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New breeding records of seabirds at Carnley Harbour (Auckland Islands), Cossack Rock (Campbell Island) and south coast of The Snares

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Two recent workshops, the first on research priorities for New Zealand breeding petrels and albatrosses (Wilson & Croxall 2012) and the second for seabirds in general (Wilson & Waugh 2013) highlighted the urgent need for information on the distributions and abundance of seabirds breeding in the New Zealand region. Similarly, 2 recent papers (Waugh *et al*. 2013; Jamieson *et al*. 2016) noted the paucity of recent information on shearwaters (*Puffinus* spp) and prions (*Pachyptila* spp) respectively. These publications show that of all the island groups in the New Zealand region the least known are the Auckland Islands, and of all seabird groups the least known are the burrow-breeding petrels. Information on the distribution and abundance of sub-Antarctic seabirds is of particular importance given the impact of anthropogenic climate change and associated marine changes on food availability (Weimerskirch *et al*. 2003; Trathan *et al*. 2007; Boyd *et al*. 2015; Turney *et al*. 2017). Particularly vulnerable are seabirds which forage locally, breed on remote islands, or those near the southern or northern limits of their distributions (Garnett & Franklin 2014).

The Australasian Antarctic Expedition (AAE) 2013-14 (http://www.spiritofmawson.com.) presented an opportunity to obtain further data on the distribution and abundance of seabirds on the Auckland Islands, Campbell Island and The Snares. In this paper we present new breeding records of seabirds at these island groups. Other observations of seabirds made by us at these islands are available online (Wilson *et al*. 2017).

On 1 December 2013 we spent 3.5 hours on Masked Island (Fig 1.), which is 150 m from the main Auckland Island and all but joined to the mainland

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by reefs. The southern rata (*Metrosideros umbellata*) forest has a luxuriant understorey of palatable ferns and megaherbs, including *Stilbocarpa polaris* which has been virtually eliminated from feral pig (*Sus scrofa*) infested Auckland Island, where the understorey is sparse (Challies 1975). We found petrel burrows scattered over most of the island, with burrow density appearing to be slightly higher closer to the coast than towards the centre of the island. We examined burrow density in 7 circular plots. Using a rope knotted at 1 m intervals, we counted the number of burrows in plots of 3 m radius (28.3 m^2). To avoid double counting and to minimize the chance of missing burrows, 2 people searched together. The outer person held the rope taut and searched the outer sector, while the inner searcher checked each burrow as it was found. The 2 researchers slowly moved the rope around the circle back to the marked start point. Burrows were inspected using a burrowscope (Sextant Technology http://www.s-t.co.nz/burrowscope) and species present recorded.

The plots were spread over most of the island, the locations chosen to be representative of the understory and slopes on the island. The mean burrow density was 0.08/m^2, with a maximum density of 0.18/m^2 on sloping ground with a dense *Blechnum* understorey close to cliffs on the island's outer coast, with none in a plot in similar habitat on flat terrain further inland. Of the 16 burrows in these plots only 3 were occupied; 1 by a sooty shearwater (*Puffinus griseus*), 1 by a white-headed petrel (*Pterodroma lessonii*) and 1 by a prion. Of about 20 other burrows inspected we found 1 occupied by a sooty shearwater, 3 by white-headed petrels and 1 by a prion. Mice (*Mus musculus*) were recorded on Masked Island in 1907 (Waite 1909) and both mice and cats (*Felis catus*) in 1973 (Taylor 1975).

In addition to those birds found in burrows, 1 dead sooty shearwater and 1 dead Antarctic prion (*Pachyptila desolata*) (bill length 27.3 mm, bill width 14.6 mm, wing 179 mm) were found on Masked Island. We assumed prions found in burrows were also Antarctic prions.

We visited Figure of Eight Island (Fig. 1) on 2 December. Weather and sea conditions were vigorous allowing only an hour and 20 minutes ashore. There was insufficient time to count burrows in density plots, so instead we counted Subantarctic skuas (*Catharacta antarctica lonnbergi*) and sampled as many petrel burrows as possible. After circumnavigating the island, we landed midway along the south coast and investigated the western third of the island. The vegetation comprised low, open rata forest on hummocky ground over a sparse *Dracophyllum*, *Coprosma* and *Stilbocarpa* understory with a luxuriant ground cover of moss. We estimated there were 50-60 petrel

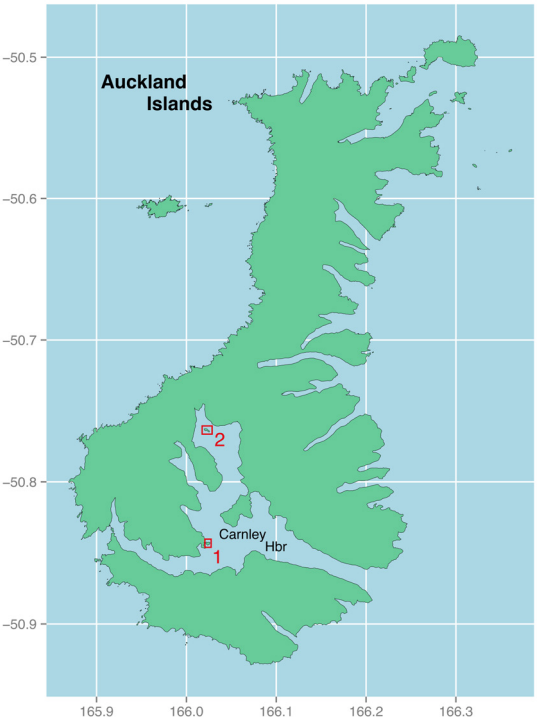

Fig. 1. The Auckland Islands showing the locations of Masked Island (1) and Figure of Eight Island (2).

burrows on that third of the island we surveyed. No introduced mammals were recorded on Figure of Eight Island in 1973 (Taylor 1975) and we assume it remains free of introduced mammals.

Of the 22 burrows inspected using a burrowscope on Figure of Eight Island, 1 contained a sooty shearwater and 3 others white-headed petrels all four of these birds were incubating. A dead prion, probably an Antarctic prion, was found in a skua midden but none was found in those burrows we inspected on Figure of Eight Island.

A pair of Subantarctic skuas was nesting at each end of Figure of Eight Island.

In the evening of 4 December 2013, we circumnavigated Cossack Rock, Campbell Island (Fig. 2) in a zodiac boat. Cossack Rock is a small, completely cliff-bound island, with a flat plateau supporting a carpet of tussock grassland. The tussock on Cossack Rock was densely burrowed and 3 white-chinned petrels (*Procellaria aequinoctialis*) were seen flying out from the grassland where Rexer-Huber *et al*. (2016) estimated there were 240 pairs. Some cliff ledges were stained with guano and Snares Cape petrels (*Daption capense australe*) were seen patrolling the cliffs on both sides of

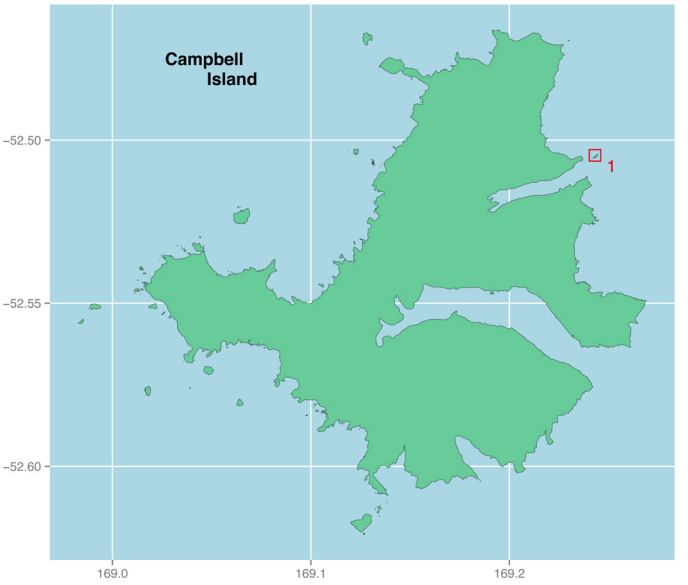

Fig. 2. Campbell Island showing the location of Cossack Rock (1).

Cossack Rock and one was seen landing on a ledge, suggesting that a few Cape petrels breed on this Island. One Subantarctic skua was seen flying over Cossack Rock suggesting that a pair nested there. Neither Cape petrels nor skuas have previously been recorded at Cossack Rock.

We visited The Snares on 6 December 2013, a day with strong northeast winds but mill-pond calm conditions along the normally wind- and sea-lashed southern coast of North East Island. We took advantage of the rare calm conditions and zodiac availability to survey Antarctic terns (*Sterna vittata bethunei*) and Snares Cape petrels along the entire southern coast of North East Island and Alert Stack.

Snares cape petrels were numerous along the south coast of North East Island and were breeding on coastal cliffs near the western end of that coast and on the eastern sector of Alert Stack (Table 1, Fig. 3). Given that we observed at least 350 Cape petrels along the southern coast of North East Island, about 150 of which were patrolling cliffs suitable for nesting, it is likely that there were at least several hundred pairs nesting along this coast. The distribution and abundance of Cape petrels at The Snares in 1984-85 have been estimated by Miskelly *et al*. (2001), the distribution mapped by them being similar to that found by us.

Antarctic tern numbers along this coast were estimated from cliff-top observation points in 1984-85 (Sagar *et al*. 2003). Some birds sitting on nests would be impossible to see from either cliff tops or a boat; thus for both 1984-1985 and 2013, numbers present must be estimated from those seen. Our actual count of 17 adults and 2 fledglings on the south coast of North East Island is in line with approximately 20 pairs estimated there in 1984-85 (Sagar *et al*. 2003). In addition, we estimated there to be about 5 pairs nesting on Alert Stack where none had been observed in previous surveys (Sagar *et al*. 2003).

In this note we present the first records of petrels breeding on Masked and Figure of Eight islands, both in Carnley Harbour, Auckland Islands. In contrast, we did not find black-backed gulls (*Larus dominicanus dominicanus*) breeding on Masked Island where they bred in 1907 (Waite 1909) nor Auckland Island shags (*Leucocarbo colensoi*) breeding on Figure of Eight Island where observations made in June 1912 suggested they bred (Falla 1937).

Our sightings of Snares Cape petrels and Subantarctic skuas on Cossack Rock, Campbell Island suggest that both species may breed on that island where they have not been recorded previously.

We observed Antarctic terns breeding on Alert Stack at The Snares where this species has not been recorded breeding before. Our survey of Cape petrels and Antarctic terns along the south coast of North East Island, The Snares showed distributions similar to those reported previously (Miskelly *et al*. 2001) and a number of terns similar to those in 1984-85 (Sagar *et al*. 2003).

Wise management of the sub-Antarctic islands and their bird faunas requires knowledge of which species nest on each island within each archipelago, plus accurate counts of representative colonies for

each species, repeated at predetermined intervals to assess population trends. Of the 3 island groups visited, The Snares is the only group where the distributions of all breeding seabirds are adequately documented and there are at least 'ball-park' estimates of population size for all species (Miskelly *et al*. 2001). Information on the distribution of seabird breeding sites is often lacking for the Auckland Islands, and population trend data are available only for some species of albatross (Elliott *et al*. 2016; Baker & Jensz 2016) and for yellow-eyed penguins (*Megadyptes antipodes*) on Enderby Island (Chilvers 2014). Globally seabirds are 1 of the most threatened groups of birds (Croxall *et al*. 2012), and this will only worsen with increased climate variability and ocean warming (Garnett & Franklin 2014), plus the insidious, growing threat from plastic ingestion (Wilcox *et al*. 2015).

Although neither Figure of Eight nor Masked Island support large populations of seabirds, we recommend full surveys be undertaken on each. Both islands are small, the habitat easy to work in and a full survey of all breeding seabirds could be undertaken in a single day for each island. Subsequent surveys at 5-year intervals would give an indication of the trends for several petrel species. Cats and mice could be eradicated from Masked Island and it should be feasible to prevent their reestablishment. This would allow research on the recovery of a sub-Antarctic petrel community following predator removal. Despite the large number of islands from which introduced mammals have been eradicated, there are few studies of the subsequent recovery of seabird populations (Buxton *et al*. 2014, 2016).

The low burrow occupancy we found does not necessarily indicate that correspondingly few burrows remain in use. White-headed petrels lay between mid-November and late December and are absent from their breeding colonies immediately before egg laying (Marchant & Higgins 1990). Thus, many burrows used by this species would be cleaned out but not occupied at the time of our visits. Antarctic prions lay late November to December. Therefore, of the 3 petrel species recorded on Masked and/or Figure of Eight Islands (sooty shearwater, white-headed petrel and Antarctic prion) only the shearwater may have completed egg-laying by 2 December (Warham *et al*. 1982).

As seas and climate warm, those seabirds

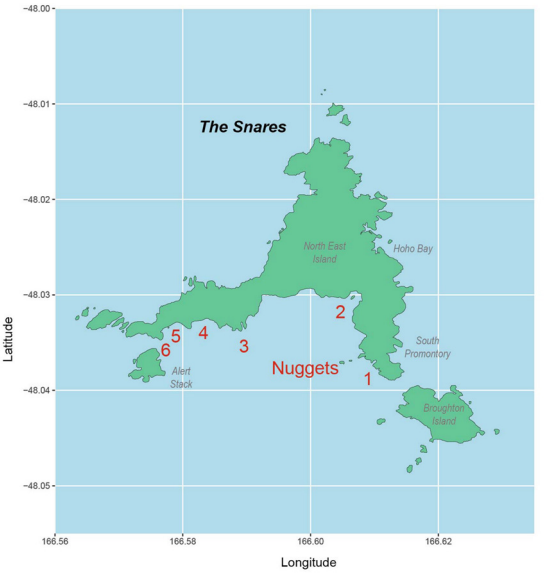

Fig. 3. The Snares showing locations (1-6) where Cape petrels and Antarctic terns were seen along the southern coast on 6 December 2013. Refer to Table 3 for details of species observations.

Table 1. Distribution of Snares Cape petrels and Antarctic terns on the south coast of North East Island and Alert Stack, The Snares, 6 December 2013. *Locations are those shown in Fig. 3.

Location*	Nesting Cape petrels	Other Cape petrels	Nesting Antarctic terns	Other Antarctic terns
1			1 pair	3
Nuggets		200		
2				4
3			1-2 pairs	4 adults, 2 fledglings
4	4 on nests	24		
5	Breeding	few		
6	Probably breeding	50+		4
Alert Stack	Several	75	2 pairs	5 adults, 2 fledglings

which forage locally, breed on remote islands, or those near the southern or northern limits of their distributions, are those most likely to be affected (Garnett & Franklin 2014). This would suggest that penguins, terns, skuas and shags breeding on the New Zealand sub-Antarctic islands are likely to be among those seabirds most affected by climate change. Colonial breeding penguins, Antarctic terns and some shags are relatively easily monitored and, with good baseline data, could serve as proxies for changes in the marine environment. Accurate counts of these species are urgently required. The least known of the seabirds are the burrow breeding petrels, despite New Zealand having many endemic and/or threatened species and globally important populations of others. Two recent papers on distribution and abundance of shearwaters and prions in the New Zealand region (Jamieson *et al*. 2016; Waugh *et al*. 2013) stress the paucity of information on distribution, abundance and population trends for most petrel species. Opportunistic surveys such as ours can provide useful data and every opportunity to obtain additional data or repeat existing counts must be taken.

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REFERENCES

Baker, G.B.; Jensz, K. 2016. *White-capped albatross aerial photographic survey 2016.* Department of Conservation Contract 4655-2. Wellington, Department of Conservation.

Boyd, P.W.; Lennartz, S.T.; Glover, D.M.; Doney, S.C. 2015. Biological ramifications of climate-change-mediated oceanic multi-stressors. *Nature Climate Change 5*: 71–79.

Buxton, R.T.; Jones, C.; Moller, H.; Towns, D.R. 2014. Drivers of seabird population recovery on New Zealand islands after predator eradication. *Conservation Biology 28*: 333–344.

Buxton, R.T.; Taylor, G.; Jones, C.; Lyver, P. O'B; Moller, H.; Cree, A.; Towns, D.R. 2016. Spatio-temporal changes in density and distribution of burrow-nesting seabird colonies after rat eradication. *New Zealand Journal of Ecology 40*: 88–99.

Challies, C.N. 1975. Feral pigs (*Sus scrofa*) on Auckland Island: Status, and effects on vegetation and nesting sea birds. *New Zealand Journal of Zoology* 2: 479–490.

Chilvers, B.L. 2014. Changes in the annual counts of yellow-eyed penguins (*Megadyptes antipodes*) at Sandy Bay, Enderby Island, 2001-2012. *Notornis 61*: 103–105.

Croxall, J.P.; Butchart, S.H.M.; Lascelles, B.; Stattersfield, A.J.; Sullivan, B.; Symes, A.; Taylor, P. 2012. Seabird conservation status, threats and priority actions: a global assessment. *Bird Conservation International 22*: 1–34.

Elliott, G.; Walker, K.; Parker, G.; Rexer-Huber, K. 2016. *Gibson's wandering albatross census and population study 2015/16.* Report on CSP Project 4655. Wellington, Department of Conservation.

Falla, R.A. 1937. Birds. *B.A.N.Z. Antarctic research expedition 1929-1931, Report Series B*, Volume 2.

Garnett, S.T.; Franklin, D.C. 2014. *Climate change adaptation plan for Australian birds*. Collingwood, CSIRO.

Jamieson, S.E.; Tennyson, A.J.D.; Wilson, K.-J.; Crotty, E.; Miskelly, C.M.; Taylor, G.A.; Waugh, S.M. 2016. A review of the distribution and size of prion (*Pachyptila* spp.) colonies throughout New Zealand. *Tuhinga 27*: 56–80.

Marchant, S.A.; Higgins, P.J. 1990. *Handbook of Australian, New Zealand & Antarctic birds: Volume 1, ratites to ducks*. Melbourne, Oxford University Press.

Miskelly, C.M.; Sagar, P.M.; Tennyson, A.J.D.; Scofield, R.P. 2001. Birds of the Snares Islands, New Zealand. *Notornis 48*: 1–40.

Rexer-Huber, K.; Parker, G.; Thompson D. 2016. *New Zealand white-chinned petrel population research update.* Third meeting of the Population and Conservation Status Working Group, La Serena, Chile.

Sagar, P.M.; Miskelly, C.M.; Sagar, J.L.; Tennyson, A.J.D. 2003. Population size, breeding and annual cycle of the New Zealand Antarctic tern (*Sterna vittata bethunei*) at the Snares Islands. *Notornis 50*: 36–42.

Taylor, R.H. 1975. The distribution and status of introduced mammals on the Auckland Islands. pp. 233–243 *In:* Yaldwyn, J.C. (*ed*.) *Preliminary results of the Auckland Islands Expedition 1972–1973*. Wellington, Department of Lands & Survey.

Trathan, P.N.; Forcada, J.; Murphy, E.J. 2007. Environmental forcing and Southern Ocean marine predator populations: Effects of climate change and variability. *Philosophical Transactions of the Royal Society B, Biological Sciences 362*: 2351–2365.

Turney, C. S. M.; Fogwill, C. J.; Palmer, J. G.; van Sebille, E.;

Thomas, Z.; McGlone, M.; Richardson, S.; Wilmshurst, J. M.; Fenwick, P.; Zunz, V.; Goosse, H.; Wilson, K.-J.; Carter, L.; Lipson, M.; Jones, R. T.; Harsch, M.; Clark, G.; Marzinelli, E.; Rogers, T.; Rainsley, E.; Ciasto, L.; Waterman, S.; Thomas, E. R.; Visbeck, M. 2017. Tropical forcing of increased Southern Ocean climate variability revealed by a 140-year subantarctic temperature reconstruction. *Climates Past 13*: 231–248.

Waite, E.R. 1909. Vertebrata of the subantarctic islands of New Zealand. pp. 542–600 *In:* Chilton, C. (*ed.*) *The Subantarctic Islands of New Zealand*. Philosophical Institute of Canterbury.

Warham, J.; Wilson, G.J.; Keeley, B.R. 1982. The annual cycle of the sooty shearwater *Puffinus griseus* at the Snares Islands, New Zealand. *Notornis 29*: 269–292.

Waugh, S.M.; Tennyson, A.J.D.; Taylor, G.A.; Wilson, K.-J. 2013. Population sizes of shearwaters (*Puffinus* spp) breeding in New Zealand with recommendations for monitoring. *Tuhinga 24*: 159–203.

Weimerskirch, H.; Inchausti, P.; Guinet, C.; Barbraud, C. 2003. Trends in bird and seal populations as indicators of a system shift in the Southern Ocean. *Antarctic Science 15*: 249–256.

Wilcox, C.; Van Sebille, E.; Hardestya, B.D. 2015. Threat of plastic pollution to seabirds is global, pervasive, and increasing. *PNAS 112*: 11899–11904.

Wilson, K.-J.; Croxall, J. 2012. *New Zealand albatross and petrel research and monitoring priorities workshop 11 August 2012.* Wellington, National Museum of New Zealand - Te Papa Tongarewa. http://www.osnz.org.nz/news/nz-albatross-and-petrel-report (Accessed 6 April 2018).

Wilson, K.-J.; Waugh, S.M. 2013. *New Zealand seabird research priorities workshop 5 May 2013.* Wellington, National Museum of New Zealand - Te Papa Tongarewa. http://www.birdlife.org.au/images/uploads/branches/documents/ASG-Seabird-Priorities-may13.pdf (Accessed 6 April 2018).

Wilson, K.-J.; Barthel, A.; Lipson, M.; Fogwill, C.; Turney, C. 2017. Observations of seabirds on the Auckland Islands and Campbell Island during the Australasian Antarctic Expedition 2013-14. http://www.bluepenguin.org.nz/wp-content/uploads/Observations-of-seabirds-on-the-Auckland-Islands-and-Campbell-Island-during-AAE-expedition-2013-14-Dec-20171.pdf (Accessed 6 April 2018).

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