



Indirect effects on seabirds in northern North Island

POP2017-06

Summarising new information on a range of seabird populations in northern New Zealand



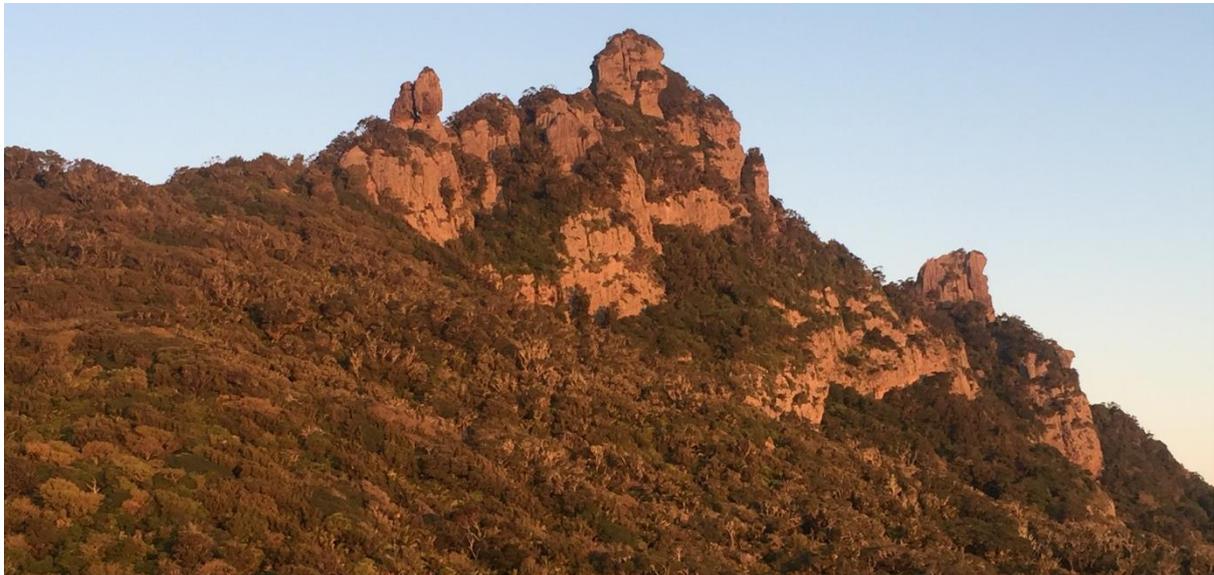
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A Foundation North initiative



Cover photo (top). Mahuki Island Australasian gannet colony, aerial survey 27 November 2018. Photo: *Richard Robinson*.

Cover photo (bottom). Buller's shearwater colony on Tawhiti Rahi, Poor Knights Islands. Photo: *Chris Gaskin*

Figure 1 (this page top). Thermal imaging of fluttering shearwaters at the lighthouse, Taranga Hen Island. Screenshot from video: NNZST

Figure 2 (this page bottom). Pinnacles and Hanging Rock from the lighthouse, Taranga Hen Island. Photo: *Chris Gaskin*

Introduction

This project (POP2017-06) builds on the findings of INT2016-04 (Gaskin 2017). A range of commercial fisheries target aggregations of surface shoaling fish and purse seining is commonly used to capture these fish schools. The dense fish schools create a phenomenon known as fish workups. These fish drive up prey items to the sea surface and observations suggest that this forms an important food source for a range of seabird species. There is currently poor knowledge of both the diet of surface-foraging seabirds and what prey items are being made available to seabirds from fish workups. This has limited our understanding of the mechanisms through which changes in the distribution and/or abundance of fish workups may be driving seabird population changes (population status and annual breeding success).

Objective 4 of POP2017-06 was to collect baseline population data on surface-nesting seabirds and population data on a sample of burrowing petrel species in the north-eastern North Island.

The following species were included in this project:

- Australasian gannet (*Morus serrator*) colonies from aerial survey conducted 27 November 2017
- Red-billed gull (*Larus novaehollandiae scopulinus*) colonies from aerial survey conducted 27 November 2017 and ground counts
- White-fronted tern (*Sterna striata*) colonies from aerial survey conducted 27 November 2017 and ground/boat counts
- Buller's shearwater (*Ardenna bulleri* (= *Puffinus bulleri*)) colonies on the Poor Knights Islands
- Fluttering shearwater (*Puffinus gavia*) on Poor Knights Islands, Bream Islands, Taranga, Marotere Chickens Islands, Mokohinau Islands
- Fairy prion (*Pachyptila turtur*) colonies on the Poor Knights Islands

This report presents new information on the populations of these six species and how these have changed over time.

Figure 3. Thermal imaging of incoming prions and shearwaters over Rock Lily Ravine. Screenshot on from video: NNZST



Species accounts

Aerial survey - Australasian gannet, red-billed gull and white-fronted tern

A full account of the aerial survey for Australasian gannet, red-billed gull and white-fronted tern colonies on 23 November 2017 is given in the POP2-017-06 Milestone 4 report (Gaskin, Frost & Friesen 2018). It presented the status of gannets on most of the colonies in northern North Island however complete counts for gannets, and gull and tern counts had not been completed in time for inclusion in that report. Aerial photographs of Australasian gannet, red-billed gull and white-fronted tern colonies on selected islands in the north-east of the North Island were from a Gippsland GA8 Airvan on 23 November 2017 (Fig 4).

These counts have now been completed and are summarised in Table 1.

Figure 4. Australasian gannet, red-billed gull and white-fronted tern aerial survey locations, 23 November 2017. Map: Peter Frost and Olivia Hamilton.

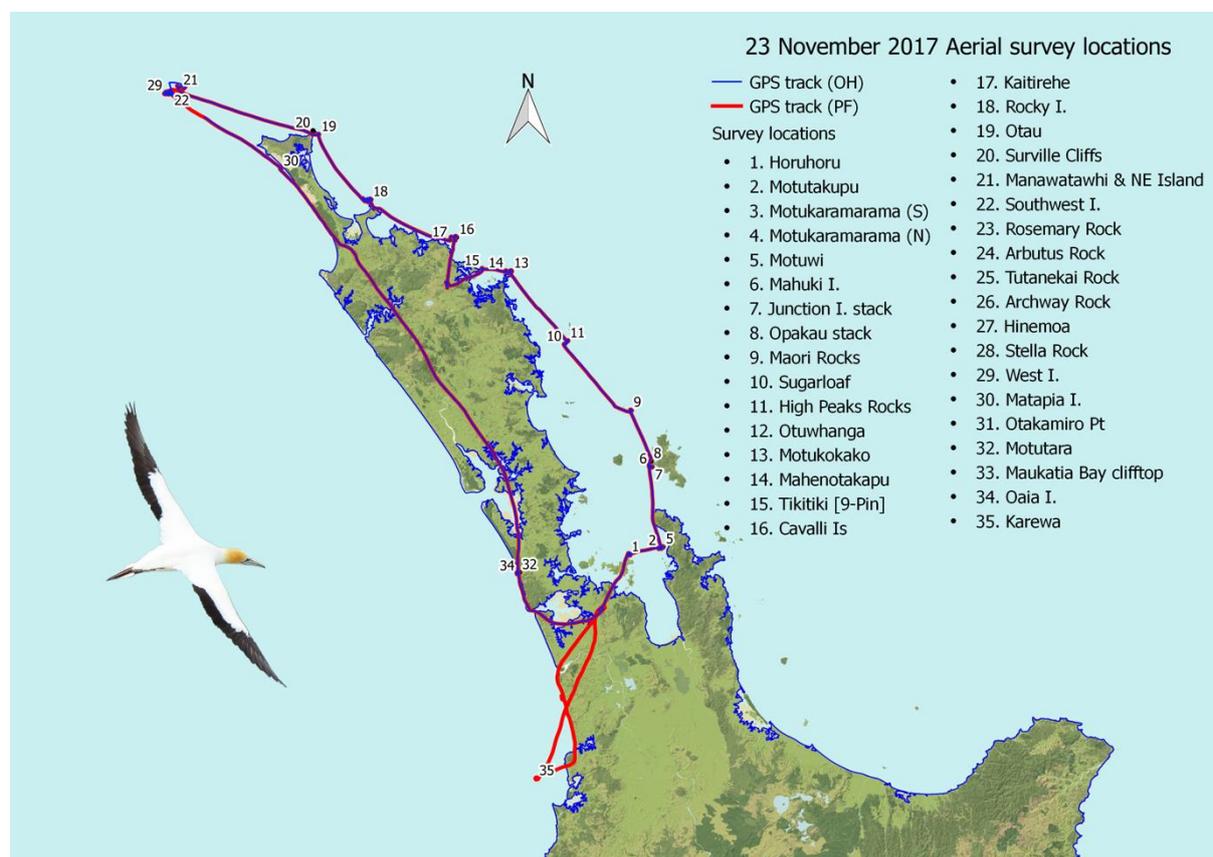


Table 1. Numbers of apparently occupied nest sites of Australasian gannet (AG), red-billed gull (RBG) and white-fronted tern (WFT) counted on photographs taken at various island localities in November 2017.

A. North Island East Coast Sites

Locality	Australasian Gannet	Red-billed gull	White-fronted tern	Note
Horuhoru	988	4	0	
Motutakupu	464	0	0	
Motukaramarama	1,956	0	0	
Islet W of Motuwi	130	0	0	
Mahuki Island	6,160	72	0	
Maori Rocks, Mokohinau Is	383	16	0	
Sugarloaf, Poor Knights Is	1,101	267	0	
High Peaks Rocks, Poor Knights Is	2,245	54	0	
Cape Brett (Motukokako)	0	0	0	¹
Cape Brett (Tiheru I.)	0	6	0	²
Mahenotakapu (Bird Rock)	0	0	0	³
Tikitiki Rock (9-Pin)	107	21	0	
Outer Cavalli Is (Te Anaputa I.)	0	182	7	
Kaitirehe Rock	0	0	0	⁴
Rocky Island & Karikari Stacks	0	0	0	⁵
North Cape (Otou, Murimotu)	0	0	0	
	13,534	622	7	

B. Three Kings Islands

Locality	Australasian Gannet	Red-billed gull	White-fronted tern	Note
Manawatāwhi/Great I. (Tapatu Bay)	0	7	0	⁶
Manawatāwhi (Crater Head)	0	327	34	
Manawatāwhi (Patea Bay)	0	384	2	
Manawatāwhi (Petu Point)	0	331	36	
Manawatāwhi (Maratea Shoals)	0	0	13	
North-east Island	0	0	0	
Farmer Rocks	0	0	0	
South-west Island	1,267	512	38	
Rosemary Rock	0	176	139	
Will Watch Rock	0	39	0	
Lion Head	0	106	0	
Top Hat	0	26	0	
Arbutus Rock	2,687	0	0	
Tutanekai Rock	654	54	0	
Archway Rock	1,362	270	0	
Hinemoa Rock	3,402	102	0	
Stella Rock (including offshore stack)	0	60	0	
West I.	0	134	51	⁷
	9,372	2,528	313	

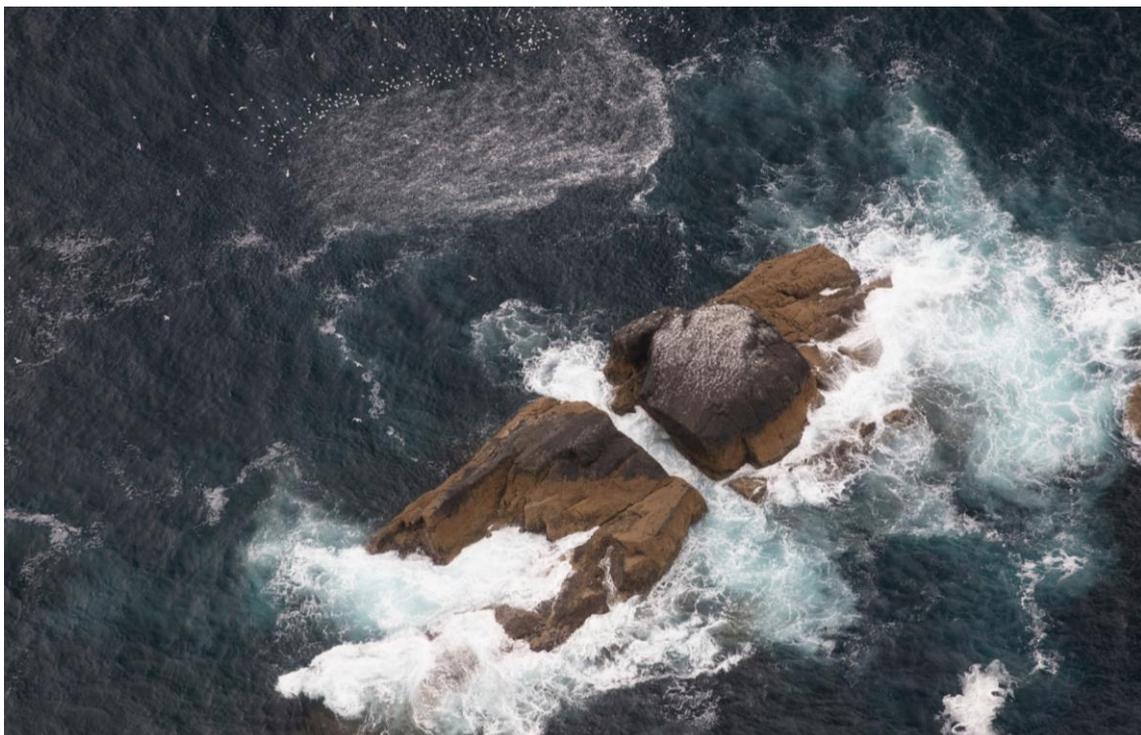
C. North Island West Coast sites

Locality	Australasian Gannet	Red-billed gull	White-fronted tern	Note
Matapia I.	0	0	0	
Oaia Island, Muriwai	25	10	463	
Muriwai (Otakamiro Pt & Maukatia Bay)	1,904	5	226	
Muriwai stack (Motutara), Muriwai	209	0	20	
Karewa (Gannet I.)	5,713	6	0	
Ngatutura Point (Waikato Coast)	0	1	77	
	7,851	22	786	
Total for offshore northern North Island	30,757	3,172	1,106	

Notes

- ¹ Steep-sided, forested island with sheer vertical cliffs; little suitable habitat for surface-nesting seabirds
- ² Nesting gulls poorly resolved on grainy image
- ³ 134 roosting WFT; no sign of breeding
- ⁴ 1 dead gannet but no evidence of recent mass occupancy of this islet by gannets
- ⁵ 1013 RBG in 4 feeding aggregations offshore; 81 roosting on island
- ⁶ 934 RBG in 5 groups roosting on water; 127 WFT roosting on rocks
- ⁷ Around 750 birds loafing on water close to island

Figure 5. Red-billed gull activity around shoaling fish and roost on reef just south of Rocky Island, Moturoa Group, Northland. Photo: Richard Robinson, taken during aerial survey 23 November 2017.



1 Tākapu Australasian gannet

Fourteen gannet colonies were identified between the southern Hauraki Gulf and the Three Kings Islands, with a further five colonies along the west coast between Muriwai and Karewa Island. All the gannet colonies have been counted with the total of 30,784 breeding pairs (Tables 1 & 2).

Table 2. Interim results on the population status of the Australasian Gannet in northern New Zealand, based on analysis of aerial photographs of the colonies taken on 23 November 2017. Counts from previous aerial surveys (1946, 1969, 1980) included for comparison.

Location	1946 ¹	1969 ²	1980 ²	2017 ³
Tutanekai Rock, Three Kings Group	300	406	402	654
South-west Island, Three Kings Group	824	804	1135	1267
Archway Rock, Three Kings Group	490	618	1530	1362
Arbutus Rock, Three Kings Group	1000	2175	2652	2687
Hinemoa Rock, Three Kings Group	1520	3232	4136	3402
9 Pin Rock (=Tikitiki Rock)	0	0	0	107
High Peaks Rocks, Poor Knights Islands	100	528	1553	2245
Sugarloaf, Poor Knights Islands	1410	2462	2617	1101
Maori Rocks, Mokohinau Islands	12	49	344	383
Mahuki Island, Aotea/GBI Group	325	1869	2681	6160
Motuwi	5	50	96	130
Motukaramarama	1513	2834	3530	1956
Motutakupu, Coromandel	288	777	925	464
Horuhoru Rock, Waiheke Group	1228	2526	2647	988
Muriwai mainland	0	0	8	1904
Motutara, Muriwai	0	0	298	209
Oaia Island, Muriwai	338	892	761	25
Karewa (Gannet Island)	3715	6132	8003	5713
Totals	13068	24354	33318	30757

¹Fleming & Wodzicki 1952; ²Wodzicki, Robertson, Thompson & Alderton 1984; ³This study

There have been significant changes at some sites, but overall only slightly down on the numbers recorded in 1980. The most notable changes were the number of breeding pairs recorded in 2017 on the Coromandel islands and Horuhoru Rock which were about 51% less than that recorded in 1980, while Mahuki had increased by 130%. On the West Coast, the combined numbers nesting at Muriwai and offshore (Motutara and Oaia Island) have increased by 100% since 1980 (the Muriwai colony itself barely existed then), while the number on Karewa seems to have decreased by just

under 29%. These changes may reflect spatial redistribution of the gannet population rather than any large-scale population change, much as has been found for the Cape gannet (*Morus capensis*) in Namibia and South Africa (Crawford et al 2007).

In summary, changes could be attributable to any or a combination of the following:

- Movements of birds among colonies (as above), or to new ones (Motutara, Muriwai, Nine-Pin/Tikitiki Rock),
- Differences in the proportion of mature birds breeding in a given year,
- Changes in conditions at sea, affecting food supply, breeding success and juvenile, immature and adult survival,
- Uncertainty around the counts themselves. Both Sugarloaf and the High Peaks Rocks proved difficult to count because of the broken and deeply fissured nature of these islands.

Figures 6. High Peak Rocks, Poor Knights Islands during gannet and red-billed gull aerial survey 23 November 2017. Photo: Richard Robinson



Difference in diets between outer and inner Hauraki Gulf suggests spatial foraging separation for birds from the colonies at Mahuki Island and Horuhoru Rock (Adams 2018, Gaskin & Adams 2019). Tracking of breeding gannets at N. Adam's two study localities (Adams 2019) using GPS technology is also suggestive of separation of foraging areas utilized by gannets from the two colonies (Gaskin unpubl.). Such spatial partitioning of foraging areas by gannets from neighbouring colonies has been demonstrated in Northern gannets (*Morus bassanus*) and been related to the consequence of density-dependent competition (Wakefield et al. 2013). Decline in populations of inner Gulf colonies, with an increase in the Mahuki colony, could be caused by a change in prey availability for the Inner Gulf.

2 Tarapunga Red-billed gull

A total of 3,172 nesting pairs of red-billed gulls were recorded at 26 sites during the aerial survey 23 November 2017, almost 80% of which occurred at 14 sites in the Three Kings Islands (Table 1). The judgement of nesting was based on the presence of 1-2 birds present at a site, sometimes with nest material visible, and either sitting in a way that suggested the bird was incubating eggs or brooding small chicks, or guarding chicks (standing upright, often facing into a cliff or depression), or one or more chicks visible at a site, with or without an attendant adult. It is assumed that each of these apparently nest sites was occupied by a single pair of nesting birds.

Some of the colonies in the Three Kings Island group were moderately large (e.g., 512 pairs nesting on the northern islet of South-west Island and 327–384 at three sites on Manawatāwhi/Great Island: Table 1). Overall, the 2,528 nesting pairs recorded at the Three Kings Islands colonies is 43–128% higher than the 1,763 and 1,106 pairs counted on aerial photographs taken of red-billed gull colonies in the Three Kings in December 2015 and November 2014 respectively. This may indicate some interannual variation in the numbers of birds breeding. From a long-term study of red-billed gulls at Kaikoura (Mills 1989), we know that breeding birds do not necessarily attempt to breed each year. Even in 2017, there may still have been non-breeding adult birds. Large rafts of apparently nonbreeding birds were recorded at Tapatu Bay (934 birds in five groups) and West Island (c.750 in one group). It is not clear what proportion, if any, these are young birds, yet to enter the breeding population; failed breeders; or birds foregoing breeding in 2017, a year marked by warm waters.

Most of the other red-billed gull colonies were situated along the east coast of the northern North I. (622 nesting pairs at six sites). The largest of these was on Sugarloaf (267 nesting pairs), Te Anaputa Island, outer Cavalli Islands (182 nesting pairs) and Mahuki (72 nesting pairs). Some large aggregations of non-breeding birds were also seen (1,013 birds in four active-feeding groups off Rocky I., with a further 81 roosting on the island). The status of these apparently non-breeding birds in these groups is also unclear.

Nesting red-billed gulls were remarkably sparsely distributed along the west coast (21 pairs at three sites). The largest of these was 10 pairs on Oaia Island (Table 1). No rafts of non-breeding gulls were seen. The search for red-billed gulls and other surface-nesting seabirds was extended at the end of the flight along the west coast from the mouth of Raglan Harbour to the mouth of the Waikato River, paying particular attention to Ngatutura Point, where spotted shag (*Stictocarbo punctatus*) had been recorded nesting in the past. Only one apparently nesting red-billed gull was seen, along with 77 pairs of white-fronted terns, 7-8 pairs of pied shags (*Phalacrocorax varius*), and 1-2 pairs of southern black-backed gulls (*Larus dominicanus*).

During 2014-2016 Birds New Zealand, in conjunction with the Department of Conservation, carried out a national survey to establish the current size of the red-billed gull breeding population (Frost & Taylor 2016). The authors suggested, together with Birds New Zealand, DOC and others, there was the need to identify several representative colonies around the country, for future monitoring over many years using comparable and consistent methods.

One the key sites is the Mokohinau Islands, formerly one of New Zealand's largest breeding sites for this species at an estimated 13,000 birds on Burgess Island in 1945 (Fleming 1946, Buddle 1947, Gurr & Kinsky 1965). Since 2005 researchers visiting the islands have kept track on gulls nesting there, in fluctuating numbers and moving from site to site. From 2013 to 2018 numbers remained steady at around 250 pairs, although during winter months red-billed gull numbers would

escalate to the low thousands with flocks of birds seen feeding over fish schools active around the islands (CG pers. obs.). This last season (2018-2019) red-billed gulls were found to be breeding in significant numbers on Maori Rocks, up to 500-1000 pairs.

Figure 7 & 8. Red-billed gulls roosting/loafing on Maori Rocks, Mokohinau Islands 13 October 2018. Photos: Edin Whitehead



The colony at Hawere (Goat Island) remains active, as do those at Marsden Point Refinery, Tiritiri Matangi Island and Tawharanui. All would be key monitoring sites in the northern region with relatively good access, whether by land or boat. Southey & Kitching (2015) reported finding sizeable colonies on Koi Island (251 nests) and Needles Rocks (250 nests) near Waiheke Island in the Inner Gulf and these two sites should also be included as key monitoring sites.

Any future surveys would need to take account of the birds relocating from year to year, for example at Tawharanui, the gulls had shifted from North Cove east of Anchor Bay to Phoenix Rocks west of Anchor Bay this season (2018-2019). The colony at North Cove was c.105 breeding pairs mid-November 2017. This was decrease from the previous count in 2015 (185-190 breeding pairs) when the colony was still located at Phoenix Rock, Anchor Bay. At Phoenix Rocks in 2018 numbers were back up to previous counts.

Figure 9. Red-billed gulls nesting at North Cove, Tawharanui Open Sanctuary, mid-November 2017. Photo: Sophie Bennett.



Figure 10. Red-billed gulls nesting at Phoenix Rocks, Tawharanui Open Sanctuary, 14 November 2018. Photo: Natalie Krellenstein



Figures 11 & 12 (inset). Red-billed gulls roosting on headlands on Coppermine Islands, Marotere Chickens Islands, 5 February 2019. Photos: Edin Whitehead



3 Tara White-fronted tern

On the six species in this study, white-fronted terns are by far the most ephemeral in terms of breeding locations. In 2017, while undertaking our at-sea sampling programme, as well as transfers to islands for field trips and private boat trips, we did not find any nesting. This was despite seeing them in good numbers feeding over fish schools in places such as Leigh Reef, the Mokohinau Islands, Marotere Chickens Islands and around the northern end of Aotea Great Barrier Island. The exception was Tiritiri Matangi (J. Stewart, pers. comm.).

In 2018, by contrast, we found colonies at Tawharanui, Hauturu and Horuhoru Rock. Confirmation of breeding at the Mokohinau Islands remained elusive, although birds were seen in numbers there throughout the season (100-200 birds). Terns had been seen nesting in previous years on the Junction Islands (Aotea Great Barrier Group) and The Noises were not present in either season of this study (J. Ross, S. Neureuter, pers. comm.). The Tiritiri Matangi colony appeared to be the only constant across the two seasons (J. Stewart, pers. comm.).

A total of 1,106 apparently nesting pairs of white-fronted terns were recorded in the aerial survey conducted 23 November 2017, more than two-thirds of which were on the west coast of the northern North Island (Table 1). The largest colony was on Oaia Island (463 pairs), with an additional 246 pairs nesting nearby at Muriwai (mainland) and Motutara (offshore stack). Another 313 pairs were recorded at seven sites in the Three Kings Is group. The largest colony was 139 pairs nesting on Rosemary Rock, with four other colonies of 34–51 pairs recorded at Crater Head and Petu Point (Manawatāwhi/Great Island), South-west Island and West Island (Table 1). Only one colony was seen on the east coast: 7 pairs nesting on Te Anaputa (Outer Cavalli Is). A large roost of 134 birds was present on Mahenotakapu (Bird Rock), off the Bay of Islands. Several white-fronted tern colonies are known from various small islands and the east coast itself (e.g., Cape Brett; Black Rocks) but these were not covered in the flight.

Figure 13. White-fronted terns nesting on Oaia Island, Muriwai, aerial survey 23 November 2017. Photo: Richard Robinson



Locating white-fronted tern colonies in photographs proved challenging, not only in being able to see birds from the air, other than large flocks, but also in finding nesting birds on anything other than close-up photographs. Ground-level photographs taken the day before the flight of the spread-out colony at Muriwai showed that most pairs had chicks, ranging from those recently hatched and still guarded by a parent, to nearly fully feathered individuals not obviously associated with any specific site. A few birds were still incubating eggs or brooding very small chicks. This variation in colony composition made it difficult to accurately count the number of nesting pairs on aerial photographs. Fortunately, at the largest colony (Oaia Island) many birds seemed still to be incubating eggs, or brooding/guarding small chicks.



Figure 14. White-fronted terns at Tokatu Point, Tawharanui. Photo: Chris Gaskin

The ephemeral nature of this species' breeding requires a new approach for future surveys – i.e. regular monitoring within a 'study area' that is large enough to cover the possibility of these birds shifting where they nest from season to season and over several years to establish trends. Recommended here is that a study area is established within the wider Hauraki Gulf region that can be monitored on a regular basis – either annually or biennially.

The extent of the study area would be determined through a comprehensive initial survey of the entire region. All previous known sites would be revisited, with searches made of coastlines by boat and from shore for any sign of new sites. The Whangarei and Waitemata Harbours would need to be included, along with estuaries and embayments within the search area. Once colonies and roost sites had been located during this survey, then a choice could be made of which sites would be monitored into the future.

4 Rako Buller's shearwater

Quantifiable and repeatable population estimates are key in establishing a species' conservation status and population trends. Buller's shearwater is endemic to the region with the Poor Knights Islands, their only known breeding site. It is a species that forages in the greater Pacific Ocean during their non-breeding season. Buller's shearwaters are also an important sentinel of ocean health as they have been relatively protected from terrestrial threats. They are commonly seen in the Hauraki Gulf during the breeding season (September to May) and population speculations in the 1980's established the species population to be around 2.5 million. Despite this large population guess, no quantitative population estimate had been done. Surveys on Aorangi Island in 2011 suggested that there were fewer than 200,000 burrows and perhaps just c. 50,000 pairs, strongly suggesting that the 1981 population estimate was far too high (Taylor 2013, Carboneras et al 2019).

Freisen et al (in prep.) have determined the first quantified population estimate for Buller's shearwater, based on field measures done on Tawhiti Rahi and Aorangi Islands during the 2016-2017 and 2017-2018 breeding seasons, and using GIS measures of environmental variables. A baseline for breeding success for this species was also established. Once published, the survey results will provide critical baseline data to identify the population trends for this important marine indicator species. This survey on Tawhiti Rahi and Aorangi, and subsequent surveys conducted on Tawhiti Rahi showed that while the population estimate established was lower than expected, the species is not currently at carrying capacity on the islands due to the large number of survey plots on the islands that had no burrow activity and the number of burrows that were inactive. With no mammalian predators or interspecific competition observed, it seems unlikely that this species is experiencing strong terrestrial population pressures.

Figure 15. Buller's shearwaters departing at cliff edge launch site at dawn, Tawhiti Rahi. *Photo: Edin Whitehead*

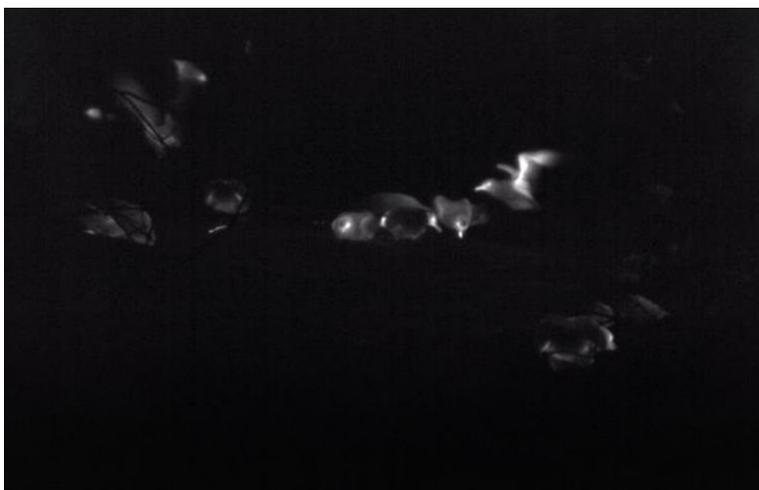


One feature of the Buller's shearwater colonies visited on Tawhiti Rahi from September to December has been the numbers of birds seen on the surface at night when birds were also occupying burrows (Figs. 17 & 18). Birds were seen mostly resting, sleeping, socialising including preening, vocalising, sometimes in pairs, other times small groups, also fighting and mating as well as investigating burrows. This is most marked mid-September with their mass return. In September 2018 during our nocturnal surveys to detect fluttering shearwaters, it was possible when walking the length of the main track to locate Buller's shearwater colonies either side by the calls emanating from them. The intense level of calling, social interaction and presence of birds on the surface persists through to December. By February there are far fewer birds on the surface, and from March to end of April the only birds seen on the surface were those returning to and leaving burrows feeding chicks. By this time the colonies were virtually silent except for the cheeping of chicks being fed and occasional interaction between adults in burrows, especially in those that are linked with multiple entrances and nest chambers.

Our observations suggest a sizeable non-breeding population, potentially a mix of non-breeders (possibly some breeders skipping a year) and pre-breeders. When juvenile birds return to colonies is unknown. Warham (1996) in discussing proportions of breeders to non-breeders, noted it varies amongst species. Richdale (1963) found 29% breeders and 71% were non-breeders or pre-breeders amongst all sooty shearwaters he handled. These were in the large colonies on islands off Rakiura Stewart Island with high numbers of birds prospecting from other islands. The birds he caught could be birds visiting for short periods (G. Taylor pers. comm.). Long-term monitoring of this species will also be important in understanding the non-breeding population, rate of successful breeding attempts, and trends in breeding attempts.



Figures 17 & 18. Thermal imaging showing Buller's shearwaters loafing and socialising within colony areas. Screenshots from video: NNZST



5 Pakahā Fluttering shearwater

This species breeds on many islands in the Hauraki Gulf and is often seen at sea in very large congregations (Fig 19). Although fluttering shearwaters have been recorded off the eastern coast of Australia post-breeding, the bulk of the northern population appears to remain in northern North Island waters throughout the year. However, one of the mysteries, given the numbers seen at sea and a major gap in our knowledge of breeding species in the wider Hauraki Gulf, has been the location of large colonies for this species.

Figure 19. Huge raft of fluttering shearwaters with some Buller's shearwaters and red-billed gulls, Northwest Reef, Hauraki Gulf, 6 October 2017. Photo: Edin Whitehead



McCallum (1981) wrote of ‘many thousands of pairs making nest preparations’ on Tawhiti Rahi, Poor Knights Islands in September 1980. In December 2017, S. Ismar, A. Tennyson (pers. comm.) and others reported this species to be very uncommon on Tawhiti Rahi. Different times of visits (i.e. September 1980 to December 2016) could have accounted for their presence not being detected. It is noteworthy that their observations did not confirm breeding of fluttering shearwaters, as the two birds seen on the ground could have been non-breeders or prospectors drawn to the ground by headlamps in cloudy and rainy conditions. On nearby Aorangi, fluttering shearwaters were similarly rare in a December 2011 survey (A. Tennyson pers. comm.), although an earlier report considered them to be the “most common of the petrels [other than Buller’s shearwaters] on that island” (Wilson 1959).

These are experienced recorders of petrel taxa, who have made several valuable contributions with respect to birds of the wider Hauraki Gulf region, so these observations hint at a big decline in the number of fluttering shearwaters on the Poor Knights Islands. And yet numbers of fluttering shearwaters seen at sea, appear to have been consistently high. With Procellariiformes

proclivity to strong philopatry, returning to natal colonies to breed suggest wholesale shifting of populations unlikely and yet that appears to have been the case.

McCallum et al. (1984) also noted that 'several thousand fluttering shearwaters breed on the plateau of Muriwhenua Island' (Northwest Chickens Islands). Also, fluttering shearwater calls were frequently detected on acoustic recorders deployed by CG at five sites on Taranga Hen Island from 26 October to 26 November 2010. These records also required further investigation.

Our surveys 2018-2019 set out to follow up on these reports as well as searching out new potential sites. Funding through the Foundation North G.I.F.T. Initiative and Birds NZ Research Fund, together with the POP2017-06 contract allowed for us to focus on several Northland offshore islands – Poor Knights Islands, Marotere Chickens Islands, Taranga Hen Island and Bream Islands.

Our surveys on Tawhiti Rahi (Poor Knights Islands) in September, October and to December 2018 confirmed Tennyson's 2017 observations that the large numbers McCallum (1981) reported for the island do not appear to be present, with very small numbers of this species (<10) heard during night counts at locations along the length of the island over four nights. None were found on the ground. Fluttering shearwaters are very vocal over their breeding grounds and easily detected as we found on Taranga Hen Island immediately following the Tawhiti Rahi survey. Also, despite the moon being quite full and rising early at night, it did not stop all the other species we found returning in very large numbers and being very vocal. Playback did not attract any fluttering shearwaters on Tawhiti Rahi, again in contrast to what we found on Taranga where we managed to ground birds using playback alone.

Our surveys in 2018-2019 suggest that Taranga and Marotere Islands (Hen & Chickens Islands) would appear to be the stronghold of this species in the Hauraki Gulf. On Taranga in late September 2018, fluttering shearwaters were detected in considerable numbers at all locations visited at night while on the island, although no birds were found on the ground or in burrows. Birds were heard calling in the air, or from inaccessible locations. Large numbers were heard below Moran Lookout on the northwest headland. Good numbers were also heard and seen using the thermal imaging scope flying across the whole of the western face of the island (from northwest headland all the way across to Pukanui Bay and Lamb Rock just south of Dragonmouth Cove) with some likely calling from the ground. We also had similar numbers flying on the north side of The Pinnacles including a number circling low and landing downslope from our lookout point. On 3 October, we made a boat-based survey of the whole northern coast of the island, starting at the northwest point and going right across to the eastern headland. Fluttering shearwaters were heard along the whole coast, with the main concentration below Moran Lookout. Several accessible forested slopes on the northern coast were identified for future surveying (i.e. accessible from the sea).

It is also noteworthy to mention that little shearwaters (*Puffinus assimilis haurakiensis*) were detected in large numbers across the whole western face of the Taranga, also up near the summit on the northern side. Good numbers were found on the ground and in burrows close to all tracks and routes we covered. Little shearwaters are highly responsive to playback and we were able to find good numbers of them in burrows using this method. The numbers we encountered was unexpected, even though this species, along with fluttering shearwaters had been detected on acoustic recordings made in 2010. However, little shearwaters are not commonly seen at sea in the Hauraki Gulf, in contrast to the huge numbers of fluttering

shearwaters. In our opinion, the numbers of little shearwaters on Taranga outnumbered those of fluttering shearwaters, at least in terms of calling. A thorough survey of Taranga is required to properly determine the status of both species on the island, together with other species that may be breeding there (e.g. flesh-footed shearwater, Cook's petrel).

Fluttering shearwaters were found to be breeding on all five of the Marotere Chickens Islands visited during this survey – Muriwhenua, Pupuha, Lady Alice, Whatupuke and Coppermine Islands. They were also detected on Mauitaha (Bream Islands) from trail camera images and acoustic recordings. Highly concentrated populations of northern diving petrels and fluttering shearwaters were found on Muriwhenua (Northwest Chickens Islands), although the 'several thousand' fluttering shearwaters (McCallum 1984) would be a generous estimate. We also found fluttering shearwaters in significant numbers around South Cove on Lady Alice Island in October 2018. These were heard calling from our boat anchored in the bay and seen using the thermal imaging scope.

Figure 20. Fluttering shearwaters in flight at the lighthouse Taranga Hen Island, Marsden Point Oil Refinery and Bream Head in the background. *Photo: Edin Whitehead*



6 Tītī wainui Fairy prion

Fairy prions are commonly seen in flocks numbering the thousands in the Hauraki Gulf and in northern waters feeding in association with shoaling fish (Gaskin & Adams 2019). The only known breeding location north of the outer Marlborough Sounds, is on the Poor Knights Islands (Harper 1976, McCallum 1979, Gaskin & Rayner 2013, Forest & Bird 2015). While fairy prions were known to be breeding on islands in the Poor Knights Group, with sizeable pockets in rocky places on Tawhiti Rahi (McCallum 1981) and Aorangi (Harper 1976, S. Bartle pers. comm.) the discrepancy between the numbers seen at sea, and confirmed breeding on the islands was significant.

Figure 21. Fairy prions feeding en masse near Maori Rocks, Mokohinau Islands, 1 December 2017. Photo: Edin Whitehead

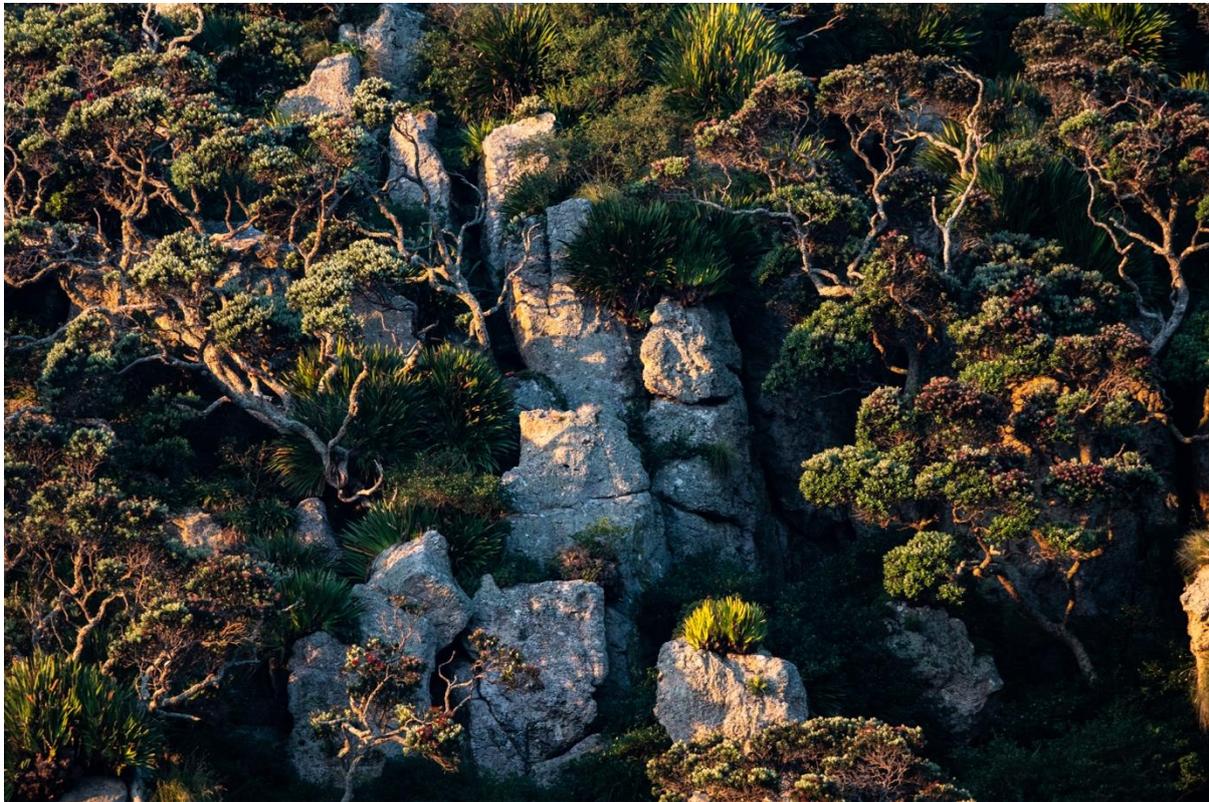


In November 2007, during a spotlight search for NZ storm petrel, clouds of prions were seen by CG from a zodiac from NZ Navy inshore patrol vessel *HMNZS Kiwi* flying about the ravine and steep rock-littered gullies behind Rock Lily Inlet on the east coast of Tawhiti Rahi. The spotlighting survey also confirmed prions on Aorangaia and High Peak Rocks.

In September 2018 four of us were heading up Tawhiti Rahi's main track at night towards the plateau. At track marker 20 we could hear an incredible din from birds, "a wall of sound" and bush-bashed away from the track to investigate. From a vantage point overlooking the ravine at the head of Rock Lily Inlet we could hear the calls of many, many birds emanating from the face of the ravine opposite. Through the thermal imaging scope, we could make out large numbers of Buller's shearwaters and fairy prions, the latter hanging in the strong wind funnelling up the ravine. Our vantage point was close to the launch site of one of the permanent plots we'd set up in April 2018 for Buller's shearwaters and marked it as a site for future night and pre-dawn watches. Subsequently we were able to confirm the presence of thousands of prions (plus Buller's shearwaters and common diving petrels (*Pelecanoides urinatrix*) nesting amongst the

fretwork of rock outcrops and cliffs along the northern face of the ravine out towards Hope Point. We also found other colonies towards the northern end of the island, one amongst the terraces and rock embankments of Maori ceremonial site and on the cliffs near the lighthouse.

Figure 22. Rock outcrops and pohutukawa with *Xeronema* clumps – prime prion, shearwater and diving petrel habitat. Photo: Edin Whitehead



One notable observation made during surveys on Tawhiti Rahi was of fairy prions and Buller's shearwaters (also common diving petrels) cohabiting in amongst the rock outcrops, sharing crevices and overhangs. Very little evidence of conflict or aggression between the two species, with prions observed stepping around Buller's shearwaters, in one instance one was observed giving a non-breeding Buller's shearwater a quick preen while passing (observed using thermal imaging scope). The limiting factor to nest sites appeared to be that fairy prions were nesting in places where Buller's shearwaters were unable to access.

During sample collecting from fairy prions in September, October and December 2018 and deploying geolocators in December an accessible study site with marked nest sites has been established for future research with this species.

Recommendations

1. Aerial surveys of all the northern colonies for Australasian gannets to be repeated every five years. This should also include Whakaari White Island, which was not included in the November 2017 survey.
2. Ground and/or boat-based surveys of Australasian gannet colonies on Horuhoru Rock (Waiheke Group), Motukaramara (Motukawao Group), Mahuki Island (Aotea Great Barrier Group) and Maori Rocks (Mokohinau Group) each year with nest, young chick and late chick counts to determine breeding success. These to be conducted during ongoing diet and tracking studies for this species at three of those sites (i.e. excluding Maori Rocks which can be surveyed during zooplankton sampling trips and island transfers).
3. A study area to be set up for monitoring white-fronted terns – essentially Hauraki Gulf with a line from Bream Head to the Needles (Aotea Great Barrier Island) to Cape Colville (Coromandel Peninsula) delimiting the outer boundary – to include Whangarei Harbour, Waitemata Harbour and Firth of Thames. This area to be surveyed across several seasons to take account of fluctuating environmental conditions (La Nina/El Nino oscillations).
4. Annual monitoring of red-billed gull colonies at key representative sites in the wider Hauraki Gulf region: Mokohinau Islands, Hawere (Goat Island), Marsden Point Refinery, Tiritiri Matangi Island, Tawharanui, Koi Island and Needles Rocks.
5. Estimate proportion of non-breeders to breeding birds for Buller's shearwaters across two seasons and frequency of successful breeding attempts.
6. Conduct a comprehensive survey of Taranga during October to determine extent of fluttering and little shearwater breeding on the island, working progressively year by year, starting from the western end of the island.
7. Establishment of study plots on four islands – Taranga, Lady Alice Island (Marotere Chickens Islands), Burgess Island (Mokohinau Islands) and Korapuki (Mercury Islands) – for the ongoing monitoring of fluttering shearwaters.

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References

- Buddle, G.A. (1947). Breeding of red-billed gull. *New Zealand Bird Notes* 2: 71–72.
- Carboneras, C., Jutglar, F. & Kirwan, G.M. (2019). Buller's Shearwater (*Ardenna bulleri*). In: del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & de Juana, E. (eds.). *Handbook of the Birds of the World Alive*. Lynx Edicions, Barcelona. (retrieved from <https://www.hbw.com/node/52569> on 26 June 2019)
- Crawford, R. J. M., Dundee, B. L., Dyer, B. M., Klages, N. T., Meyer, M. A., Upfold, L. (2007). Trends in numbers of Cape gannets (*Morus capensis*), 1956/57–2005/06, with a consideration of the influence of food and other factors. *ICES Journal of Marine Science* 64: 169–177
- Fleming, C.A. (1946). Breeding of red-billed gull: a preliminary census of Mokohinau colony. *New Zealand Bird Notes* 2: 27–29.
- Frost, P.G.H., Taylor, G.A. (2018). The status of the red-billed gull (*Larus novaehollandiae scopulinus*) in New Zealand, 2014–2016. *Notornis* 65: 1–13
- Forest & Bird (2014). *New Zealand Seabirds: Important Bird Areas and Conservation*. The Royal Forest & Bird Protection Society of New Zealand, Wellington, New Zealand. 72 pp.
- Gaskin, C.P. (2017). Procellariiformes associating with shoaling fish schools – Northern New Zealand. Report for INT 2016-04 Conservation Services Programme. Department of Conservation, Wellington.
- Gaskin, C.P., Frost, P.G.H., Friesen, M.R. (2018). Summary of activities carried out to collect population estimates of priority seabirds in 2017-2018 (Milestone 4). Report prepared for the Conservation Services Programme POP2017-06. Department of Conservation, Wellington.
- Gaskin, C.P., Rayner, M. (2013). *Seabirds of the Hauraki Gulf: Natural History, Research and Conservation*. Hauraki Gulf Forum, Auckland. 142pp.
- Gaskin, C.P., Adams, N. (2018). Summary of activities carried out to collect samples from seabirds 2017-2018 (Milestone 3). Report prepared for the Conservation Services Programme POP2017-06. Department of Conservation, Wellington.
- Gaskin, C.P., Adams, N. (2019). Comparison of availability of food species in fish shoals and how those items are represented in different seabird diets in the region. Report prepared for the Conservation Services Programme POP2017-06. Department of Conservation, Wellington.
- Gurr, L., Kinsky, F. (1965). The distribution of breeding colonies and status of the red-billed gull in New Zealand and its outlying islands. *Notornis* 12: 223–240.
- Harper, P.C. (1976). Breeding biology of the fairy prion (*Pachyptila turtur*) at the Poor Knights Islands, New Zealand. *New Zealand Journal of Zoology*, 3:4, 351-371,
- McCallum, J. (1981). Birds of Tawhiti Rahi Island, Poor Knights Group, Northland, New Zealand. *Tane* 27: 59-66
- McCallum, J., Bellingham, P.J., Hay, J.R., Hitchmough, R.A. (1984). The birds of the Chickens Islands, Northern New Zealand. *Tane* 30: 105-124

Richdale, L.E. (1963). Biology of the Sooty Shearwater *Puffinus griseus*. *Proceedings of the Zoological Society of London* 141: 1 - 117

Southey, I., Kitchen, T. (2015). Red-billed Gull colony Survey, northern Coromandel Peninsula and southern Hauraki Gulf Islands 5-12/11/15. Unpublished report to OSNZ

Taylor, G.A. (2013). Buller's shearwater. In Miskelly, C.M. (ed.) *New Zealand Birds Online*. www.nzbirdsonline.org.nz

Wakefield, E. D., Bodey, T. W., Bearhop, S., Blackburn, J., Colhoun, K., Davies, R., ... & Jessopp, M. J. (2013). Space partitioning without territoriality in gannets. *Science*, 341(6141): 68-70.

Warham, J. (1996). *The Behaviour, Population Biology and Physiology of the Petrels*. Academic Press. 616 pp

Wilson, R.A. (1959). *Bird islands of New Zealand*. Christchurch, Whitcomb & Tombs Ltd.