



PARKER CONSERVATION

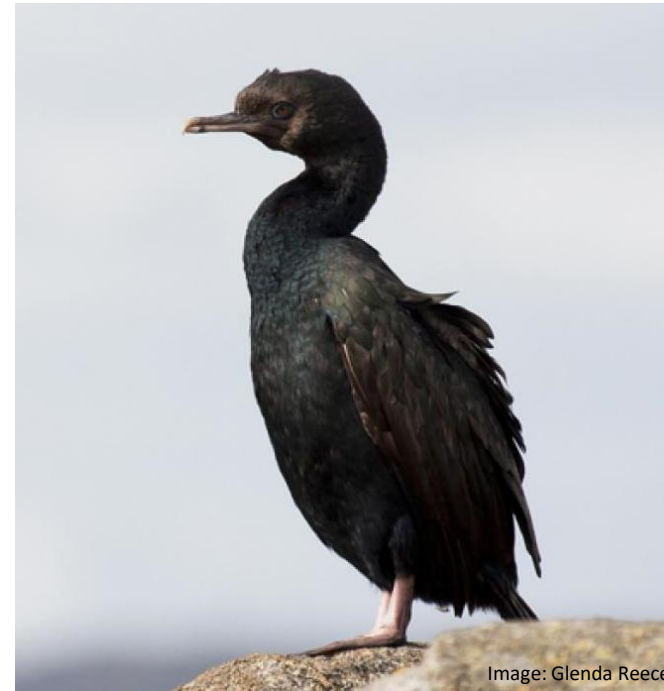


Foveaux and Otago shag population census methods

Graham Parker and Kalinka Rexer Huber



- 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)



- Otago's 20–30% pied morphs
Foveaux's 50–60%
- Otago birds small facial caruncles vs
scattered papillae
Foveaux Strait birds always have
scattered papillae
- Otago birds larger
- Temporal differences breeding



Conservation threats

- Set net captures (Abraham & Thompson 2015)
- Disturbance (Watt 1975; McKinlay 2013)
- Expansion of aquaculture? (DOC CSP annual plan 2021)



Information gaps

- Little up to date breeding population information
- No population estimates and trends
- Can't assess impact of proposed aquaculture farms



Aims

- Identify current breeding sites
- Develop a suitable methodology for breeding population census



Objectives

1. Identify Foveaux and Otago shag breeding colony locations



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1. Identify Foveaux and Otago shag breeding colony locations
2. Determine temporal colony attendance, species intermixing and nest survival rates
3. Identify suitability of drone use for Foveaux and Otago shag aerial population census data



Methods: breeding site locations

- Published literature
- Grey literature
- NZ Birds Online
- eBird
- iNaturalist
- Consultation with knowledgeable experts



Methods: colony attendance, intermixing and nest survival



Methods: drone trials

- Sensitivity of shags to drone flight
- Ideally wild 'undisturbed' sites
- Drone pilot + observer + filming shags as flown over
- DJI Mavic 2 Pro - Hasselblad camera (20MP 1" CMOS sensor)
- Manual flight, DJI Go4 drone interface
- Started high, progressed lower or aborted



Results: breeding site locations

- Expert opinion – good engagement
- Little published work
- Biased towards Otago
- E-bird not very helpful, nor inaturalist



Otago breeding sites

	eBird (n = 4995) 2021	Crossland (1996-07) 2012	Lalas & Perriman 2005	Lalas 1993	Marchant & Higgins 1990	Lalas 1983	Watt 1975
Maukiekie Island (Moeraki Point)	breeding	breeding	breeding	breeding	-	breeding	-
Pukekura / Taiaroa Head	breeding	-	breeding	breeding	breeding	breeding	breeding
Wharekakahu (Allans Beach, Otago Peninsula)	-	-	breeding	breeding	-	breeding	-
Okaihe / Green Island	breeding	-	breeding	breeding	breeding	breeding	breeding
Kinakina Island (Chaslands, Catlins)	-	-	breeding	-	-	-	-
Gull Rocks (Sandfly Bay, Otago Peninsula)	-	-	former	-	breeding	-	breeding
Otago Harbour	-	-	transient	-	-	breeding	-
Sumpter Wharf (Oamaru)	breeding	-	NA *	-	-	-	-
Goat Island (Moeraki)	-	-	-	-	breeding	-	breeding



Foveaux breeding sites

	eBird 2021	DOC database (1911-2005)	Crossland (1996-07) 2012	Lalas & Perriman 2005	Marchant & Higgins 1990	Lalas 1983	Watt 1975
Kanetotoe Island	-	breeding	-	-	breeding	-	breeding
Whero Rock	breeding	breeding	-	-	breeding	breeding	breeding
Centre Island and Kuru-kuru rocks	-	breeding	-	-	breeding	breeding	breeding
Whenua Hou / Codfish Island (Sealer's Bay)	breeding	breeding	-	-	breeding	-	breeding
Papa-Kaha Rocks (Bluff Harbour entrance)		breeding	-	-	breeding	breeding	breeding
Islet off Rabbit Island		breeding					
Bluff Harbour							
Tiwai Rocks		breeding					
Tihaka / Pig Island		breeding					
Zero Rock	-	breeding	-	-	breeding	-	breeding
Ulva Island (The Snuggery)		breeding					
Pukeokaoka / Jacky Lee Island	-	-	-	-	breeding	-	breeding
Omaui Island	breeding	breeding	-	-	-	-	-
Breaksea Isles	-	-	-	-	-	breeding	-
High Rock off Codfish	-	-	-	-	-	breeding	-
Fife Rock	-	-	-	-	-	breeding	-



Trail cameras: Sumpter

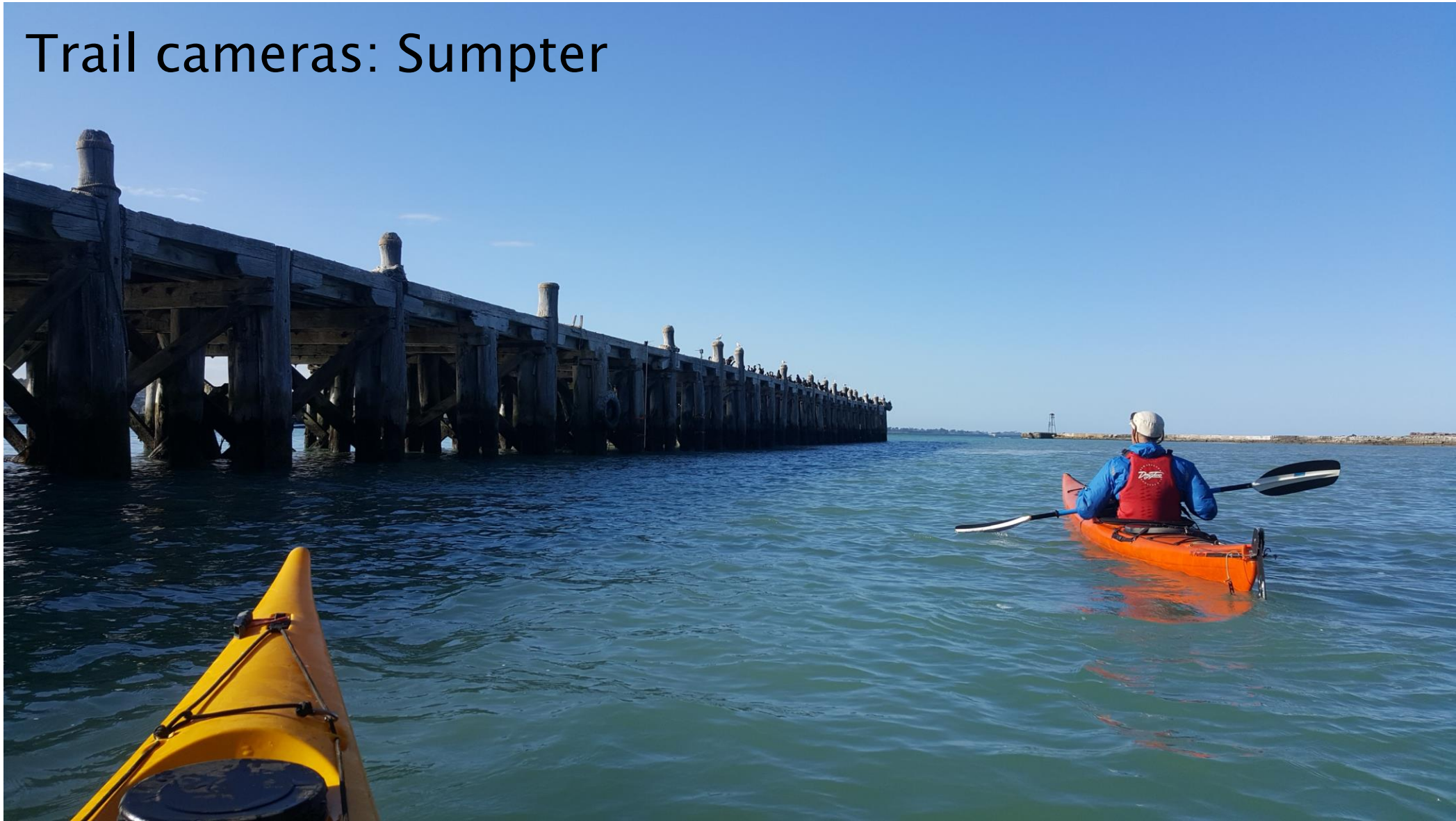


SWITZ
ENDURO

063F 17°C 20/03/2021 18:30:18



Trail cameras: Sumpter



Trail cameras: Pukekura / Taiaroa Head



ENCINO

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18°C

HYPERFIRE 2 COVERT

RECONYX

Trail cameras: Whero

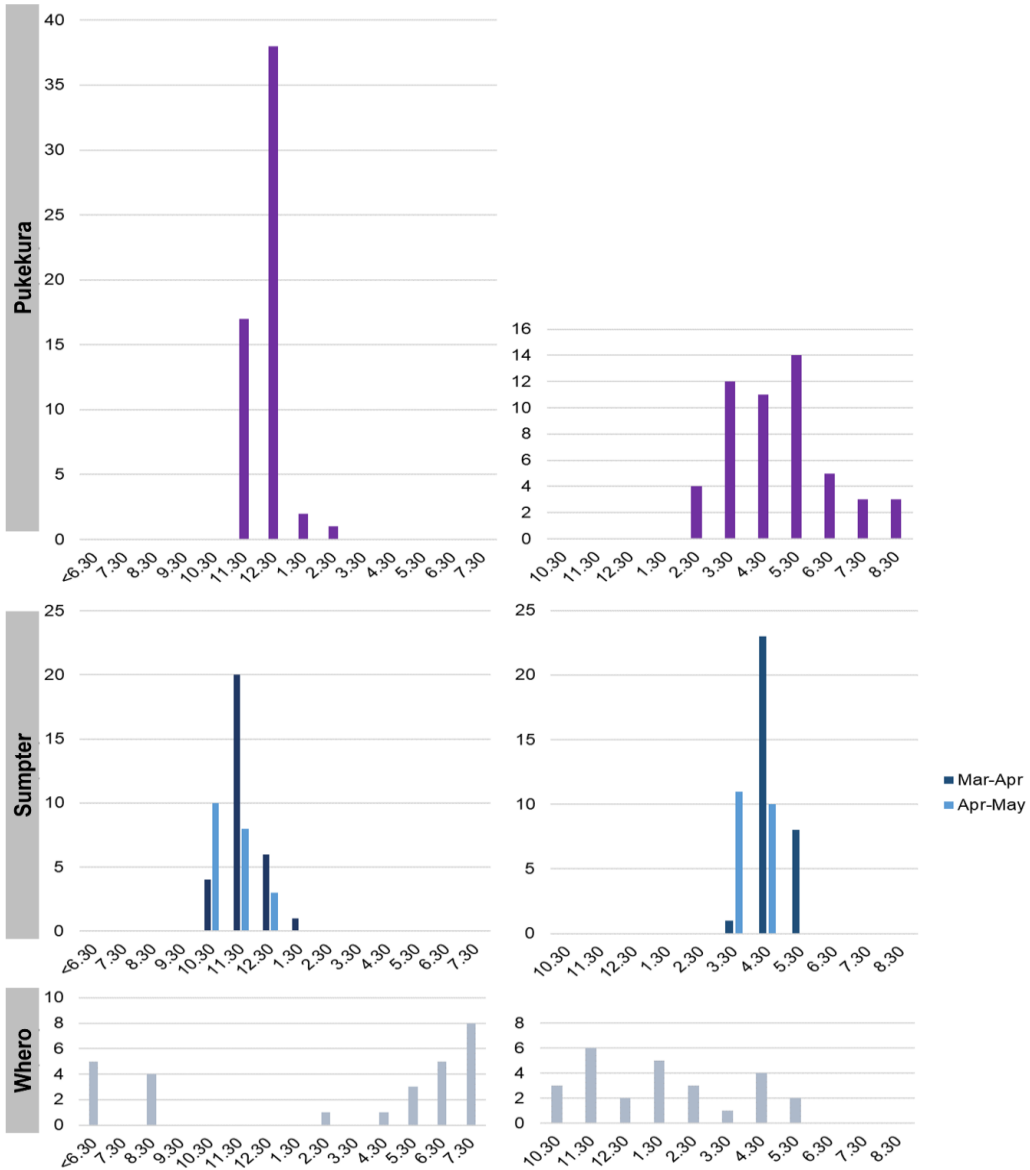


ENDURO

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Colony attendance



Arrivals

Departures





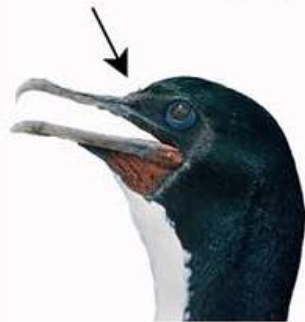
Pied morph ○



Bronze morph ●

Scattered papillae ●

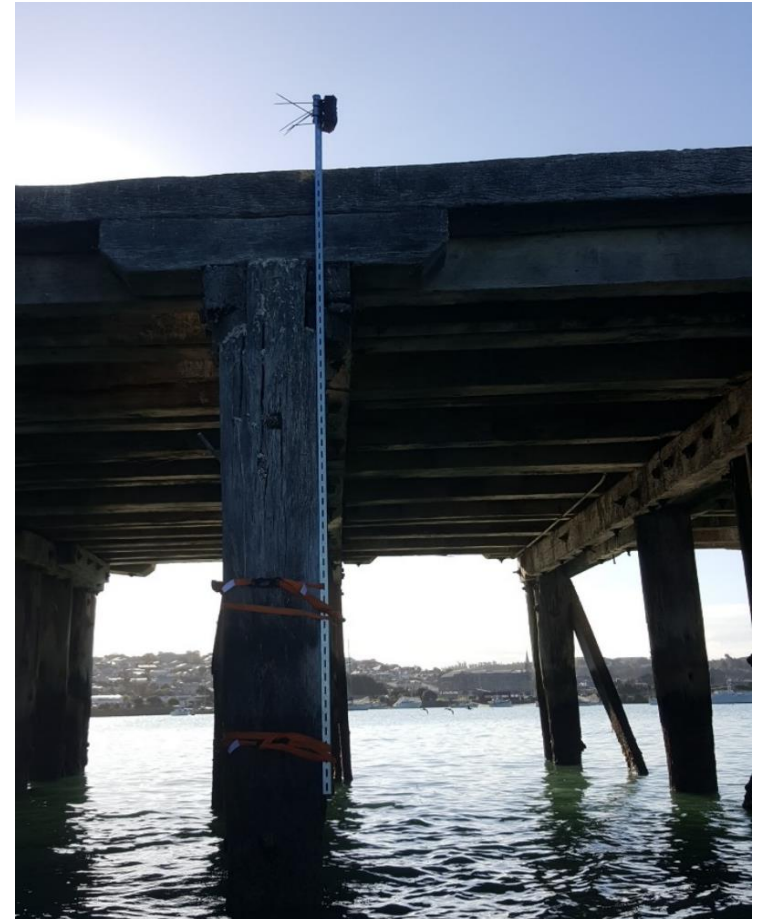
Small caruncles ●



From: Rawlence et al. 2014



Left in place for nest survival data

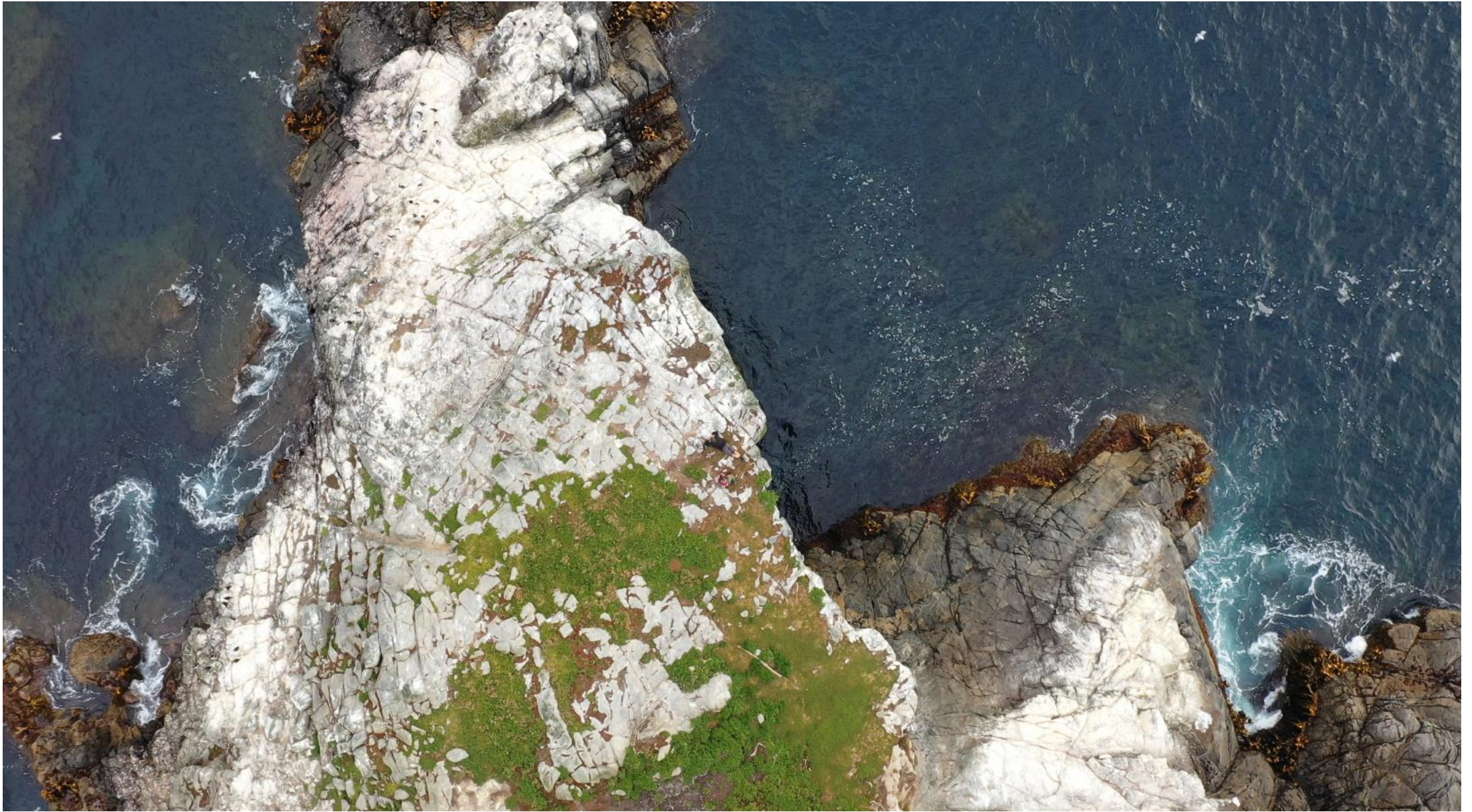


Drone use







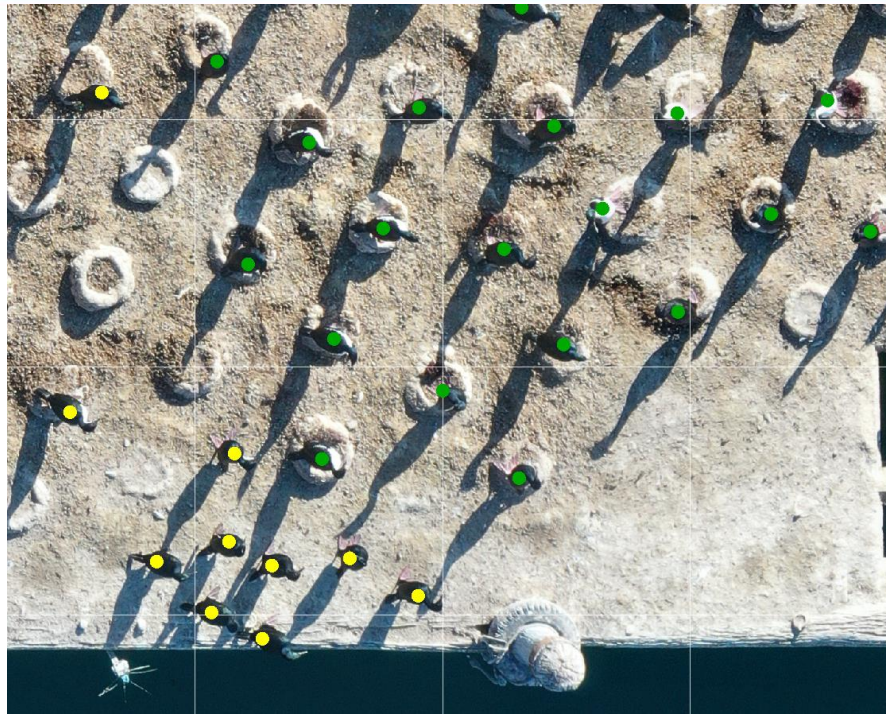
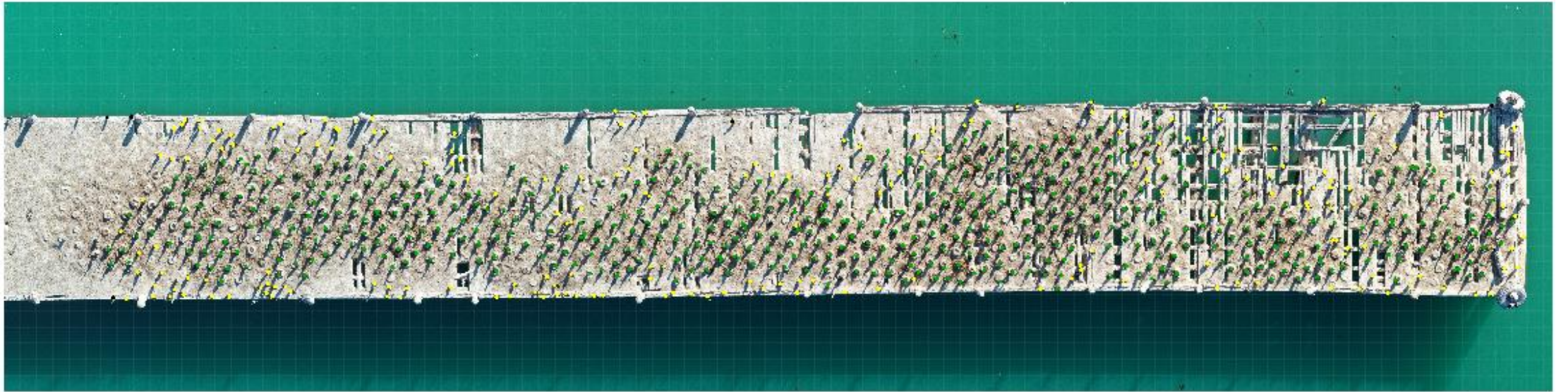












Site	Flight	Time	Flight altitude	Animal responses
Whero Rock, Rakiura	1	09:46 to 09:52	50 m dropping in 10 m steps to 30 metres	Red gulls took flight, returned in 10 seconds. Foveaux shags alert, heads cocked at first when drone at 50 m, then returned to preening behaviours. All birds remained in relaxed postures and many preening for the remainder of flight.
	2	09:54 to 09:56	20 m	Red gulls took flight, returned in 10 sec. Foveaux shags no obvious reaction to drone. Remained in relaxed postures and many preening for the duration of the flight.
Kanetetoe Island, Rakiura	1	10:59 to 11:09	50 m dropping in 10 m steps to 20 m above shags	Foveaux shags alert, heads cocked at first when drone approached from seaward and one Foveaux shag departed. At 50 m flight height shag posture relaxed, with change in postures at 40 m flight altitude. At 30 m flight altitude approximately 75% of Foveaux shags displayed alert postures with heads cocked skyward, but relaxed again. A single spotted shag was present and displayed alert and nervous behaviours. At 20 m height above shags, shuffling and looking then relaxed, no further response to the drone.



Flight	Time	Flight altitude	Animal responses
1	15:35 to	10–30 m asl	All red billed gulls took flight, landed after 10 seconds.
	15:38	~ 20 m from wharf edge, 20m altitude	Otago and spotted shags displayed alert postures with heads cocked and looking skyward, moved to wharf edge. Red billed gulls took flight again, landed after 10 sec.
2	15:41 to	50 m above wharf	Otago and spotted shags heads cocked and approximately a quarter of shags looking skyward. Shags stayed on the wharf edge where they were positioned after flight one.
	15:43		Bird postures appear relaxed, but birds stayed.
3	15:44 to	30 m above wharf	All red billed gulls took flight, landed after 10 sec.
	15:48		Otago and spotted shags heads cocked and approximately a quarter of shags looking skyward. Shags stayed on the wharf edge where they were positioned after flights one and two.
4	15:49 to	20 m above wharf	All red billed gulls and five Otago shags took flight, all landed after 10 seconds. Red billed gulls took flight again, landed after 10 sec.
	15:57		One Otago shag returned to centre of wharf.
5	15:59 to	15 m above wharf	Otago shags moving about, appear agitated and about to take flight.
	16:08		Flight abandoned due to behaviours displayed. Spotted shags alert but not moving.



Conclusions

- 26 breeding sites identified to determine population size of Otago and Foveaux shags
- Trail cameras during non-breeding: clear diurnal colony attendance; not able to determine intermixing, should provide nest survival rates for correction of population size estimates
- Animal response trials showed that drones can be flown slowly over Otago and Foveaux shags as low as 20 m without notable disturbance
- Drone footage from 20 m flight height is of excellent quality for counting shag numbers in colonies
- Counts of apparently nesting shags from photographs must be calibrated to account for non-nesting birds



Acknowledgements

- Accesss to Sumpter Wharf, Oamaru, Mathew Scott at Waitaki District Council
- Kevin Carter, Phred Dobbins and Alasdair Burns (Rakiura DOC); Matt Jones Rakiura water taxi
- Marine Science Otago University for use of Rakiura Field Station
- Pukekura Co-management Trust, Jim Watts and the DOC Taiaroa team
- Expert consultation:
 - Phillipa Agnew, Mike Bell, Ros Cole, Phred Dobbins, Graeme Loh, Martyn Kennedy, Sandy King, Pete McClelland, Bruce McKinlay, Neil Robertson
- Karen Middlemiss (DOC CSP)

