WHAKAARI

TAKAPU AUSTRALASIAN GANNET *MORUS SERRATOR* AERIAL SURVEY

23 NOVEMBER 2024

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NORTHERN NZ SEABIRD TRUST

INTRODUCTION

Australasian gannets breed in dense colonies on mainland headlands and adjacent coastal stacks and islands in New Zealand, as well as on islands off the south-eastern Australian and Tasmanian coasts. The breeding season extends from July, when colonies are re-occupied, to April when the last chicks fledge (Frost 2017). Males arrive before females, re-occupying or establishing and defending a nest site. Both sexes incubate and rear the single egg and chick. Post-breeding juveniles and some adults leave New Zealand waters in autumn to winter in coastal Australian waters (Ismar et al. 2011).

Most New Zealand gannet colonies are situated on or around the North Island. The largest mainland colonies are at Cape Kidnappers (around 5000 pairs) and Muriwai, Auckland's West Coast (2318 pairs in 2017). The largest offshore colonies have historically been on the Three Kings Islands (five colonies totalling 9372 breeding pairs in 2017), Karewa/Gannet Island (5713 pairs in 2017) and Whakaari / White Island (three colonies totalling 6662 pairs in 1980-81: Wodzicki et al. 1984) (Frost 2017, Gaskin *et al.* 2017).

The last aerial survey of Whakaari was conducted in November 2015 by J. Fitter. A total of 5306 incubating birds, the count undertaken P. Frost. This was a 20% decline from the 6662 pairs recorded from aerial photographs taken in 1980 (Wodzicki et al. 1984, Frost 2017)(Table 1).

Table 1

Location	1946	1969	1976	1980	2015
Te Matawiwi (West Point)	1254	1419	-	1419	621
Ohauroa (West)					620
Ohauroa (East)	1408	1615	1040	1257	605
Otaketake (West)					265
Otaketake (East)	2565	3679	3000	3986	3195
Total	5227	6713	4040	6662	5306

Whakaari

Whakaari is a 313 ha (Taylor 1989) island volcano (highest Point 321m asl) located 50 km north of North Island mainland in the Bay of Plenty. It has been in the state of continuous solfataric activity, with intermittent small steam and tephra eruptions occurring since 1826. In recent times, major damage to the vegetation has resulted from significant and complex eruptive sequences between 1976–1981 and also 1984–1994. Further volcanic unrest began in July 2012 and continued intermittently, culminating in the explosive, catastrophic eruption on 9 December 2019 which took the lives of 22 people, tourists and guides. A further 25 were injured, many requiring intensive care for severe burns.

Most recent volcanic activity

The recent eruptive episode at Whakaari/White Island started with a steam-driven eruption on 24 May 2024, creating a plume up to about 2.5 km above sea level and a thin, narrow ash deposit on the north flank. The crater lake level also noticeably dropped. Further steam-driven events occurred over the ensuing days. In the following weeks, the steam plume above Whakaari was unsteady and pulsatory. Simultaneously,

emitted magmatic gas fluxes were elevated whilst the crater lake level continued to fall, largely disappearing in early July. Satellite data and aerial imagery captured from 8-12 July showed a new vent had been created, with vigorous steam and minor ash emissions; ballistic impacts up to 250 m from the vent; and a more widespread, but thin, local ashfall deposit. On 9 August, activity switched to a new vent which emitted a continuous low-altitude ash plume. This plume extended tens of kilometres downwind, occasionally reaching over the mainland whilst local ashfall also occurred near the island. This activity continued with varying rate until late-September/early-October at which time ash emissions gradually decreased and then stopped (https://www.geonet.org.nz/ White Island, viewed 13 February 2025)

SURVEY APPROACH

The 2024 survey of Whakaari (this study) was conducted to see how the gannets were coping with the recent volcanic eruptions, and to get an updated count for a new population baseline should HPAI make it to Aotearoa New Zealand. Also updating numbers for future monitoring of the potential impacts of offshore wind farms (G. Taylor, *pers. comm.*). Whakaari was not included in the aerial survey of northern Australasian gannet colonies undertaken on 23 November 2017 (Frost 2017, Gaskin *et al* 2019).

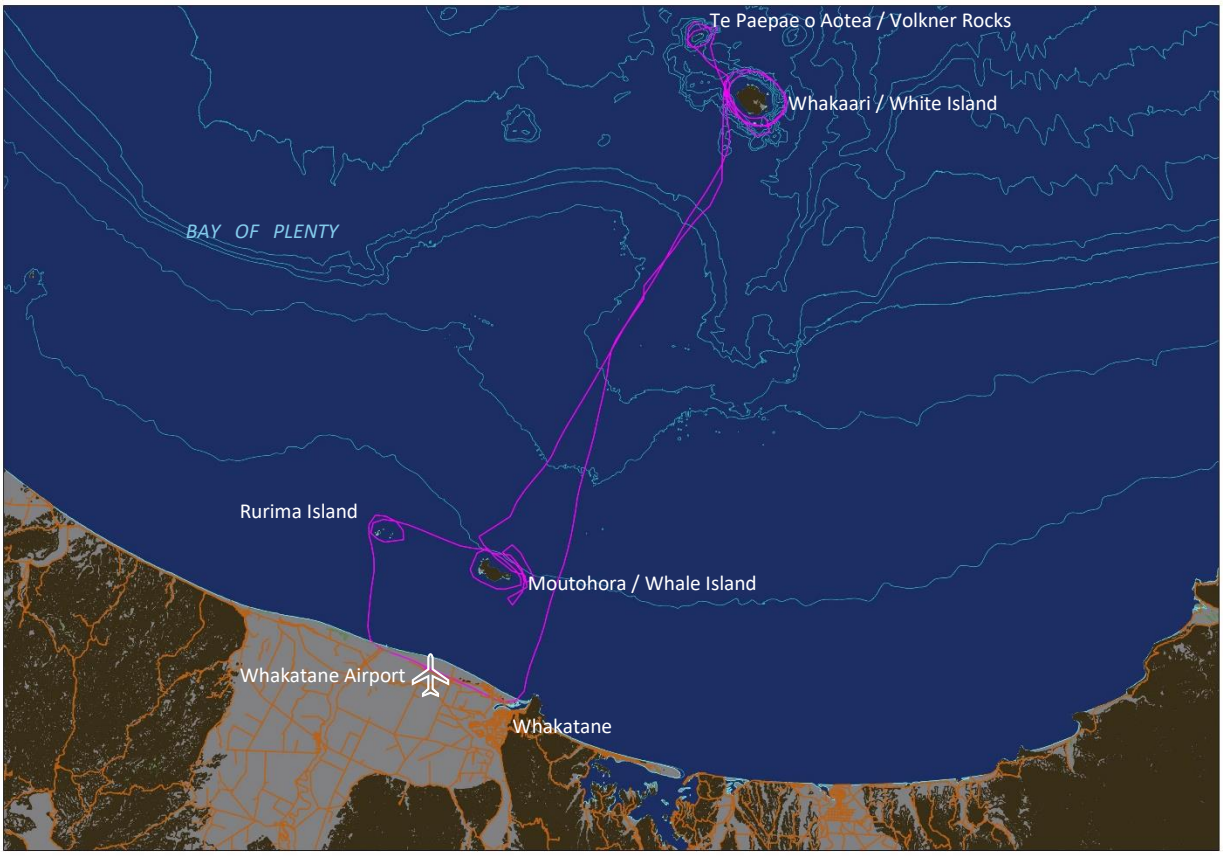
The aerial survey of 23 November 2024 was organised through a small contract with the Department of Conservation Marine Species Team, using a fixed wing aircraft (White Island Flights, Whakatane), with three photographers (Edin and Tony Whitehead, and Neil Fitzgerald) plus the pilot.

The overall flight path also included circuits of Moutohora / Whale Island, Rurima Island group, and Te Paepae o Aotea / Volkner Rocks (Figure 1).

With the focus on Whakaari, two whole island circuits were undertaken, plus an additional run back and forth along the west coast at a lower altitude. Flight height ranged between 615m at the approach to the island, and 240m along the west coast (Figure 2).

Figure 1. Approaching Whakaari from the north. Photo: Edin Whitehead.

Figure 2. Complete flight path.



Gannet colonies

There are three colonies on Whakaari, Otaketake, Ohauora and Te Matawiwi (Figures 3 & 4). Earlier counts 1946 to 1980 lumped the counts per colony. The 2015 survey divided the colonies into sub-colonies Otaketake (East and West), Ohauora (East and West) and Te Matawiwi (Table 1). To facilitate counting and to utilise photographs taken from different angles and altitude during this survey, the colonies were further divided; Otaketake (OT1 and OT2), Ohauora (OH1-4), and Te Matawiwi (TM1-4) (Figures 5-7).

Figure 3. Whakaari showing flight path, altitude (auto waypoints at 20sec intervals) and general location of the gannet colonies.

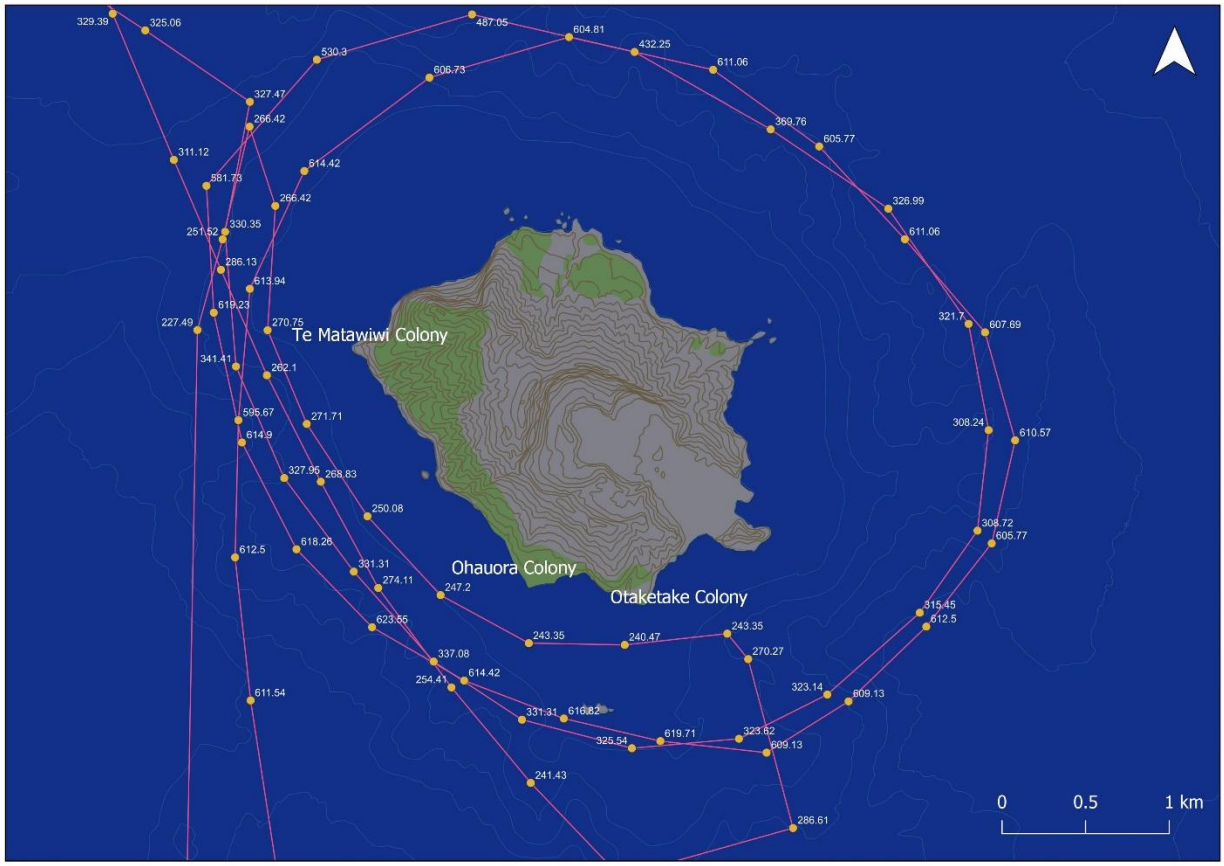


Figure 4.

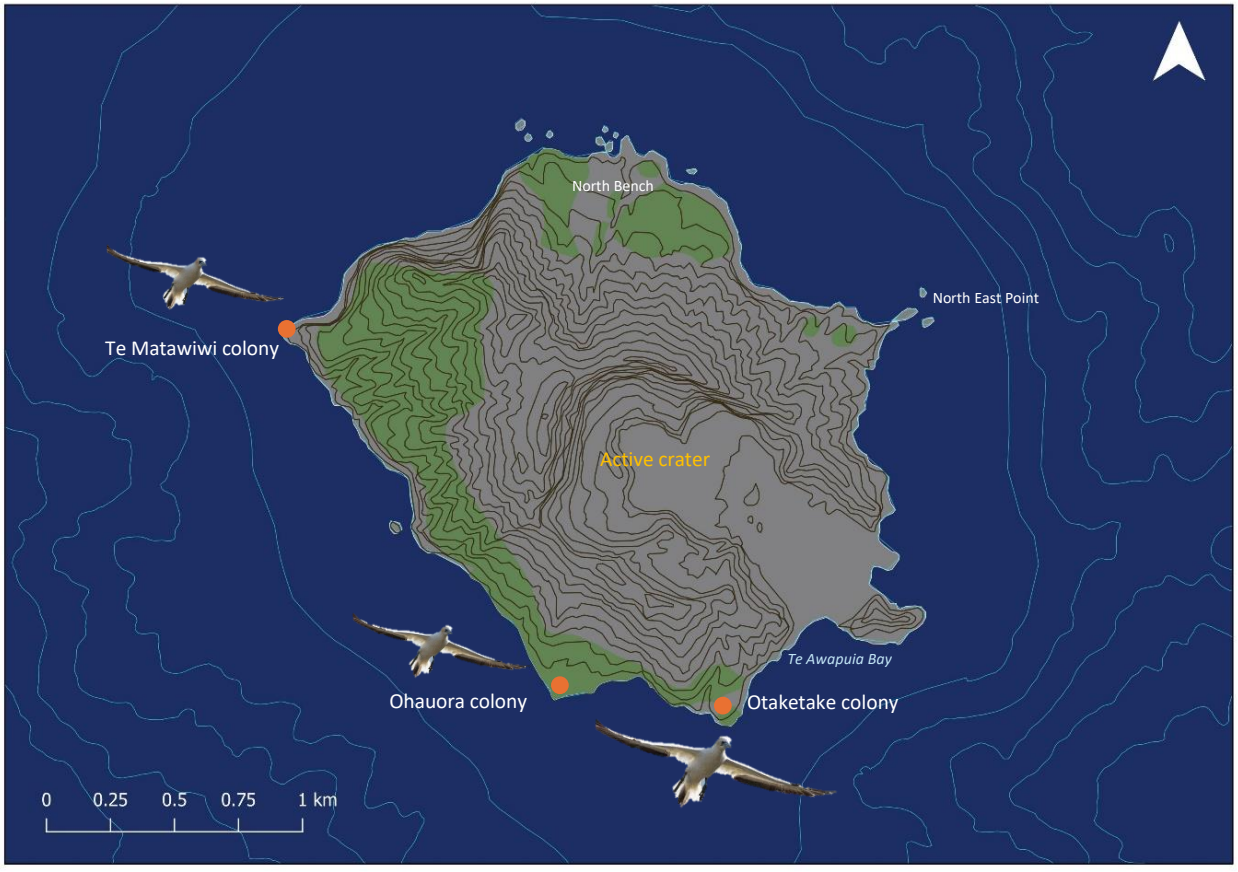


Figure 5. Te Matawiwi Colony

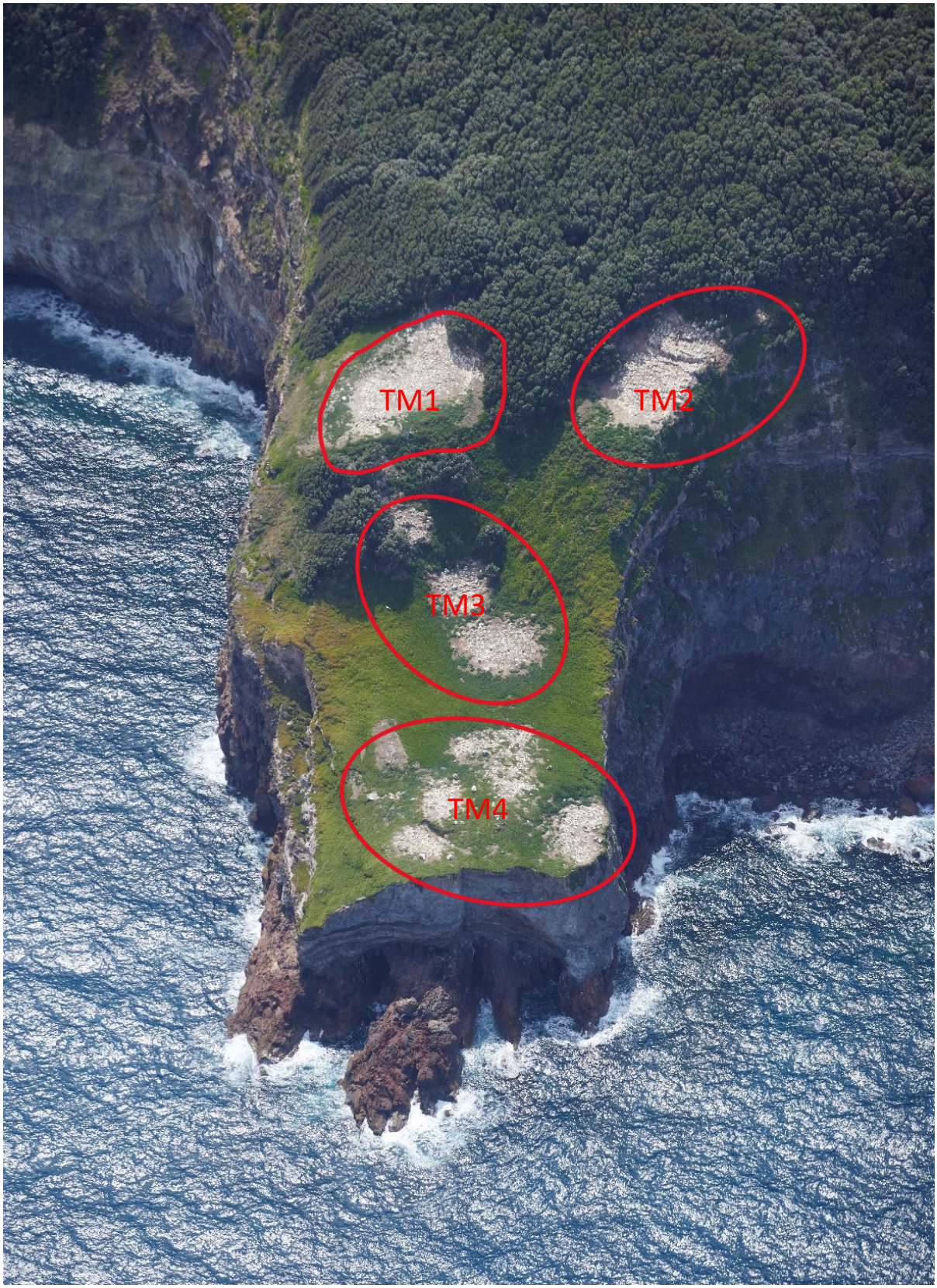
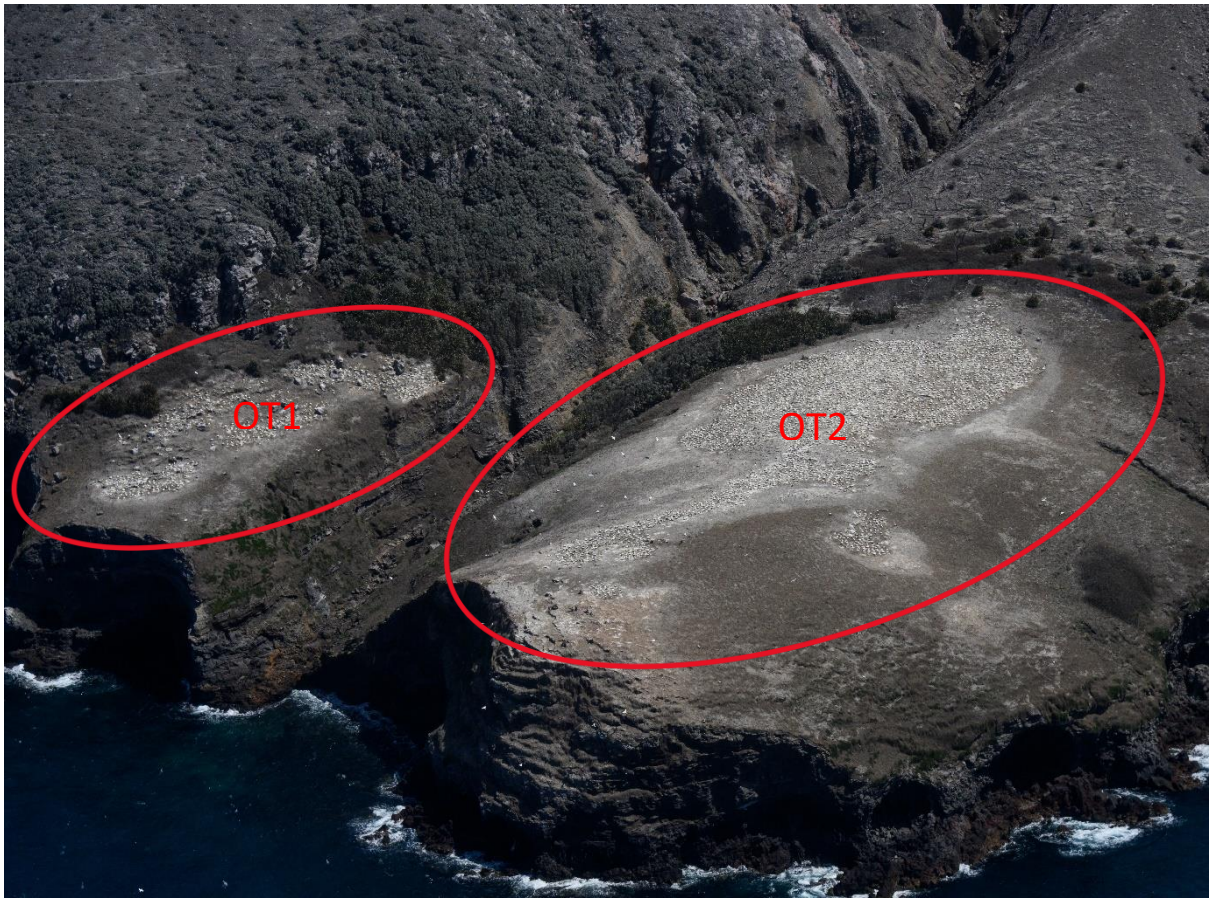


Figure 6. Ohauora Colony

Figure 7. Otaketake Colony

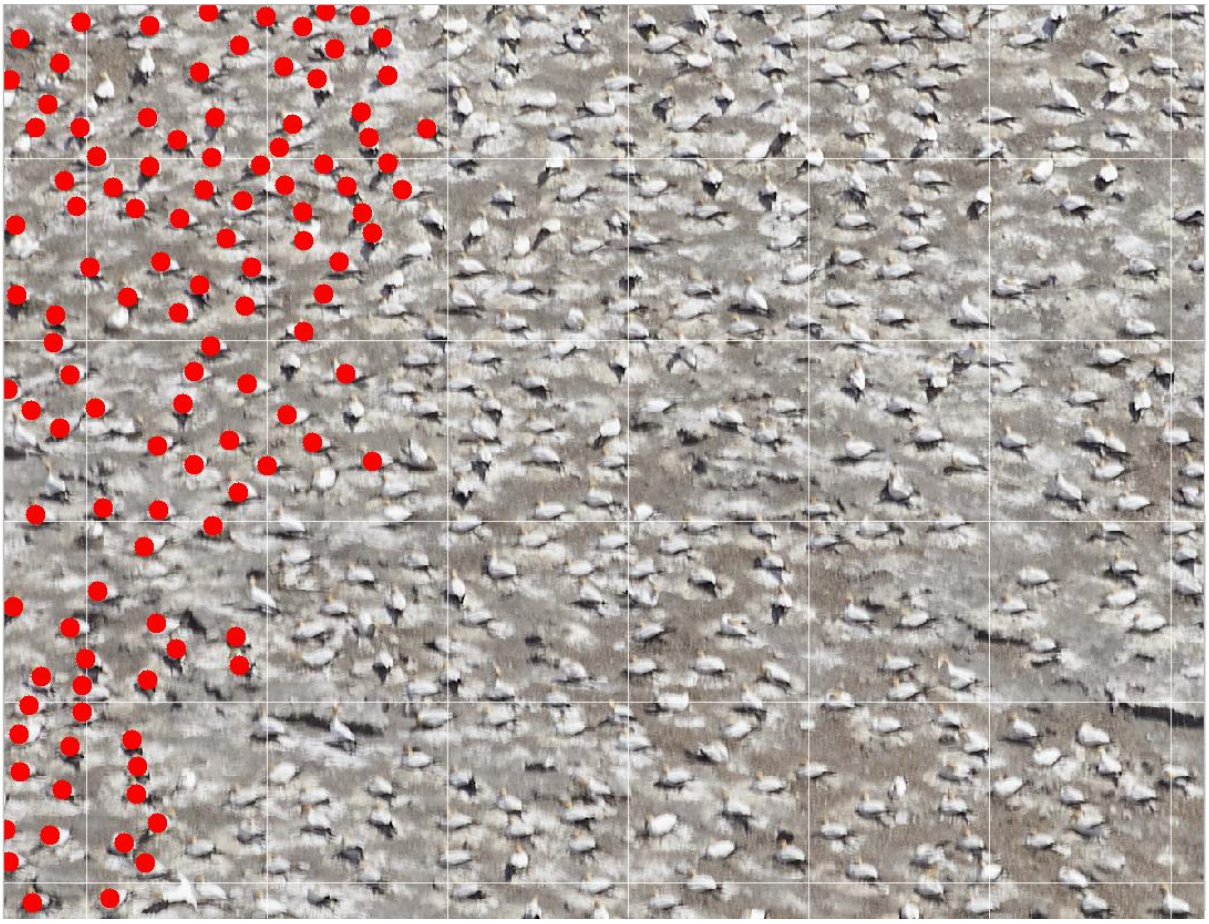


Counts

All the gannet colonies are in the open and birds are all highly visible. Each photograph encompassed one sub colony, or close groups as with TM3 and TM4. The photographs were analysed visually using the app DotDotGoose [v.1.7.0] by counting every individual seen to be incubating eggs, most commonly on guano stained nest mounds. Any pairs of birds were counted as one, likewise any chicks with an adult. Birds standing around the fringes of the colony or flying were ignored (Figure 8).

For each sub colony photographs were selected from each photographers' sets of images (jpgs), with an additional count undertaken on a set of RAW files.

Figure 8. Screenshot showing count using DotDotGoose in progress; the image is a detail of the Otaketake sub colony OT2.



Overall the colonies showed typical gannetry behaviour: adults with chicks clearly visible (Figs. 9 & 10); adults from their upright posture suggested a chick underneath; birds hunkered down on nests incubating eggs, or with small chicks; pairs of birds some preening, others resting; restless birds flapping their wings; interactions bill to bill between neighbours; birds standing around, both within the colonies and around the fringes; some flying. Any empty nest mounds were checked for unguarded chicks; none were detected.

Resulting counts are shown in Table 1. See also Appendix 1 (Table 2)

Figures 9 & 10. Two examples of chicks on nests with parent guarding.

Table 2.

Table 3 Comparing this survey's counts with those of the 2015 survey.

Sub colony (2015)	**Sub colony (this survey)**	**2015 count**	**2024 count**	**% change**
TE MATAWIWI	TM1, TM2, TM3, TM4	621	878	29% increase
OHAUORA WEST	OH1, OH2	620	456	26% decrease
OHAUORA EAST	OH3, OH4	605	569	6% decrease
OTAKETAKE WEST	OT1	265	354	35% increase
OTAKETAKE EAST	OT2	3195	2392	25% decrease
		5306	**4649**	**12% decrease**

Discussion and Conclusions

The results of this survey show a 12% decrease from the 2015 survey, which in turn was a 20% decrease on the previous 1980 survey (See Tables 1 & 2).

The largest colony, Otaketake East and West, had the greatest decrease in numbers (-714 pairs); 2746 pairs (2024) from 3460 pairs (2015) despite the western sub colony increasing by 35%. Te Matawiwi colony, by contrast increased in size (+257 pairs), 878 pairs (2024) compared to 621 pairs (2015). The Ohauora colony also had a decrease (-302 pairs).

We agree with Frost (2017), it is not clear if changes in numbers is part of a long-term trend or simply a feature of the year in question, illustrating the difficulty of interpreting change when only sporadic counts are available, especially at long intervals.

The gannets were at an early chick stage, with no chicks seen unguarded. Any chicks visible were with an adult.

Gannets and Whakaari's eruptive history

While it is possible that eruptions of the volcano may affect gannet numbers, it is worth noting that after a major eruption in December 1976, V. T. Davis, who had banded gannet chicks at White Island for many years, did not notice any change in numbers in the 1977/78 season (*in* Wodzicki 1978). Davis further noted in 1979, after more eruptions, that, although the land and sea had been affected, the gannets appeared to be breeding in the usual numbers.

Clarkson & Clarkson (1994) reported that eruptions 1976 to 1990 on White Island had a major impact on the flora and vegetation, reducing the extent of *M. excelsa* forest and scrub by more than two-thirds and causing the extinction of several species. The greatest change was to forest all along the western side of the island. The actual cause of death of the *M. excelsa* trees and shrubs was difficult to determine so long after the

eruptive events; that is during visits to the island in 1986 and 1990. However, as no evidence of blast or burn was seen, and ultimate branches remained intact on the majority of individual trees, the most probable causes were the toxic fumes emitted during the eruption, wet ash coating leaves and interfering with vital processes, and "acid rain".

B. Clarkson (*pers. comm.*, February 2025) notes the following with respect to vegetation changes around the three colonies as a result of the 2019 eruption and more recent eruptive activity:

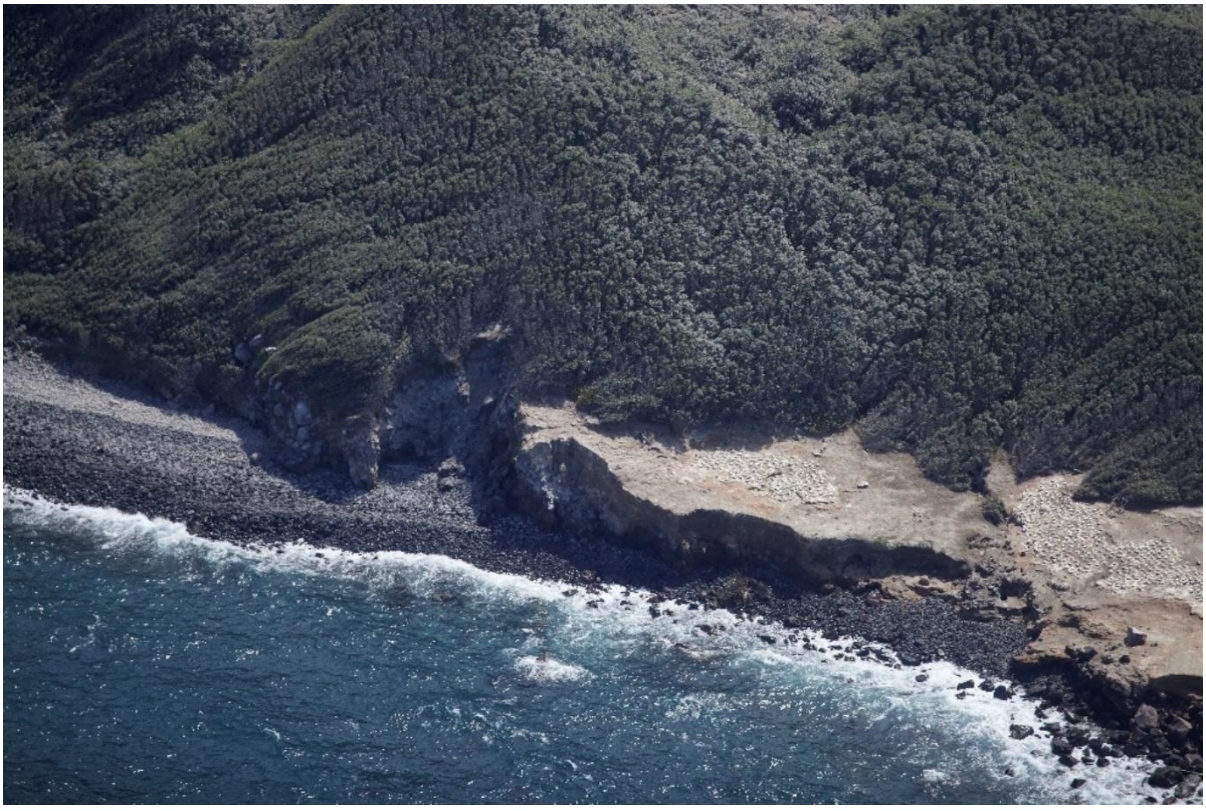
Te Matawiwi: Pohutukawa forest next to gannetry hardly affected by eruption. Herbfield associated with gannetry still present and looks vigorous.

Ohauora West: Pohutukawa canopy intact and shrub belt apparent. No herbfield associated with gannetry.

Ohauora East: Same as West. Obvious new layer of ash over both sub-colonies. Forest in better condition than in Clarkson & Clarkson (1994).

Otaketake West and Otaketake East: Forest virtually gone but some limited recolonisation of pohutukawa. In 2005 widely spaced trees were standing dead and there almost complete weedy groundcover (mainly Dicotyledon herbs such as *Conyza* sp. and *Senecio* sp.) surrounding the gannetry. Deep ash layer evident across whole area. A close up photo would be required to see what has happened to the weedy groundcover.

Figure 11. The Ohauora West sub colonies, showing forest cover with wind-shorn canopy highlighting the direction of the prevailing wind.

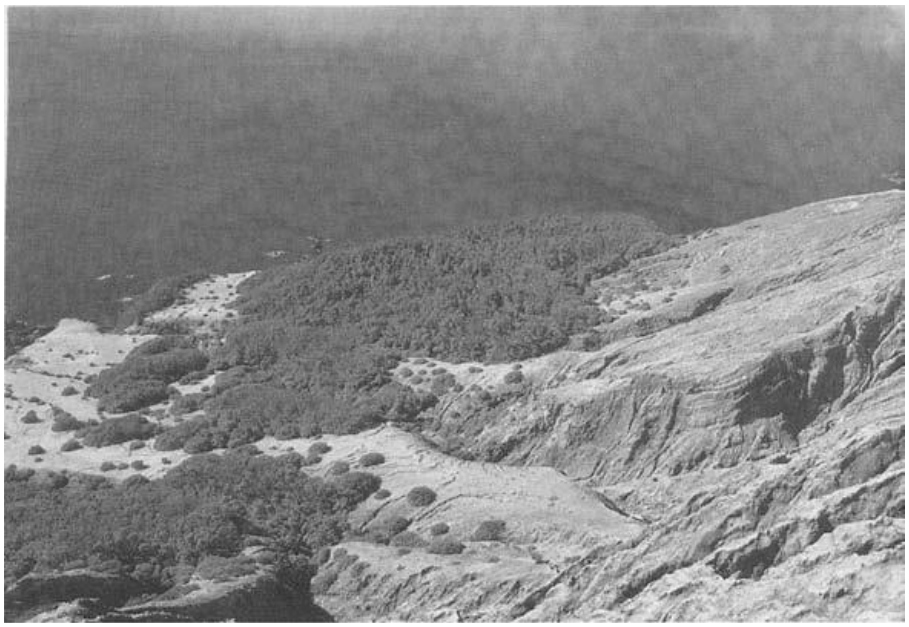


All the gannet colonies are located on the western side of the island and exposed to the prevailing wind as evidenced by wind-shorn vegetation at Ohauora (Fig. 9). Colonies on

the west side are also less exposed to acid rain or toxic fumes (hydrogen sulphide) as the prevailing winds are from NW and SW.

Certainly it is well known that gannets prefer windward coastal sites for their colonies, which can provide consistent updrafts that assist birds in takeoff and landing. These may be factors why there are no colonies on the north or eastern coasts, for example on North Bench where open and gently sloping areas exist (Figs 10 & 11). The forest cover on North Bench showed little damage following the eruptions 1976 to 1990, contrasting markedly with the damage the forest suffered on the western side of the island. After the most recent eruptive activity (August to October 2024) White Island flights reported seeing gannets sitting on nests with a coating of ash in September 2024 (G. Walker, *pers. comm.*).

Figures 12 & 13. North Bench in 2024 and 1990. Photos: Tony Whitehead and Bruce Clarkson.



Gannets were considered to have important local effects on vegetation; in fact, the herbaceous communities are regarded as being induced by their presence (Clarkson & Clarkson 1994).

HPAI

While one of the purposes of this survey was to get an updated count for a new population baseline should HPAI make it to Aotearoa New Zealand (i.e., there are no records of HPAI in Aotearoa, New Zealand, February 2025), we were on the lookout for any dead birds when working through the sets of photographs.

We found three clearly dead birds, two outside the Otaketake West (OT1) sub-colony, the other at the Ohauora East (OH3) sub-colony. There could well be others in amongst the birds and nests, but difficult to separate from the actual live birds, especially those flexing their wings atop nest mounds.

Seabird resilience with volcanic activity

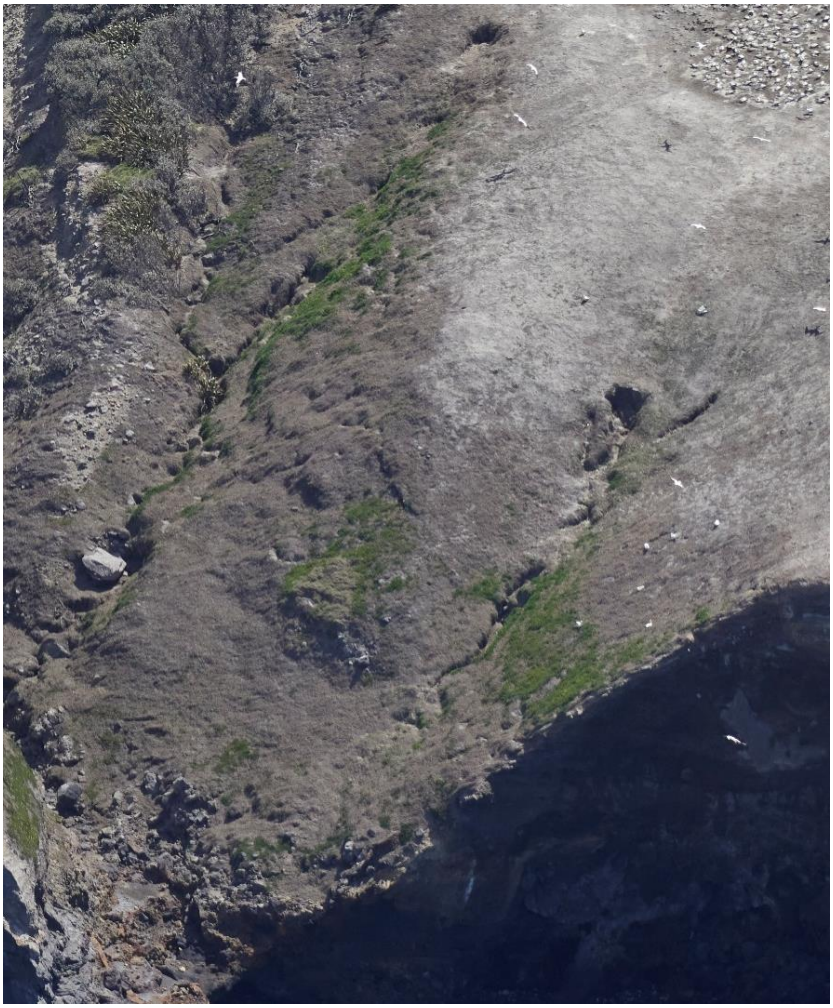
Many Pacific islands are volcanic in origin and the beginnings of their terrestrial ecologies can be due to seabirds, roosting initially, then breeding. Species such as boobies (gannet relatives), noddies and terns can roost on vegetated islands, and can transfer seeds to the bare ground on new islands. An extreme example of this is Nishinoshima Island, an active volcanic island in the Ogasawara Group, Japan (Fig. 14). On this island, eruptions have buried all previous seabird breeding grounds in lava. The eruptions are continuing intermittently (2024), but seabirds such as boobies and terns have resumed breeding (K. Kawakami *pers. comm.*). Other recent examples are within the Tonga archipelago.

Figure 14. Nishinoshima Island, Japan. Photo: Kawakami from the Asahi Shimbun airplane.

Other species breeding on Whakaari

Both ōi/ grey-faced petrels (*Pterodroma gouldi*) and titi / sooty shearwaters (*Ardenna grisia*) are recorded breeding on Whakaari. Several observers record extensive burrowing by petrels at various locations, including North Bench on the island's north coast (Oliver 1915, Hamilton 1959, Gillham 1965), Clarkson & Clarkson 1994). Oliver (1915) recorded that certain areas of scrub and on slopes facing the sea were occupied by grey-faced petrels. He doesn't list sooty shearwaters. He notes that the petrels breed in burrows, and in the course of the breeding season completely undermine and overturn the soil in the portions they occupy. Their effect is seen in the luxuriant growth of grasses and herbaceous plants on the slopes and edge of scrub facing the sea. Gillham describes the lower forest, floored by a considerable depth of peaty soil copiously tunneled by thousands of petrels and shearwaters (Gillham 1965). Gillham also mapped petrel burrows in the vicinity of the large Otaketake East colony, and burrows appear to still exist (Fig. 12). In "Island Volcano" by W.T. Parham (1973) gives an estimate of 60,000 grey-faced petrels using the island (presumably birds, not pairs) and noted that muttonbirders were taking 5000+ chicks in a season in the past. Parham noted that sooty shearwaters only bred in very small numbers on White Island and listed white-faced storm petrels as nesting there also in small numbers. Although Greene *et al.* (2015) include Whakaari on the map showing distribution of grey-faced petrel breeding sites on the North Island mainland and islands, there is no mention in the main text.

Figure 15. Area near the edge of the Otaketake East (OT1) sub colony, with what appears to be burrowed ground. This is the area close to the Otaketake colony that M. Gillham marked as heavily burrowed by ōi/ grey-faced petrels.



There was no sign of white-fronted tern or red-billed gulls nesting or roosting around Whakaari. There were, however, a few black-backed gulls in amongst the gannets.

Other islands

Moutohora

Completed a full close circuit in great conditions. Moutohora supports the largest ōi/ grey-faced petrel population with around 70,000 breeding pairs (Whitehead *et al.* 2014). Aside from a few red-billed gulls close to shore or flying over the forest, no roosting or nesting gulls.

Figure 16. Moutohora from the north, Whakatane and the mainland coast in the background.

Rurima and Motutoki

There were 28 pied shags (*Phalacrocorax varius*), 37 southern black-backed gulls (*Larus dominicanus*) with some possibly nesting, and 2 Caspian terns (*Hydroprogne caspia*) on Rurima; and 7 pied shags and several red-billed gulls on Motutoki, some flying close to two stationary jet skis.

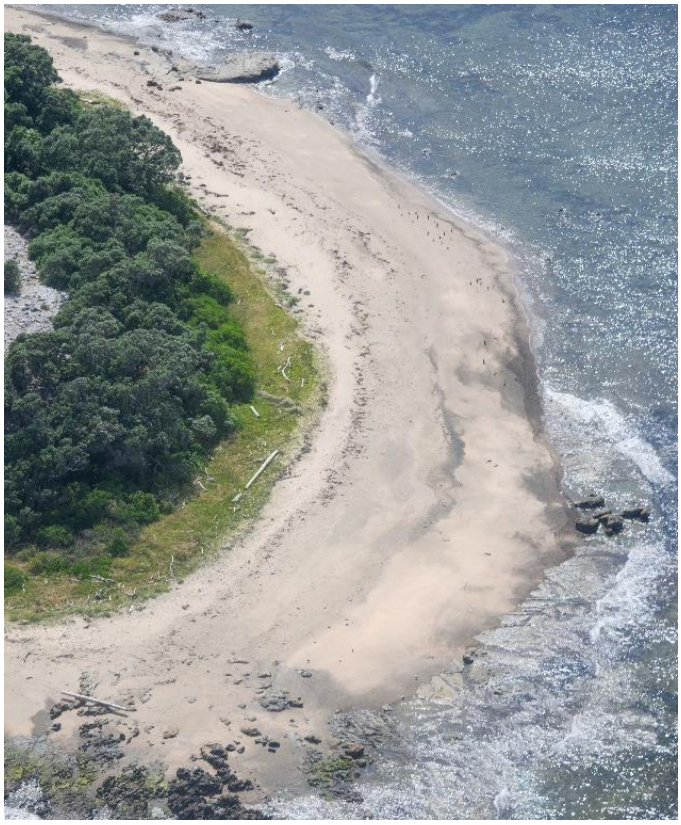


Figure 17. Pied shags and black-backed gulls on one of the beaches on Rurima.

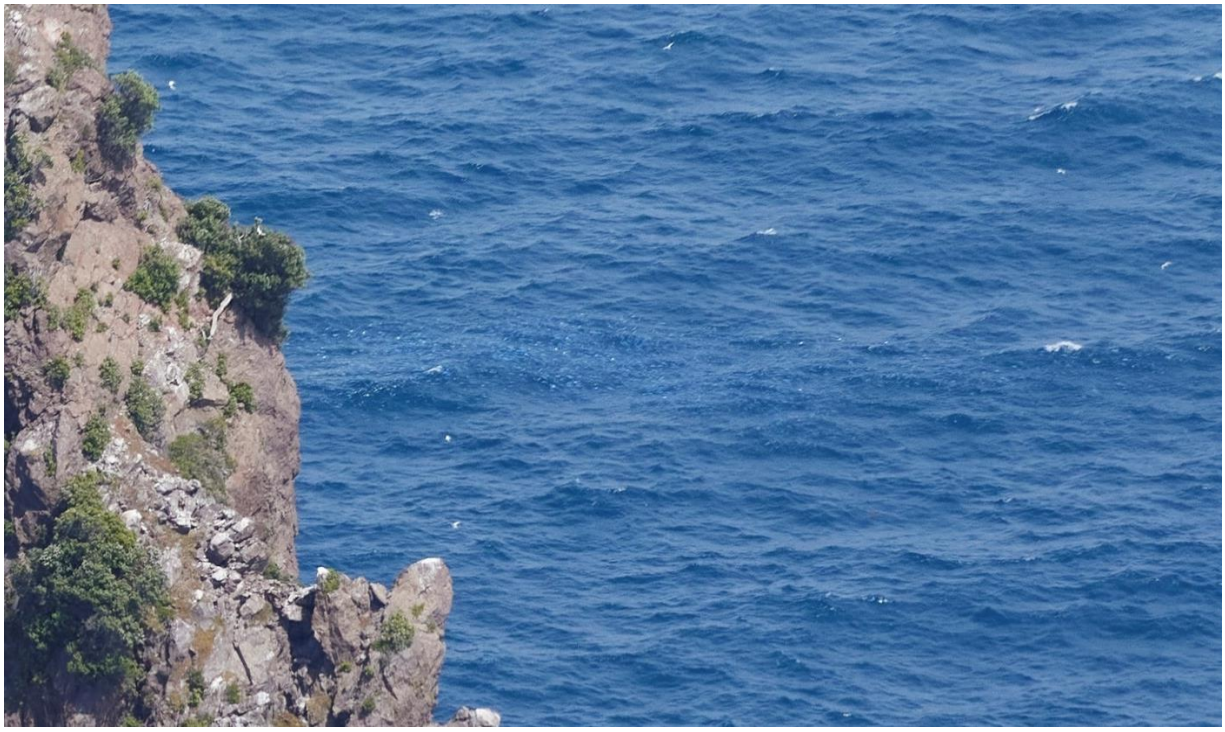
Te Paepae o Aotea / Volkner Rocks

Red-billed gulls, black-backed gulls and white-fronted terns were detected nesting on the main stacks.

Figure 18. Main stack.

Figure 19. Top of smaller stack, nesting, roosting and flying terns and gulls.

Figure 20. Main stack with fish school (trevally).



The photographers

Figure 21. From the left Tony Whitehead, Edin Whitehead and Neil Fitzgerald.

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Appendix 1

SUB-COLONY	PHOTOGRAPH FILE #	Counter 1				Counter 2	
		1A	1B	1C	1D	2A	2B
OTAKETAKE 1	Tony 7806	363					
OTAKETAKE 1	Neil 27977		392			343	
OTAKETAKE 1	Edin 95087			362			310
OTAKETAKE 1	Edin94781RAW				408		
OTAKETAKE 2	Tony 7803	2449					
OTAKETAKE 2	Neil 28181		2513			2326	
OTAKETAKE 2	Edin 95115			2500			2317
OTAKETAKE 2	Edin 94012RAW				2383		
OHAUORA 1	Neil 28214	123				119	
OHAUORA 1	Tony 7921		123				
OHAUORA 1	Edin 95048			123			122
OHAUORA 1	Edin94585RAW				124		
OHAUORA 2	Neil 28214	354				321	
OHAUORA 2	Tony 7920		321				
OHAUORA 2	Edin 95048			345			332
OHAUORA 2	Edin94585RAW				344		
OHAUORA 3	Tony 7919	308					
OHAUORA 3	Neil 27981		322			312	
OHAUORA 3	Edin 95062			317			308
OHAUORA 3	Edin 95067RAW				314		
OHAUORA 4	Tony 7918	230					
OHAUORA 4	Neil 27981		279			251	
OHAUORA 4	Edin 95062			254			256
OHAUORA 4	Edin 95065RAW				269		
TE MATAWIWI 1	Neil 28202	238				228	
TE MATAWIWI 1	Neil 28165		235				
TE MATAWIWI 1	Edin 94472			226			222
TE MATAWIWI 1	Edin 94905RAW				239		
TE MATAWIWI 2	Neil 28201	194				182	
TE MATAWIWI 2	Tony 7923		192				
TE MATAWIWI 2	Edin 94474			195			182
TE MATAWIWI 2	Edin 94908RAW				187		
TE MATAWIWI 3	Neil 28203	173				163	
TE MATAWIWI 3	Tony 7929		185				
TE MATAWIWI 3	Edin 94492			171			167
TE MATAWIWI 3	Edin 94527RAW				165		
TE MATAWIWI 4	Neil 28204	288				275	
TE MATAWIWI 4	Tony 7929		301				
TE MATAWIWI 4	Edin 94492			297			296
TE MATAWIWI 4	Edin94486RAW				298		
		4720	4863	4790	4731	4520	4512