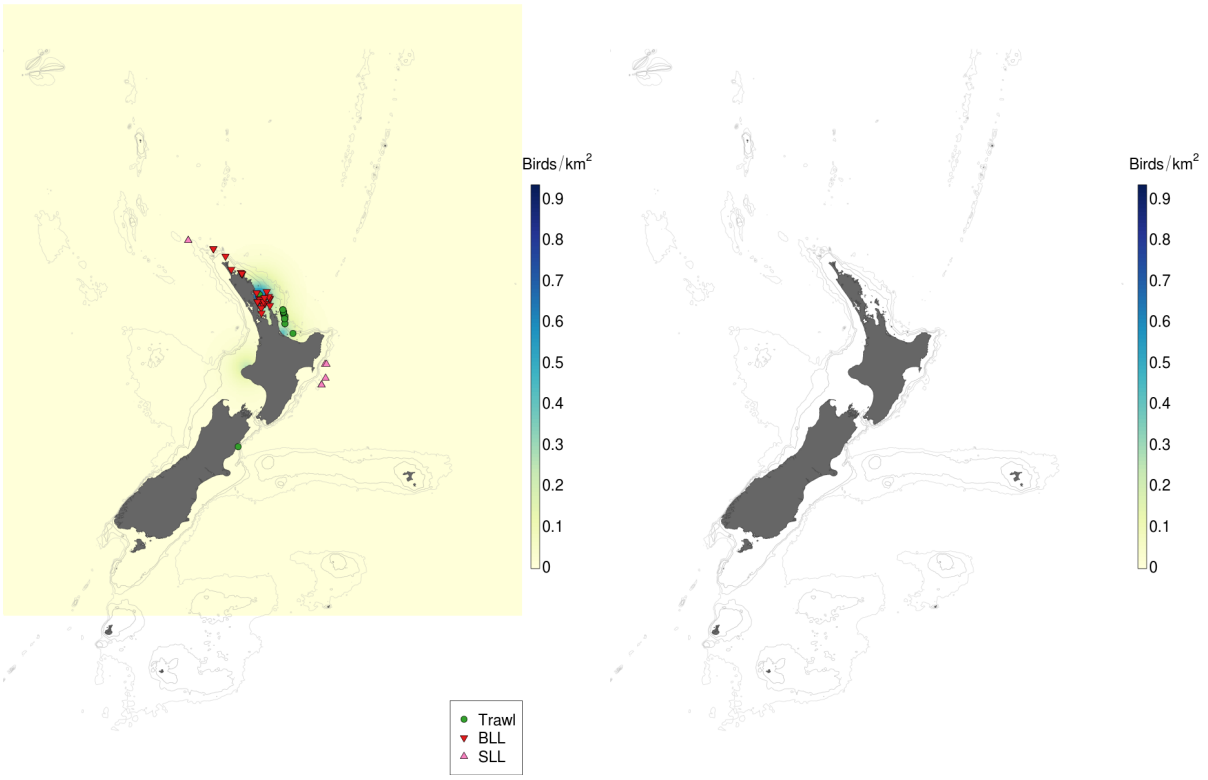
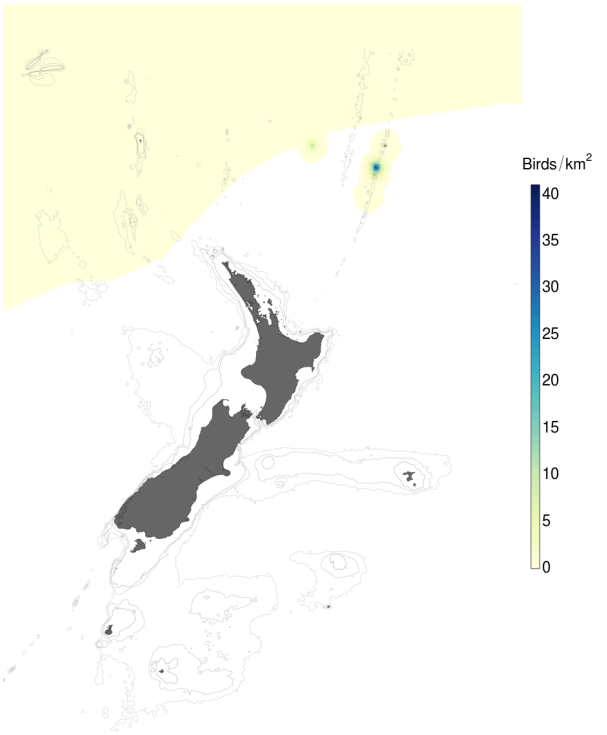


Figure S-18: Relative density of flesh-footed shearwater (*Puffinus carneipes*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from September to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.19 Wedge-tailed shearwater (*Puffinus pacificus*)

Population (NZ)	52 500 to 60 000 pairs	Taylor (2000b)
Age at first reproduction	4 years	Schreiber & Burger (2001)
Survival rate	93.1 (88.9 – 95.8)% [1999]	Hutton's shearwater as proxy, Cuthbert & Davis (2002)

(a) Breeding distribution



(b) Non-breeding distribution

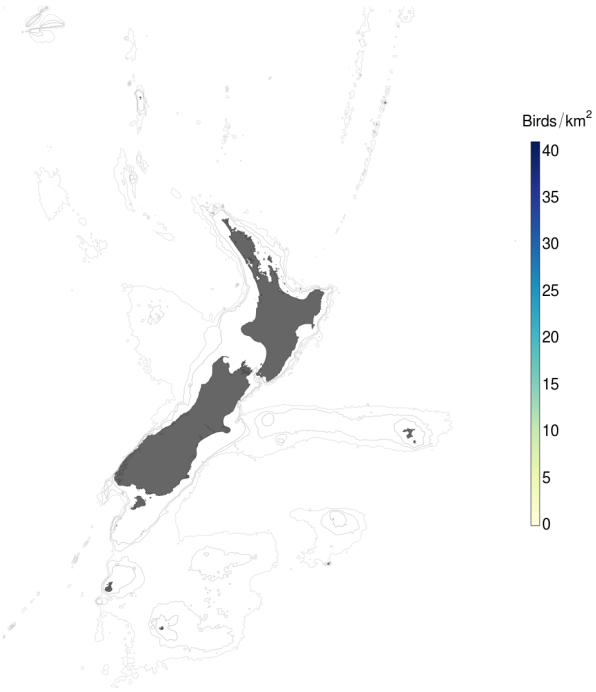
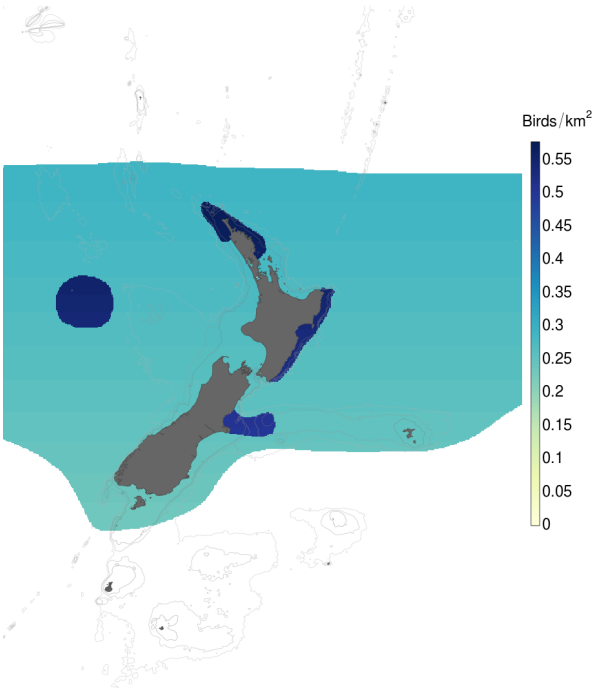


Figure S-19: Relative density of wedge-tailed shearwater (*Puffinus pacificus*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from June to December. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.20 Buller's shearwater (*Puffinus bulleri*)

Population (NZ)	200 000 pairs	L. Brooke (2004)
Age at first reproduction	4 to 9 years [1973]	Bradley et al. (1999)
Survival rate	92%	Short-tailed shearwater as proxy, L. Brooke (2004)

(a) Breeding distribution



(b) Non-breeding distribution

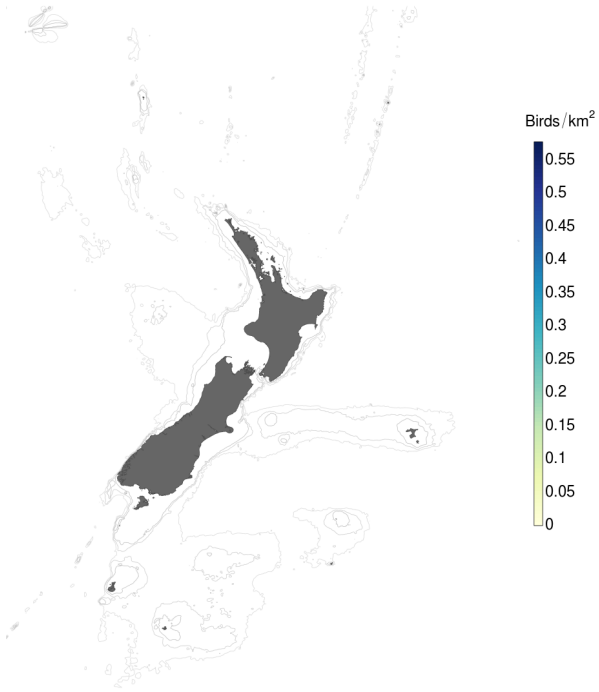
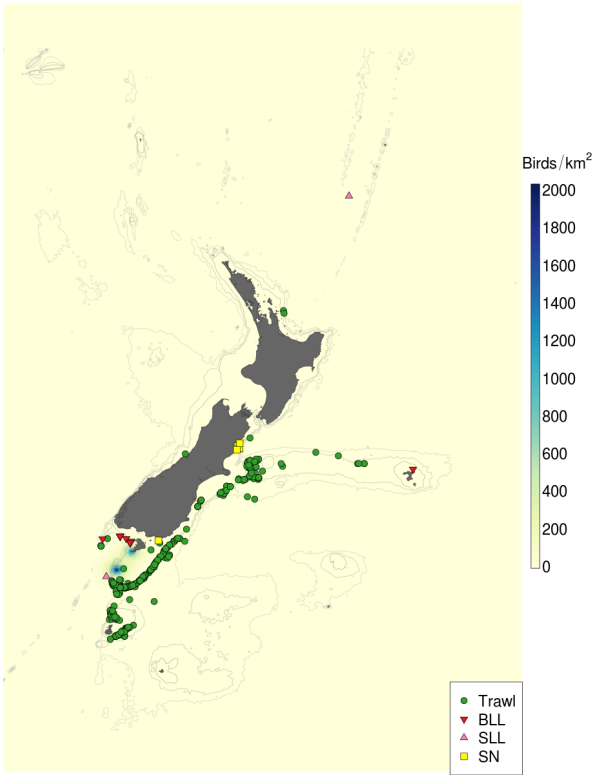


Figure S-20: Relative density of Buller's shearwater (*Puffinus bulleri*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from September to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.21 Sooty shearwater (*Puffinus griseus*)

Population (NZ)	5 000 000 pairs	Taylor (2000b)
Age at first reproduction	5 to 7 years	L. Brooke (2004)
Survival rate	86 to 97.9% [2005]	Clucas et al. (2008)

(a) Breeding distribution



(b) Non-breeding distribution

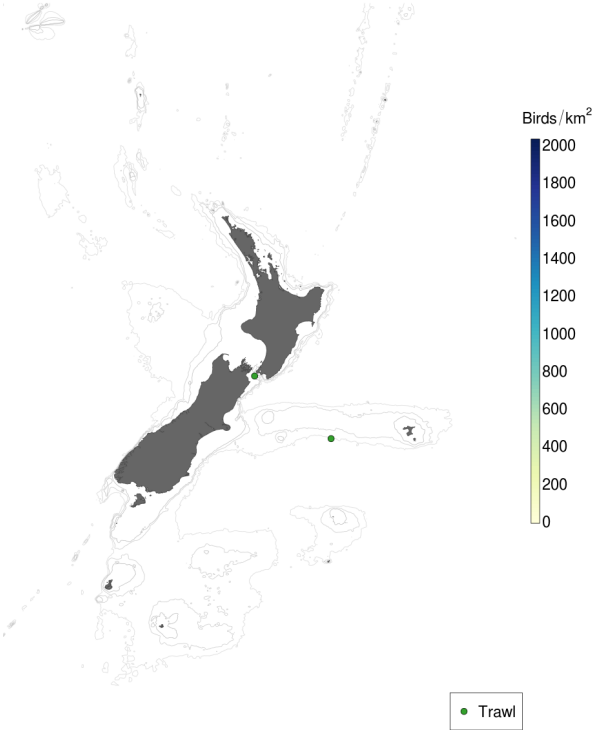
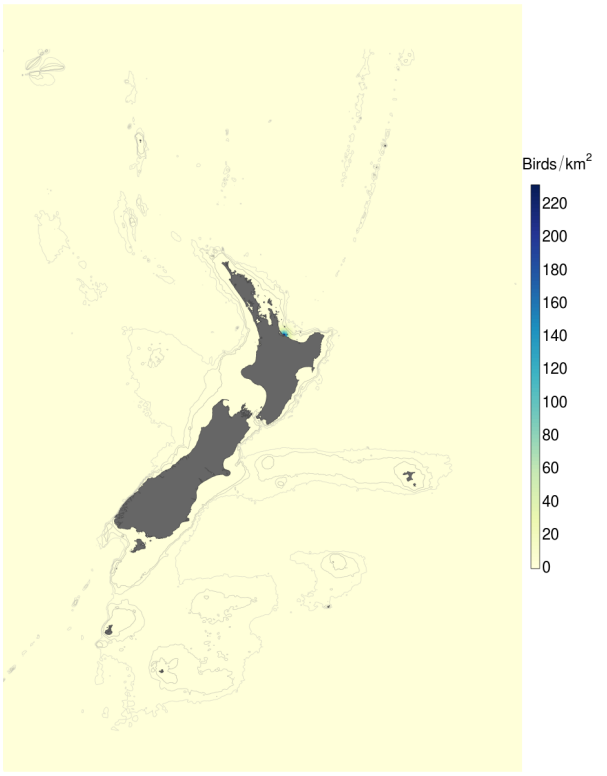


Figure S-21: Relative density of sooty shearwater (*Puffinus griseus*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from September to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.22 Fluttering shearwater (*Puffinus gavia*)

Population (NZ)	20 000 to 200 000 pairs	Taylor (2000b)
Age at first reproduction	4 to 6 years	Hutton's shearwater as proxy, Waugh et al. (1999)
Survival rate	93.1 (88.9 – 95.8)% [1999]	Hutton's shearwater as proxy, Cuthbert & Davis (2002)

(a) Breeding distribution



(b) Non-breeding distribution

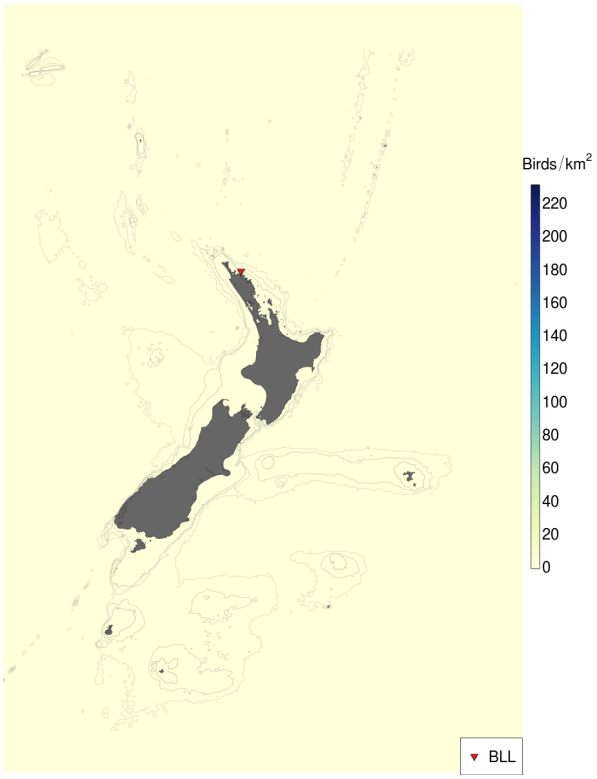


Figure S-22: Relative density of fluttering shearwater (*Puffinus gavia*). The breeding season runs from August to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.23 Hutton's shearwater (*Puffinus huttoni*)

Population (NZ)	94 000 pairs	Taylor (2000a)
Age at first reproduction	4 to 6 years	Waugh et al. (1999)
Survival rate	93.1 (88.9 – 95.8)% [1999]	Cuthbert & Davis (2002)

(a) Breeding distribution **(b) Non-breeding distribution**

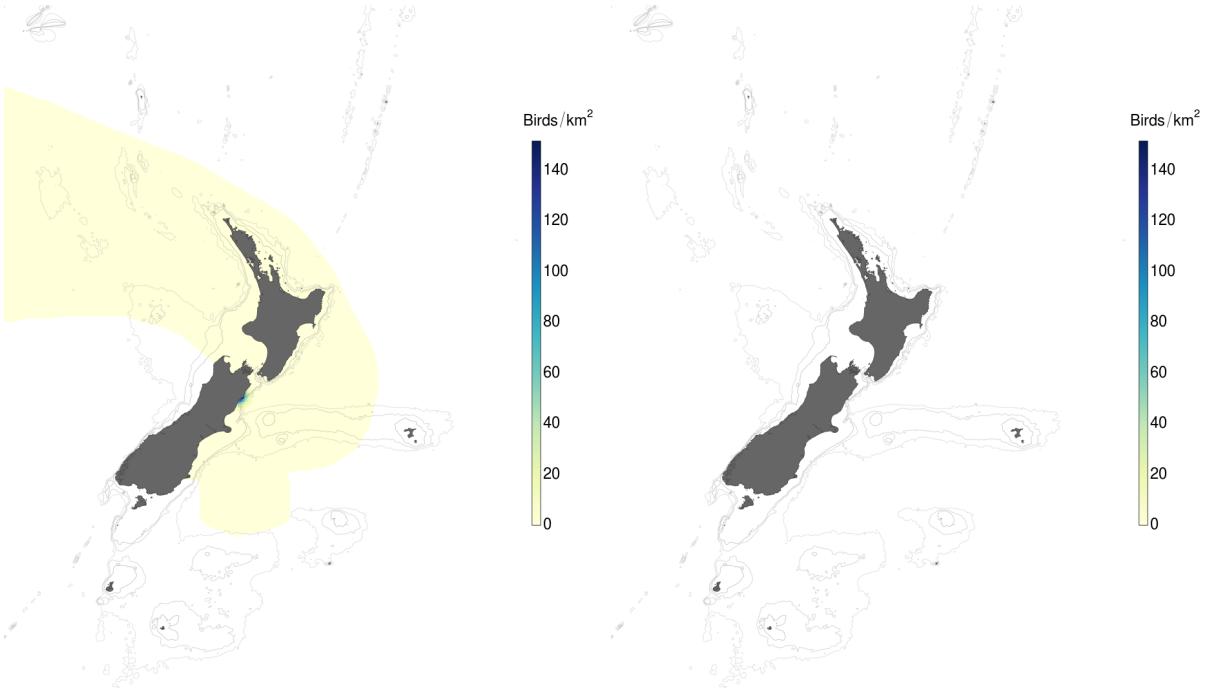


Figure S-23: Relative density of Hutton's shearwater (*Puffinus huttoni*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from October to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.24 Little shearwater (*Puffinus assimilis*)

Population (NZ)	100 000 to 220 000 pairs	Taylor (2000a)
Age at first reproduction	4 to 6 years	Hutton's shearwater as proxy, Waugh et al. (1999)
Survival rate	93.1 (88.9 – 95.8)% [1999]	Hutton's shearwater as proxy, Cuthbert & Davis (2002)

(a) Breeding distribution **(b) Non-breeding distribution**

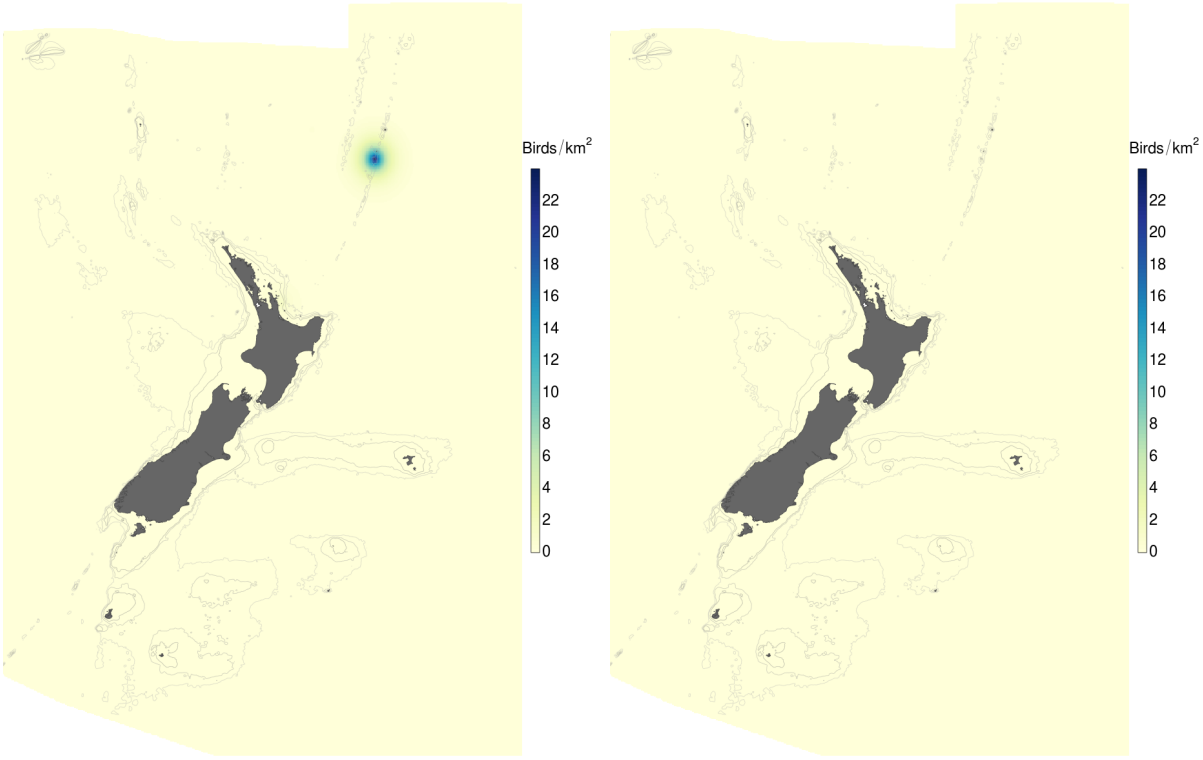
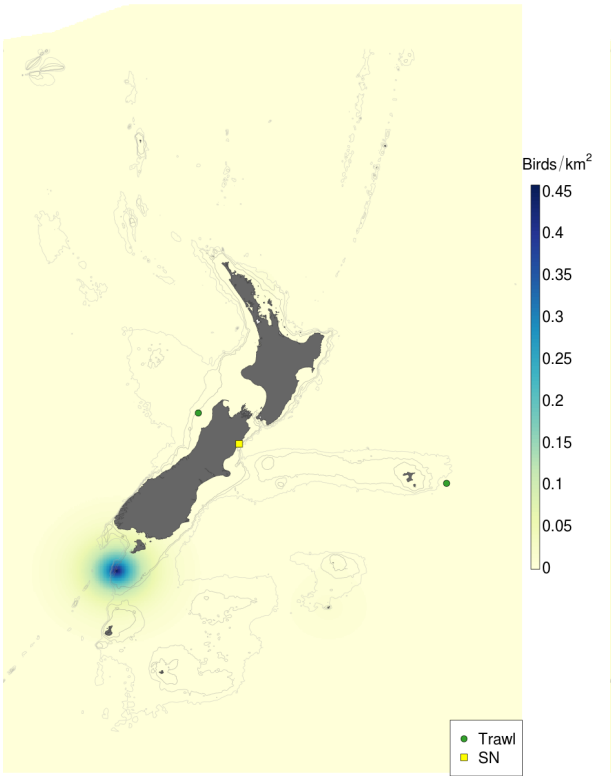


Figure S-24: Relative density of little shearwater (*Puffinus assimilis*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from June to December. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.25 Cape petrel (*Daption capense*)

Population (NZ)	8420 pairs	L. Brooke (2004)
Age at first reproduction	6 years 3 to 5 years [1968]	Schreiber & Burger (2001) Beck (1969)
Survival rate	77.1 to 93.9% [1987]	Sagar et al. (1996)

(a) Breeding distribution



(b) Non-breeding distribution

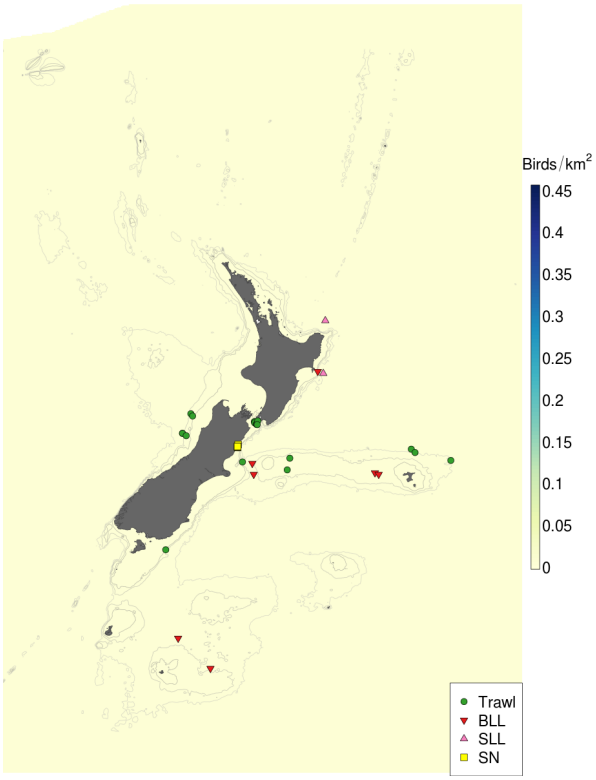


Figure S-25: Relative density of Cape petrel (*Daption capense*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from October to January. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.26 Fairy prion (*Pachyptila turtur*)

Population (NZ)	more than 1 000 000 pairs	Taylor (2000b)
Age at first reproduction	4 to 5 years	Schreiber & Burger (2001)
Survival rate	84%	L. Brooke (2004)

(a) Breeding distribution **(b) Non-breeding distribution**

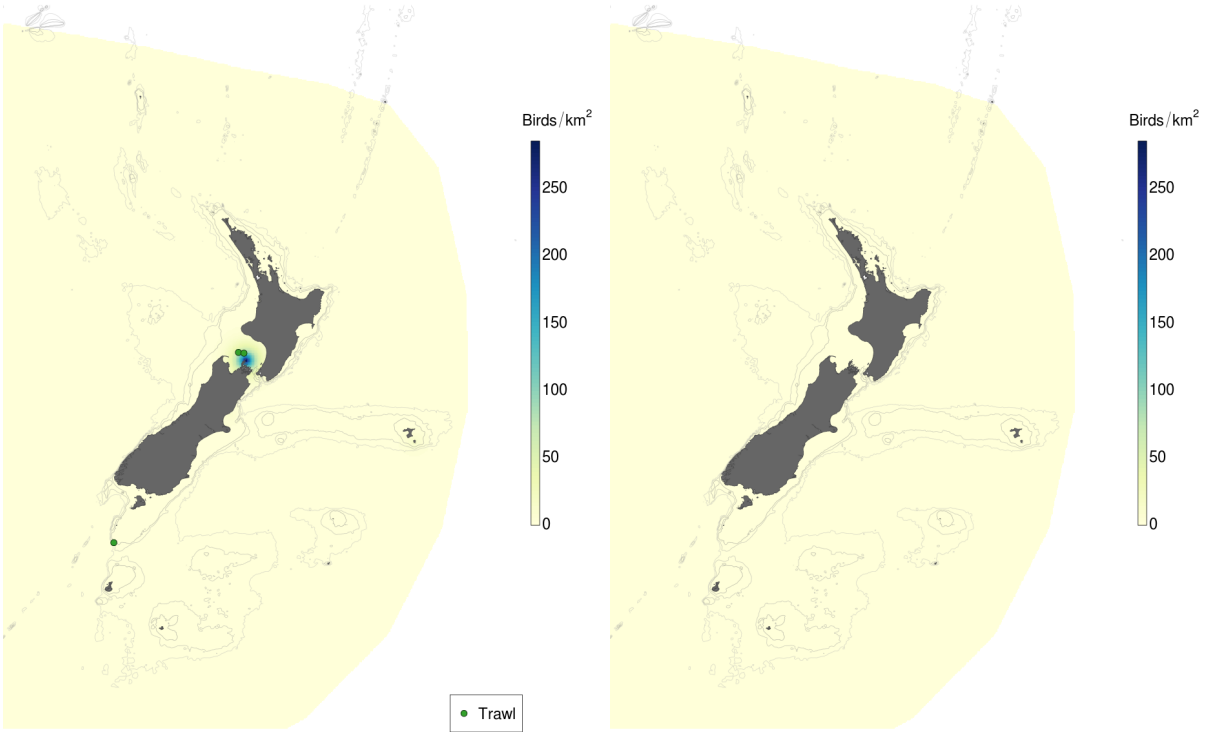


Figure S-26: Relative density of fairy prion (*Pachyptila turtur*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from September to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.27 Antarctic prion (*Pachyptila desolata*)

Population (NZ)	100 000 to 1 000 000 pairs	Taylor (2000b)
Age at first reproduction	5 to 6 years	L. Brooke (2004)
Survival rate	84%	Fairy prion as proxy, L. Brooke (2004)

(a) Breeding distribution **(b) Non-breeding distribution**

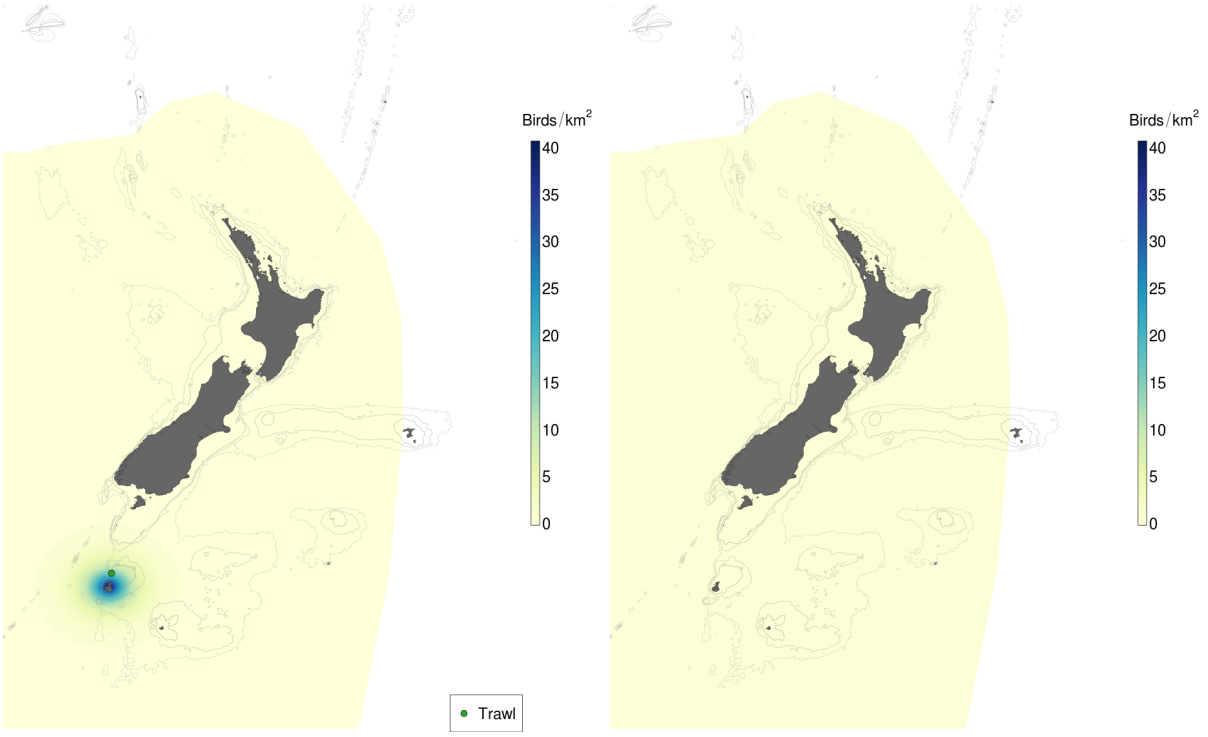


Figure S-27: Relative density of Antarctic prion (*Pachyptila desolata*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from November to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.28 Broad-billed prion (*Pachyptila vittata*)

Population (NZ)	1 000 000 pairs	L. Brooke (2004)
Age at first reproduction	4 to 5 years	Fairy prion as proxy, Schreiber & Burger (2001)
Survival rate	84%	Fairy prion as proxy, L. Brooke (2004)

(a) Breeding distribution

(b) Non-breeding distribution

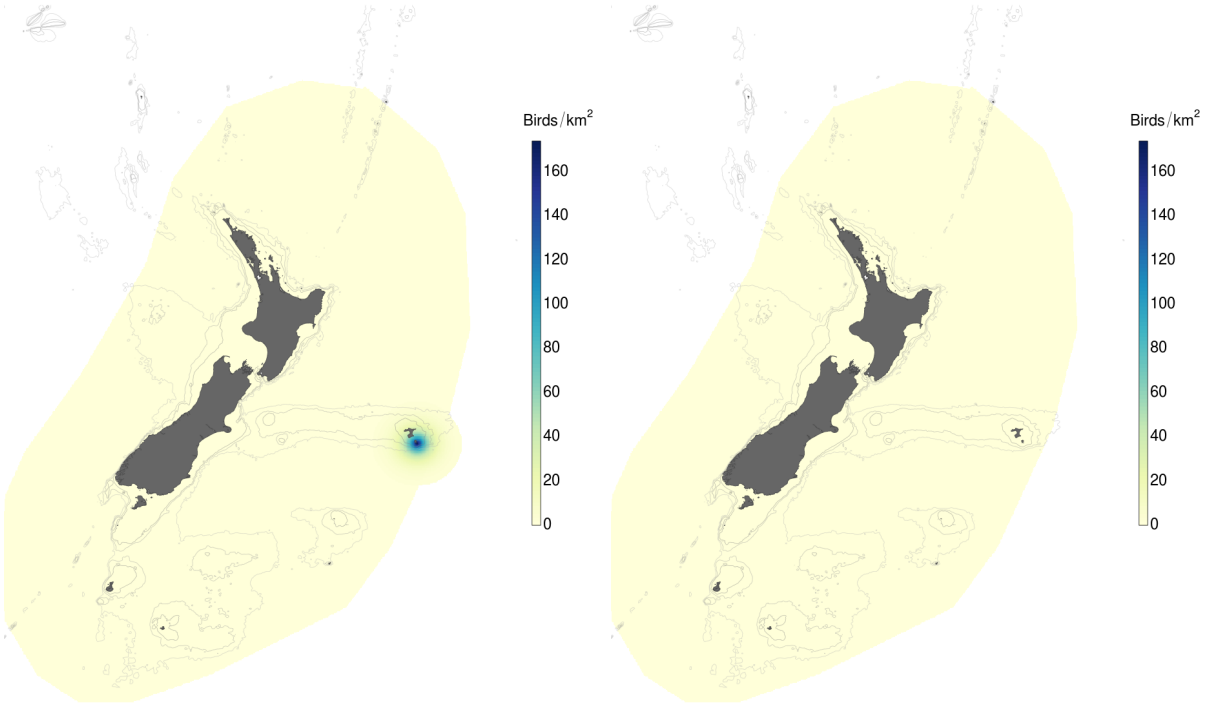


Figure S-28: Relative density of broad-billed prion (*Pachyptila vittata*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from July to November. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.29 Pycroft's petrel (*Pterodroma pycrofti*)

Population (NZ)	2000 to 3000 pairs [1998]	Taylor (2000a)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution **(b) Non-breeding distribution**

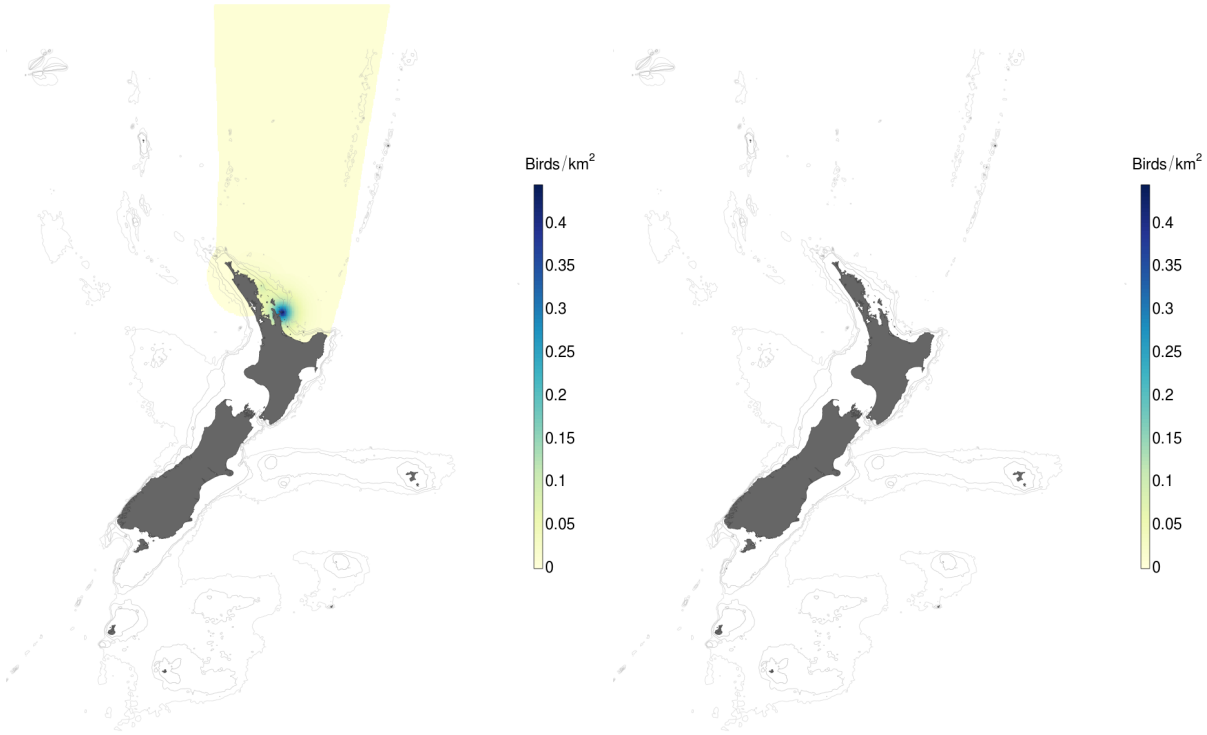


Figure S-29: Relative density of Pycroft's petrel (*Pterodroma pycrofti*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from October to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.30 Cook's petrel (*Pterodroma cookii*)

Population (NZ)	50 000 to 60 000 pairs	Taylor (2000a)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution

(b) Non-breeding distribution

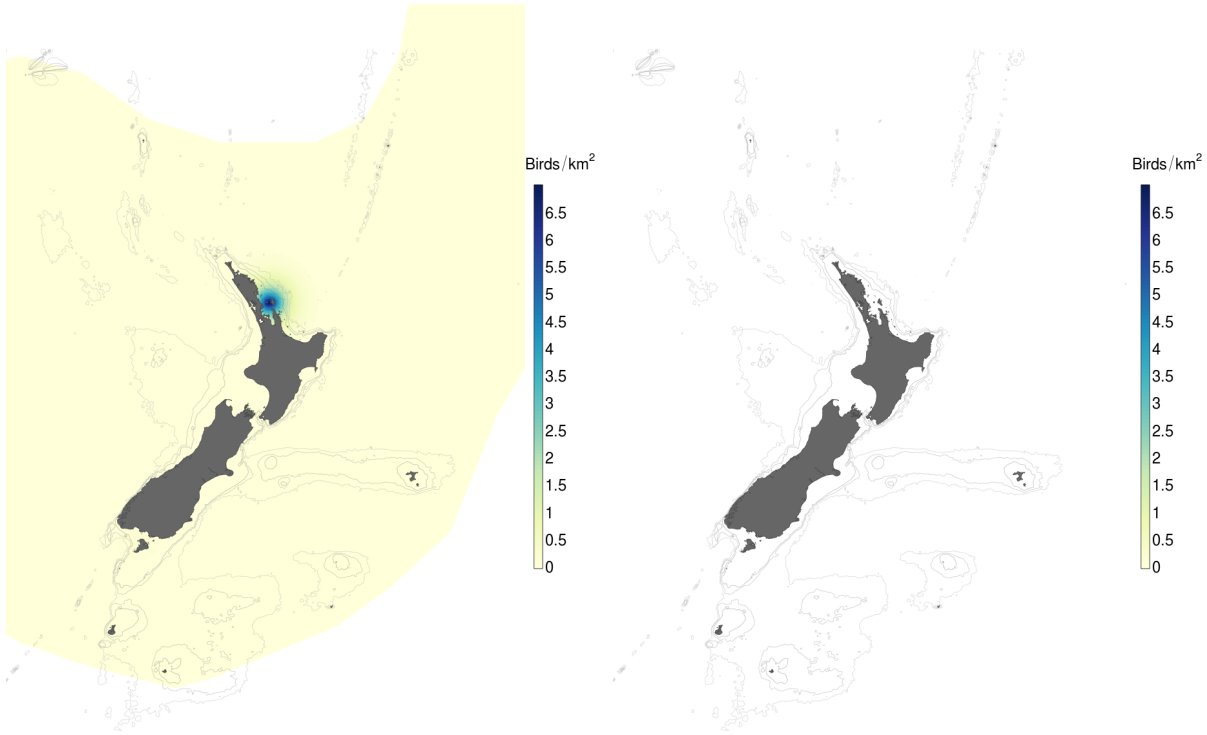


Figure S-30: Relative density of Cook's petrel (*Pterodroma cookii*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from October to April. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.31 Chatham petrel (*Pterodroma axillaris*)

Population (NZ)	250 pairs [2009]	Birdlife International (2012)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution

(b) Non-breeding distribution

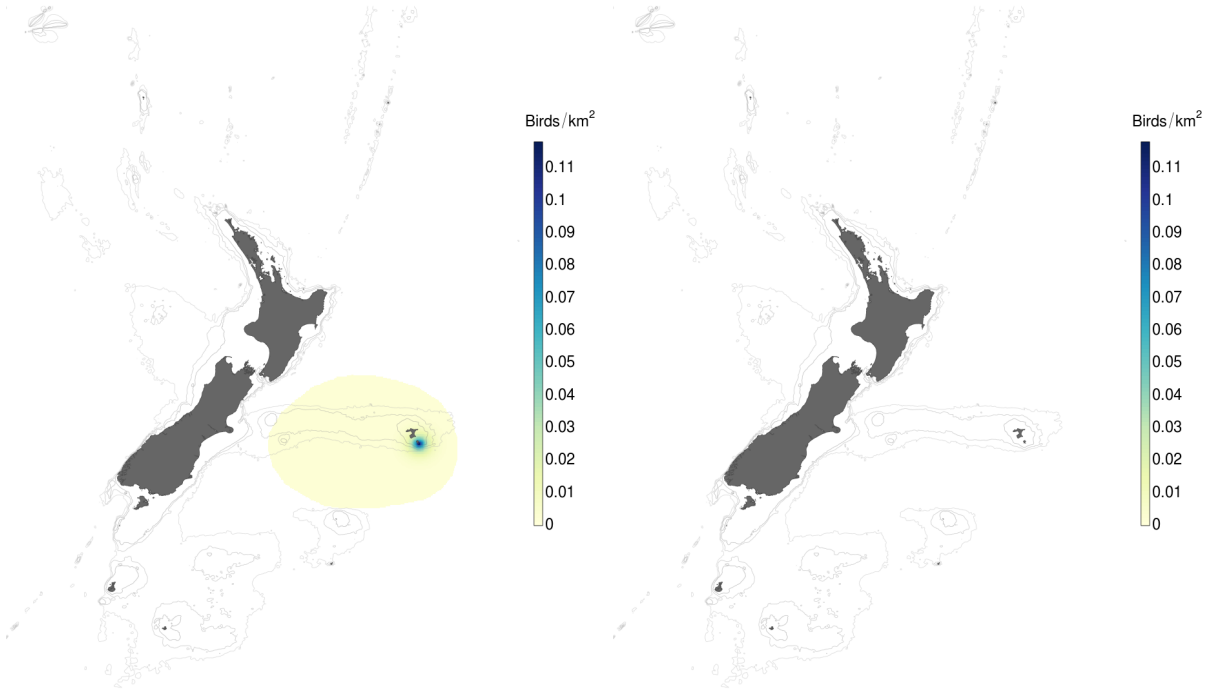


Figure S-31: Relative density of Chatham petrel (*Pterodroma axillaris*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from November to April. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.32 Mottled petrel (*Pterodroma inexpectata*)

Population (NZ)	300 000 to 400 000 pairs [1999]	Taylor (2000b)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution

(b) Non-breeding distribution

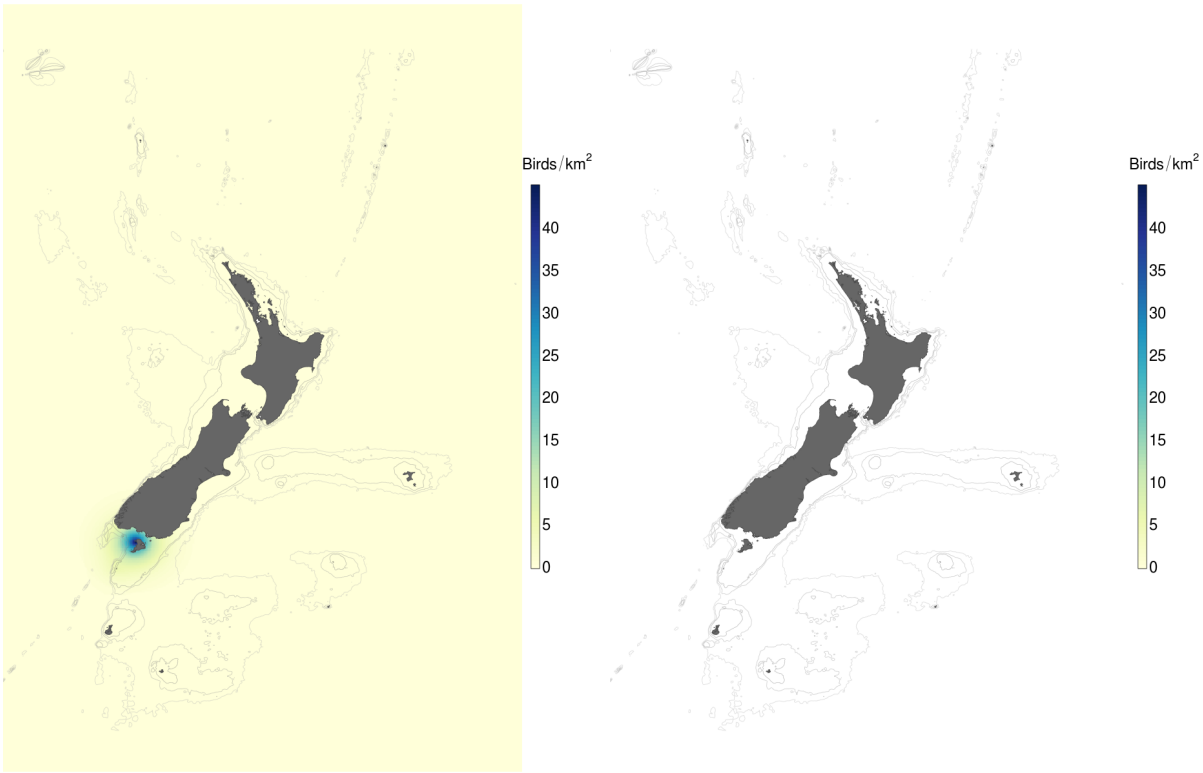


Figure S-32: Relative density of mottled petrel (*Pterodroma inexpectata*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from October to June. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.33 White-necked petrel (*Pterodroma cervicalis*)

Population (NZ)	50 000 pairs [1988]	Taylor (2000a)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution

(b) Non-breeding distribution

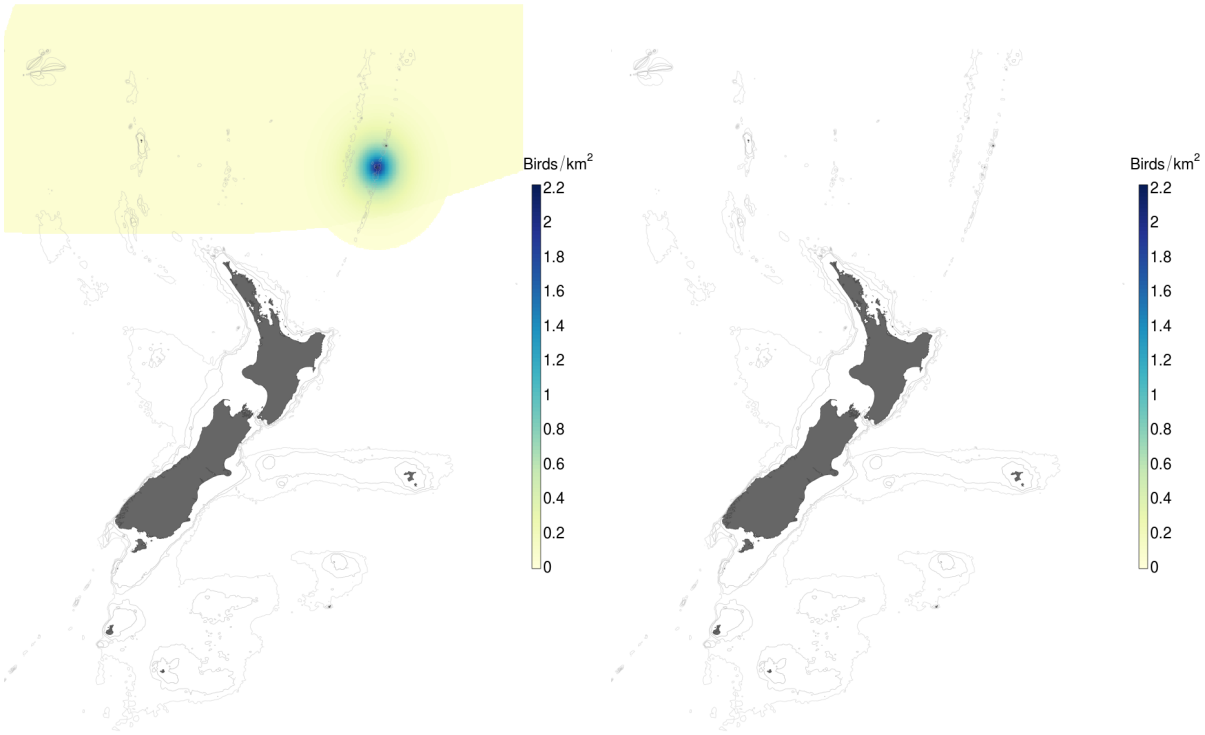


Figure S-33: Relative density of white-necked petrel (*Pterodroma cervicalis*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from August to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.34 Kermadec petrel (*Pterodroma neglecta*)

Population (NZ)	5000 to 7000 pairs	Taylor (2000b)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution

(b) Non-breeding distribution

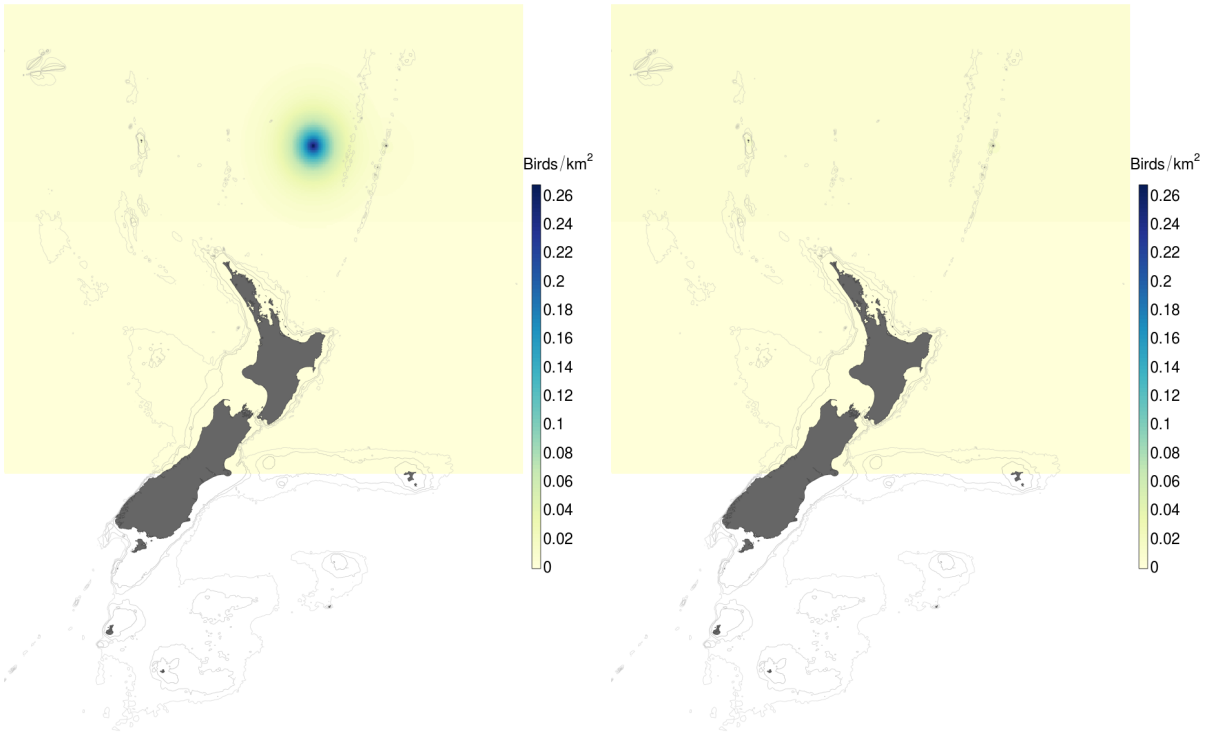
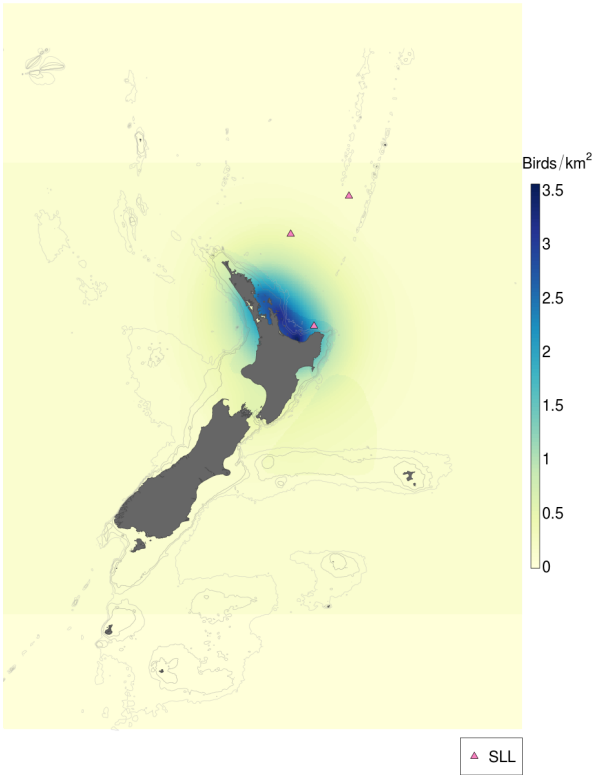


Figure S-34: Relative density of Kermadec petrel (*Pterodroma neglecta*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from October to June. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.35 Grey-faced petrel (*Pterodroma macroptera*)

Population (NZ)	200 000 to 300 000 pairs	Taylor (2000b)
Age at first reproduction	6 to 7 years	Schreiber & Burger (2001)
Survival rate	94%	Marchant & Higgins (1990)

(a) Breeding distribution



(b) Non-breeding distribution

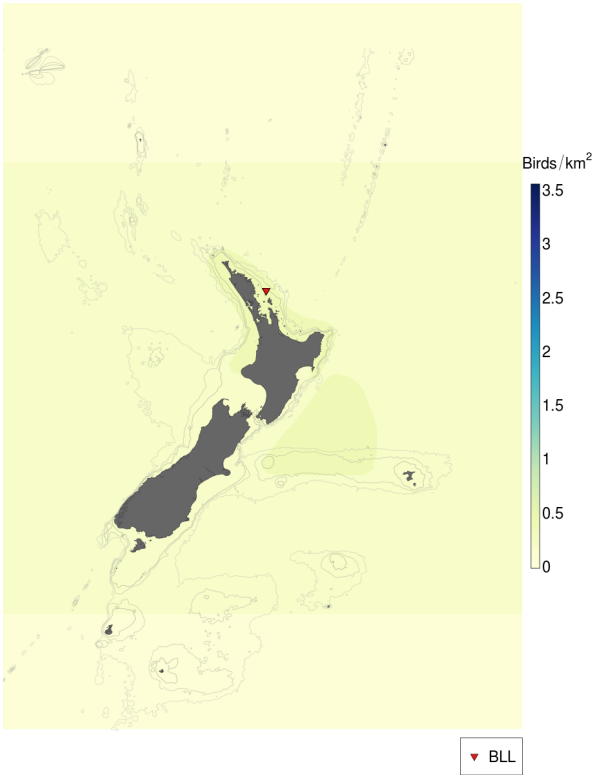


Figure S-35: Relative density of grey-faced petrel (*Pterodroma macroptera*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from June to January. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.36 Chatham Island taiko (*Pterodroma magentae*)

Population (NZ)	17 pairs [2010]	Birdlife International (2012)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution **(b) Non-breeding distribution**

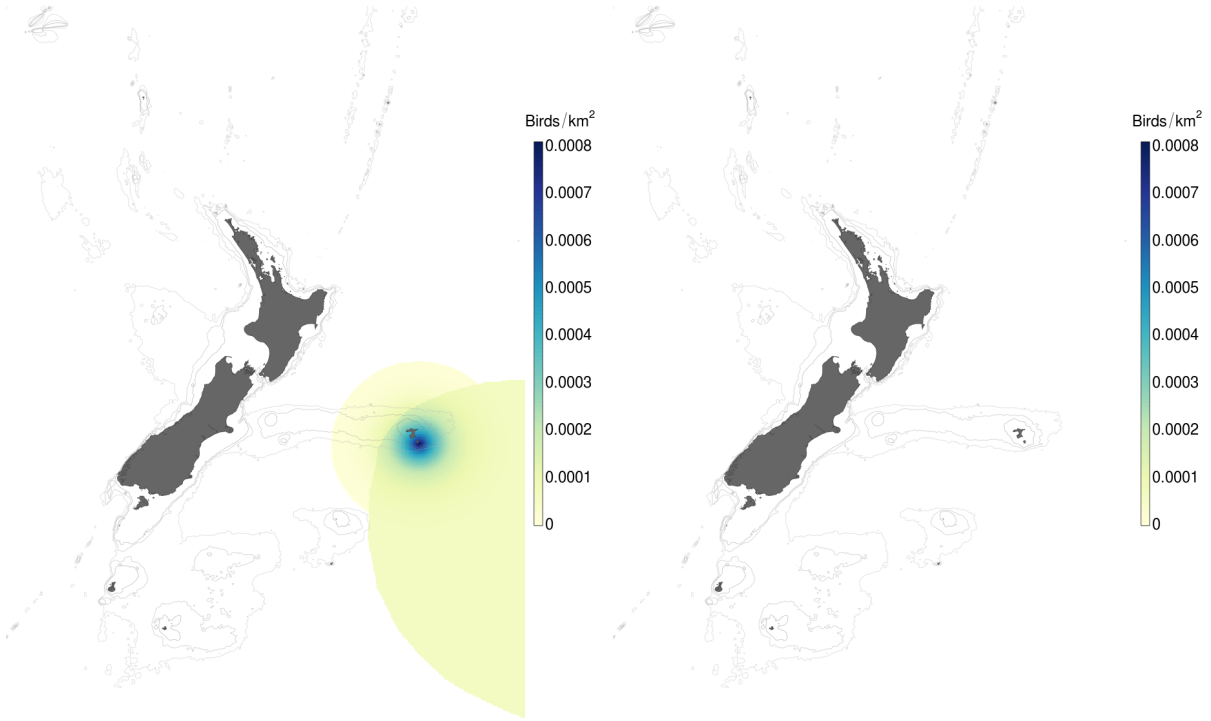


Figure S-36: Relative density of Chatham Island taiko (*Pterodroma magentae*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from December to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.37 White-headed petrel (*Pterodroma lessonii*)

Population (NZ)	200 000 pairs	L. Brooke (2004)
Age at first reproduction	5.5 years	Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution

(b) Non-breeding distribution

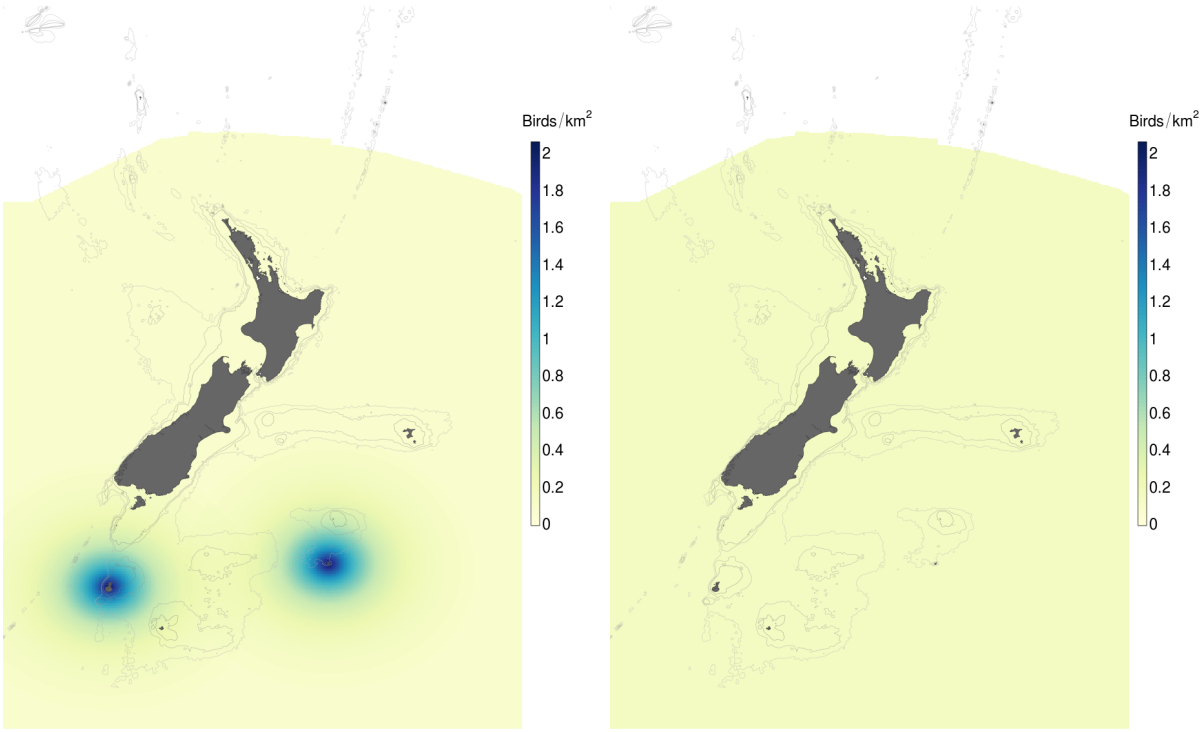


Figure S-37: Relative density of white-headed petrel (*Pterodroma lessonii*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from November to April. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.38 Soft-plumaged petrel (*Pterodroma mollis*)

Population (NZ)	1000 to 9999 pairs	Taylor (2000b)
Age at first reproduction	6 to 7 years	Grey-faced petrel as proxy, Schreiber & Burger (2001)
Survival rate	94%	Grey-faced petrel as proxy, Marchant & Higgins (1990)

(a) Breeding distribution

(b) Non-breeding distribution

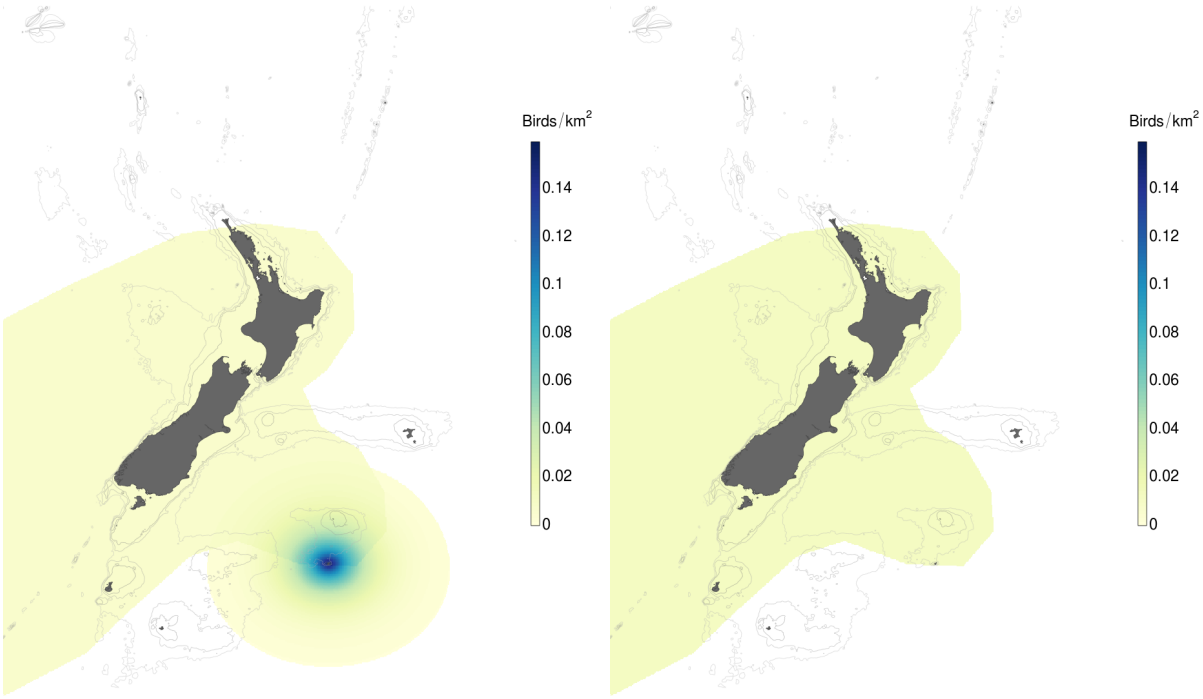


Figure S-38: Relative density of soft-plumaged petrel (*Pterodroma mollis*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from November to April. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.39 Common diving petrel (*Pelecanoides urinatrix*)

Population (NZ)	300 000 to 2 150 000 pairs	Taylor (2000b)
Age at first reproduction	2 to 3 years	L. Brooke (2004)
Survival rate	75 to 87%	Schreiber & Burger (2001)

(a) Breeding distribution **(b) Non-breeding distribution**

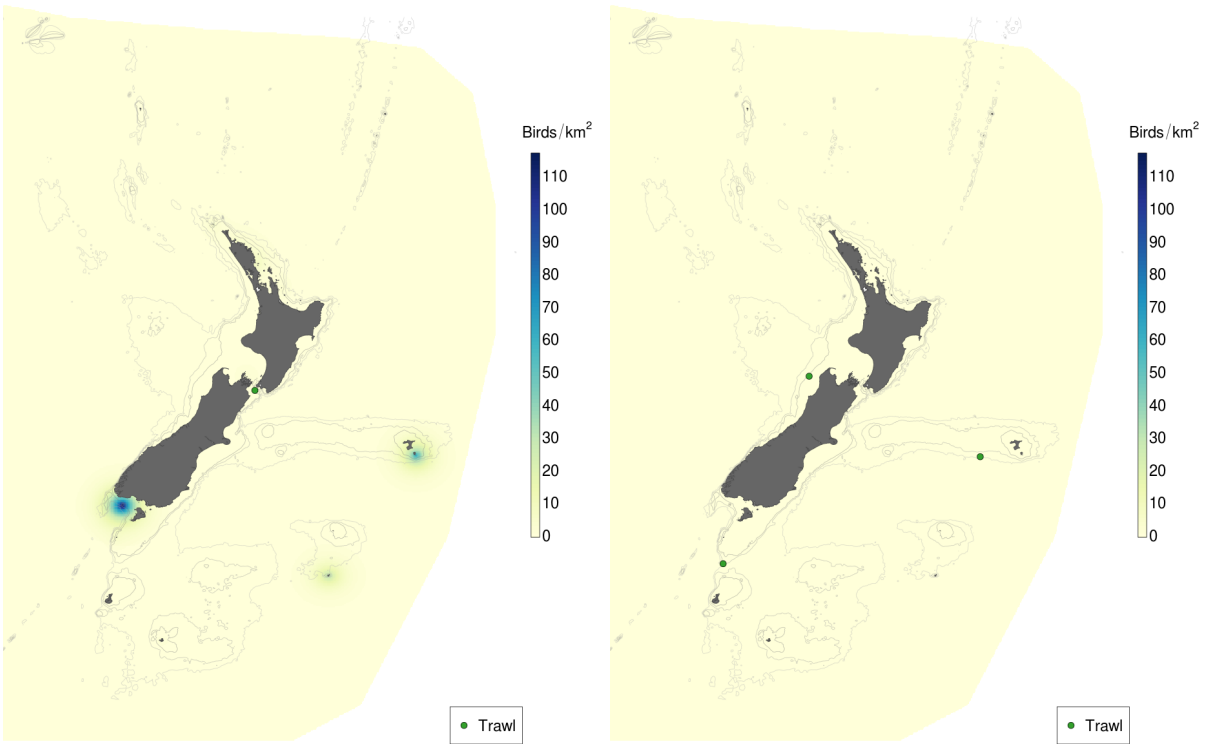


Figure S-39: Relative density of common diving petrel (*Pelecanoides urinatrix*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from September to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.40 South Georgia diving petrel (*Pelecanoides georgicus*)

Population (NZ)	64 pairs [1998]	Taylor (2000b)
Age at first reproduction	2 to 3 years	Common diving petrel as proxy, L. Brooke (2004)
Survival rate	75 to 87%	Common diving petrel as proxy, Schreiber & Burger (2001)

(a) Breeding distribution

(b) Non-breeding distribution

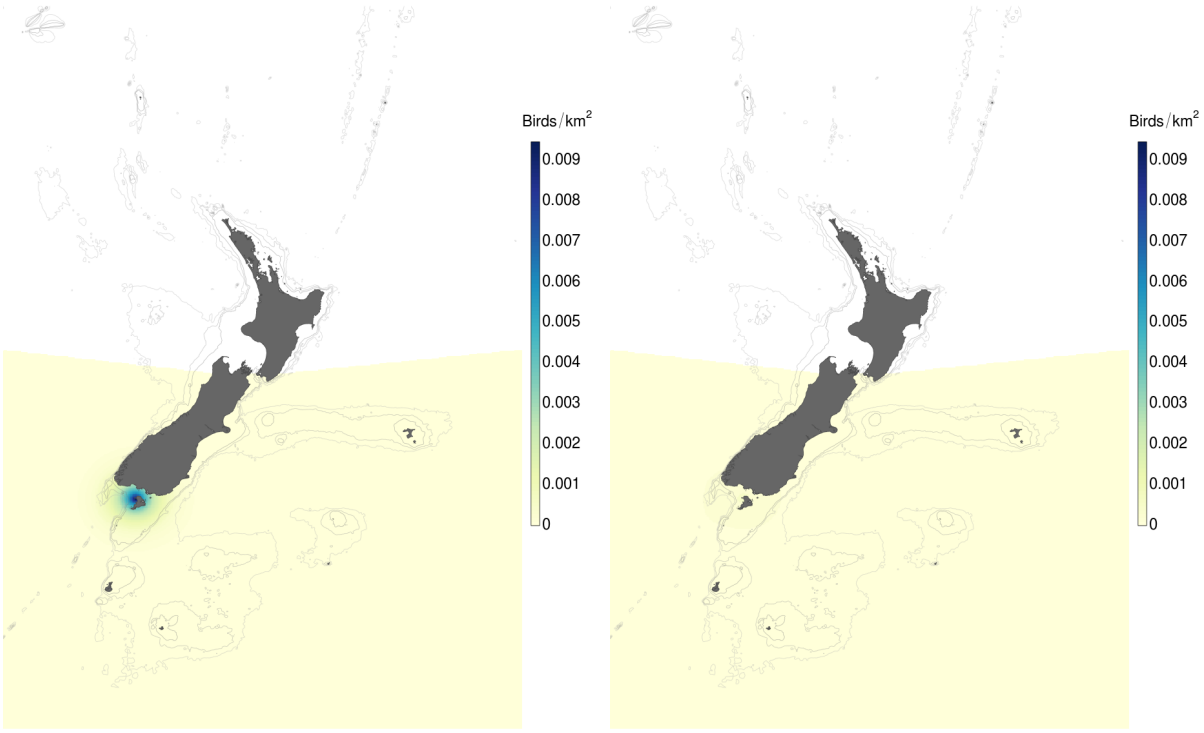
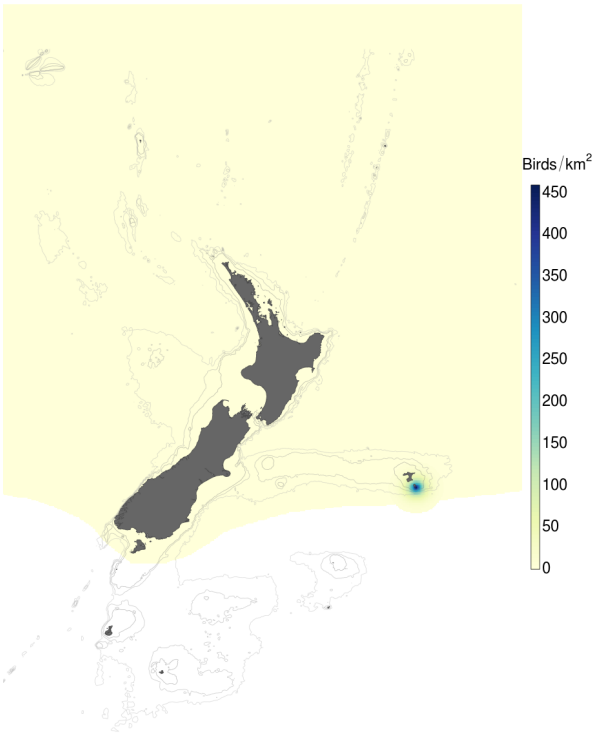


Figure S-40: Relative density of South Georgia diving petrel (*Pelecanoides georgicus*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from November to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.41 New Zealand white-faced storm petrel (*Pelagodroma marina*)

Population (NZ)	more than 1 000 000 pairs	Taylor (2000b)
Age at first reproduction	4 to 5 years more than 3 years	Several species as proxy, Croxall (1987) L. Brooke (2004)
Survival rate	90%	Several species as proxy, Croxall (1987)

(a) Breeding distribution



(b) Non-breeding distribution

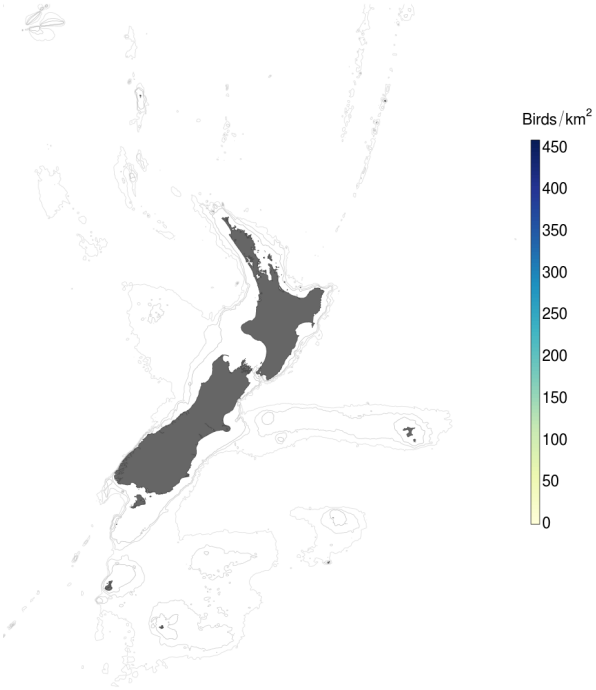


Figure S-41: Relative density of New Zealand white-faced storm petrel (*Pelagodroma marina*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from October to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.42 White-bellied storm petrel (*Fregetta grallaria*)

Population (NZ)	1000 pairs	Taylor (2000a)
Age at first reproduction	4 to 5 years	Several species as proxy, Croxall (1987)
Survival rate	90%	Several species as proxy, Croxall (1987)

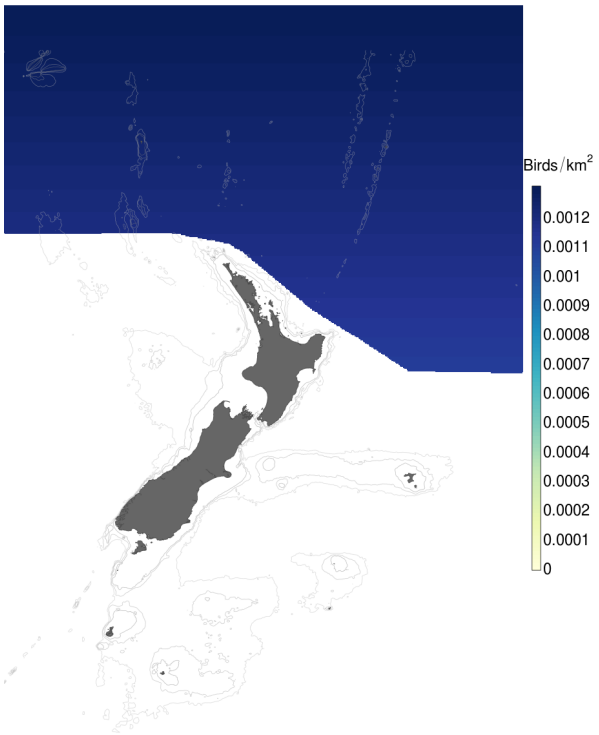


Figure S-42: Relative density of white-bellied storm petrel (*Fregetta grallaria*). The distribution base map was obtained from BirdLife single-layer range maps. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.43 Black-bellied storm petrel (*Fregetta tropica*)

Population (NZ)	50 000 to 100 000 pairs	Taylor (2000b)
Age at first reproduction	4 to 5 years	Several species as proxy, Croxall (1987)
Survival rate	90%	Several species as proxy, Croxall (1987)

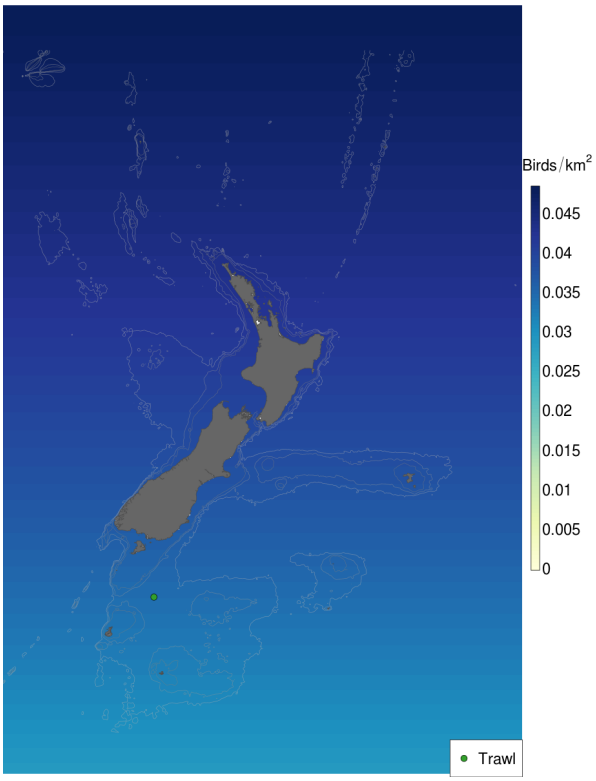


Figure S-43: Relative density of black-bellied storm petrel (*Fregetta tropica*). The distribution base map was obtained from BirdLife single-layer range maps. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.44 Kermadec white-faced storm petrel (*Pelagodroma marina albiclunis*)

Population (NZ)	fewer than 100 pairs	Taylor (2000a)
Age at first reproduction	4 to 5 years more than 3 years	Several species as proxy, Croxall (1987) L. Brooke (2004)
Survival rate	90%	Several species as proxy, Croxall (1987)

(a) Breeding distribution

(b) Non-breeding distribution

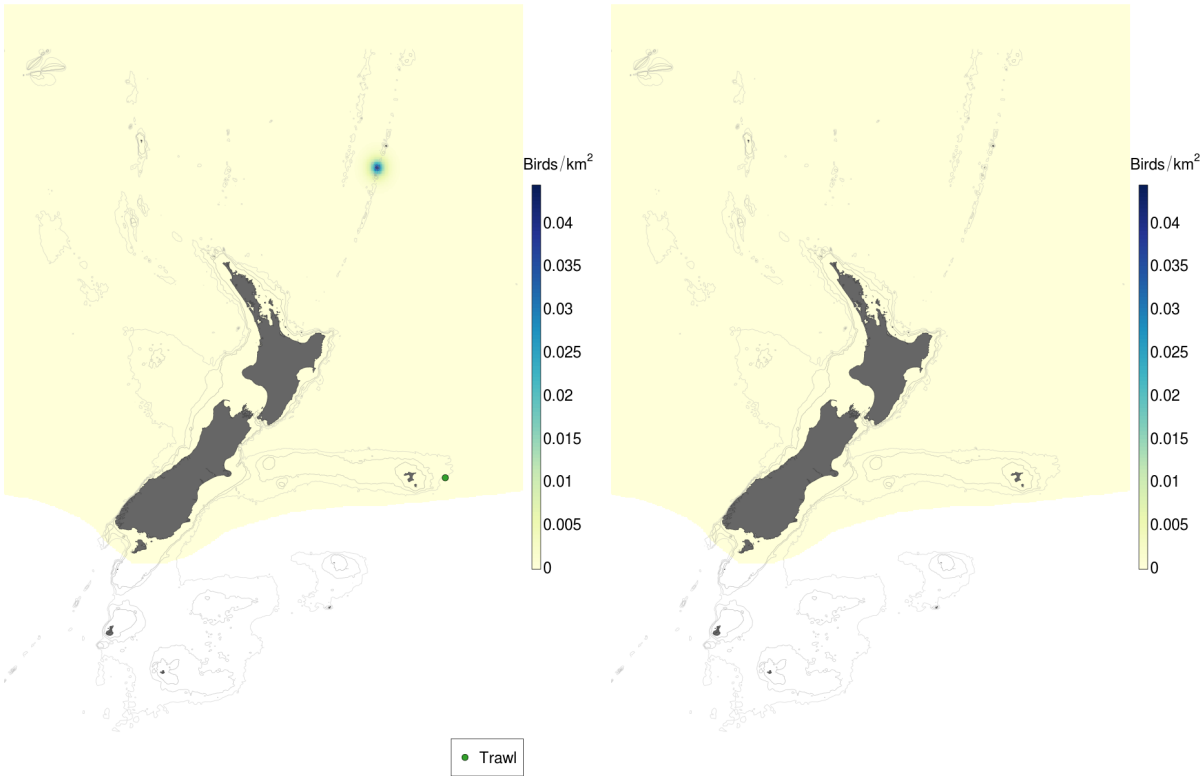


Figure S-44: Relative density of Kermadec white-faced storm petrel (*Pelagodroma marina albiclunis*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from October to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.45 New Zealand storm petrel (*Oceanites maorianus*)

Population (NZ)	20 to 1000 pairs	
Age at first reproduction	4 to 5 years	Several species as proxy, Croxall (1987)
Survival rate	90%	Several species as proxy, Croxall (1987)

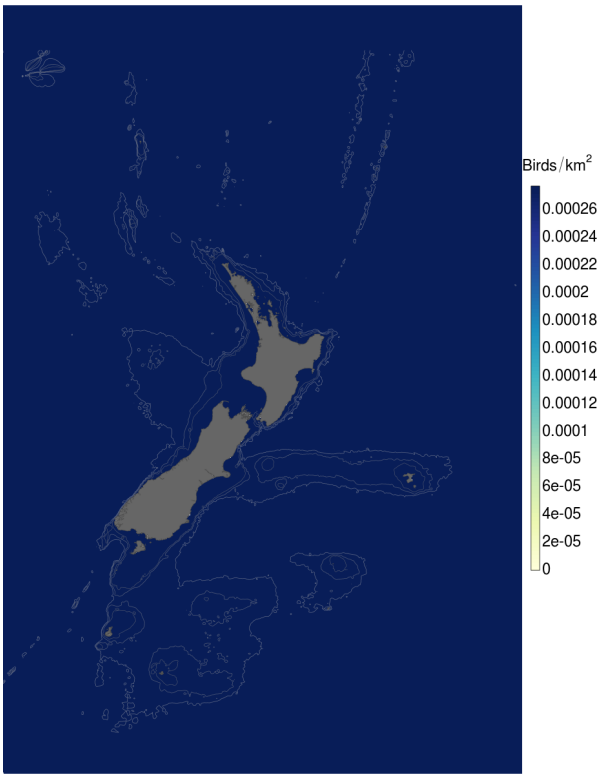


Figure S-45: Relative density of New Zealand storm petrel (*Oceanites maorianus*). Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.46 Yellow-eyed penguin (*Megadyptes antipodes*)

Population (NZ)	1700 to 2420 pairs	Taylor (2000a)
Age at first reproduction	2 to 3 years	Schreiber & Burger (2001)
Survival rate	87%	Schreiber & Burger (2001)

(a) Breeding distribution **(b) Non-breeding distribution**

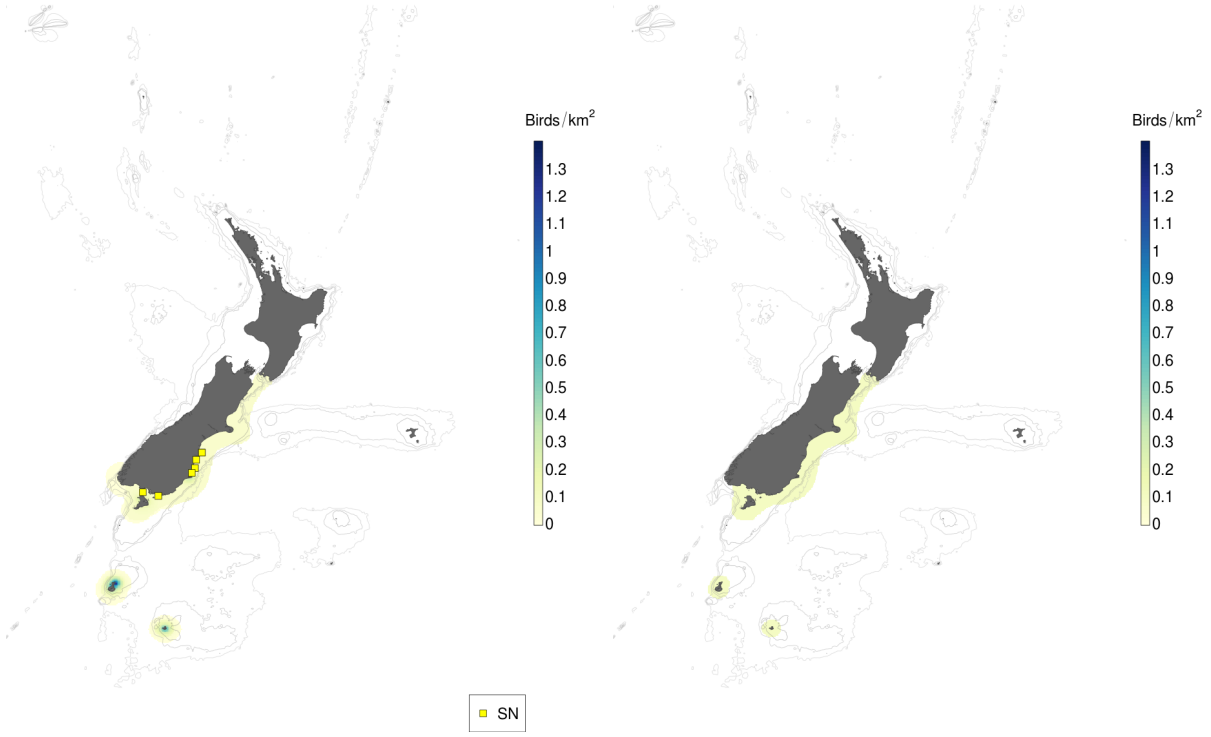


Figure S-46: Relative density of yellow-eyed penguin (*Megadyptes antipodes*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from August to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.47 Northern little penguin (*Eudyptula minor*)

Population (NZ)	5000 to 10 000 pairs [1984]	Taylor (2000b)
Age at first reproduction	2 to 3 years	Schreiber & Burger (2001)
Survival rate	83%	Sidhu et al. (2007)

(a) Breeding distribution **(b) Non-breeding distribution**

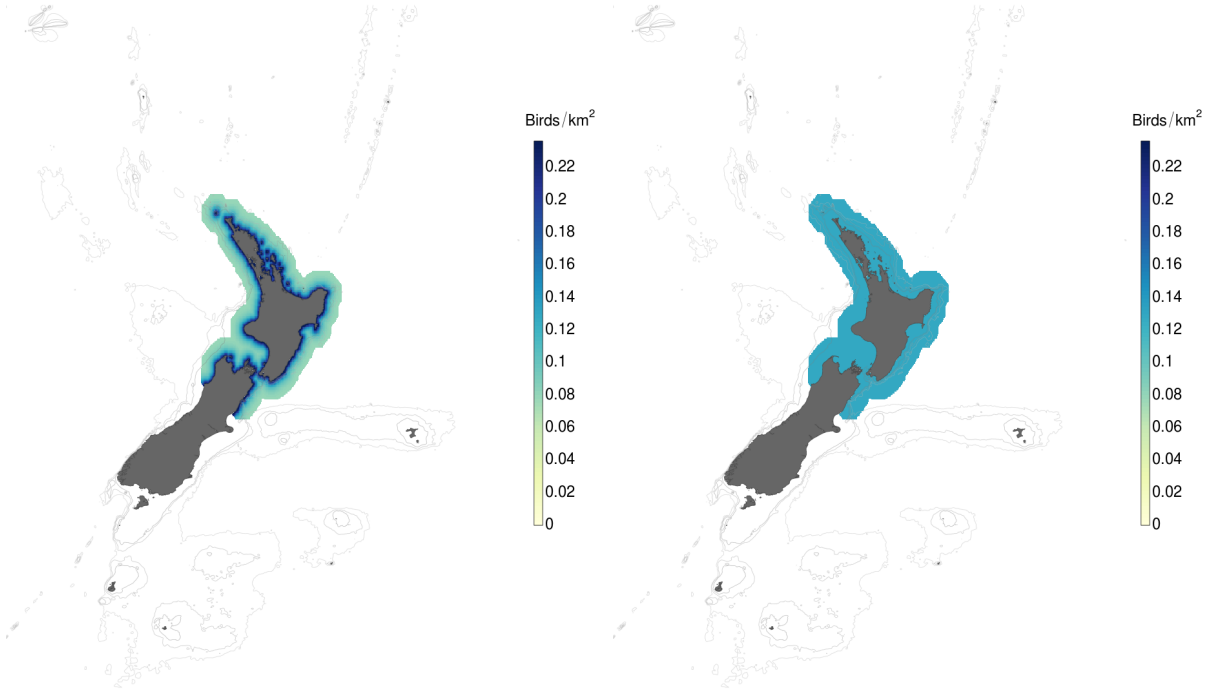


Figure S-47: Relative density of northern little penguin (*Eudyptula minor*). The base map was obtained by creating a buffer around coastal locations where the species has been found. The breeding season runs from August to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.48 White-flippered little penguin (*Eudyptula minor*)

Population (NZ)	2200 pairs [1998]	Taylor (2000a)
Age at first reproduction	2 to 3 years	Schreiber & Burger (2001)
Survival rate	83%	Sidhu et al. (2007)

(a) Breeding distribution **(b) Non-breeding distribution**

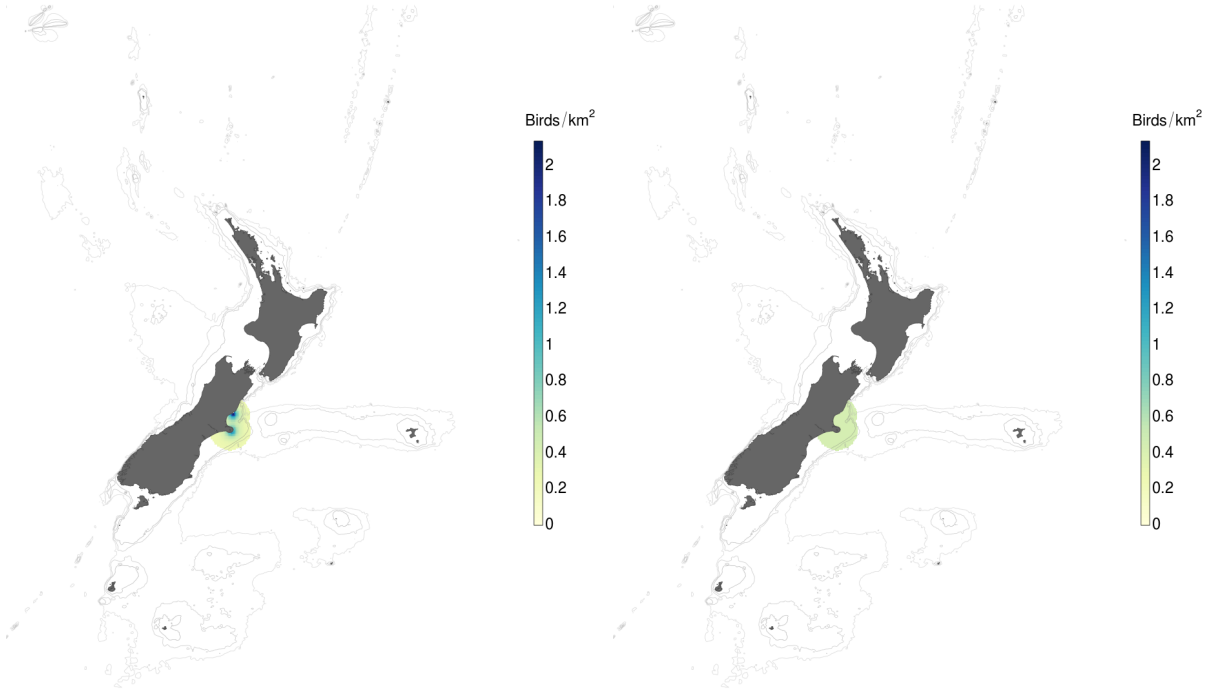


Figure S-48: Relative density of white-flippered little penguin (*Eudyptula minor*). The base map was obtained by creating a buffer around coastal locations where the species has been found. The breeding season runs from August to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.49 Southern little penguin (*Eudyptula minor*)

Population (NZ)	5000 to 10 000 pairs [1984]	Taylor (2000b)
Age at first reproduction	2 to 3 years	Schreiber & Burger (2001)
Survival rate	83%	Sidhu et al. (2007)

(a) Breeding distribution **(b) Non-breeding distribution**

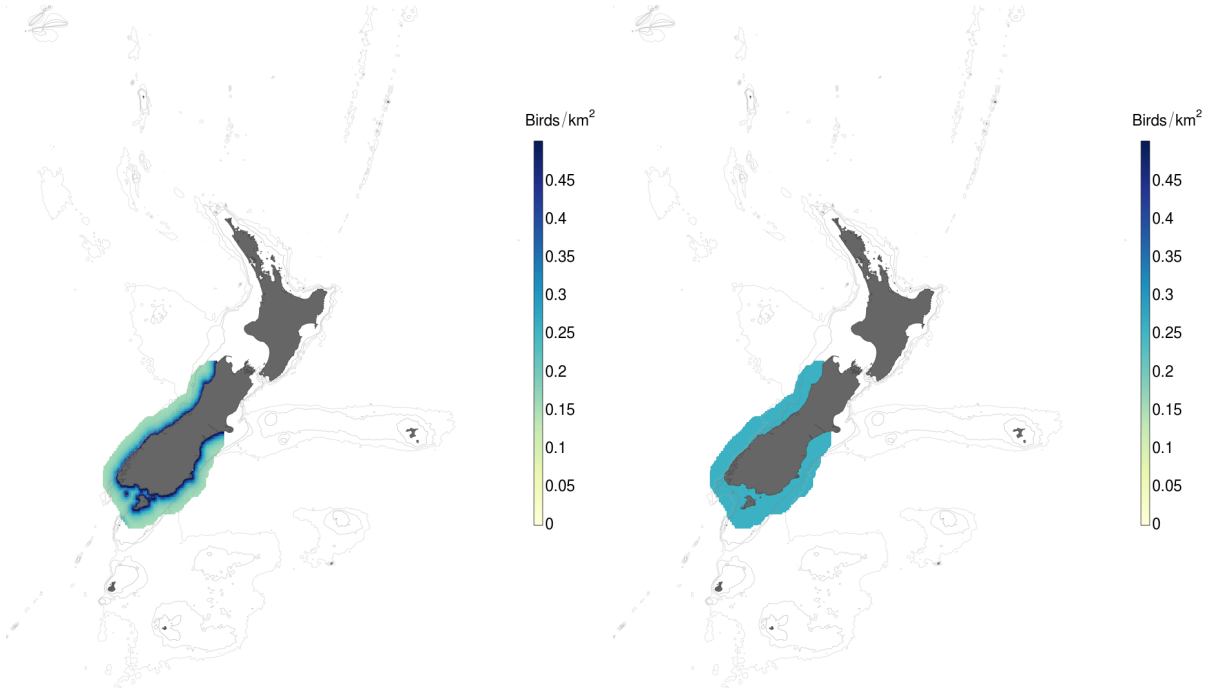


Figure S-49: Relative density of southern little penguin (*Eudyptula minor*). The base map was obtained by creating a buffer around coastal locations where the species has been found. The breeding season runs from August to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.50 Chatham Island little penguin (*Eudyptula minor*)

Population (NZ)	5000 to 10 000 pairs [1984]	Taylor (2000b)
Age at first reproduction	2 to 3 years	Schreiber & Burger (2001)
Survival rate	83%	Sidhu et al. (2007)

(a) Breeding distribution **(b) Non-breeding distribution**

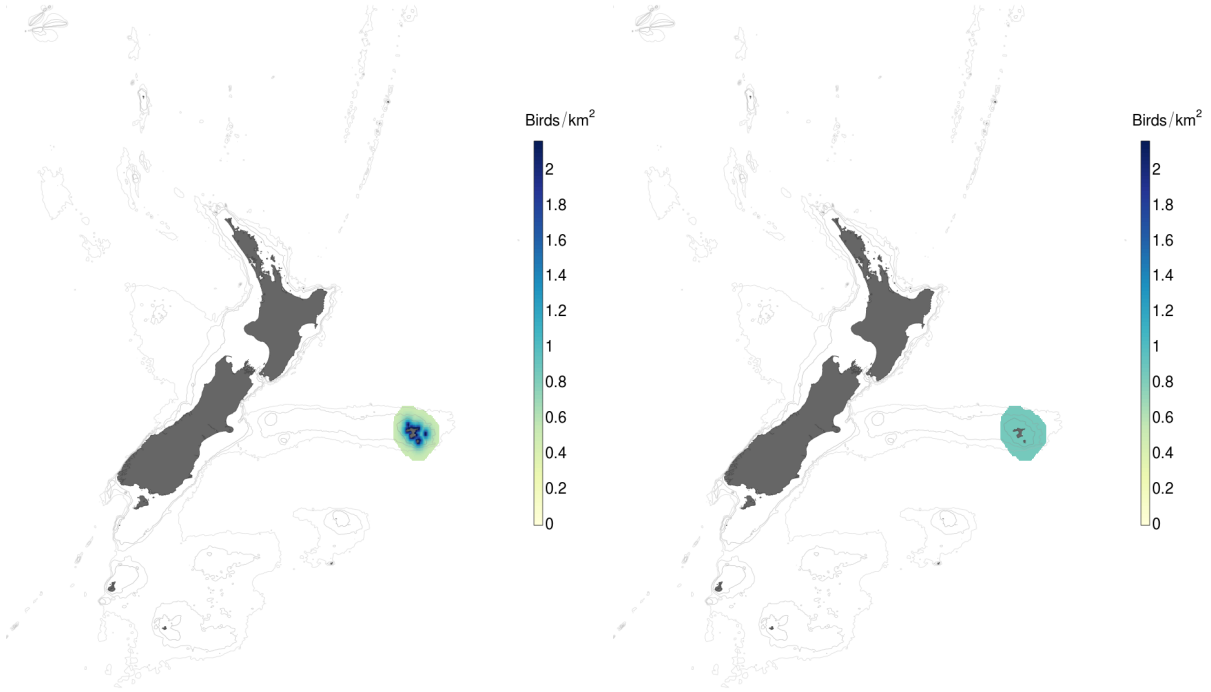


Figure S-50: Relative density of Chatham Island little penguin (*Eudyptula minor*). The base map was obtained by creating a buffer around coastal locations where the species has been found. The breeding season runs from August to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.51 Southern rockhopper penguin (*Eudyptes chrysocome*)

Population (NZ)	38 961 to 58 500 pairs	Taylor (2000a)
Age at first reproduction	4.7 years	Moseley's rockhopper penguin as proxy, Guinard et al. (1998)
Survival rate	84 ± 1.1% [1995]	Northern rockhopper penguin as proxy, Guinard et al. (1998)

(a) Breeding distribution

(b) Non-breeding distribution

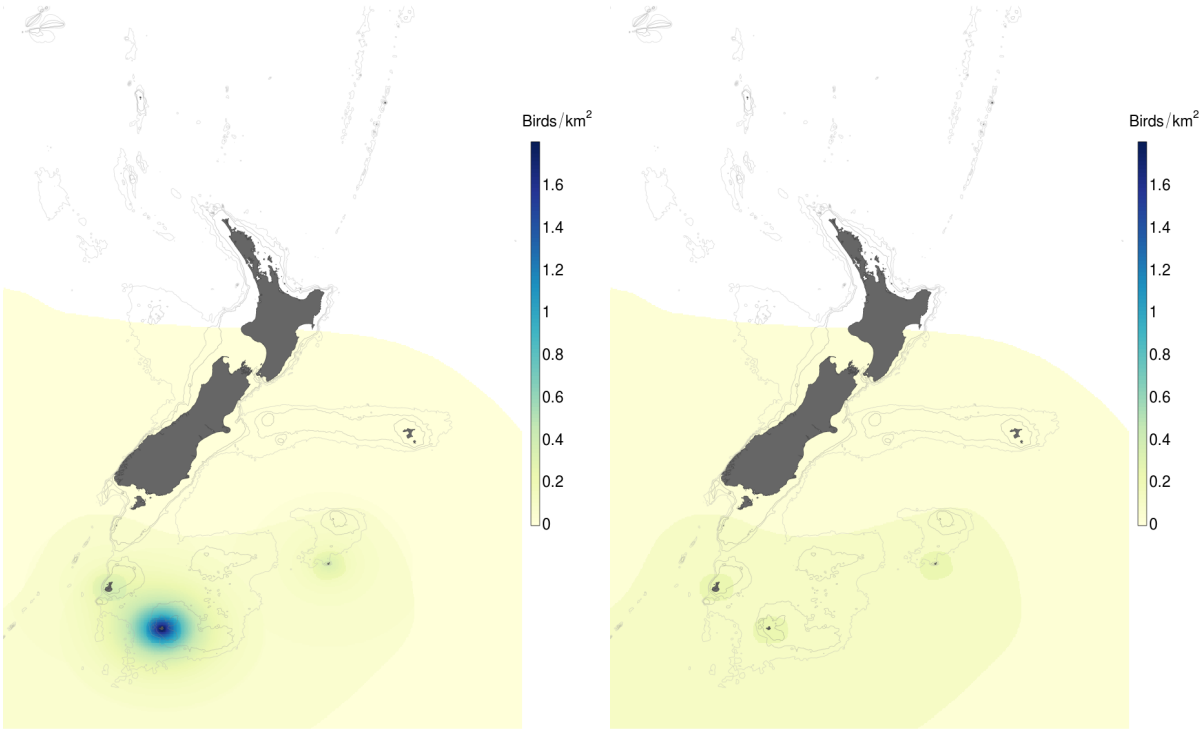


Figure S-51: Relative density of southern rockhopper penguin (*Eudyptes chrysocome*). The base map for the distribution was obtained from the NABIS database. The breeding season runs from October to May. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.52 Fiordland crested penguin (*Eudyptes pachyrhynchus*)

Population (NZ)	3000 pairs	Roots (2006)
Age at first reproduction	3 to 4 years 5 to 6 years	Schreiber & Burger (2001) Marchant & Higgins (1990)
Survival rate	84 ± 1.1% [1995]	Northern rockhopper penguin as proxy, Guinard et al. (1998)

(a) Breeding distribution

(b) Non-breeding distribution

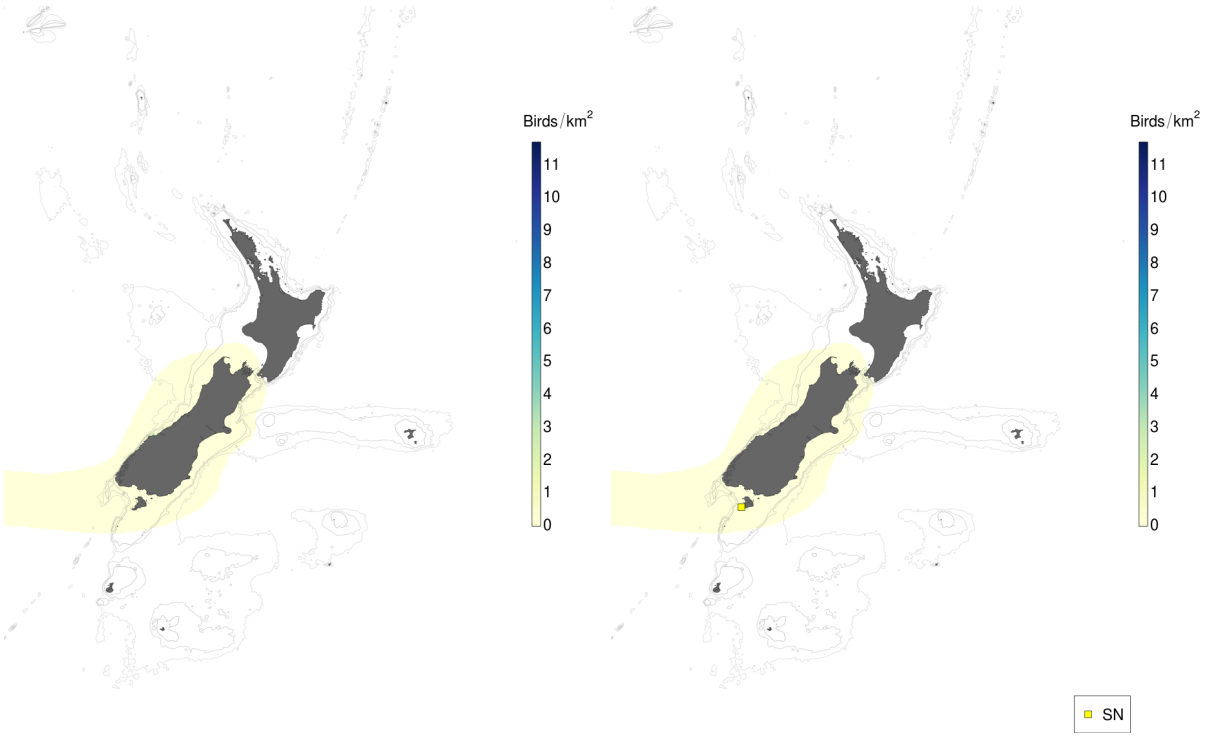


Figure S-52: Relative density of Fiordland crested penguin (*Eudyptes pachyrhynchus*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from June to November. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.53 Snares crested penguin (*Eudyptes robustus*)

Population (NZ)	30 000 pairs	Roots (2006)
Age at first reproduction	5 to 6 years	Roots (2006)
Survival rate	84 $\pm$ 1.1% [1995]	Northern rockhopper penguin as proxy, Guinard et al. (1998)

(a) Breeding distribution

(b) Non-breeding distribution

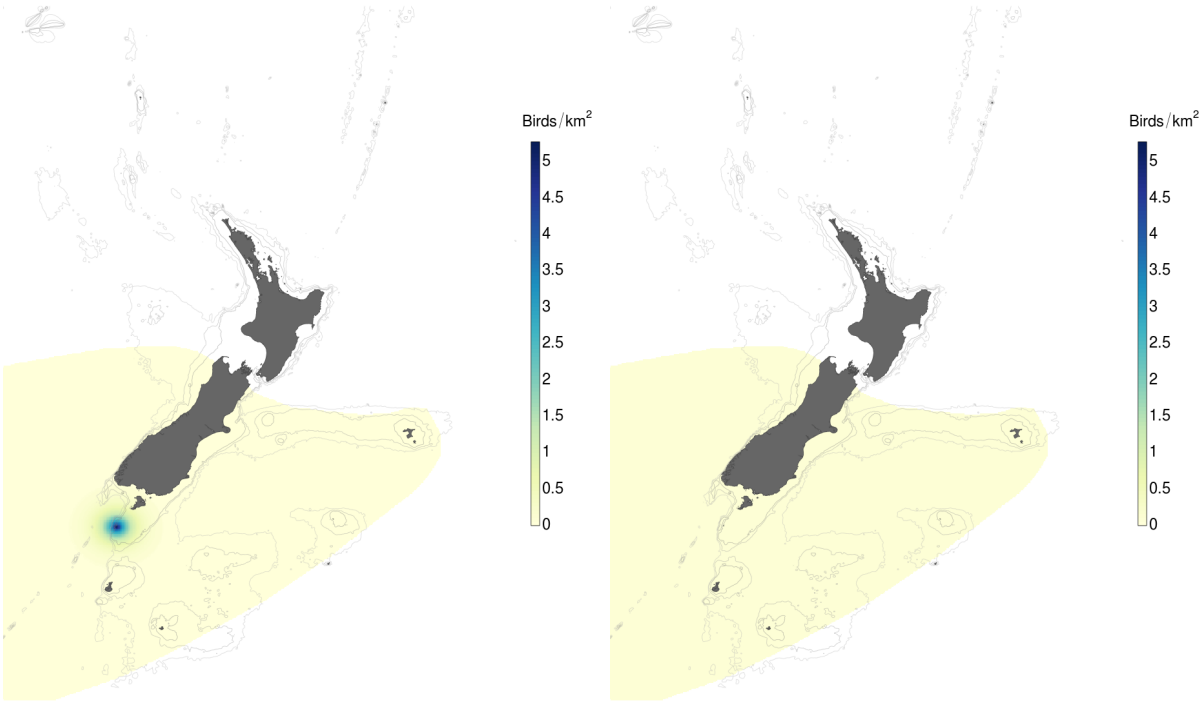
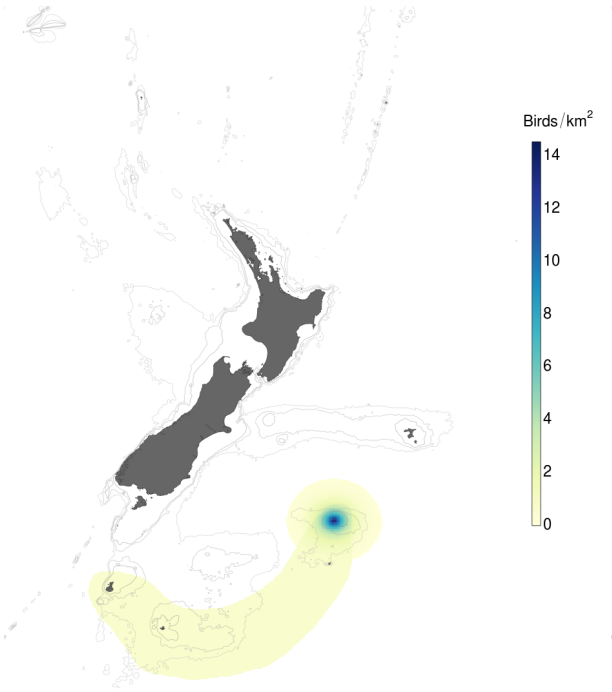


Figure S-53: Relative density of Snares crested penguin (*Eudyptes robustus*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from September to January. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.54 Erect-crested penguin (*Eudyptes sclateri*)

Population (NZ)	81 000 (77 000 – 85 000) pairs	Taylor (2000a)
Age at first reproduction	5 to 6 years	Fiordland crested penguin as proxy, Roots (2006)
Survival rate	84 ± 1.1% [1995]	Northern rockhopper penguin as proxy, Guinard et al. (1998)

(a) Breeding distribution



(b) Non-breeding distribution

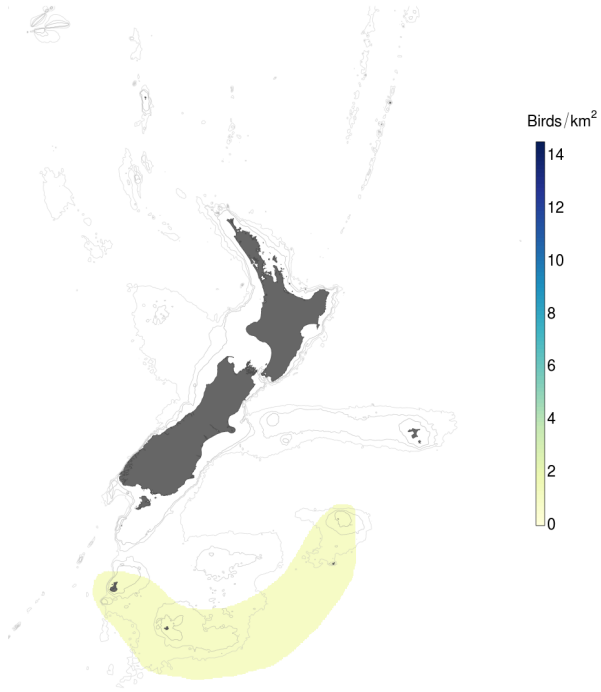


Figure S-54: Relative density of erect-crested penguin (*Eudyptes sclateri*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from September to March. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.55 Australasian gannet (*Morus serrator*)

Population (NZ)	46 004 pairs [1981]	Wodzicki et al. (1984)
Age at first reproduction	3 to 7 years	Schreiber & Burger (2001)
Survival rate	94%	Northern gannet as proxy, Schreiber & Burger (2001)

(a) Breeding distribution

(b) Non-breeding distribution

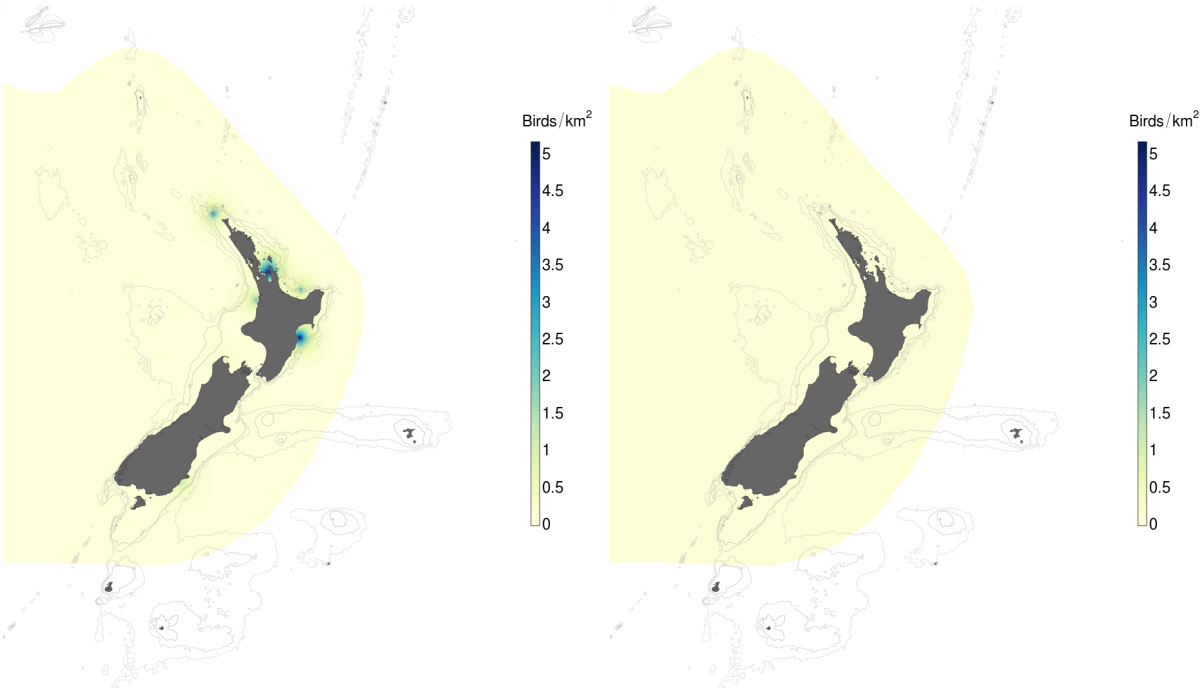


Figure S-55: Relative density of Australasian gannet (*Morus serrator*). The distribution base map was obtained from BirdLife single-layer range maps. The breeding season runs from August to February. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.56 Masked booby (*Sula dactylatra*)

Population (NZ)	240 pairs	Veitch et al. (2004)
Age at first reproduction	2 to 4 years	Schreiber & Burger (2001)
Survival rate	85% [1979]	Harris (1979)

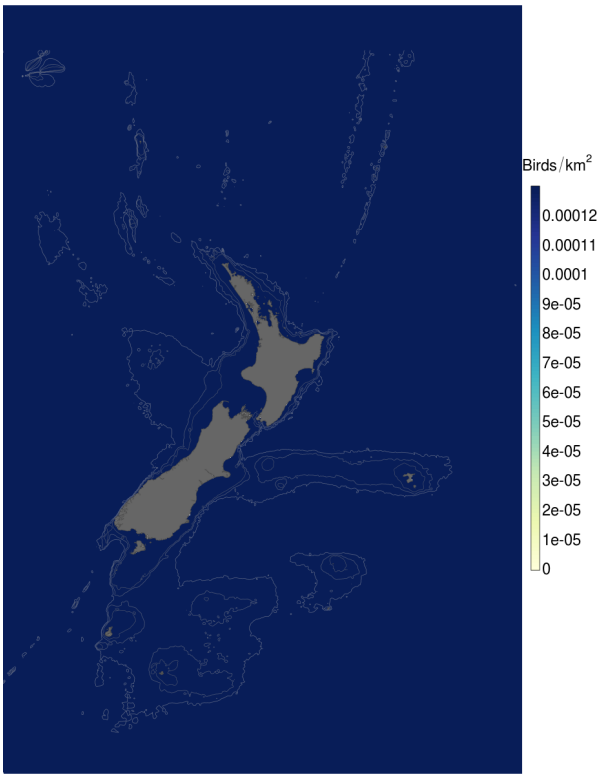


Figure S-56: Relative density of masked booby (*Sula dactylatra*). A uniform distribution across the area was chosen in absence of sufficient information. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.57 Pied shag (*Phalacrocorax varius varius*)

Population (NZ)	more than 652 pairs [1990]	Marchant & Higgins (1990)
Age at first reproduction	more than 2 years	Schreiber & Burger (2001)
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

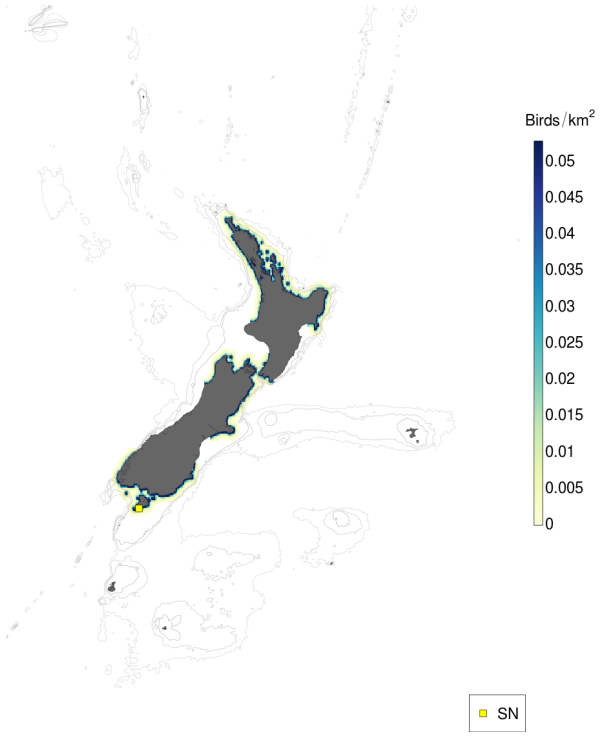


Figure S-57: Relative density of pied shag (*Phalacrocorax varius varius*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.58 Little black shag (*Phalacrocorax sulcirostris*)

Population (NZ)	400 to 800 pairs	Taylor (2000b)
Age at first reproduction	2 years	Pied shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

(a) Breeding distribution **(b) Non-breeding distribution**

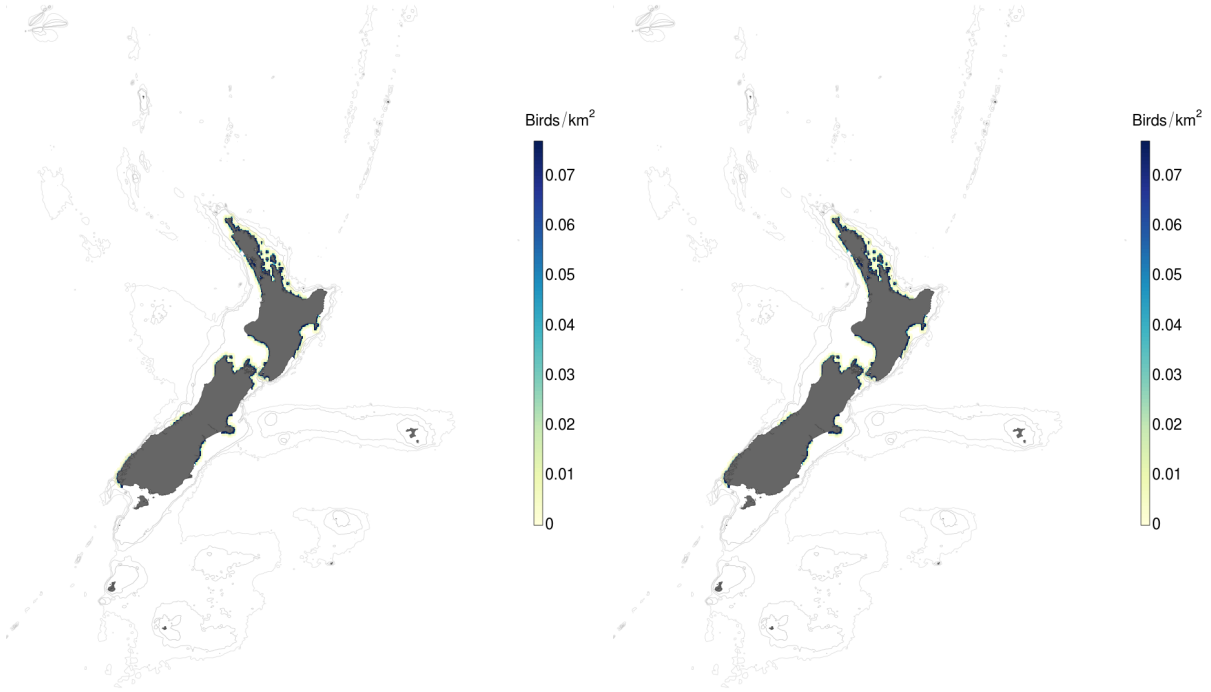


Figure S-58: Relative density of little black shag (*Phalacrocorax sulcirostris*). The base map was obtained by creating a buffer around coastal locations where the species has been found. The breeding season runs from October to December. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.59 New Zealand king shag (*Phalacrocorax carunculatus*)

Population (NZ)	102 to 126 pairs [2002]	Birdlife International (2012)
Age at first reproduction	more than 3 years	Black shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

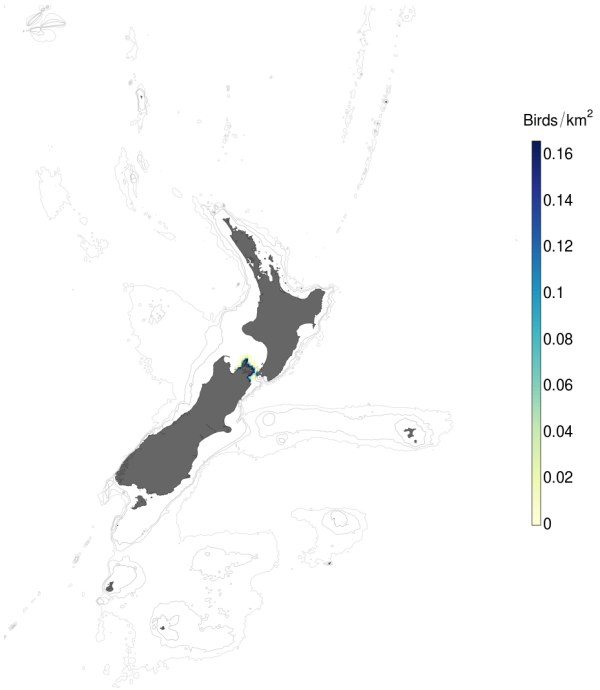


Figure S-59: Relative density of New Zealand king shag (*Phalacrocorax carunculatus*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.60 Stewart Island shag (*Phalacrocorax chalconotus*)

Population (NZ)	1800 to 2000 pairs [1981]	Birdlife International (2012)
Age at first reproduction	more than 3 years	Black shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

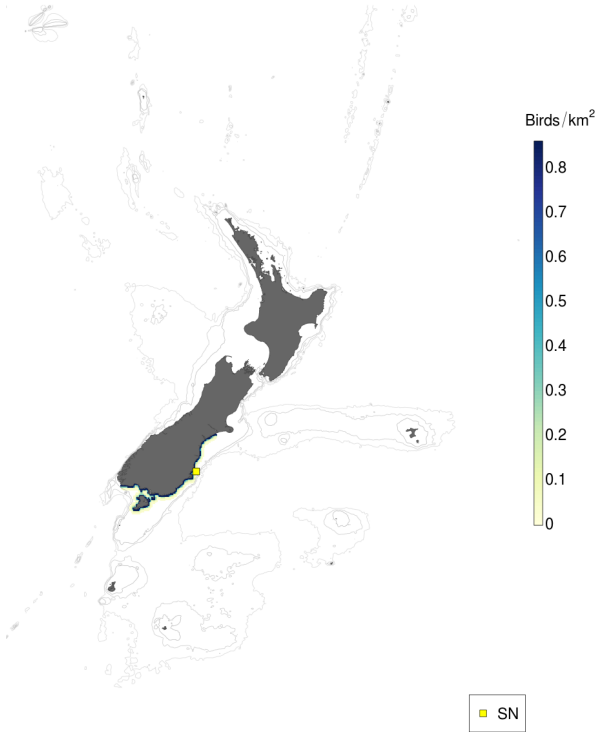


Figure S-60: Relative density of Stewart Island shag (*Phalacrocorax chalconotus*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.61 Chatham Island shag (*Phalacrocorax onslowi*)

Population (NZ)	357 pairs [2011]	Birdlife International (2012)
Age at first reproduction	more than 3 years	Black shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

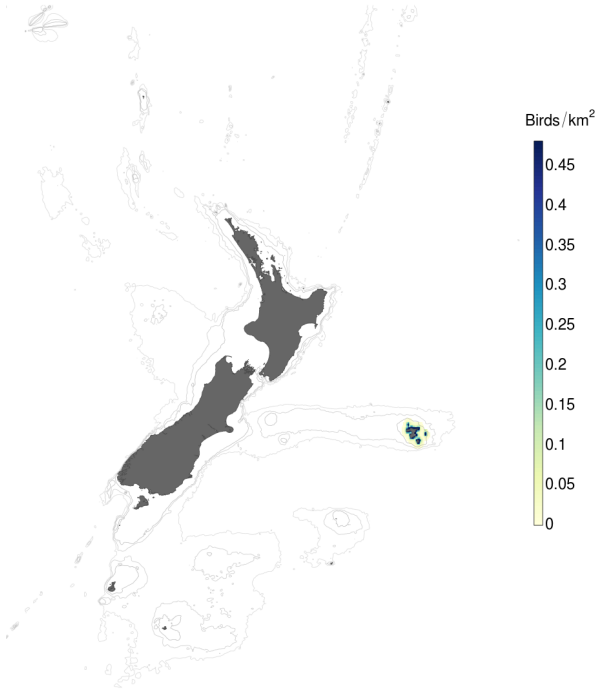


Figure S-61: Relative density of Chatham Island shag (*Phalacrocorax onslowi*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.62 Bounty Island shag (*Phalacrocorax ranfurlyi*)

Population (NZ)	120 pairs [2005]	Birdlife International (2012)
Age at first reproduction	more than 3 years	Black shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

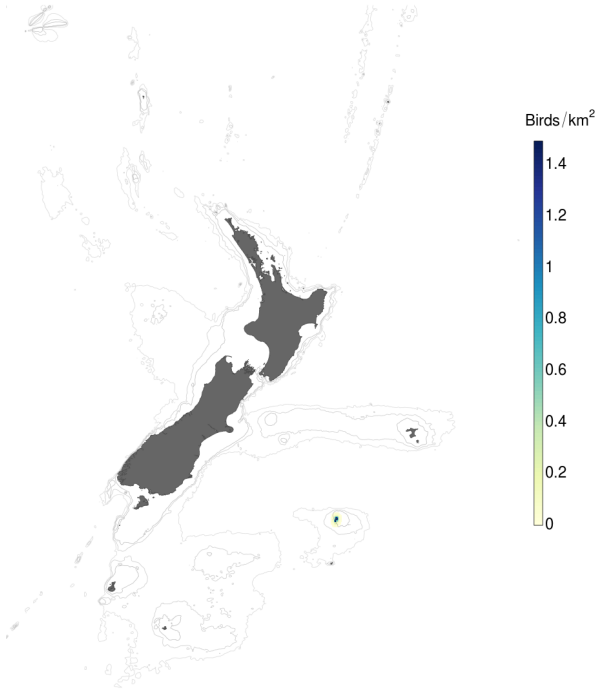


Figure S-62: Relative density of Bounty Island shag (*Phalacrocorax ranfurlyi*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.63 Auckland Island shag (*Phalacrocorax colensoi*)

Population (NZ)	more than 1366 pairs [2011]	Birdlife International (2012)
Age at first reproduction	more than 3 years	Black shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

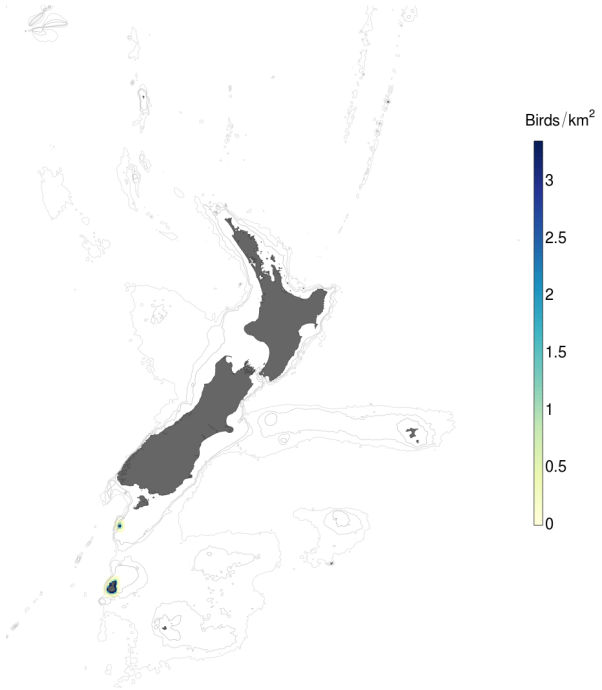


Figure S-63: Relative density of Auckland Island shag (*Phalacrocorax colensoi*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.64 Campbell Island shag (*Phalacrocorax campbelli*)

Population (NZ)	2000 pairs [1975]	Birdlife International (2012)
Age at first reproduction	more than 3 years	Black shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

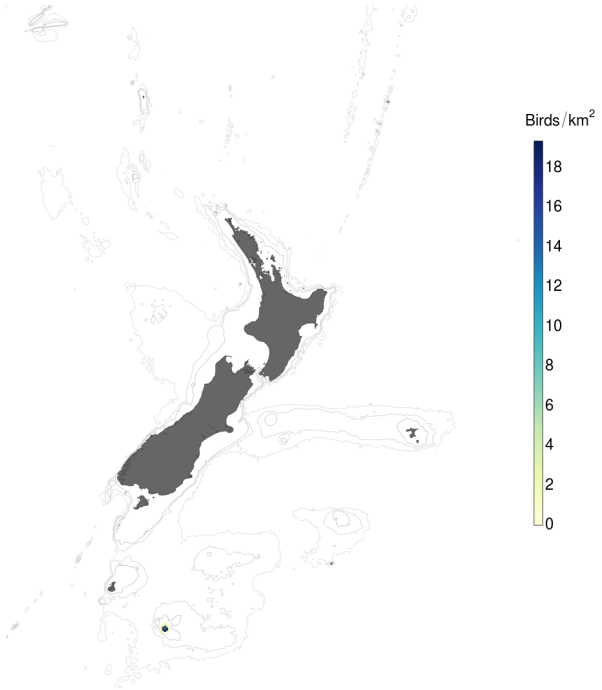


Figure S-64: Relative density of Campbell Island shag (*Phalacrocorax campbelli*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.65 Spotted shag (*Phalacrocorax punctatus*)

Population (NZ)	10 000 to 30 000 pairs	Taylor (2000b)
Age at first reproduction	2 years	Schreiber & Burger (2001)
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

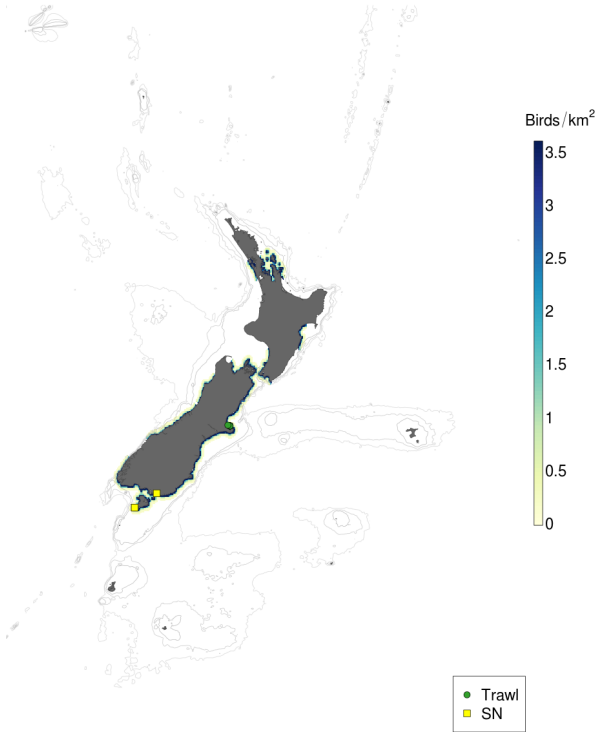


Figure S-65: Relative density of spotted shag (*Phalacrocorax punctatus*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.66 Pitt Island shag (*Phalacrocorax featherstoni*)

Population (NZ)	669 pairs [1997]	Taylor (2000a)
Age at first reproduction	more than 3 years	Black shag as proxy
Survival rate	87.8 (85.9 – 89.7)%	European shag as proxy, Harris et al. (1994)

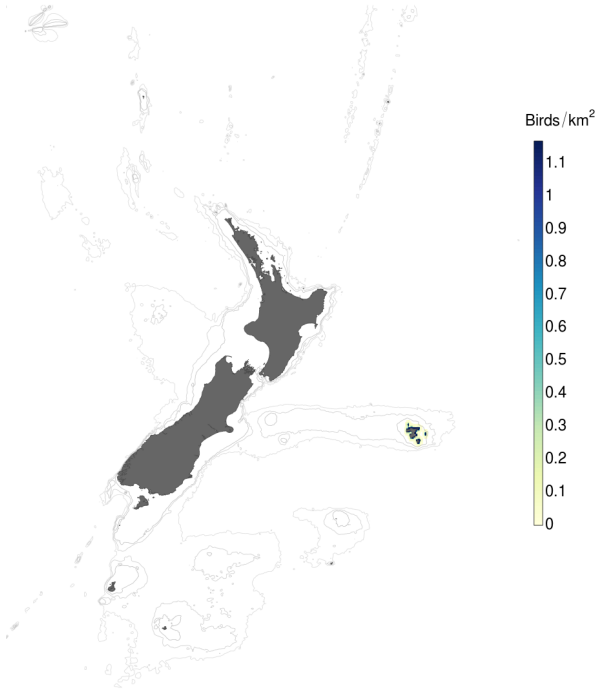


Figure S-66: Relative density of Pitt Island shag (*Phalacrocorax featherstoni*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.67 Subantarctic skua (*Catharacta antarctica lonnbergi*)

Population (NZ)	450 to 470 pairs	Wilson (2006)
Age at first reproduction	8.03 ± 0.21 years ($N = 96$) [1996]	Young (1998)
Survival rate	93.8 (91 – 97)% [1965]	Wood (1971)

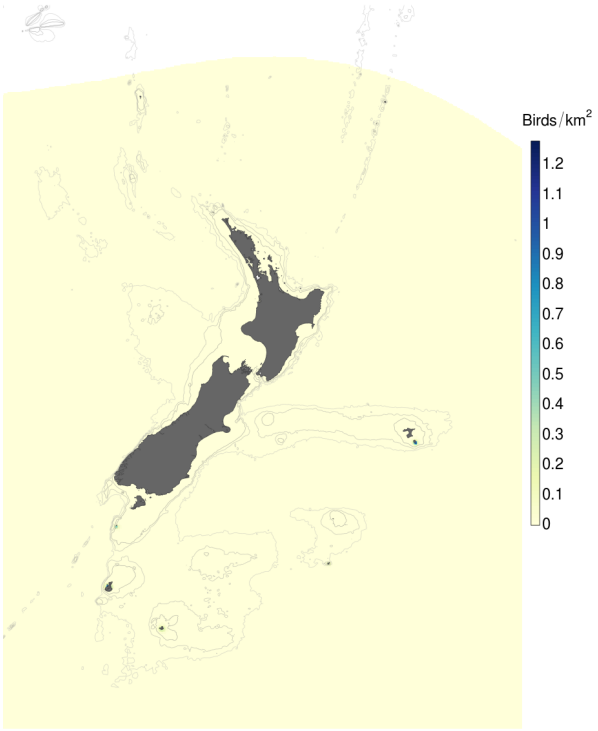


Figure S-67: Relative density of subantarctic skua (*Catharacta antarctica lonnbergi*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.68 Black-backed gull (*Larus dominicanus*)

Population (NZ)	more than 1 000 000 pairs	Taylor (2000b)
Age at first reproduction	4 years	Schreiber & Burger (2001)
Survival rate	81%	Schreiber & Burger (2001)

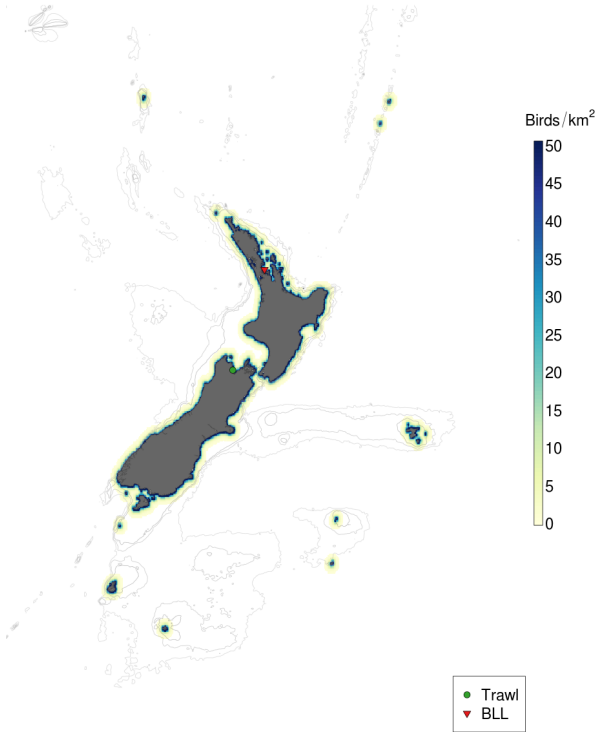


Figure S-68: Relative density of black-backed gull (*Larus dominicanus*). The base map was obtained by creating a buffer around coastal locations where the species has been found. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.69 Caspian tern (*Sterna caspia*)

Population (NZ)	1000 pairs [1992]	Taylor (2000b)
Age at first reproduction	2 to 4 years	Schreiber & Burger (2001)
Survival rate	87 to 91% 89% [1980]	Schreiber & Burger (2001) Gill & Mewaldt (1983)

(a) Breeding distribution **(b) Non-breeding distribution**

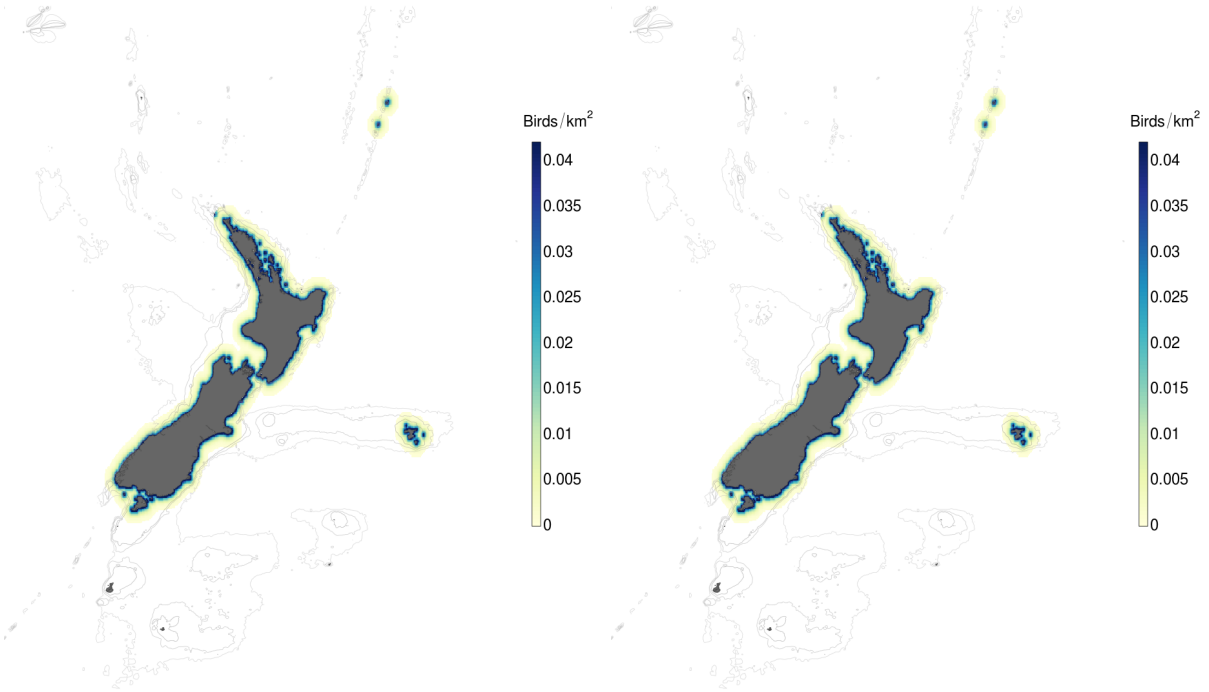


Figure S-69: Relative density of Caspian tern (*Sterna caspia*). The base map was obtained by creating a buffer around coastal locations where the species has been found. The breeding season runs from October to December. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

S.70 Common white tern (*Gygis alba*)

Population (NZ)	60 to 100 pairs	Taylor (2000b)
Age at first reproduction	3 to 5 years	Schreiber & Burger (2001)
Survival rate	78 to 83%	Bridled tern as proxy, Schreiber & Burger (2001)

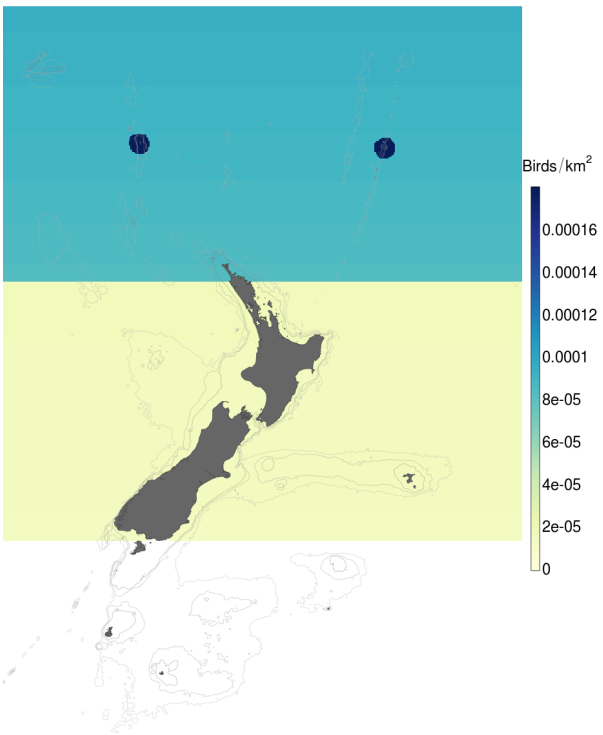


Figure S-70: Relative density of common white tern (*Gygis alba*). The base map for the distribution was obtained from the NABIS database. Also shown are incidental captures recorded by observers between the 2006–07 and 2010–11 fishing years in trawl, surface-longline (SLL), bottom-longline (BLL), and set-net (SN) fisheries.

SUPPLEMENTARY REFERENCES

Agreement on the Conservation of Albatrosses and Petrels (ACAP) (2010). ACAP species assessment. Retrieved 7 May 2010, from http://www.acap.aq.

Baker, B.; Hedley, G.; Cunningham, R. (2010). Data collection of demographic, distributional, and trophic information on the flesh-footed shearwater to allow estimation of effects of fishing on population viability: 2009–10 field season. Final Research Report for Ministry for Primary Industries Research Project PRO2006/01 (Unpublished report held by the Ministry for Primary Industries, Wellington).

Barbraud, C.; Delord, K.; Marteau, C.; Weimerskirch, H. (2009). Estimates of population size of white-chinned petrels and grey petrels at Kerguelen Islands and sensitivity to fisheries. *Animal Conservation 12*: 258–265.

Beck, J.R. (1969). Food, moult and age of first breeding in the Cape pigeon, *Daption capensis* (Linnaeus). *British Antarctic Survey Bulletin 21*: 33–44.

Bell, E.A. (2002). Grey petrels (*Procellaria cinerea*) on Antipodes Island, New Zealand: research feasibility, April to June 2001. *DOC Science internal series 60*. 31 p.

Bell, E.A.; Sim, J.L.; Scofield, P.; Francis, R.I.C.C. (2011). Population parameters of the black petrels (*Procellaria parkinsoni*) on Great Barrier Island (Aotea Island), 2009/10. Unpublished report prepared for the Department of Conservation, retrieved from http://www.doc.govt.nz/publications/conservation/marine-and-coastal/conservation-services-programme/csp-reports/population-parameters-of-black-petrels-on-great-barrier-aotea-island-2009-10/, January 2012.

Birdlife International (2009). Birdlife International. Species factsheets. http://www.birdlife.org. Retrieved 21 May 2010, from http://www.birdlife.org

Birdlife International (2012). Birdlife International. Species factsheets. http://www.birdlife.org. Retrieved 10 May 2012, from http://www.birdlife.org

Bradley, J.S.; Gunn, B.M.; Skira, I.J.; Meathrel, C.E.; Wooller, R.D. (1999). Age-dependent prospecting and recruitment to a breeding colony of short-tailed shearwaters *Puffinus tenuirostris*. *Ibis 141*: 277–285.

Clucas, R.J.; Fletcher, D.J.; Moller, H. (2008). Estimates of adult survival rate for three colonies of sooty shearwater (*Puffinus griseus*) in New Zealand. *Emu 108*: 237–250.

Croxall, J.P. (1987). The status and conservation of Antarctic seals and seabirds: a review. *Environment International 13*: 55–70.

Croxall, J.P.; Gales, R. (1998). An assessment of the conservation status of albatrosses. In, Robertson, G.; Gales, R. (Eds.), The albatross: biology and conservation, pp. 46–65. Surrey Beatty & Sons, Chipping Norton, Australia.

Cuthbert, R.; Davis, L.S. (2002). Adult survival and productivity of Hutton's shearwaters. *Ibis 144(3)*: 423–432.

Dillingham, P.W.; Fletcher, D. (2008). Estimating the ability of birds to sustain additional human-caused mortalities using a simple decision rule and allometric relationships. *Biological Conservation 141*: 1783–1792.

Francis, R.I.C.C. (2012). Fisheries risks to the population viability of white-capped albatross (*Thalassarche steadi*). *New Zealand Aquatic Environment and Biodiversity Report No. 104*. 24 p.

Francis, R.I.C.C.; Sagar, P.M. (2012). Modelling the effect of fishing on southern Buller's albatross using a 60-year dataset. *New Zealand Journal of Zoology 39(1)*: 3–17.

Gill, R.E.; Mewaldt, L.R. (1983). Pacific coast caspian terns: dynamics of an expanding population. *The Auk 100(2)*: 369–381.

Guinard, E.; Weimerskirch, H.; Jouventin, P. (1998). Population changes and demography of the northern rockhopper penguin on Amsterdam and Saint Paul islands. *Colonial waterbirds 21(2)*: 222–228.

Harris, M.P. (1979). Survival and ages of first breeding of Galapagos seabirds. *Bird-Banding 50(1)*: 56–61.

Harris, M.P.; Buckland, S.T.; Russell, S.M.; Wanless, S. (1994). Year-and age-related variation in the survival of adult European shags over a 24-year period. *Condor 96(3)*: 600–605.

L. Brooke, M. de (2004). Albatrosses and petrels across the world. Oxford University Press. 499 p.

Marchant, S.; Higgins, P.J. (1990). Handbook of Australian, New Zealand and Antarctic birds. Volume 1, part A. Oxford University Press, Melbourne, Australia. 735 p.

Robertson, C.J.R. (1993). Survival and longevity of the northern royal albatross *Diomedea epomophora sanfordi* at Taiaroa Head 1937–93. *Emu 93(4)*: 269–276.

Roots, C. (2006). Flightless birds. Greenwood Press, Connecticut. 248 p.

Sagar, P.; Carroll, J.; Charteris, M.; Thompson, D.; Scofield, P. (2011). Population assessment of Salvin's albatrosses at the Snares Western Chain, 25 September – 14 October 2010. Final Research Report for research project PRO200601-E (Unpublished report held by Ministry for Primary Industries, Wellington.)

Sagar, P.M.; Stahl, J.C. (2005). Increases in the numbers of breeding pairs in two populations of Buller's albatross (*Thalassarche bulleri bulleri*). *Emu 105(1)*: 49–55.

Sagar, P.; Tennyson, A.; Miskelly, C. (1996). Breeding and survival of Snares Cape pigeons *Daption capense australe* at The Snares, New Zealand. *Notornis 43*: 197–207.

Schreiber, E.A.; Burger, J. (2001). Biology of marine birds. CRC Press, Boca Raton.

Sidhu, L.A.; Catchpole, E.A.; Dann, P.; Shaffer, T.L. (2007). Mark-recapture-recovery modeling and age-related survival in little penguins (*Eudyptula minor*). *The Auk 124(3)*: 815–827.

Taylor, G.A. (2000a). Action plan for seabird conservation in New Zealand. Part A: Threatened seabirds. *Threatened Species Occasional Publication No. 16*. 234 p.

Taylor, G.A. (2000b). Action plan for seabird conservation in New Zealand. Part B: Non-threatened seabirds. *Threatened Species Occasional Publication No. 17*. 435 p.

Trivelpiece, S.G.; Trivelpiece, W.Z. (1998). Post-fledging dispersal of southern giant petrels *Macronectes giganteus* banded at Admiralty Bay, King George Island, Antarctica. *Marine Ornithology 26*: 63–68.

Veitch, C.R.; Miskelly, C.M.; Harper, G.A.; Taylor, G.A.; Tennyson, A.J.D. (2004). Birds of the Kermadec Islands, south-west Pacific. *Notornis 51(2)*: 61–90.

Walker, K.; Elliott, G. (1999). Population changes and biology of the wandering albatross *Diomedea exulans gibsoni* at the Auckland Islands. *Emu 99*: 239–247.

Walker, K.; Elliott, G. (2002). Monitoring Antipodean and Gibson's wandering albatross, 1996/97. *Department of Conservation Science Internal Series 75*. 14 p.

Waugh, S.M.; Doherty, P.F.; Freeman, A.N.D.; Adams, L.; Woods, G.C.; Bartle, J.A.; Hedley, G.K. (2006). Demography of Westland petrels (*procellaria westlandica*), 1995–2003. *Emu 106*: 219–226.

Waugh, S.M.; Weimerskirch, H.; Moore, P.J.; Sagar, P.M. (1999). Population dynamics of black-browed and grey-headed albatrosses *Diomedea melanophrys* and *D. chrysostoma* at Campbell Island, New Zealand, 1942–96. *Ibis 141*: 216–225.

Wilson, K.-J. (2006). The state of New Zealand's birds. Special report seabirds. Ornithological Society of New Zealand, Nelson.

Wodzicki, K.; Robertson, C.; Thompson, H.; Alderton, C. (1984). The distribution and numbers of gannets in New Zealand. *Notornis 31*: 232–261.

Wood, R.C. (1971). Population dynamics of breeding south polar skuas of unknown age. *The Auk 88(4)*: 805–814.

Young, E.C. (1998). Dispersal from natal territories and the origin of cooperatively polyandrous breeding groups in the brown skua. *Condor 100*: 335–342.