

Breeding population of Foveaux and Otago shags 2021-23: Foveaux shags



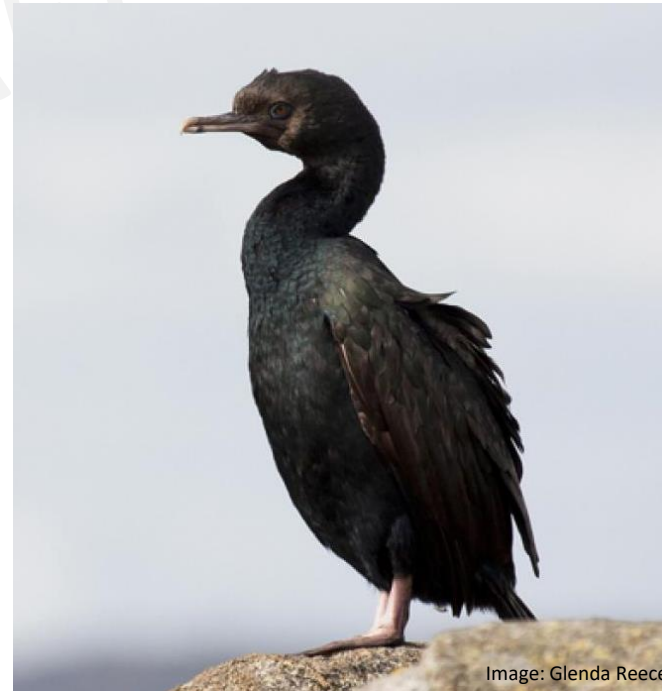
POP2021-07

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PARKER CONSERVATION

- Endemic
- Previously Stewart Island shags *Leucocarbo chalconotus*
 - Otago *Leucocarbo chalconotus* At Risk (Robertson *et al.* 2017)
 - Foveaux *Leucocarbo stewartia* Nationally Vulnerable (Robertson *et al.* 2017)



Threats to Foveaux shags



- Disturbance at breeding sites
- Marine pollution event
- Fisheries bycatch
- Aqua-culture



Aerial photo-survey

Drone

- Small, cost- and risk-effective
- Repeatable
- Animal disturbance tested

Helicopter

- Whenua Hou
- Droning not possible



Objective

Foveaux shag breeding population size estimate
- aerial photo survey

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Breeding sites

Table 1. Breeding sites used by Foveaux shags in 2022, and the abandoned breeding locations where breeding ceased before 2022.

Breeding site	Site details †	Manager †	Year nesting started	Last year nesting recorded	Max no. nes
Raratoka / Centre Isl	SSE of Oraka Pt (10.5km)	Ōraka Aparima Rūnaka	<1954	present	>600 in 1951
Rabbit Isl islet (Bird Isl locally)	Bluff Harbour, NE of Greenpoint Reserve (1.8km)	Invercargill City Council	1980-92 ^{b,c}	present	96 in 2022
Tihaka / Pig Isl	S of Taramea beaches (2.8km)	DOC Murihiku	~1998 ^e	present	139 in 2022
Omaui Isl	New River mouth	Invercargill City Council	1981-91 ^{b,d}	present	65 in 1991 ^d
Dog Isl	SE of Bluff (5.6km)	Maritime NZ	< 2001 ^h	present	84 in 2022
Whero Rock	In Carter Passage, betw the Neck and Bench Isl	DOC Rakiura	~1950 ^a	present	400 in 1980
Ruapuke: Fife Rock	W of Ruapuke (7km)	Awarua Rūnanga	<1980 ^b	present	334 in 2011
Ruapuke: Seal Rocks	E of Ruapuke (3.6km)	Awarua Rūnanga	<1979 ^b	present	117 in 2022
Rakiura: Long Harry	N Rakiura	DOC Murihiku	<2016	2016	~20 in 2016
Papakaha Rocks / Tiwai Rocks	S of Tiwai Pt (225m)	DOC Murihiku	~1953 ^h	2011 ^b	90 in 1955 ^a
High Rock	E of Whenua Hou (1.75km)	DOC Rakiura	<1980 ^b	2011	77 in 1980 ^b
Whenua Hou: islet off Sealer's Bay	Sealer's Bay	DOC Murihiku	<1934 ^h	~1970	64 in 1966
Whenua Hou: the Knobbies	NW corner Whenua Hou	DOC Murihiku	<1966 ^h	< 1971	colony in 1911
Ruapuke: Breaksea Islands	SE of Ruapuke	Awarua Rūnanga	unknown ~1980?	1980	5 in 1980 ^b
Ruapuke: White Isl (Shit Rock locally)	NW of Ruapuke	Awarua Rūnanga	unknown ~1970s?	<1979 ‡	20 <1979
Kanetetoe Isl	Outer Rakiura SE of Bunker Islets/Haumaiteaki	Rakiura Titi Islands Admin Body	<1911 ⁱ	1960s ^a	400-500 in 1911 ^a
Zero Rock	Titi Islands northmost	DOC Murihiku	Early 1960s?	1968	19 in 1968
Islet off Pukeokaoka / Jacky Lee Isl	Titi Islands	Rakiura Titi Islands Admin Body	1950s ^h	1955	22 in 1955



Timing



Ideally peak laying when most pairs present

- Laying not synchronous
- Most lay early October, some early September
- Where cameras to inform phenology
- Targeted aerial photography earlyish October
- Last surveys were conducted 9 October 2011 (Lalas unpubl. data 2015)
- Ideally colonies are each visited at the start of breeding at that site
- Colony-specific breeding timing data are not available so the timing of best fit across all colonies was sought

Survey



- Obtaining approvals was involved process
- Drone flown from:
 - On island if landing possible
 - Boat
 - From adjacent headlands

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Photography

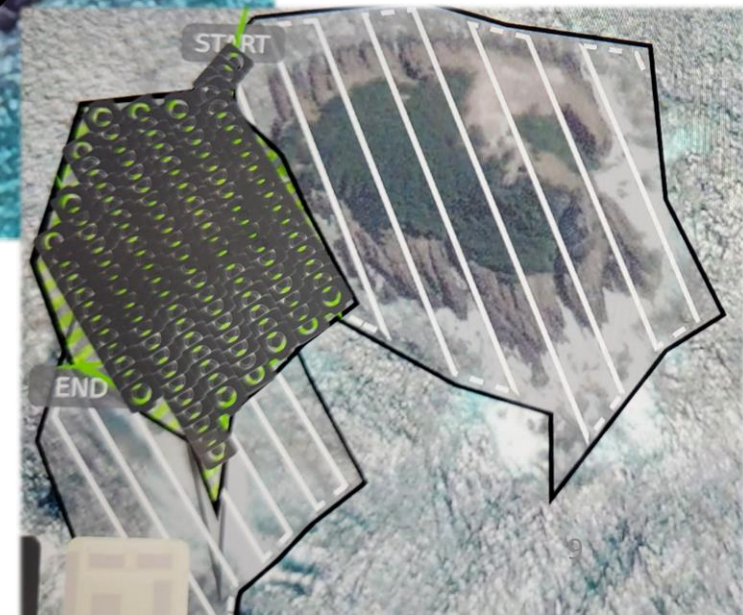
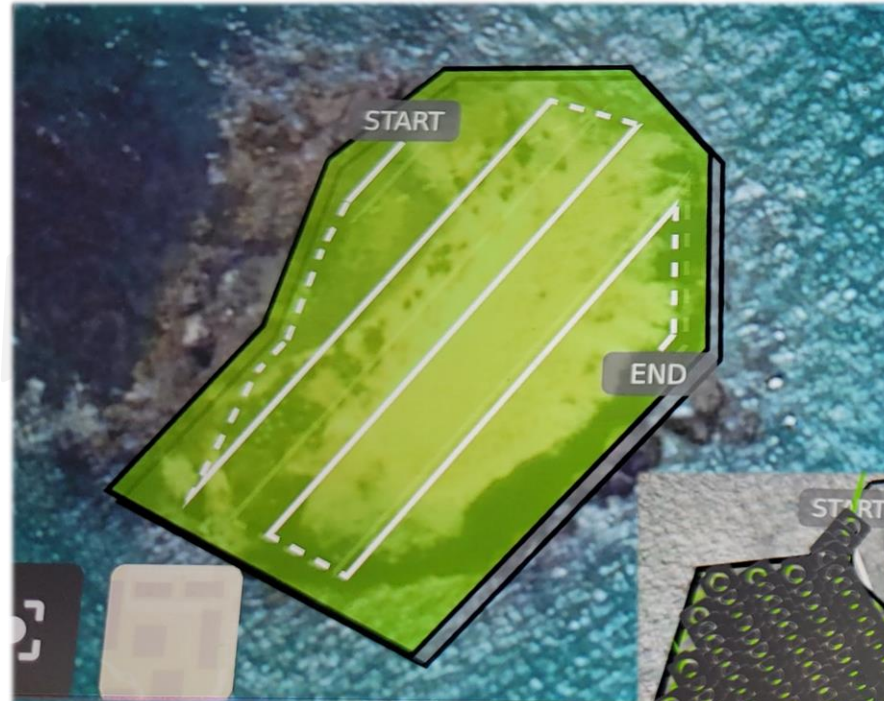
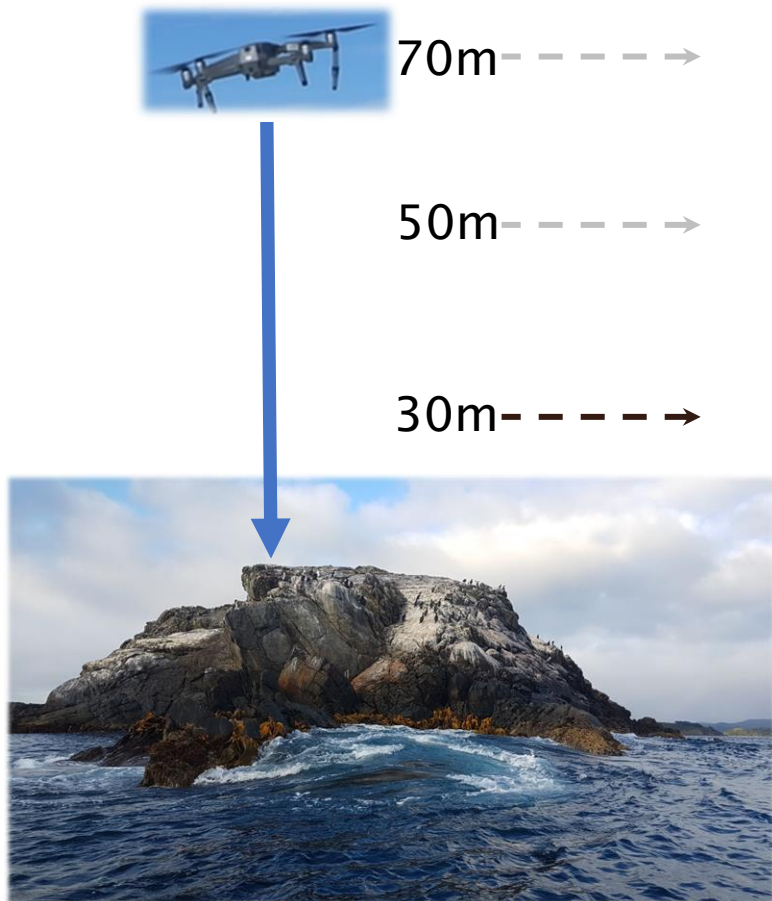


Fig. 2

Photography



- Drone
 - Manual
 - Programmed
- DSLR



Results

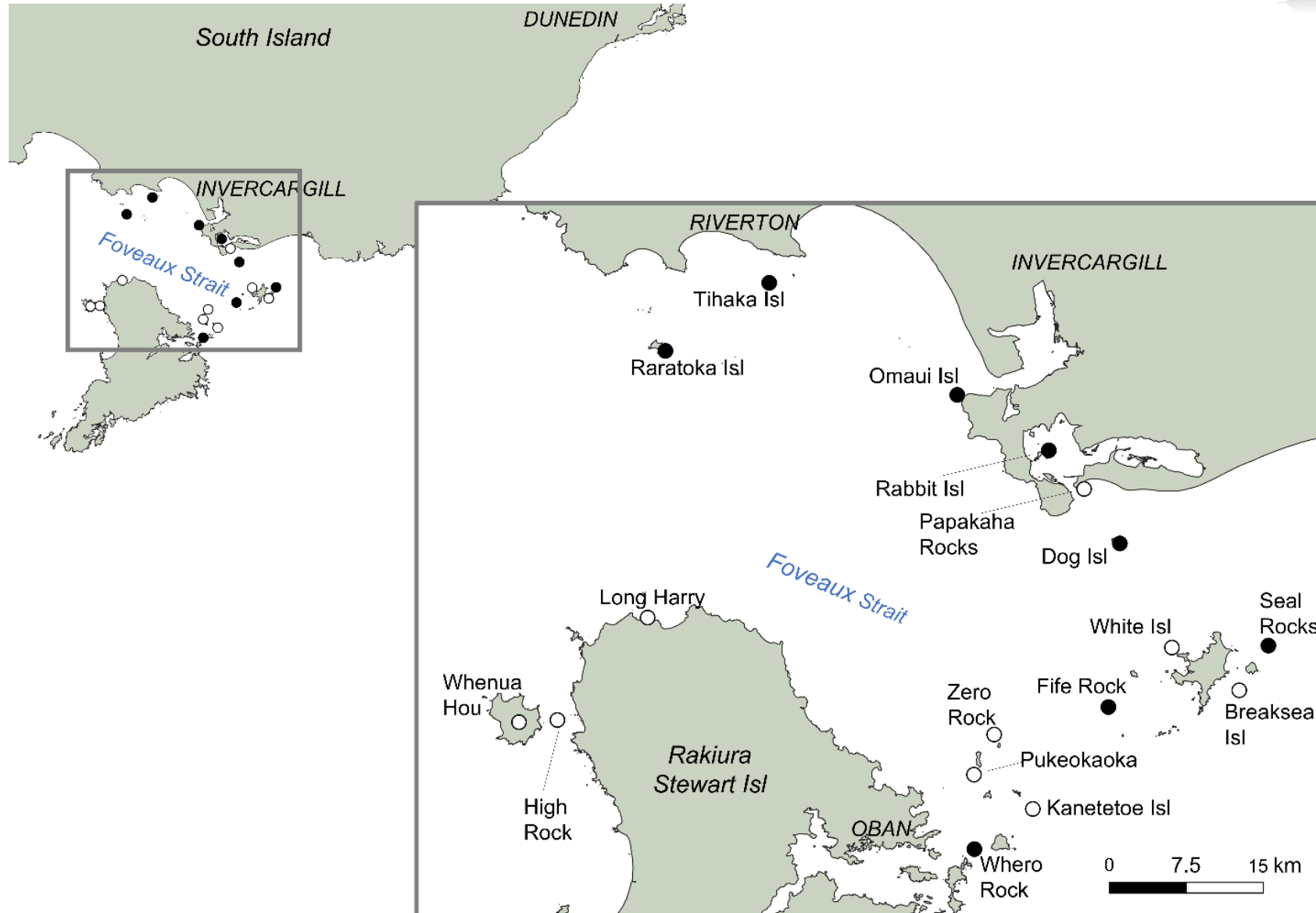


All colony photos over three days,
October 12 - 14

- Nesting shags: no response to 20 m flight height
- Loafers, other spp: Ignore or move (30m), and ignore or flight (25m)
- Most response when oblique manual



Drone 11 sites, DSLR 2 sites



Photographic platform

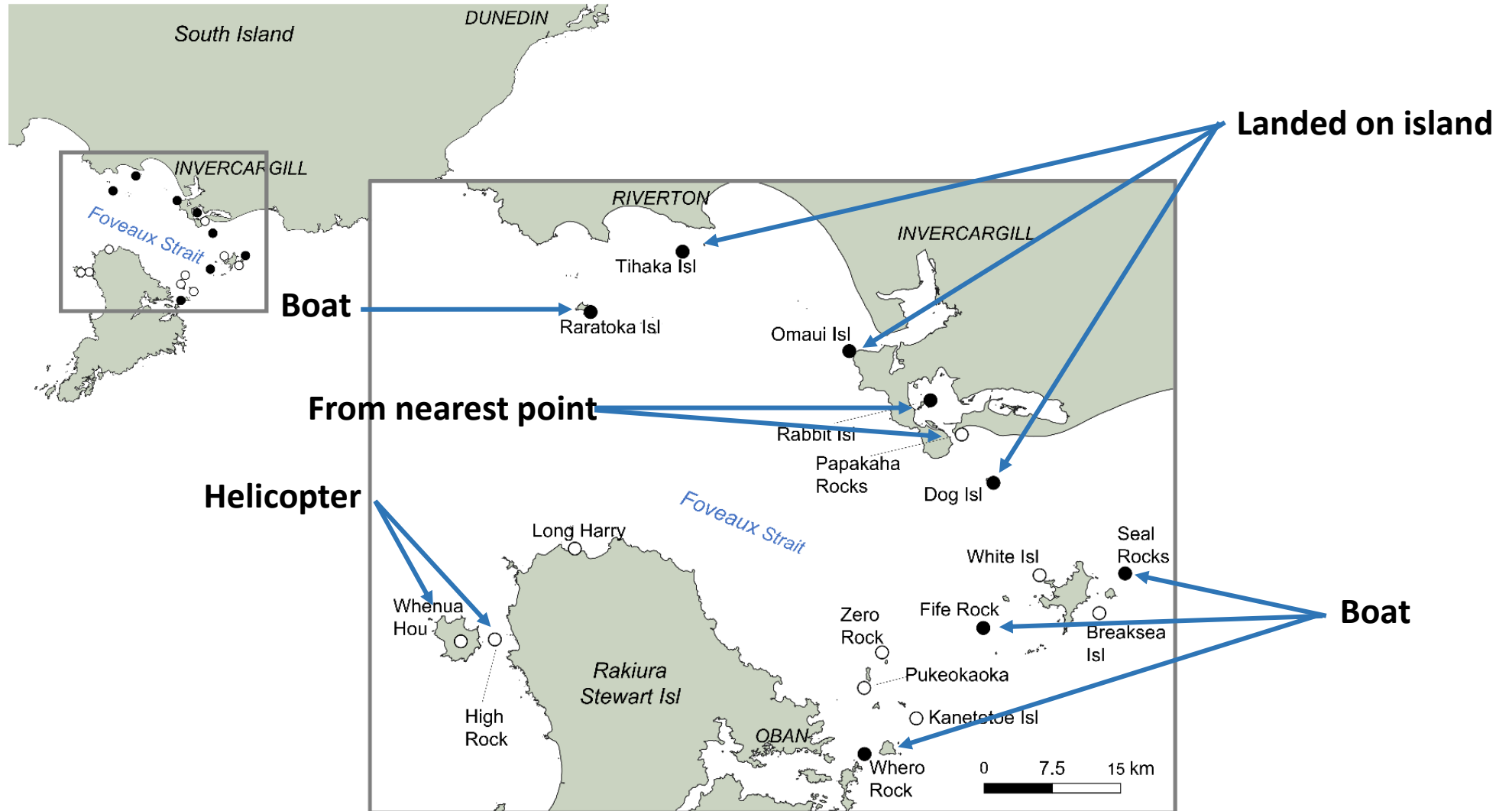


Table 2. Foveaux shag colony photographic survey October 2022

Breeding site	Colony	Date	Flight m above colony	Animal responses ^a	Image quality	Status ^b
Raratoka / Centre Isl	Raratoka/Centre Isl: notch	13/10/2022	40	No animal reactions	OK	C
	Raratoka/Centre Isl: peninsula	13/10/2022	60	None	poor	C
	Raratoka: Kuru-kuru Rocks	13/10/2022	60	None	poor	C
	Raratoka: Green Isl	13/10/2022	60	None	poor	C
Papakaha Rocks / Tiwai Rocks	Papakaha Rocks	12/10/2022	30	No response from shags. Paradise duck and 2 RBG left on first approach by drone	good	H
Rabbit Isl	Rabbit Isl: peninsula	12/10/2022	25	No response from shags. At 25m BBG started rising but no shag response	good	C
	Rabbit Isl: islet	12/10/2022	25	No animal reactions	good	C
Tihaka / Pig Isl	Tihaka / Pig Isl	12/10/2022	28	Drone: At 50m four loafing shags started walking - settle once drone unmoving hover. No further reactions at 40m or 30m. Person: crawling to 25m shags alert; at 25m standing most shags started walking. Left quickly before shags flight. Lots BBG nesting; no response to drone; but response to people landing on beach (rose en mass and calling before settling quickly).	good	C
Omaui Isl	Omaui Isl	13/10/2022	30	No shag reaction. Spoonbills reacted to people not drone (took off on people-arrival then landed among shags; no further response during drone flight).	good	C
Dog Isl	Dog Isl	13/10/2022	25	No reaction until 30m. At 25m loafing shags looking alert but not reaction from nesters. Brief response from gulls at takeoff then nothing more.	good	C
Whero Rock	Whero Rock	14/10/2022	20	No animal reactions	good	C
Kanetetoe Isl	Kanetetoe Isl	14/10/2022	—	To boat: No response from loafing shag	OK ^c	H
Ruapuke: Fife Rock	Ruapuke: Fife Rock	14/10/2022	30	No shag reactions. Gulls rose on drone launch but settled	good	C
Ruapuke: Seal Rocks	Ruapuke: Seal Rocks	14/10/2022	30	No animal reactions	good	C
Ruapuke: White Isl	Ruapuke: White Isl	14/10/2022	—	To boat: No response from loafing shags	OK ^c	H
Whenua Hou / Codfish	Whenua Hou coastline	12/10/2022	—	None	n/a	H
	Whenua Hou: islet off Sealer's Bay	12/10/2022	—	None	n/a	H
	Whenua Hou: the Knobbies	12/10/2022	—	None	n/a	H
High Rock	High Rock	12/10/2022	—	None	OK ^d	H

^a BBG is black-backed gull and RBG is red-billed gull; ^b Colony breeding status is C currently active, H historical, no current breeding; ^c Photographs taken from boat ~30-40 m from island; ^d DSLR photographs taken from helicopter 80-100 m from island

Analyses



The screenshot displays the 'Image Composite Editor' software interface. On the left, a grid of satellite images is shown, with file names ranging from D:\I_0829.JPG to D:\I_0884.JPG. The main workspace shows a large composite map of a coastal area, with a grid overlay. The software interface includes a top navigation bar with steps: 1 IMPORT, 2 STITCH, 3 CROP, and 4 EXPORT. On the right, a 'Projection' menu is open, listing various map projections: Cylindrical, Transverse Cylindrical, Mercator, Transverse Mercator (highlighted), Spherical, Transverse Spherical, Orthographic, Fisheye, Stereographic, and Perspective. Below the projection menu, an 'Orientation' section shows settings for 'Auto orientation', 'Roll' (0.404 degrees), 'Pitch' (-78.664 degrees), and 'Yaw' (-0.396 degrees).

Fig. 3

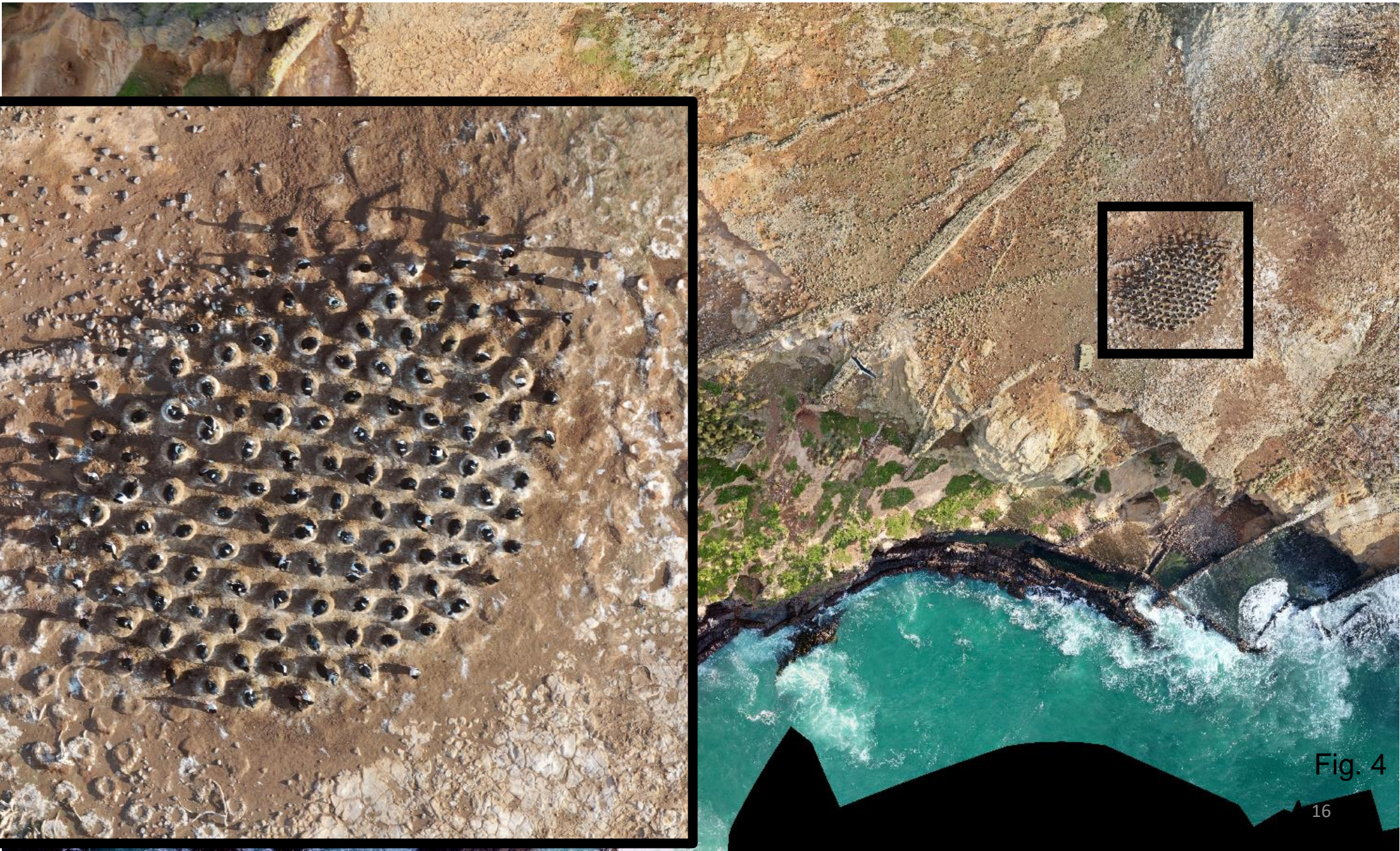
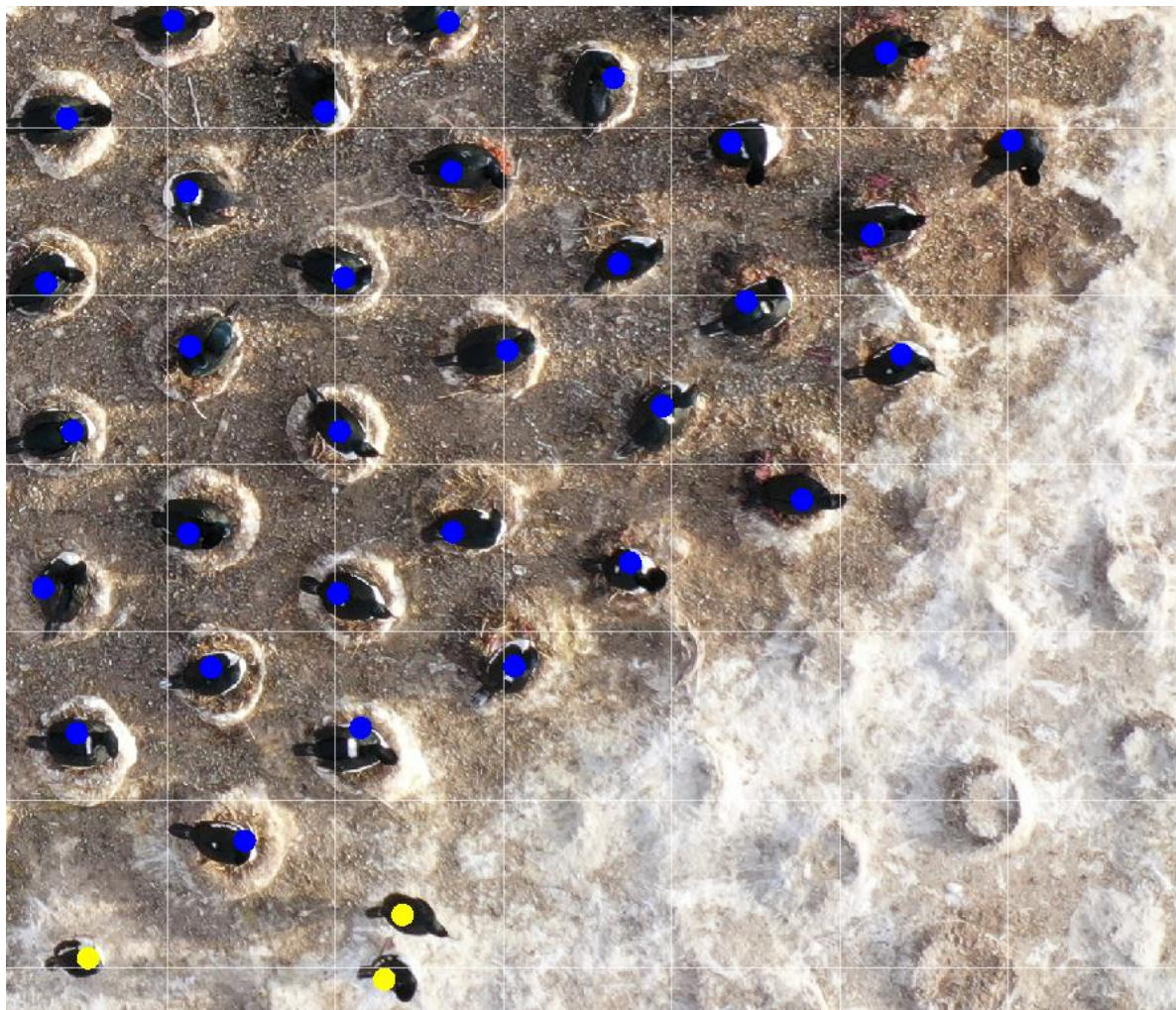


Fig. 4



Whero Island



Seal Rocks

- Apparently on nest
- Loafers not nesting
- Chicks alone on the nest
- Chick with a parent also on nest

Table 3. Foveaux shag breeding colony census October 2022

Breeding site	Colony	Status	All birds		Nests ^a		
			A	B	Best estimate	A	B
Raratoka / Centre Isl	Raratoka: notch	C	63	62	40	39	40
	Raratoka: peninsula	C	36	33	25	24	25
	Kuru-kuru Rocks	C	14	14	9	8	10
	Green Isl	C	10	11	9	8	9
Papakaha Rocks / Tiwai Rocks	Papakaha Rocks	H	4	4	0	0	0
Rabbit Isl	Rabbit Isl: peninsula	C	117	118	67	67	67
	Rabbit Isl: islet	C	55	54	29	29	29
Tihaka / Pig Isl	Tihaka	C	179	181	139	139	139
Omaui Isl	Omaui Isl	C	36	35	26	25	26
Motu Piu / Dog Isl	Dog Isl	C	107	105	84	83	85
Whero Rock	Whero Rock	C	211	214	189	187	191
Ruapuke: Fife Rock	Fife Rock	C	363	362	275	277	273
Ruapuke: Seal Rocks	Seal Rocks	C	164	165	117	116	118
Ruapuke: White Isl	White Isl ^b	H	50	56	0	0	0
Whenua Hou / Codfish	Whenua Hou coastline ^c	H	0		0	0	0
	islet off Sealer's Bay ^c	H	0		0	0	0
	the Knobbies ^c	H	0		0	0	0
High Rock	High Rock ^c	H	0		0	0	0
Kanetetoe Isl	Kanetetoe Isl	H	1		0	0	0
Zero Rock	Zero Rock ^d	H	0		0	0	0
Islet off Pukeokaoka / Jacky Lee Isl	Islet Pukeokaoka ^d	H	0		0	0	0
Rakiura: Long Harry	Long Harry ^d	H	0		0	0	0
TOTAL BREEDING PAIRS					1007	1002	1012

^a Nests should be taken as the minimum number, since some breeding attempts will have already failed by the time of survey; ^b count image from boat with DSLR camera; ^c survey by binoculars from low-altitude helicopter; ^d record from check in Oct 2022 as part of other work (P. Dobbins, R. Cole pers. comm. 2022)

Breeding pairs estimate

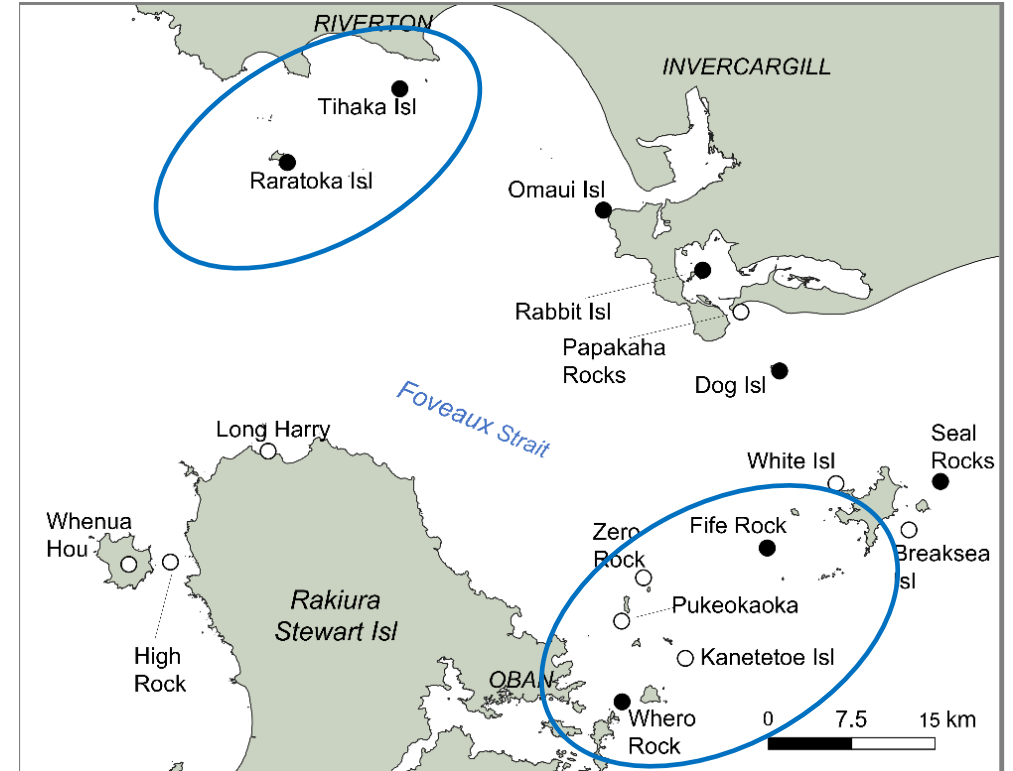


- Total breeding pairs est. 1007 (1002-1012)
- Similar to 2011 (Lalas et al.)
- Stable since 1980s, unlike Otago shags
- Our estimate is a minimum as some failures will have occurred
 - but no evidence we were too early

Population distribution



- Fife Rock – 275 pairs (27%)
 - Whero Island - 189 pairs (19%)
 - Seal Rocks – 117 (12%)
- } 58%
- Tihaka – 139 (14%)
 - Raratoka – 83 (8%)
- } 22%



Historic sites confirmed to still be unoccupied



- Papakaha
- White Island
- Seal Rocks
- Zero Rock
- Pukeokaoka
- Kanetetoe
- High Rock
- Whenua Hou



Local variability, and change



- Raratoka Isl,
 - >600 in 1955
 - 25 in 1991
 - 138 in 1980
 - 129 in 2011
 - 83 in 2022
- Tihaka
 - 10 in 1998
 - 110 in 2011
 - 139 nests this survey

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Nest contents calibration



- Nest contents inspection problematic
- Boat not close enough
- Shags sensitised to human disturbance
- Cameras at Whero did not work due to shags moving

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Recommendations



- Repeat all-sites breeding pop. est. periodically
- More frequent counts at main sites (e.g. Rabbit, Whero)
- In absence of nest-failure rate data, time photography to the start of the breeding season to avoid underestimating breeding numbers due to early failures
- If surveys cannot be timed to the start of breeding, footage from colony cameras at the two annually-monitored sites could provide nest survival data.
- Occupancy rate: Nest contents should be recorded for at least one of the annually-monitored sites, to build a dataset of occupancy error at the time of imagery

Acknowledgements



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