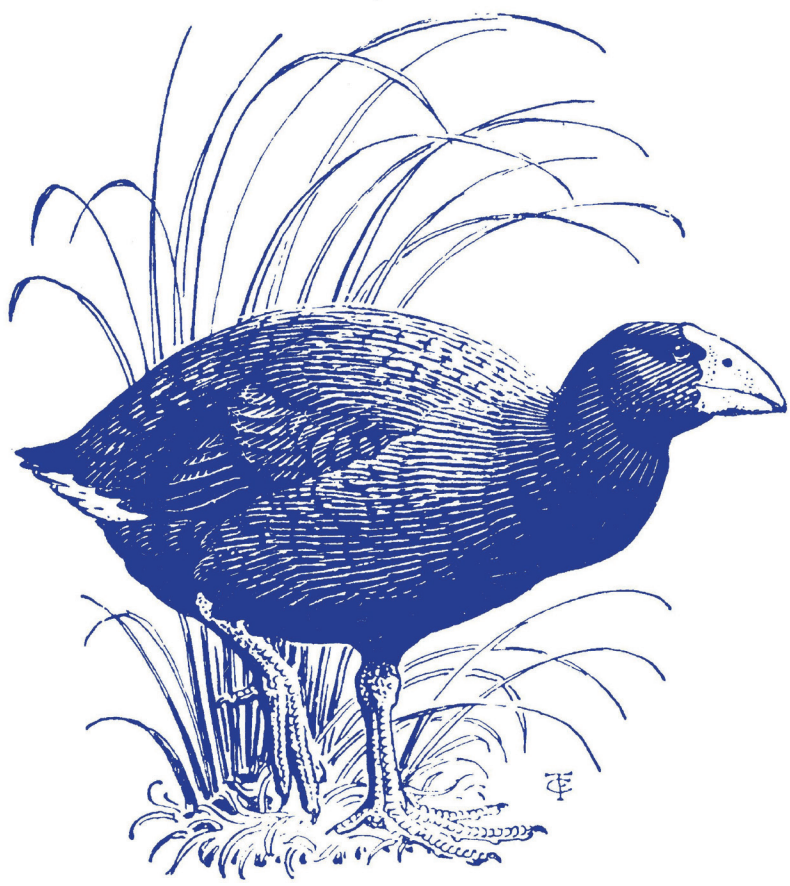
NOTORNIS

Ornithology of the Southern Pacific



ISSN 0029-4470

Volume 70 Part 2
June 2023
Journal of the Ornithological Society of New Zealand

NOTORNIS

Scope *Notornis* is published quarterly by the Ornithological Society of New Zealand Inc. The journal publishes original papers and short notes on all aspects of field or laboratory ornithology, and reviews of ornithological books and literature, student research, and reports of specialist ornithological events. *Notornis* concentrates on the birds of the ocean and lands of the Southern Pacific, with special emphasis on the New Zealand region. It seeks to serve professional, amateur and student ornithologists alike, and to foster the study, knowledge and enjoyment of birds.

Editor: CRAIG T. SYMES

Assistant Editor: JAMES SAVAGE & ZOHARA RAFI

Submission of manuscripts Manuscripts submitted for consideration for publication in *Notornis* should be prepared in accordance with the Instructions to Authors obtainable from the web page *http://osnz.org.nz* (abbreviated instructions are on the inside back cover of each issue). Submissions may be sent by email to The Managing Editor, *Notornis*, E-mail: *Notornis.Editor@gmail.com*

The Ornithological Society of New Zealand Inc. exists to create a nation-wide study group with individual members or groups working on different aspects of ornithology as suits their interests or circumstances and all contributing to the sum of ornithological knowledge. This aim cannot be achieved in a day or a decade but each year brings a variety of new accomplishments and insights into the biology of birds.

President: BRUCE McKINLAY

Secretary: LYNNE ANDERSON

The objects of the Society are:

- To encourage, organise and promote the study of birds and their habitat use particularly within the New Zealand region.
- To foster and support the wider knowledge and enjoyment of birds generally.
- To promote the recording and wide circulation of the results of bird studies and observations.
- To produce a journal and any other publication containing matters of ornithological interest.
- To effect co-operation and exchange of information with other organisations having similar aims and objects.
- To assist the conservation and management of birds by providing information, from which sound management decisions can be derived.
- To maintain a library of ornithological literature for the use of members and to promote a wider knowledge of birds.
- To promote the archiving of observations, studies and records of birds particularly in the New Zealand region.
- To carry out any other activity which is capable of being conveniently carried out in connection with the above objects, or which directly or indirectly advances those objects or any of them.

Notornis, Vol. 4, No. 1 (July 1950) (ISSN 0029-4470)
In continuation of Reports and Bulletins (1939-1942) and New Zealand Bird Notes (1942-1950)

Vol. 70, No.2 (June 2023) (Published June 2023)

Full details of the **Ornithological Society of New Zealand** can be obtained from the Secretary, PO Box 834, Nelson 7040, New Zealand, New Zealand or from the Society web page at *https://www.birdsnz.org.nz*
Notornis is on-line at *https://www.notornis.osnz.org.nz/publications*

NOTORNIS

Journal of the
Ornithological Society of New Zealand

Volume 70 Part 2 June 2023

Notornis, Vol. 1, No. 1 (July 1950) (ISSN 0029-4470)

In continuation of Reports and Bulletins (1939-1942) and New Zealand Bird Notes (1942-1950)

Vol. 70, Part 2 (June 2023) (Published June 2023)

Editor: CRAIG T. SYMES
Assistant Editor: JAMES SAVAGE & ZOHARA RAFI

The Ornithological Society of New Zealand, Inc. exists to create a nation-wide study group with individual members or groups working on different aspects of ornithology as suits their interests or circumstances and all contributing to the sum of ornithological knowledge. This aim cannot be achieved in a day or a decade but each year brings a variety of new accomplishments and insights into the biology of birds.

The aims and objectives of the Society are:

- To encourage, organise and promote the study of birds and their habitat use particularly within the New Zealand region.
- To foster and support the wider knowledge and enjoyment of birds generally.
- To promote the recording and wide circulation of the results of bird studies and observations.
- To produce a journal and any other publication containing matters of ornithological interest.
- To effect co-operation and exchange of information with other organisations having similar aims and objects.
- To assist the conservation and management of birds by providing information, from which sound management decisions can be derived.
- To maintain a library of ornithological literature for the use of members and to promote a wider knowledge of birds.
- To promote the archiving of observations, studies and records of birds particularly in the New Zealand region.
- To carry out any other activity which is capable of being conveniently carried out in connection with the above objects, or which directly or indirectly advances those objects or any of them.

Notornis, 2023, Vol. 70: 49-59
0029-4470 © The Ornithological Society of New Zealand Inc.

Identifying northern Buller´s albatross (*Thalassarche bulleri* subsp.) in offshore waters of southern Perú

JAVIER QUIÑONES
Oficina de Investigaciones en Depredadores Superiores, Instituto del Mar del Perú, Callao, Perú

CARLOS ZAVALAGA
Unidad de Investigación de Ecosistemas Marinos-Grupo de Aves Marinas,
Universidad Científica del Sur, Lima, Perú

CHRISTOPHER J.R. ROBERTSON*
PO Box 12397, Wellington, New Zealand

Abstract: The current Buller's albatross taxa (*Thalassarche bulleri bulleri* [southern] and *T. b. platei* [northern]) engage in transpacific migrations from breeding sites on New Zealand offshore islands to non-breeding areas in the south-eastern Pacific Ocean. Both taxa are identifiable from a combination of plumage colour features in the head and bill that are easy to detect at short distance (<15 m). There is also breeding allopatry between the taxa, with the onset of breeding 2.5 months earlier in the 'northern taxon'. In this study, close-range sightings and captures of lured Buller´s albatross individuals off southern Perú were carried out during two pelagic trips in May–July 2021 onboard a small-scale longline fishery wooden boat (12 m long), during their normal operations when targeting sharks. We report on the presence of 41 Buller´s albatross, of which 40 were recognized as 'northern taxon' and one as 'southern taxon'. The great majority of the 'northern taxon' were adults (92.5%), with the remaining identified as sub-adults (7.5%). Birds were sighted between 126 and 223 km offshore west-south-west from the port of Ilo, Perú (17°38.64´S, 71°20.77´W). Birds sighted were preferentially in oceanic areas above the abyssal plain (68% of sightings), with a mean depth of 4,537 m, demonstrating that the 'northern taxon' is a truly oceanic species. No birds were observed by us over the continental shelf. Discrimination of 'northern taxon' from 'southern taxon' is possible from a combination of the plumage colour features in the head and bill. However, identification and comparison of photographs for both taxa taken at sea can be problematic, due to varying light conditions, unless the birds can be drawn close to the photographer using attractants, such as offal discards.

Quiñones, J.; Zavalaga, C.; Robertson, C.J.R. 2023. Identifying northern Buller´s albatross (*Thalassarche bulleri* subsp.) in offshore waters of southern Perú. *Notornis 70(2)*: 49–59.

Keywords: Buller's albatross, *Thalassarche bulleri*, *Thalassarche platei*, migration, morphology, non-breeding, Perú, Humboldt current, Chatham Islands, The Snares

INTRODUCTION

The coastal and pelagic sea off western South America is the preferred habitat for four medium/small New Zealand breeding albatrosses (mollymawks) for much of their juvenile, adolescent, and adult non-breeding stages of their life cycle (Robertson 1985; Robertson & Gales 1998; Robertson *et al*. 2003a; Checklist Committee 2022). The largest is Salvin's albatross (*Thalassarche*

Received 21 March 2022; accepted 3 February 2023
*Correspondence: *cjrr@wildpress.org*

salvini), breeding at the Bounty Islands and The Snares (Sagar *et al*. 2011, 2015), and the Chatham albatross (*Thalassarche eremita*) confined to The Pyramid in the southern Chatham Islands group (Robertson 1991; Robertson *et al*. 2003b). The two smaller albatrosses – northern and southern Buller's albatross – are currently classified as sub-species (ACAP 2010; del Hoyo & Collar 2014), but recent genetic studies (Wold *et al.* 2018, 2021) indicate a valid specific separation. Southern Buller's albatross (*Thalassarche bulleri bulleri*) breed at The Snares (48°01′S, 166°36′E) (Sagar & Warham 1998; Sagar 2014) and Solander Island (46°56′S, 166°85′E) (Thompson *et al.* 2017), while northern Buller's albatross are found in the Chatham Island group at the Sisters islands [Rangitatahi] (43°56′S, 176°81′W) and The Forty-Fours [Motuhara, Bertier Rock] (43°44′S, 175°50′W) (Robertson 1991; Robertson & Sawyer 1994; Robertson 1998; Bell *et al*. 2018), with a further small colony at Rosemary Rock in The Three Kings Islands [Manawatāwhi] (34°17′S, 172°09′E), close to the northern tip of the North Island (Frost *et al*. 2018).

The few published South American at-sea sightings (Spear *et al.* 2003; Spear & Ainley 2008; Quiñones *et al*. 2021) all refer to Buller's albatross without noting subspecies. Museum specimens for northern Buller's albatross from Peruvian locations are also few. Those published records do not provide sufficiently precise identification of observations at sea to determine a timetable of when the two Buller's albatross subspecies are present in western South American waters. However, Deppe (2012) used GLS trackers on northern Buller's albatross breeding adults from The Forty-Fours to show that they reach Chilean and Peruvian waters from March–July and depart August–October. The BirdLife International Seabird Tracking Database contains a dataset (# 636) of non-breeding southern Buller's albatross tracked with GLS loggers, and Roberts *et al*. (2022) using those records show them reaching Peruvian waters from August to September.

There are marked differences in the breeding cycles of the Buller's albatross taxa. In southern Buller's albatross, breeding birds return to The Snares and Solander islands from mid-December onwards with an extended egg-laying period from the end of December through to the end of February. Peak laying is from 21–26 January (Sagar & Warham 1998). Fledging of chicks occurs from 22 August to 23 October (Sagar & Warham 1998). The cycle of northern Buller's albatross is less well documented, but pre-breeding birds return to their colonies from early September, and egg-laying from 27 October to 23 November with a peak at 10–11 November (CJRR *pers. obs.*). Fledging of chicks occurs from late May to early July (Robertson 1991; Robertson & Nunn 1998; CJRR *pers. obs.*), suggesting that an approximately 2.5-month gap separates the breeding activities of the two taxa.

Both taxa have well-documented interactions with fisheries in New Zealand waters, with captures throughout the fishing year peaking from April to June. Two banded birds, one from each taxon, have been recovered close to western South American waters: M-19006 banded as a 'southern taxon' chick at The Snares on 6 August 1972 was captured on a longline on 11 October 1979 at 12°23′S, 105°06′W (Warham 1982), and M-33196 banded by CJRR on 30 October 1973 as a 'northern taxon' adult at the Middle Sister Island was caught in January 2007 on a longline by an artisanal fisher targeting mahi-mahi (*Coryphaena hippurus*) at 13°S, 80°W, in oceanic waters 180 nautical miles (333 km) off the coast from the port of Callao near Lima.

The American Museum of Natural History (AMNH) has two important groups of specimen skins for the 'northern taxon'. The first group was obtained by Rollo Beck from the Brewster-Sanford expedition in 1913–1914. Two birds (AMNH 445390[M] and 445391[F]) were collected on 26 June 1913 some 20 miles west of Cañete, Perú (13°S, 78°W). The female bird had previously bred, and showed signs of moult in the head plumage, while the tail has a mix of old and new feathers. The wing tips of both birds were very worn. The male bird had small testes. A third bird AMNH 445392 (male, with small testes) was collected off Valparaiso, Chile on 9 March 1914. This bird is illustrated in Murphy (1936, p493) and shows the narrow yellow stripe on the lower mandible often cited as typical of the 'northern taxon' and the squared base of the culmen plate often present in 'northern taxon' males in specimen skins from the Chatham Island colonies (CJRR *pers. obs.*). Beck, subsequently with the Whitney South Sea Expedition, collected a large group of the 'northern taxon' at the Chatham Islands, mainly about The Forty-Fours on 8 March 1926 (12 specimens held at the AMNH).

A fourth specimen from the western South American coast is the type specimen of *Thalassarche platei* (Reichenow 1898; Godman 1907–10; Jouanin & Mougin 1979), (specimen # 47-77) held at the Museum fur Naturkunde in Berlin. The specimen was collected 13 July 1893 at Cavancha in Iquique, Chile (20°14'S). CJRR has viewed the specimen and agrees with Murphy (1936), J. Warham, and W.R.P. Bourne (*in litt.* to CJRR) in their various assessments that the bird was a typical young of *T. b. bulleri.* Warham and Bourne were able to compare the *platei* specimen with a specimen of a fledgling from the Chatham Islands sent to Berlin by the Museum of New Zealand for comparison. The *platei* type specimen shows overall pale head plumage and a smaller bill depth at base of the culmen than northern juveniles. These features suggest that it is not a recent northern Buller's albatross fledgling but was a southern Buller's albatross fledgling probably

half-way through its first year, with no obvious body moult, but having worn wing tips.

CJRR has undertaken field studies and collected voucher specimens of both taxa at their breeding sites and has studied specimen skins in 20 museums internationally. Both taxa are morphologically close, both in measurements and plumage. The identification from photographs in the field can be bedevilled by varying light conditions and in New Zealand waters they are rarely observed in concurrent feeding zones. Field guides for oceanic birds (Onley & Scofield 2006; Shirihai 2008; Howell 2009; Scofield & Stephenson 2013; Howell & Zufelt 2019; Harrison *et al.* 2021) all illustrate the 'northern taxon' with varying levels of detail and accuracy, using adult plumage identifications based on birds about New Zealand during the breeding season, and not during the non-breeding season offshore. Studies of DNA tested bycatch samples indicated that the width of the yellow stripe in both taxa is variable and overlapping between taxa and sexes (CJRR *pers. obs.*). An adult 'northern taxon' has a distinctively dark grey/brown head and neck, similar in tone to that seen in the Chatham albatross (*T. eremita*). The adult 'southern taxon' head and neck is paler, like the head and neck tones of Salvin's albatross (*T. salvini*). A practical example of Gloger's Rule, where plumages darken in similar taxa closest to the equator.

A close examination of head plumage in

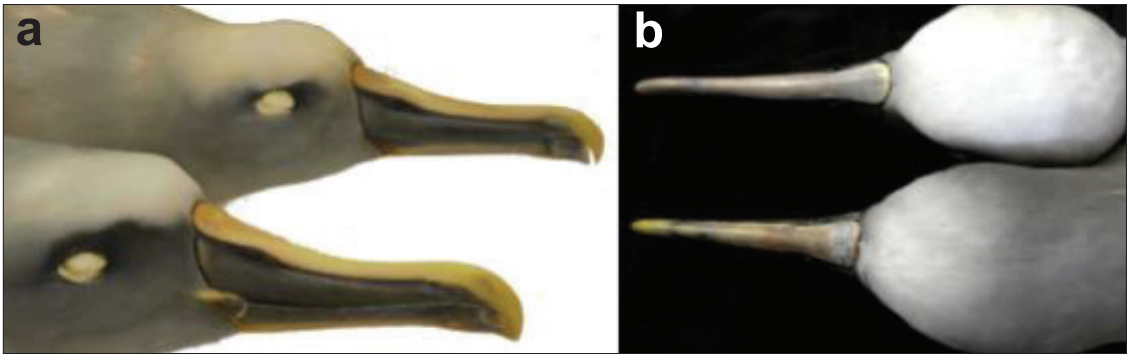


Figure 1. **(a)** Heads of Buller's ssp. albatross collected during the respective breeding seasons. TOP. A southern Buller's albatross from North-East Island, The Snares (48°01'S, 166°36'E) (MONZ 18632 F. 28/07/1975). Actual culmen length 117 mm. Length distorted by photograph depth of view and angle. BOTTOM. A northern Buller's albatross from Middle Sister Island (43°56'S, 176°81'W) (MONZ 18635 F. 18/11/1974). The principal distinguishing feature here is the extensive dark patch forward of the eye/lores, usually reaching the base of the bill in the northern bird. Actual culmen length 120 mm. **(b)** Heads of representative museum skins, not those featured in (a), indicating the differing extent of white plumage in the forehead and crown/nape of each Buller's albatross taxon. Top = 'southern', bottom = 'northern'. (Photographs: C.J.R. Robertson).

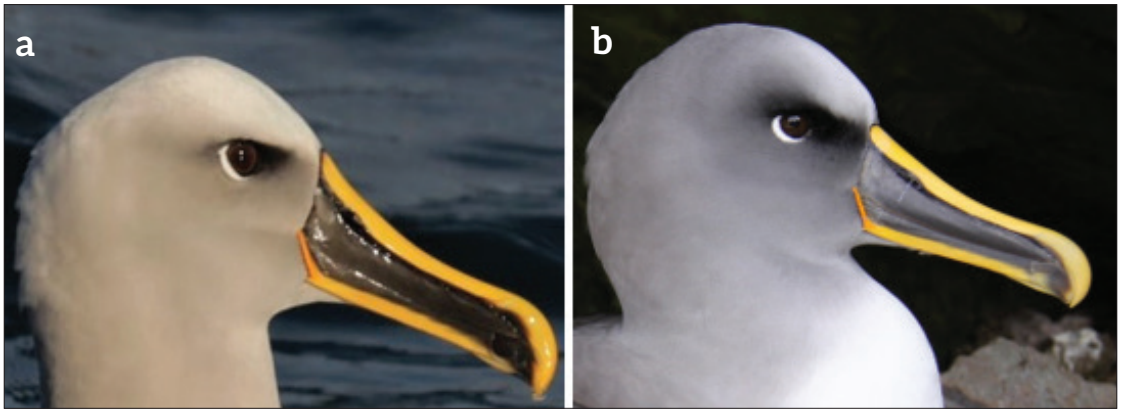


Figure 2. (a) Head view of a southern Buller's albatross, at sea in July (near Taiaroa Head, Dunedin) showing the extensive pale cap reaching to the hind neck and pale grey head and neck plumage. The limited eye patch does not reach the base of the bill. (Photograph: M. Szabo). **(b)**. Head of a northern Buller's albatross on The Forty-Fours breeding colony (Chatham Islands), showing the limited pale cap and overall dark head plumage for this taxon, and the clearly distinguishing dark eyebrow/lores patch. (Photograph: M. Fraser).

museum skins allows a consistent identification of both taxa from birds collected at breeding colonies. The 'southern taxon' (Figs. 1 & 2) has a much paler general grey/brown head and neck plumage (like that found in *T. salvini*), with the pale forehead/crown extending to the back of the head and nape. The eyebrow/lores dark patch is small and rarely extends to the base of the bill but is occasionally darker in fresh breeding plumage.

In the 'northern taxon' (Figs. 1 & 2) the pale silvery cap is restricted to the front part of the forehead/crown and changes to the dark grey of the head and neck beyond the back of the eye (similar in tone to that seen in *T. eremita*). The sooty black eyebrow extends forward of the eye to the base of the bill, while the area below the front part of the eye (the lores) is similarly dark, and when combined with the dark head plumage produces a frowning appearance. The yellow stripe along the lower mandible is generally narrower in 'northern taxon' birds with a trend towards further narrowing of the stripe towards the tip of the bill. The combination of dark head colour, restricted pale crown, extended dark eyebrow/cheek/lores, and occasionally narrow yellow bill stripe give a good guide to this taxon in adult plumage.

The discrimination of the two Buller´s albatross taxa using the external features described above is challenging during conventional vessel surveys at sea, as birds are usually sighted at some distance from the observer. Further, when both taxa are on the South American coast, their non-breeding plumages (often modified by moult) are imperfectly known, or have been described from birds of known origin during the breeding season in New Zealand waters. This study of closely observed and handled birds at sea, addresses the distinguishing diagnostic mix of plumage and behavioural features of the northern Buller's albatross upon their arrival at non-breeding locations in Perú.

METHODS

These observations were a by-product of the principal study to evaluate the interactions between small-scale long-line fisheries and Chatham albatross (*T. eremita*) in their wintering grounds. Sightings and captures of Buller's albatrosses were undertaken during two pelagic trips from 29 May – 6 June 2021 and 1–9 July 2021 onboard a small-scale longline fishery (SSF) wooden boat (12 m long) during their normal operations targeting Blue sharks (*Prionace glauca*) and Mako sharks (*Isurus oxyrhynchus*). A close approach to the birds (2–10 m) allowed the capture of high-resolution pictures and to unequivocally identify northern Buller´s albatross based on plumage and bill colour features, recorded during their wintering non-breeding cycle. We departed from the port of Ilo (17°38.64´S, 71°20.77´W), heading to the south-west in May–June and July out to 180–250 km offshore (Fig. 3).

Bird captures were conducted as part of other field work to apply GPS-satellite transmitters. The permit to undertake this research was issued by Servicio Nacional Forestal y de Fauna Silvestre – SERFOR (Resolución de Dirección General No. D000381-2021-MIDAGRI-SERFOR-DGGSPFFS. Código de Autorización No AUT-IFS-2021-045). Ethical considerations for capturing and handling albatrosses were reviewed by Universidad Científica del Sur and approved by a certificate No. 082-CIEI-AB-CIENTIFICA 2021.

Luring birds

For both sightings and captures, we used 'chumming' (discharging of fish offal bits) to lure birds close to the boat. Once sharks were captured and butchered onboard by fishermen, intestines and liver were stored to be used as 'chum' bait. Usually, the boat was stopped near groups of flying birds (petrels and albatrosses) in daylight. When white-chinned petrels (*Procellaria aequinoctialis*) and south polar skuas (*Catharacta maccormicii*) were sighted, we threw shark intestines to create feeding frenzies where birds fought for food and 'shouted aggressively' during antagonistic encounters. The petrel and skua behaviour attracted first black-browed albatrosses (*T. melanophris*) and then Buller´s albatross (*T. bulleri* ssp.). When the Buller´s albatrosses were at close range, we threw the shark liver close to the boat to attract them closer (Bugoni *et al.* 2008). The liver attracted birds more effectively than the intestines.

Sightings

Close-proximity sightings were made possible by throwing shark offal overboard at fixed points along random time intervals of 0.75–1.5 hours. When birds approached, we recorded the species, number of individuals per species, and behaviour. Close-range photographs (2–10 m from the boat) were taken of Buller's albatrosses from different angles to record the plumage-colouring features of the crown, head, and nape, as well as the patterns of bill colouring. A Canon Powershot SX70HS camera, with 70X optical zoom was used for all field photographs. All individuals were photographed on multiple occasions and at different angles and at short distances to record all their specified plumage characteristics.

Captures

We used 'chumming' to attract birds, and once in range, captures were made using either a dip-net,

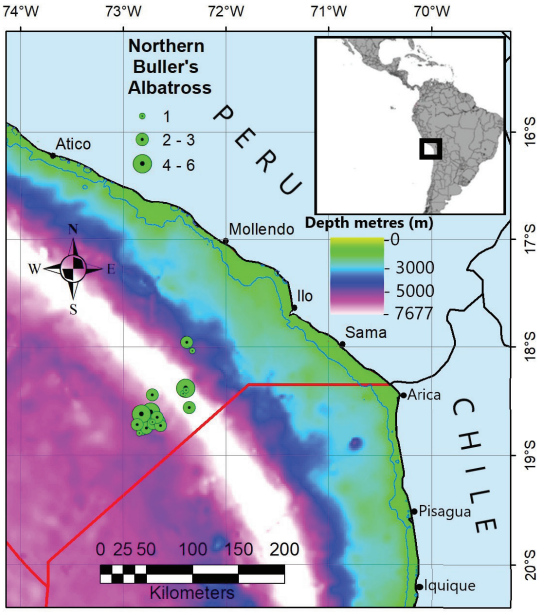


Figure 3. Geographical distribution of our northern Buller's albatross observations in southern Perú. The fine blue line (following the coastline) represents the 200 m isobath where the shelf breaks. The bold black line is the country boundary. The bold red line represents the oceanic national limits, that extends up to 370 km offshore.

or rapidly throwing a modified hoop-net (Ronconi *et al.* 2010). The dip-net on a 4-m pole had a lightweight aluminium 75 cm diameter ring with a sardine net (36 mm mesh) attached to the perimeter. The modified hoop-net was made of a 1.8 m diameter lightweight wire circular hoop lined with a plastic hose, with sardine netting (36 mm mesh) attached to the perimeter.

Habitat

The habitat classification used was an adaptation of Wakefield *et al*. (2011) for the specific bathymetric zones off the Peruvian coast. We characterized the habitat used by albatrosses according to ocean depth: continental shelf (0–200 m isobath), continental slope (201–4,500 m), Perú-Chile Trench (>4,500 m), and the Abyssal plain (offshore, beyond the Perú-Chile Trench).

RESULTS

We recorded a total of 41 individuals of Buller´s albatross ssp., of which 40 corresponded to the 'northern taxon' based on the colouration characteristics described in the introduction above. Only one individual had plumage characteristics suggestive of the 'southern taxon' (Fig. 4a). Of the 41 identified birds, five were captured to attach the satellite transmitters, all of the northern taxon.

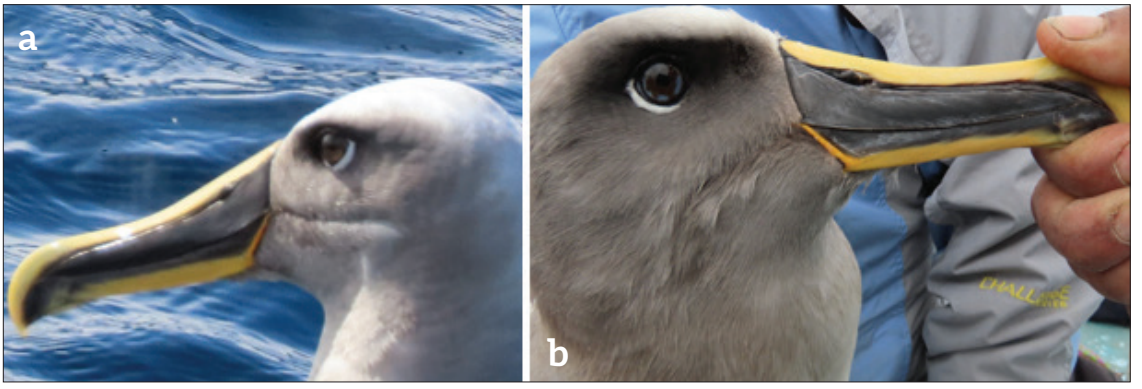


Figure 4 (a). A probable 'southern taxon' with noticeably paler head and small eye patch and pale lores. Note broad yellow stripe on lower mandible, (18°26'S, 72°23'W) recorded on 8 July 2021. (Photograph: J. Quiñones). **(b).** A close-up view of the head characters of a 'northern taxon' bird in the hand matching the description given in the introduction. A northern Buller's albatross in the hand (18°36.32'S, 72°43.63'W) on 31 May 2021 (Photograph: J. Quiñones).

The great majority of the 'northern taxon' were adults (92.5%, n=37). We recorded only three sub-adults (7.5%), all showing a well-developed pale forehead/crown and dark head and neck plumage (Fig. 6b). None were as pale as birds on the breeding islands at fledging (CJRR *pers. obs.*). Most birds presented with some obviously worn body feathers and a moulting mixture of old and new feathers. Figures 5 & 6 show examples of new and old feathers in tail, back and most parts of the upper wing. From the five captured northern Buller's albatross the mean measures were as follows:

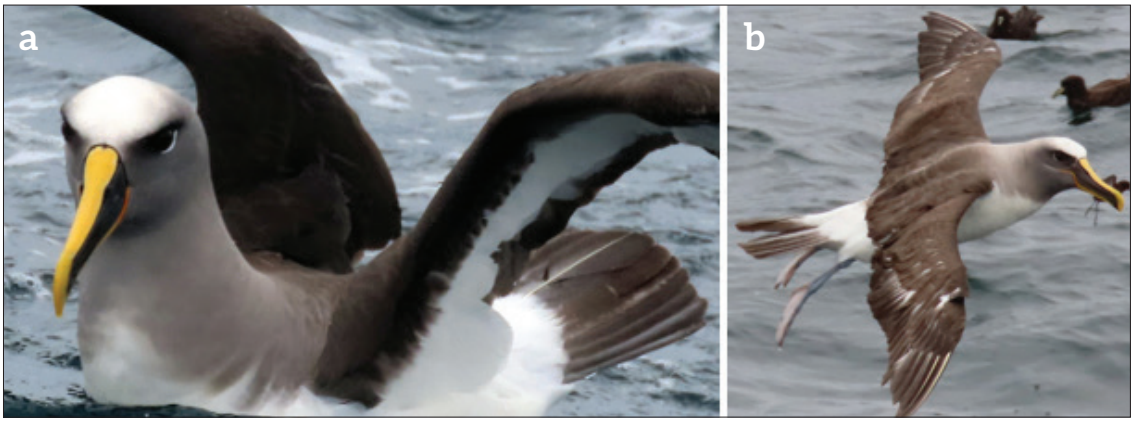


Figure 5 (a). A northern Buller's albatross (18°45.541'S, 72°48.839'W), recorded 1 June 2021 (Photograph: J. Quiñones). This illustrates an adult 'northern taxon' showing the distinctive pale forehead/crown, dark head, and neck, and showing moult with a mix of old and new feathers in the tail, and layers of old feathers in the back. **(b).** A northern Buller's albatross with extensive wing moult, restricted pale cap, and dark eye patch/lores. (18°25.175'S, 72°42.188'W) recorded on 31 May 2021 (Photograph: J. Quiñones).

Figure 6 (a). A northern Buller's albatross (centre) and Chatham albatross (right) showing closely related dark grey head and neck plumages (except crown) (18°36'S, 72°48'W) 31 May 2021. The bird on the extreme left is showing extensive nape, back and wing moult of a northern Buller's albatross, typical of an end of season breeder (Photograph: J. Quiñones). **(b).** Buller's albatross ssp. sub-adult. Probable 'northern taxon' based on darkness of head and neck plumage and eye patch, plus small pale forehead/cap. (18°23.013'S, 72°23.400'W) 8 July 2021. This is not a plumage recorded at the breeding grounds for the 'northern taxon' (Photograph: J. Quiñones).

culmen length 123.1 ± 3.5 mm, wing-chord length 97.5 ± 4.6 cm, and body weight 3.02 ± 0.14 kg.

Our observations occurred between 30 May and 7 July 2021, coinciding with the late autumn and early winter seasons. The number of 'northern taxon' sightings per day ranged from 1–6 over oceanic areas (>120 km offshore). This timing matched the nonbreeding distribution of 15 breeding birds (on eggs in December 2007) that were tracked with GLS loggers (Fig. 7) from The Forty-Fours within the Chatham Islands group. L. Deppe provided us with general data on these 15 birds. Seven birds (failed breeders) departed from The Forty-Fours from late February to late April and averaged 25 (8 to 57) days to reach the Humboldt current. Eight successful breeders departed from mid-May to early July and averaged 11 (7–20) days to reach their destination. Arrival and occupation latitudes averaged 26–30°S (March to May), moving north to <20°S during June and July. Departure from the Humboldt current occurred from August to October centred on 28°S.

During our observations, most of the 'northern taxon' birds (28, 70%) occurred offshore in the ocean above the abyssal plain, in areas with a depth range from 4,057 to 4,972 m. Ten other birds (24% of the total), including the 'southern taxon' individual, were recorded over the Perú–Chile trench where the mean depth of the ocean was around 6,300 m (rounded to the nearest 100 m). Only three birds, all 'northern taxon' individuals, were observed over the continental slope, in waters with a mean depth of only 3,200 m. No birds were observed over the continental shelf. The mean distance from shore

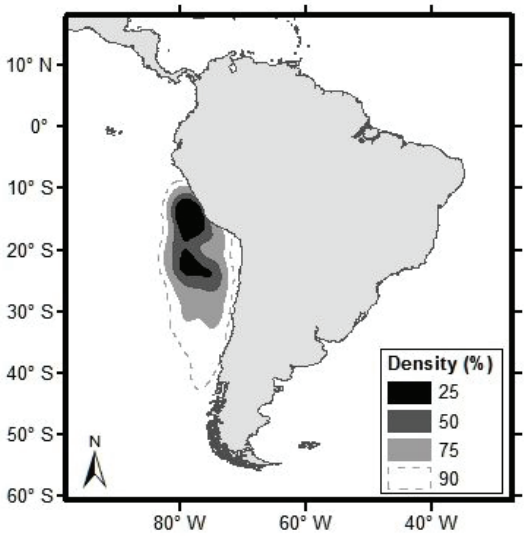


Figure 7. Non-breeding kernel density estimates of northern Buller's albatross distribution. Derived during 2008 from 15 GLS loggers deployed on breeding birds incubating eggs at The Forty-Fours in December 2007. Seven birds arrived March–April (probable failed breeders), eight birds May–July. Birds departed August to October. (Published with permission from Deppe [2012]).

of these sighting locations was 184 ± 32 km (range: 126–223 km, n=18) (Table 1).

Behaviour:
During fishing activities, we observed that discarded shark offal triggered different scavenging behaviours depending on the type of discard. With intestines, white-chinned petrels (*Procellaria aequinoctialis*) were the first to approach and after 'shouting' high-pitch vocalizations, black-browed albatross (*Thalassarche melanophris*) cautiously approached. With shark liver, the approach of the birds was much more intense, and fights were generated between these two species. The northern Buller's albatrosses arrived late, having to fight aggressively with black-browed albatrosses. The shark liver discards also catalysed the presence of Chatham albatrosses (*T. eremita*) and northern giant petrels (*Macronectes halli*), which displaced all other species to obtain food.

DISCUSSION

The northern Buller's albatross is a poorly documented small albatross with their main breeding sites in the Chatham Islands, east of New Zealand. Its taxonomic status is becoming

Table 1. Observed northern Buller's albatross (n=40). * Represents a probable southern Buller's albatross. DC = distance to coast.

Date	Lat. (S)	Long. (W)	Number	% Adults	DC (km)	Habitat	Depth (m)
30 May 2021	18°26′	72°43′	2	100	192	Perú-Chile Trench	5,502
31 May 2021	18°36′	72°44′	6	100	201	Abyssal Plain	4,972
01 June 2021	18°37′	72°49′	4	100	214	Abyssal Plain	4,540
01 June 2021	18°45′	72°48′	3	100	217	Abyssal Plain	4,068
02 June 2021	18°02′	72°19′	1	100	128	Cont. Slope	3,476
02 June 2021	17°57′	72°23′	2	100	126	Cont. Slope	3,102
03 July 2021	18°43′	72°52′	2	100	222	Abyssal Plain	4,173
03 July 2021	18°48′	72°50′	1	100	223	Abyssal Plain	4,057
04 July 2021	18°45′	72°46′	3	66	211	Abyssal Plain	4,107
04 July 2021	18°43′	72°42′	2	100	199	Abyssal Plain	4,453
05 July 2021	18°41′	72°39′	2	100	193	Abyssal Plain	4,784
05 July 2021	18°44′	72°38′	2	100	184	Abyssal Plain	4,714
06 July 2021	18°41′	72°43′	1	100	198	Abyssal Plain	4,466
06 July 2021	18°39′	72°40′	2	100	197	Abyssal Plain	4,878
07 July 2021	18°33′	72°21′	2	100	152	Perú-Chile Trench	6,309
08 July 2021	18°26′	72°23′	1*	100	154	Perú-Chile Trench	6,767
08 July 2021	18°24′	72°23′	1	100	149	Perú-Chile Trench	6,643
08 July 2021	18°23′	72°23′	4	50	150	Perú-Chile Trench	6,475

clearer following the genetic studies published by Wold *et al.* (2018, 2021). The current Buller's albatross taxa (*Thalassarche bulleri bulleri* [southern] and *T. b. platei* [northern]) have asynchronous breeding seasons with a gap of 2.5 months between the start of their respective breeding seasons. Limited trans-Pacific tracking studies for the 'northern taxon' (Deppe 2012) and 'southern taxon' (Roberts *et al.* 2022), and single band recoveries for each taxon in Peruvian waters, support the transpacific migration to non-breeding areas off South America over the Humboldt current, but have not previously provided morphological guidance for the identification of non-breeding adults when seen or photographed.

Both taxa are identifiable at, and around, their breeding islands in New Zealand waters, both in the hand as live adults, or as museum specimen skins. Identification is from a combination of the plumage colour features in the head and bill. Identification and comparison of photographs for both taxa taken at sea can be problematic, due to varying light conditions, unless the birds can be drawn close to the photographer using attractants.

The asynchronous breeding cycles of both taxa mean that there will be differing periods of peak attendance at non-breeding areas. Further, as little is known of the progress of moult in the non-breeding birds, observers need to assess whether this can frustrate identification. The study of photographic material in eBird for the Perú and Chile locations of adult birds, shows many examples of the pale-headed, small-eyebrowed 'southern' birds and few of the darker-headed, dark-eyebrowed/lores 'northern taxon' birds. The eBird Basic Dataset (2021) distribution of observations throughout the year (Fig. 8) is biased by not distinguishing between adult and sub-adult/juvenile birds but shows a heavy concentration in austral summer months. This is indicative of observations from short birdwatching excursions, or views from large cruise vessels transiting the coast, whose habitat coverage is generally <40 km close to shore.

The Deppe (2012) map of GLS kernel density estimate distributions (Fig. 7) show the 15 'northern taxon' birds remaining well offshore in pelagic waters west of 75°W longitude until reaching 25°S and then increasing in density northwards. The only area closer to shore was along the Peruvian coast between 18°to 10°S.

Our observations and photographs suggest that during the period of study, late May to early July, 'northern taxon' birds were prevalent. Viewing of 'southern taxon' birds with light heads (eBird – pictures for both New Zealand and South American locations) showed that the small eyebrow of the 'southern taxon' remained constant throughout all locations throughout the year. The 'northern taxon'

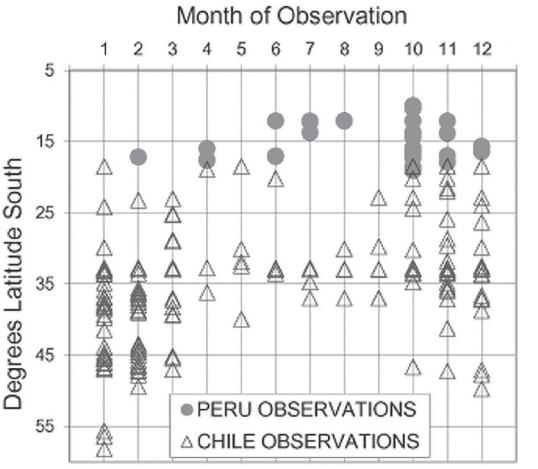


Figure 8. Monthly latitudinal distribution of eBird observation reports for Buller's albatross ssp. of unknown age, origin, and status, off the coasts of Chile and Perú (eBird Basic Dataset 2021). Country as recorded by observer in eBird. Perú n=66 records (1974–2019), Chile n=988 records (1990–2020).

birds retained the dark eyebrow/lores stripe even when birds were showing heavy head, wing, and body moult. The birds recorded during this study had a wide range of moult states, suggesting early arriving failed or non-breeders were followed progressively by breeding birds showing the most obviously moulting states in head, wing, tail, and body.

All our observations of these birds were >126 km from shore. These records provide more specific evidence that northern Buller's albatross prefer deep temperate oceanic waters (SST range of 17–19°C, Deppe [2012]) during their non-breeding period. The timing of their breeding season means that the bulk of the end-of-season breeding birds will arrive in South American waters during May–July. Adult non-breeders can be expected to arrive earlier. These are times when the bulk of the 'southern' taxa are attached to breeding colonies in New Zealand and rearing chicks.

Both, northern and southern Buller's albatross visit the south-eastern Pacific off Perú during the austral autumn-winter from 14°S to the border with Chile (Quiñones *et al.* 2021). However, northern Buller's albatross seems to use more oceanic habitats, preferably over the abyssal plain and the Peruvian-Chilean trench, while southern Buller's also include the continental slope, with aggregations closer to the coastline, and in the vicinity of the submarine Nazca seamounts (Quiñones *et al.* 2021). However, the trophic landscape of these two albatrosses in

the oceanic zones of southern Perú may be similar. Cherel *et al*. (2013) using chest feather samples showed that the two Buller's taxa have almost identical C and N isotopic signatures, though the northern Buller's albatross had slightly lower $\delta^{13}C$ (15.9) compared to southern Buller's (16.3). Neritic waters are represented by higher $\delta^{13}C$ values and this suggests that northern Buller's albatross have slightly more oceanic foraging habitats than the southern Buller's albatross. Oceanographic features during the austral autumn-winter, including eddy like-structures and fronts could well influence the presence of northern Buller's albatross in the south-eastern Pacific between 15°S and 17°S (Chaigneau *et al.* 2013). In southern Perú eddies can extend the propagation of high primary productivity to oceanic waters well offshore of the Humboldt Current (Chaigneau *et al.* 2008).

Notably, no newly fledged birds of the year were recorded during this study. Additional GLS, GPS, or PTT tracking studies are needed to reveal a more precise timing of events for both taxa and the distribution of juvenile, sub-adult, and pre/post-breeding adult age groupings in South American waters. Plumage identification studies on juvenile and sub-adult birds would benefit from the DNA identification of captured and photographed birds, allowing for better identification, recording of seasonal movement patterns and their timing.

ACKNOWLEDGEMENTS

This study was possible with the support of the ACAP small grants program to the project titled: "Integrating an onboard observer programme and remote tracking data to evaluate the interactions between the small-scale longline fisheries and adult Chatham albatrosses in their wintering grounds off Perú" granted to Carlos Zavalaga and Javier Quiñones, We thank Francisco Bernedo who helped us onboard with the sighting and handling the albatrosses and David Ururi, who twice allowed us aboard his vessel for our observations. CJRR acknowledges the support of a wide international range of museum curators and institutions holding specimen skins, for access to study their Buller's albatross ssp. material – especially the American Museum of Natural History in New York, and Museum fur Naturkunde in Berlin for access to the type specimens of *Thalassarche bulleri* and *Thalassarche platei*, and the Museum of New Zealand (Te Papa Tongarewa) for access to the only extant voucher study skins of for both taxa of breeding Buller's albatross ssp. collected from the respective breeding sites. Thanks to Dr Jeffrey Mangel of Pro Delphinus, Lima, Perú, for reporting the capture of M-33196, and to Lorna Deppe for permission to publish the kernel map from her thesis, including access to her GLS arrival and departure data. Thanks to the New Zealand Wildlife Service and its successor the New Zealand Department of Conservation and various colleagues in the field (especially David Bell and the late Alan Wright) who supported CJRR's extensive field work in the Chatham Islands (especially including the owners of the relevant islands there for landing permissions), and a short period at The Snares, enabling the field study of both taxa; both Departments partially funded some overseas travel and time, thus allowing access to museum collections. Additional logistic support and funding was provided by Wild Press and the Robertson family. The authors acknowledge the helpful suggestions of two anonymous reviewers.

LITERATURE CITED

Agreement on the Conservation of Albatrosses and Petrels (ACAP). 2010. *Taxonomy of albatrosses and larger petrels*. Unpublished report prepared by the Taxonomic Working Group of the Agreement on the Conservation of Albatrosses and Petrels for the Convention on the Conservation of Migratory Species of Wild Animals 16th Meeting of the CMS Scientific Council. Bonn, Germany, 28–30 June 2010. 11p.

Bell, M.D.; Bell, D.J.; Boyle, D.P.; Tuanui-Chisholm, H. 2018. Rangitatahi seabird research: December 2017. Technical report prepared for the Conservation Services Programme. Wellington, New Zealand Department of Conservation. https://www.doc.govt.nz/our-work/conservation-services-programme/csp-reports/2017-18/seabird-population-research-chatham-islands-2017-18/

Bugoni, L.; Neves, T.S.; Peppes, F.V.; Furness, R.W. 2008. An effective method for trapping scavenging seabirds at sea. *Journal of Field Ornithology 79*: 308–313.

Chaigneau, A.; Gizolme, A.; Grados, C. 2008. Mesoscale eddies off Perú in altimeter records: Identification algorithms and eddy spatiotemporal patterns. *Progress in Oceanography 79*: 106–119.

Chaigneau, A.; Dominguez, N.; Eldin, G.; Vasquez, L.; Flores, R.; Grados, C.; Echevin, V. 2013. Near coastal circulation in the Northern Humboldt Current System from shipboard ADCP data. *Journal of Geophysical Research: Oceans 118*: 5251–5266.

Checklist Committee (OSNZ). 2022. *Checklist of the Birds of New Zealand* (5th edn.). Ornithological Society of New Zealand Occasional Publication No. 1. Wellington, Ornithological Society of New Zealand.

Cherel, Y.; Jaeger, A.; Alderman, R.; Jaquemet, S.; Richard, P.; Wanless, R.M.; Philips, R.A.;

Thompson, D.R. 2013. A comprehensive isotopic investigation of habitat preferences in nonbreeding albatrosses from the Southern Ocean. *Ecography 36(3)*: 277–286.

del Hoyo, J.; Collar, N.J. 2014. *HBW and Birdlife International Illustrated Checklist of the Birds of the World.* Vol.1: non-Passerines. Barcelona, Lynx Edicions.

Deppe, L. 2012. *Spatial and temporal patterns of at-sea distribution and habitat use of New Zealand albatrosses.* Unpublished PhD thesis. University of Canterbury. https://ir.canterbury.ac.nz/handle/10092/7610

eBird. 2021. Buller's Albatross *Thalassarche bulleri*. Ithaca, Cornell Laboratory of Ornithology. https://ebird.org/species/bulalb2

Frost, P.G.H; Fitzgerald, N.; Robinson, R.; Hamilton, O. 2018. Buller's mollymawk (*Thalassarche bulleri*) on Rosemary Rock, Three Kings Islands, New Zealand. *Notornis 65*:164–167.

Godman, F. du Cane. 1907–1910. *A Monograph of the Petrels*. London, Witherby.

Harrison, P.; Perrow, M.R.; Larsson, H. 2021. *Seabirds. The new identification guide*. Barcelona, Lynx Edicions.

Howell, S.N.G. 2009. Identification of immature Salvin's, Chatham, and Buller's albatrosses. *Neotropical Birding 4*: 19–25.

Howell, S.; Zufelt, K. 2019. *Oceanic birds of the world: a photo guide*. Princeton NJ, Princeton University Press.

Jouanin, C.; Mougin, J-L. (*eds*) 1979. Order Procellariiformes. *In*: Mayr, E.; Cottrell, G.W. (*eds*), Peters Checklist of Birds of the World (2nd edn), Vol. 1. Museum of Comparative Zoology, Cambridge, Massachusetts.

Murphy, R.C. 1936. *Oceanic Birds of South America, vol. 1.* The American Museum of Natural History, Macmillan.

Onley, D.; Scofield, P. 2006. *Albatrosses, petrels & shearwaters of the world*. London, Helm.

Quiñones, J.; Alegre, A.; Romero, C.; Manrique, M.; Vásquez, L. 2021. Fine-scale distribution, abundance, and foraging behavior of Salvin's, Buller's, and Chatham Albatrosses in the Northern Humboldt Upwelling System. *Pacific Science 75(1)*: 85–105.

Reichenow, A. 1898. *Thalassarche (Diomedea) platei. Ornith. Monatsberichte 6*: 190

Roberts, J.O.; Webber, D.N.; Goad, D.W.; Arnould, J.P.Y.; Bell, E.A.; Crowe, P.; Deppe, L.; Elliott, G.P.; Landers, T.J.; Freeman, A.N.D.; Mattern, T.; Moore, P.J.; Nicholls, D.G.; Parker, G.P.; Rexer-Huber, K.; Taylor, G.A.; Thompson, D.R.; Walker, K.J.; Waugh, S.M.; Young, M.J. 2022. Spatial distribution modelling of at-risk seabirds in New Zealand commercial fisheries. New Zealand Aquatic Environment and Biodiversity Report No. 298. Fisheries New Zealand. 167 p.

Robertson, C.J.R. 1985. Buller's Mollymawk. p. 64; *In:* Robertson C.J.R. (*ed*.) *The Complete Book of New Zealand Birds*. Sydney, Reader's Digest Services. 319 pp.

Robertson, C.J.R. 1991. Questions on the harvesting of Toroa in the Chatham Islands. *Science & Research Series 35,* Wellington, New Zealand Department of Conservation.

Robertson, C.J.R.; Sawyer, S. 1994. Albatross research on (Motuhara) Forty-Fours Islands: 6–15 December 1993. *Conservation Advisory Science Notes No. 70.* Wellington, New Zealand Department of Conservation.

Robertson, C.J.R. 1998. Pacific albatross p. 53–54; *In:* Robertson, G.; Gales, R. (*eds*) *Albatross biology and conservation*. Chipping Norton NSW, Surrey Beatty and Sons.

Robertson, C.J.R.; Nunn, G.B. 1998. Towards a new taxonomy for albatrosses. Pp. 13–19; *In:* Robertson, G.; Gales, R. (*eds*) *Albatross biology and conservation*. Chipping Norton NSW, Surrey Beatty and Sons.

Robertson, C.J.R.; Bell, E.A.; Sinclair, N.; Bell, B.D. 2003a. Distribution of seabirds from New Zealand that overlap with fisheries worldwide. *Science for Conservation 233*. Wellington, New Zealand Department of Conservation. 102 p.

Robertson, C.J.R.; Bell, D.; Scofield, R.P. 2003b. Population assessment of the Chatham mollymawk at The Pyramid, December 2001. New Zealand Department of Conservation. 105 p.

Robertson, G.; Gales, R. (*eds*). 1998. *Albatross biology and conservation.* Chipping Norton NSW, Surrey Beatty & Sons.

Ronconi, R.A.; Swaim, Z.T.; Lane, H.A.; Hunnewell, R.W.; Westage, A.J.; Koopman, H.N. 2010. Modified hoop-net techniques for capturing birds at sea and comparison with other capture methods. *Marine Ornithology 38*: 23–29.

Sagar, P.M.; Warham, J. 1998. Breeding biology of southern Buller's albatrosses at The Snares, New Zealand. pp. 92–98 *In:* Robertson, G.; Gales, R. (*eds*) *Albatross biology and conservation*. Chipping Norton NSW, Surrey Beatty and Sons.

Sagar, P.M.; Charteris, M.R.; Carroll, J.W.A.; Scofield, R.P. 2011. Population size, breeding frequency and survival of Salvin's albatrosses (*Thalassarche salvini*) at the Western Chain, The Snares, New Zealand. *Notornis 58:* 57–63.

Sagar, P. 2014. Population studies of Southern Buller's albatrosses on The Snares (NIWA Client Report CHC2014-026). Christchurch, NIWA. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/meetings/pre-2020-meetings/population-studies-of-southern-bullers-albatrosses-on-the-snares.pdf

Sagar, P.M.; Amey, J.; Scofield, R.P.; Robertson, C.J.R. 2015. Population trends, timing of breeding and survival of Salvin's albatrosses (*Thalassarche salvini*) at Proclamation Island, Bounty Islands, New Zealand. *Notornis 62(1)*: 21–29.

Scofield, R.P.; Stephenson, B. 2013. *Birds of New Zealand: a photographic guide*. Auckland University Press.

Shirihai, H. 2008. *The complete guide to Antarctic wildlife, birds and marine mammals of the Antarctic Continent and the Southern Ocean*, 2nd edn. London, A.C. Black.

Spear, L.B.; Ainley, D.G.; Webb, S.W. 2003. Distribution, abundance and behaviour of Buller's, Chatham Island and Salvin's Albatrosses off Chile and Peru. *Ibis 145(2)*: 253–269.

Spear, L.B.; Ainley, D.G. 2008. The seabird community of the Peru Current, 1980–1995, with comparisons to other eastern boundary currents. *Marine Ornithology 36*: 125–144.

Thompson, D.; Sagar, P.; Baker, B.; Jensz, K. 2017. Southern Buller's albatross survey at the Solander Islands 2016 (NIWA Client Report 2017079WN). Wellington, NIWA. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pre-2019-annual-plans/pop2014-02bullers-solander-final-report.pdf

Wakefield, E.D.; Phillips, R.A.; Trathan, P.N.; Arata, J.; Gales, R.; Huin, H.; Robertson, G.; Waugh, S.M.; Weimerskirch, H.; Matthiopoulos, J. 2011. Habitat preference, accessibility, and competition limit the global distribution of breeding black-browed Albatrosses. *Ecology Monographs 81*: 141–167. doi: 10.1890/09-0763.1

Warham, J. 1982. A distant recovery of a Buller's mollymawk. *Notornis 29*: 213–214.

Wold, J.R.; Robertson, C.J.R.; Chambers, G.K.; Ritchie, P.A. 2018. Phylogenetic structure and a genetic assignment method for Buller's albatross ssp. (*Thalassarche bulleri* ssp.). *Notornis 65*: 152–163.

Wold, J.R.; Robertson, C.J.R.; Chambers, G.K.; Van Stijn. T.; Ritchie, P.A. 2021. Genetic connectivity in allopatric seabirds: lack of inferred gene flow between northern and southern Buller's albatross populations (*Thalassarche bulleri* ssp.). *Emu 121(1–2)*: 113–123. doi: 10.1080/01584197.2021.1894406

Notornis, 2023, Vol. 70: 60-73
0029-4470 © The Ornithological Society of New Zealand Inc.

Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2021–2022

COLIN M. MISKELLY*
Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington 6140, New Zealand

ANDREW C. CROSSLAND
Parks Biodiversity Team, Parks Unit, Christchurch City Council, PO Box 73011, Christchurch 8154, New Zealand

IAN SAVILLE
Wrybill Birding Tours, 83 James Cook St, Havelock North 4130, New Zealand

IAN SOUTHEY
82 Red Hill Rd, Papakura, Red Hills, Auckland 2110, New Zealand

ALAN J. D. TENNYSON
Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington 6140, New Zealand

ELIZABETH A. BELL
Wildlife Management International Ltd, PO Box 607, Blenheim 7240, New Zealand

Abstract: We report Records Appraisal Committee (RAC) decisions regarding Unusual Bird Reports received between 1 January 2021 and 31 December 2022. Among the 160 submissions accepted by the RAC were the first New Zealand records of black tern (*Chlidonias niger*), black-naped tern (*Sterna sumatrana*), and Matsudaira's storm petrel (*Hydrobates matsudairae*). We also report the second accepted sightings of northern pintail (*Anas acuta*) and bridled tern (*Onychoprion anaethetus*), the third accepted sightings of long-toed stint (*Calidris subminuta*) and grey-backed tern (*Onychoprion lunatus*), and the third to fifth accepted records of Adelie penguin (*Pygoscelis adeliae*). Other notable records included the first record of long-tailed cuckoo (*Eudynamys taitensis*) from Campbell Island and of sooty tern (*Onychoprion fuscatus*) from the Chatham Islands.

Miskelly, C.M.; Crossland, A.C.; Saville, I.; Southey, I.; Tennyson, A.J.D.; Bell, E.A. 2023. Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2021–2022. *Notornis 70(2)*: 60–73.

Keywords: black tern, black-naped tern, first record, Matsudaira's storm petrel, New Zealand bird, vagrant

INTRODUCTION

Birds New Zealand (Birds NZ) requires sightings of vagrant or extra-limital bird species, or species otherwise considered to be extinct, to be verified by the Records Appraisal Committee (RAC) before the records can be presented as accepted New Zealand records in the periodicals *Notornis*, *New Zealand Birds*, and *Ornithological Society of New Zealand Occasional Publications*, or in other books and websites published by Birds NZ.

We report RAC decisions made on Unusual Bird Reports (UBRs) received between 1 January 2021 and 31 December 2022, following on from the last report of the RAC (Miskelly *et al.* 2021).

Received 28 March 2023; accepted 6 May 2023
*Correspondence: *colin.miskelly@tepapa.govt.nz*

Results of RAC decisions are posted on the Unusual Bird Report website (http://rare.birds.org.nz/) every 2 months. The website provides a means for observers to determine whether a UBR has already been submitted for any vagrant bird seen or reported, and (within 2–4 months) to see the RAC decision on the UBR. This biennial report provides more detail about sightings than what is presented on the website, including providing context for the significance of each sighting.

Each UBR received is given a number whereby the first four digits represent the year the record was received and the last three digits the chronological sequence of receipt within that year. These reference numbers are given for each record below and match those on the Unusual Bird Report website. Nomenclature and taxonomic sequence follow Checklist Committee (2022). Where images of birds reported here have been published on New Zealand Birds Online (NZBO, www.nzbirdsonline.org.nz, viewed 15 March 2023) this is mentioned in the text. 'Kermadec pelagic' refers to submissions by Fraser Gurney with supporting images and information from Tim Barnard, Harry Boorman, Scott Brooks, Igor Debski, Richard Fenner, Phil Hammond, Dave Howes, John Kyngdon, Hennie Peters, Ian Saville, Brent Stephenson, and Steve Wood.

The RAC convenor maintains a database of verified sightings of vagrant birds in New Zealand. Information from this database is presented below (sourced as "CMM, *unpubl. data*") if it conflicts with or augments information from published sources.

DECISIONS ON SUBMITTED SIGHTINGS

Accepted records of vagrant and rare migrant species to New Zealand

Plumed whistling duck (*Dendrocygna eytoni*)
Five at Kopuawhara River mouth, Oraka beach, Mahia Peninsula, on 19 Apr 2022 (Janet & Bruce Campbell; UBR 2022/049). There are 16 previous accepted records of singles or flocks of up to 14 birds (Miskelly *et al*. 2017).

Chestnut-breasted shelduck (*Tadorna tadornoides*)
Two at Tip Lagoon, Invercargill, on 30 Oct 2020 (Sean Jacques; UBR 2021/004); one at Wairau Lagoons, Blenheim, on 30 Oct 2021 (Jacob Holland; UBR 2021/062). There are about 40 previous accepted records in New Zealand (Heather 1987; Miskelly *et al.* 2021).

Australian wood duck (*Chenonetta jubata*)
A total of 23 at Hoddy Estuary Park and Playhouse Café pond, Tasman, on 27 Jan 2022 (Alan Tennyson; UBR 2022/043). This submission reveals that a population derived from birds that arrived and started breeding in the area in 2014 remains present (Cook *et al.* 2016; Miskelly *et al*. 2017).

Chestnut teal (*Anas castanea*)
One at Grovetown Lagoon, Marlborough, on 24 March 2022 (Bill Cash, Dan Burgin, Mike Bell, and Pat Crowe; UBR 2022/041); one at Travis Wetland, Canterbury, on 6 Jun 2022 (Noah Fenwick; UBR 2022/059); one at Sinclair Wetlands, Otago, on 17 Sep 2022 (Oscar Thomas and Ela Hunt; UBR 2022/087). There are 19 previous accepted records from New Zealand (Miskelly *et al.* 2021).

Northern pintail (*Anas acuta*)
A female at Tip Lagoon, Invercargill, on 16 Oct 2021 (Sean Jacques; UBR 2021/060) was the second record from New Zealand (Petyt 1999). See Fig. 1, and images on NZBO.

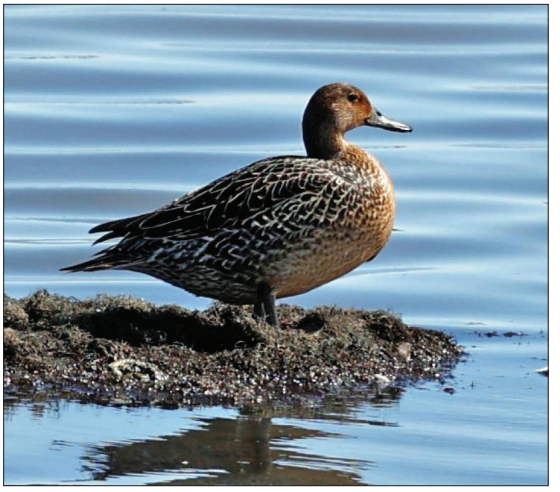


Figure 1. Female northern pintail (*Anas acuta*) at Tip Lagoon, Invercargill, October 2021. Second New Zealand record (Photograph: Duncan Watson).

Northern shoveler (*Spatula clypeata*)
One at Bromley Oxidation Ponds, Christchurch, on 1 May 2021 (Warwick Allen and Harry Boorman; UBR 2021/032); one at Pegasus Wetland, Canterbury, on 8 May 2021 and 7 June 2022 (Bev Alexander, Gregor Tims, and Fraser Gurney; UBRs 2021/034 & 2022/058).

There was an unprecedented influx of northern shovelers in 2017–18, with at least five different birds present in June 2018 (Miskelly *et al*. 2019). They continued to be reported frequently during 2019 & 2020 (Miskelly *et al*. 2021), and it is likely that the bird or birds reported in 2021 & 2022 were the last survivors of this influx.

Oriental cuckoo (*Cuculus optatus*)
One near Lake Mapourika, Franz Josef, on 17 Nov 2021 (Lynda Giles; UBR 2021/064; images on NZBO) was the 37th accepted record from New Zealand (Miskelly *et al*. 2019).

White-throated needletail (*Hirundapus caudacutus*)
Three at Paringa River, West Coast, on 21 Nov 2021 (Oscar Thomas, Georgie Archibald, and Ela Hunt; UBR 2021/067). White-throated needletails are frequent vagrants to New Zealand (Checklist Committee 2022).

Greater sand plover (*Charadrius leschenaultii*)
One at Farewell Spit on 6 Nov 2021 and 8 Oct 2022 (Bradley Shields, Mark Ayre, Robin & Sandy Toy, David Melville, and Nina Visker; UBRs 2022/070 & 2022/089). Considered an annual visitor to New Zealand before 2010, these are only the fifth and sixth records accepted since then (Checklist Committee 2010; Miskelly *et al.* 2017, 2021).

Little whimbrel (*Numenius minutus*)
One at Riverton on 4 Feb 2021 (David Melville and Willie Cook; UBR 2021/010); one at Awarua Bay on 12 Dec 2021 (Dave Howes, John Kyngdon, and Scott Brooks; UBR 2022/003). Considered an uncommon visitor to New Zealand (Checklist Committee 2022); there have been six accepted records since 2010 (CMM, *unpubl*. *data*).

Black-tailed godwit (*Limosa limosa melanuroides*)
One at New River estuary, Invercargill, on 31 Oct 2020 (Sean Jacques; UBR 2021/051); one at Motueka sandspit on 8–9 Oct 2021 (David Melville, Mark Ayre, Robin & Sandy Toy, Craig Martin, Bernd Huss, and Christine Grove; UBR 2021/058); one at Bell Island, Waimea Inlet, on 13 Nov 2021 and 26 Dec 2022 (David and Julia Melville; UBRs 2021/063 & 2022/122), one at Ahuriri estuary, Hawke's Bay, on 19 Nov 2022 (Lynne Anderson and David Thomas; UBR 2022/098). Black-tailed godwits are uncommon but probably annual visitors to New Zealand (Checklist Committee 2022).

Hudsonian godwit (*Limosa haemastica*)
One at Bluff highway, Southland, on 13 June 2021 (Sean Jacques; UBR 2021/049); one at Aramoana saltmarsh, Otago, on 12 Jun 2022 (Oscar Thomas and Ela Hunt; UBR 2022/061). Hudsonian godwits are uncommon but probably annual visitors to New Zealand (Checklist Committee 2022).

Great knot (*Calidris tenuirostris*)
One at Big Sand Island, Kaipara Harbour, on 22 Dec 2021 (Dave Howes, David Thomas, and John Kyngdon; UBR 2022/004). There are about 22 previous accepted records from New Zealand (Miskelly *et al*. 2021).

Ruff (*Calidris pugnax*)
One at Miranda stilt ponds on 21 Feb 2022 (Fraser Gurney, Dave Howes, and Scott Brooks; UBR 2022/019) was the 15th accepted record from New Zealand, and the first since 2007 (Scofield 2008).

Long-toed stint (*Calidris subminuta*)
One at Lake Ellesmere on 24 Dec 2022 (Fraser Gurney, Samuel Amaris, and Adam Colley; UBR 2022/121; images on NZBO) was the third accepted record from New Zealand (Petch *et al*. 2002; Checklist Committee 2022). All three records were from Lake Ellesmere (*ibid*.)

Sanderling (*Calidris alba*)
One at Awarua Bay, Southland, on 22 Dec 2020 (Sean Jacques, John Kyngdon, and Phil Rhodes; UBR 2021/006); one at Mangawhai Heads on 10 Jan 2021 (Oscar Thomas and Ela Hunt; UBR 2021/008); one at Lake Ellesmere on 17 Mar 2021 (Warwick Allen and Harry Boorman; UBR 2021/026); one at Papakanui Spit, Kaipara Harbour, on 27 Mar 2021 (Tony Crocker and Helen & Greg Smith; UBR 2021/029); one at Ashley River estuary, Canterbury, on 17 Nov 2021 (Bev Alexander and Jill Hanna; UBR 2021/070). One or two sanderlings reach New Zealand most years (Miskelly *et al.* 2019, 2021).

Western sandpiper (*Calidris mauri*)
One at North Omaha sandspit, Whangateau Harbour, on 15 Feb 2022 (Sue Cook, Gwenda Pulham, and Marie-Louise Ward; UBR 2022/050); likely the same bird was at Clifton Beach, Whitford estuary, 68 km to the south, on 19 Feb 2022 (David Thomas, Bruce Keeley, Chris Cooke, Paul Godolphin, and Logan Milicich; UBR 2022/069; images on NZBO). These were the seventh and eighth accepted records from New Zealand, and the first since 1984 (Fennell 1986).

Red-necked phalarope (*Phalaropus lobatus*)
One at Waituna Lagoon, Southland, on 4 Feb 2022 (Pete McClelland; UBR 2022/039); one at Grovetown Lagoons, Blenheim, on 25 Nov 2022 (Dan Burgin, Bill Cash, Mike Bell, Samantha Ray, and Pat Crowe; UBR 2022/117). There are 15 previous accepted records from New Zealand (Miskelly *et al.* 2021).

Terek sandpiper (*Xenus cinereus*)
One at Awarua Bay, Southland, on 22 Dec 2020 (Sean Jacques, John Kyngdon, and Phil Rhodes; UBR 2021/003; images on NZBO); one at Big Sand Island, Kaipara Harbour, on 7 Aug 2021 (Warwick Allen and Harry Boorman; UBR 2021/048) and 7 Mar 2022 (Tony Crocker and 11 others; UBR 2022/038). These are the first accepted records since 2014 (Miskelly *et al.* 2015).

Wandering tattler (*Tringa incana*)
One at Spirits Bay, Far North, on 17 Mar 1990 (Alan Tennyson; UBR 2021/002) was incorrectly reported as a grey-tailed tattler (*T. brevipes*) in Taylor & Parrish (1991); one at Ocean Beach, Whangarei, on 22 Jan 2022 (Cathy Mitchell; UBR 2022/008). Wandering tattlers are uncommon but probably annual visitors to the New Zealand mainland (Checklist Committee 2022). Two at Waitangi West, Chatham Island, on 25 Jan & 2 Feb 2022 (Oscar Thomas and Ela Hunt; UBR 2022/017; images on NZBO) were the ninth accepted record from the Chatham Islands (Miskelly *et al.* 2021).

Common greenshank (*Tringa nebularia*)
One at Riverton on 3 May, 27 Jun & 3 Jul 2020 (Sean Jacques, Paul Jacques, Lloyd Blakie, Oscar Thomas, and Fraser Gurney; UBR 2021/005). Formerly a regular vagrant to New Zealand, greenshanks have been reported at a rate of less than one per annum since 2000 (Miskelly *et al.* 2015, 2021).

South Polar skua (*Catharacta maccormicki*)
Single birds east of Poor Knights Islands on 1 Nov 2020, 25 Oct 2021, 1 Nov 2022 & 10 Dec 2022 (Scott Brooks and 23 others; UBRs 2022/025, 2022/022, 2022/106 & 2022/107). One 66 km north of Raoul Island, Kermadec Islands, on 1 Apr 2021 (Fraser Gurney, Kermadec pelagic; UBR 2022/081; images on NZBO). South Polar skuas are scarce but likely annual migrants to New Zealand, with about 20 previous records (Miskelly *et al.* 2019, 2021).

Long-tailed skua (*Stercorarius longicaudus*)
One 30 km off Otago Peninsula on 29 Mar 2021 (Oscar Thomas; UBR 2021/027); one at Star of Bengal Bank north-east of New Zealand on 3 Apr 2021 (Fraser Gurney, Kermadec pelagic; UBR 2022/080; images on NZBO); singles east of Poor Knights Islands on 30 Oct 2021, 6 & 17 Nov 2022 & 10 Dec 2022 (Scott Brooks and 23 others; UBRs 2022/029, 2022/108, 2022/109 & 2022/110); one in Foveaux Strait on 11 Dec 2022 (Oscar Thomas, Ela Hunt, Sean Jacques, and Kit Hustler; UBR 2022/114). Long-tailed skuas are scarce annual migrants to New Zealand (Miskelly *et al.* 2019).

Figure 2. Bridled tern (*Onychoprion anaethetus*) at Maunganui Bluff, Ninety Mile Beach, 13 February 2022. Second New Zealand record (Photograph: Scott Brooks).

Grey-backed tern (*Onychoprion lunatus*)
One at Papakanui Spit, Kaipara Harbour, on 18 Dec 2022 (Jacob Ball; UBR 2022/119) was the third accepted record from New Zealand (Scofield 2006).

Bridled tern (*Onychoprion anaethetus*)
One at Maunganui Bluff, Ninety Mile Beach, on 13 Feb 2022 (Dave Howes and Scott Brooks; UBR 2022/014) was the second accepted record from New Zealand, and the first live record (Tunnicliffe & Langlands 1990). See Fig. 2, and images on NZBO.

Little tern (*Sternula albifrons*)
One at Argyle Beach, Bluff, on 10 & 12 Nov 2020, with three there 19 Oct to 26 Dec 2021 (Sean Jacques; UBRs 2021/050 & 2022/040); one at New River Estuary, Southland, on 26 Mar 2022 (Sean Jacques, Phil Rhodes, and Pete McClelland; UBR 2022/045). Little terns are annual migrants to northern New Zealand; however, they are scarce (and reportable) south of Cook Strait, with a few previous records as far south as Invercargill and Stewart Island (Higgins & Davies 1996).

Gull-billed tern (*Gelochelidon nilotica*)
An adult and fledgling at the New River estuary, Invercargill, on 24 & 28 Feb 2021 (Sean Jacques, Joseph Bliss, Pete McClelland, Bob Rigter, and Joseph Roberts; UBR 2021/022) was the second recorded breeding of this species in New Zealand, and the first successful breeding (Miskelly *et al.* 2021; Jacques *et al.* 2023).

Whiskered tern (*Chlidonias hybridus*)
One at Mangere sewage ponds 5–7 Oct 2017 (Oscar Thomas, Phil Hammond, and Scott Brooks; UBR 2022/065); one at Upukerora River, Te Anau, on

21 Jan 2021 (Anja Kohler; UBR 2021/012); one at Pharazyn Reserve, Kapiti Coast, on 13 Oct 2021 (Jan Keast; UBR 2021/057); one at Waituna Lagoon, Southland, on 31 Jan 2022 (Bradley Shields; UBR 2022/011, images on NZBO); one at New River estuary, Southland 24 Jun–10 Jul 2022 (Sean Jacques, Rose Collen, Megan Bogisch, Joseph Roberts, and others; UBR 2022/075, images on NZBO).

Whiskered terns were reported at an unusually high rate during 2021–22. There had been 12 previous accepted records since the first report in 1977 (Heather & Jones 1979; Miskelly *et al.* 2021).

Black tern (*Chlidonias niger*)
One at Waikanae estuary, Kapiti coast, on 21 Jan 2022 (Oscar Thomas, Ela Hunt, Sunita Singh, Helen Duncan, and Elizabeth Taylor; UBR 2022/006) was a new record for New Zealand (Thomas & Hunt 2023). The bird subsequently moved to Plimmerton, 25 km to the south (Alan Tennyson; UBR 2022/006A, 31 Jan & 7 Feb 2022). See Fig. 3, and images on NZBO. Based on the bird's white flanks, the small extent of the dark 'shoulder' patch, and its very dark head markings, this bird is considered to have been of the nominate (Eurasian/African) subspecies.

Figure 3. Black tern (*Chlidonias niger*) at Waikanae estuary, Kapiti coast, January 2022. First New Zealand record (Photograph: Oscar Thomas).

Black-naped tern (*Sterna sumatrana*)
One at Muriwai gannet colony, Auckland west coast, on 13 Feb 2022 (Hayden Pye; UBR 2022/012, Fig. 4 and images on NZBO) was a new record for New Zealand. The bird died overnight, and is now a study skin and spread wing in Auckland Museum (LB15957), with the internal skeleton and soft tissues held at Te Papa (OR.031151). Based on the short bill-length of 33.7 mm, the bird was determined to be of the nominate subspecies, which occurs in the south-west Pacific, including around New Caledonia and the Coral Sea (Higgins & Davies 1996).

Figure 4. Black-naped tern (*Sterna sumatrana*) at Muriwai gannet colony, Auckland west coast, 13 February 2022. First New Zealand record (Photograph: Hayden Pye).

Arctic tern (*Sterna paradisaea*)
One at Waikanae River mouth on 28 Apr 2022 (Michael Szabo, Elizabeth Taylor, and Eddie Bright; UBR 2022/068); one 30 km off Moeraki on 13 Nov 2022 (Oskar Ehrhardt; UBR 2022/095). Arctic terns are presumed to be annual visitors to New Zealand (Checklist Committee 2022).

Common tern (*Sterna hirundo*)
One at Argyle Beach, Bluff, on 11 Nov 2021 (Sean Jacques; UBR 2022/042); one at Manawatu River mouth on 8 Jan & 3 Apr 2022 (Alan and Sam Tennyson; UBR 2022/048); one at Waikanae River mouth on 24 Jan, 9 Apr & 11 Dec 2022 (Alan Tennyson, Dave Howes, Bradley Shields, Phil Hammond, Paul Gibson, Jim Norris, Richard Fenner, and others; UBRs 2022/047 & 2022/115); one at Plimmerton, Wellington, on 8 Feb 2022 (Michael Szabo, Bob Rigter, Ken George, and Hamish Laing; UBR 2022/072); one at Island Bay, Wellington, on 26 Mar 2022 (Michael Szabo; UBR 2022/067); one at Milnthorpe Beach, Golden Bay, 6–12 Apr 2022 (Bradley Shields; UBR 2022/051).

There are about 65 accepted records of common terns from New Zealand, with nearly half of these being from the Manawatu estuary/Foxton Beach or from Waikanae, 49 km to the south (Miskelly *et al.* 2021).

Crested tern (*Thalasseus bergii*)
One dead on Maui Platform A, 35 km west of Cape Egmont on 11 Jul 2011 (Alan Tennyson on behalf of unknown observer; UBR 2022/053) becomes the 13th accepted record from New Zealand. The bird had been banded as a chick at Phillip Island, Victoria,

Australia on 22 Dec 2009. It was found dead (and disposed of overboard) 18 months later, after travelling 2,438 km. Its identification was based on the band number and details in the Australian Bird and Bat Banding Scheme (Michelle Bradshaw *pers. comm*. to AJDT).

White-tailed tropicbird (*Phaethon lepturus*)
One found alive at Onerahi, Whangarei, on 8 Feb 2022 (Scott Brooks and Robert Webb, Whangarei Native Bird Recovery Centre; UBR 2022/023). There have been 17 previous accepted records of this species in New Zealand, most recently in 2012 (Miskelly *et al*. 2013).

King penguin (*Aptenodytes patagonicus*)
One at Fortrose Spit, Catlins coast, on 15 Nov 2022 (Oscar Thomas; UBR 2022/096) was the seventh record of a king penguin from the South Island (Checklist Committee 2022).

Adelie penguin (*Pygoscelis adeliae*)
An adult at Birdlings Flat, Canterbury, on 11 Nov 2021 (Anita Spencer, Harry Singh, Allanah Purdie, Thomas Stracke, Kristina Schutt, and Pauline Howard; UBR 2021/065) and another at Scotts Landing, Manawatu, on 12 Nov 2021 (Michael Szabo on behalf of Malcolm Dellow and Peter & Kelsi Walker; UBR 2022/001); one dead on Masons Bay, Stewart Island, on 31 Dec 2021 (Colin Miskelly; UBR 2022/044). These were the third, fourth, and fifth records of the species from New Zealand, and included the second and third live records (Miskelly, Purdie *et al*. 2022).

Royal penguin (*Eudyptes schlegeli*)
One at Sarah Cove, Halfmoon Bay, Stewart Island, 24 Feb to 5 Mar 2022 (Brittany Mathias, Benjamin McClelland, Fraser Gurney, Matt Jones, and Will Abbott; UBRs 2022/064 & 2022/078) was the first record of this species from Stewart Island. There have been at least 11 records from the South Island and two from the southern North Island (Miskelly *et al*. 2019, 2021).

Indian Ocean yellow-nosed albatross (*Thalassarche carteri*)
One alive on Ninety Mile Beach, Far North, on 19 Sep 2021 subsequently died while in care (Richard Bresgi, Robert Webb and staff at Whangarei Native Bird Recovery Centre, and Scott Brooks; UBR 2022/035, Te Papa specimen OR.031103). This species was an annual visitor to northern New Zealand until the 1980s; since then, it has been reported only once or twice a decade (Miskelly *et al*. 2019; CMM, *unpubl. data*).

Matsudaira's storm petrel (*Hybrobates matsudairae*)
One found dead at Maukatia Bay, Muriwai, Auckland, on 27 May 2022 (Oscar Thomas on behalf of Susan Anderson; UBR 2022/055, Auckland Museum specimen LB16104) was the first record of this species from New Zealand. See Fig. 5, and images on NZBO.

Figure 5. Dead Matsudaira's storm petrel (*Hybrobates matsudairae*) found at Maukatia Bay, Muriwai, Auckland, 27 May 2022. First New Zealand record (Photograph: Susan Anderson).

Antarctic petrel (*Thalassoica antarctica*)
One at Birdlings Flat, Canterbury, on 31 May 2021 (Niall Mugan, Fraser Gurney, Phil Crutchley, Georgie Archibald, and others; UBR 2022/116) was a rare live record from New Zealand. The only known previous report of live birds near the mainland was a second-hand report of multiple birds in Foveaux Strait in the 1978 winter (Barlow 1979).

Providence petrel (*Pterodroma solandri*)
One east of the Poor Knights Islands on 10 Jul 2022 (Scott Brooks and seven others; UBR 2022/092) was the sixth accepted record of the species from New Zealand (Miskelly *et al*. 2015).

Juan Fernandez petrel (*Pterodroma externa*)
One at Rangatira Island, Chatham Islands, on 24 Jan 2021 (Alan Tennyson, Graeme Taylor, Brent Stephenson, Alex Wilson, Erin Patterson, Helen Jonas, Rachel Hufton, and Andrea Rix; UBR 2021/016) was the eighth accepted record from New Zealand (Miskelly *et al*. 2006, 2015). There were multiple records of Juan Fernandez petrels on Rangatira Island during 1984–1999 (Imber *et al*. 1991; these are grouped as a single record in the Unusual Bird Report database).

Stejneger's petrel (*Pterodroma longirostris*)
One east of the Poor Knights Islands on 13 Oct 2022 (Aaron Skelton, Scott Brooks, and eight others; UBR 2022/091) was the second live record accepted from New Zealand, and the tenth overall (Checklist Committee 2022).

Gould's petrel (*Pterodroma leucoptera*)
One north-east of Tauranga on 28 Mar 2021; two north of the Kermadec Islands on 1 Apr 2021; one at Star of Bengal Banks, north-east of New Zealand, on 3 Apr 2021 (all Fraser Gurney, Kermadec pelagic; UBRs 2022/101, 2022/102 & 2022/103); one east of Poor Knights Islands on 10 Dec 2022 (Scott Brooks and nine others; UBR 2022/111). Most of the 40 or so records of Gould's petrels from New Zealand were beach-wrecked birds found between November and July (Bull 1943; Powlesland 1987). However, there are multiple at-sea records from the south-east Tasman Sea during December to April (Imber & Jenkins 1981). These latest records reveal that the species also occurs to the north-east of New Zealand during the same part of the year.

Collared petrel (*Pterodroma brevipes*)
One 68 km north of Raoul Island, Kermadec Islands, on 1 Apr 2021 (Fraser Gurney, Kermadec pelagic; UBR 2022/079; images on NZBO) was the fourth record from New Zealand (Miskelly *et al*. 2021).

Thin-billed prion (*Pachyptila belcheri*)
Two off Kawhia on 8 May 2018 (Oscar Thomas and nine others; UBR2022/063). Thin-billed prions are regularly found dead on New Zealand beaches in winter (Powlesland 1989). However, the Records Appraisal Committee has accepted only three previous reports of birds seen at sea (Miskelly *et al*. 2019).

Great shearwater (*Ardenna gravis*)
One at Wreck Reef, Stewart Island, on 7 Apr 2011 (Brent Stephenson, Matt Jones, and Ty Jenkins; UBR 2021/019) was the fourth record from New Zealand, and was one of five sightings in April 2011 (Miskelly *et al*. 2013, 2021).

Pink-footed shearwater (*Ardenna creatopus*)
One east of the Poor Knights Islands on 24 Jul 2021 (Scott Brooks and eight others; UBR 2022/030, images on NZBO) was the eleventh record from New Zealand (Miskelly *et al*. 2021).

Great frigatebird (*Fregata minor*)
One at Rangaunu Harbour entrance, Far North, on 13 Feb 2022 (Les Feasey, Scott Brooks, and Dave Howes; UBR 2022/013); at least 43 at the Herald Islets, Kermadec Islands, on 30 Mar 2021 (Fraser Gurney, Kermadec pelagic; UBR 2022/084, images on NZBO). There are at least 17 previous records, with the only previous flock record being at least eight on and over the Herald Islets in March–April 2016 (Miskelly *et al*. 2017).

Lesser frigatebird (*Fregata ariel*)
One at Sandy Bay, Tutukaka, on 14 Feb 2022 (Irene & Crispin Middleton; UBR 2022/033). There are at least 41 previous records, with the most recent in 2018 (Miskelly *et al*. 2019).

Frigatebird sp. (*Fregata* sp.)
A frigatebird of uncertain specific identity was seen at Waihi Beach on 28 Jan 2021 (Greg Upton; UBR 2021/015).

Red-footed booby (*Sula sula*)
Three at Napier Islet, Kermadec Islands, on 30 Mar 2021 (Fraser Gurney, Kermadec pelagic; UBR 2022/082) was the fifth record of the species from New Zealand (Miskelly *et al*. 2017, 2019, 2021). The image included with the submission showed a white-tailed bird, considered to be of the Indo-Pacific subspecies *S. s. rubripes*.

Darter (*Anhinga melanogaster novaehollandiae*)
One at Clive, Hawke's Bay, on 18 Nov 2022 (Steve Sutcliffe; UBR 2022/097) was the fifth record from New Zealand (Checklist Committee 2022).

Dollarbird (*Eurystomus orientalis*)
Two at Upper Waiwera, Warkworth, on 24 Dec 2021 (Suzi Phillips; UBR 2021/074). There are about two dozen previous records, most recently in 2001 (Medway 2002).

Nankeen kestrel (*Falco cenchroides*)
One photographed at Otakeho, south Taranaki, on 2 May 2008 (Rod Le Fleming; UBR 2021/014). The nankeen kestrel is an infrequent straggler to New Zealand (Checklist Committee 2022).

Accepted extra-limital records of New Zealand breeding species

New Zealand dabchick (*Poliocephalus rufopectus*)
One at St Annes Lagoon, Cheviot, on 16 Jul 2021, with three there on 4 & 28 May 2022 (Matt Jones, Bev Alexander, and Jill Hanna; UBRs 2021/054 & 2022/057). New Zealand dabchicks are widespread in the North Island and have a small, recently established population in the Nelson and

Marlborough regions (Miskelly *et al*. 2019, 2021). They are no longer reportable in Marlborough, Nelson, and Golden Bay.

Australasian little grebe (*Tachybaptus novaehollandiae*)
One at Upper Moutere on 25 Nov 2021 (David Melville; UBR 2021/069). This rare breeding species is resident in Northland and North Auckland; however, there have been few records in the South Island since 2008 (Beauchamp 2019; Miskelly *et al.* 2015, 2019).

Spotted dove (*Streptopelia chinensis*)
One at Charing Cross Junction, Canterbury, 22 Sep 2021 (Andrew Crossland; UBR 2021/072). The submission referred to several eBird records from the same vicinity between 22 Dec 2020 and 20 Dec 2021. These include several sightings of 3–5 birds, with a maximum count of 5 by Fraser Gurney on 20 May 2021. Spotted doves are not recognised as being established in the South Island (Checklist Committee 2022).

Long-tailed cuckoo (*Eudynamys taitensis*)
One found dead at Northwest Bay, Campbell Island, on 6 Dec 2021 (Lindsay Wilson via Colin Miskelly; UBR 2022/016, tail feathers retained as Te Papa specimen OR.031059) was the first record from Campbell Island. Note that there are no confirmed records from the Auckland Islands (Miskelly *et al*. 2020), which are closer to the New Zealand mainland than Campbell Island.

Northern New Zealand dotterel (*Charadrius obscurus aquilonius*)
One at Karamea estuary on 18 Sep 2022 (Fraser Gurney and Facebook user "Karamea Wild"; UBR 2022/077) was the first accepted record of this subspecies from the South Island west coast, and the second South Island record (Dowding 2020).

Subantarctic skua (*Catharacta antarctica*)
One off the Canterbury coast on 29 Mar 2021 (Glenn Kincaid; UBR 2021/028). Within the New Zealand region, subantarctic skuas breed on the Chatham Islands and the subantarctic islands, with a few in Fiordland and the Stewart Island region (Higgins & Davies 1996).

Brown noddy (*Anous stolidus*)
One at Muriwai, west Auckland, on 13 Jan 2022 (Sara and Lucy Dean; UBR 2022/066); one at the entrance to Whangarei Harbour on 18 Feb 2022 (Cathy & Peter Mitchell; UBR 2022/020). Within the New Zealand region, brown noddies breed only on the Kermadec Islands (Veitch *et al*. 2004). There are three previous accepted records from the mainland, most recently in 2002 (Medway 2004).

Black noddy (*Anous minutus*)
One at Duffer's Reef, outer Pelorus Sound, on 4 Mar 2021 (Mike Bell; UBR 2021/020); one at Maunganui Bluff, Ninety Mile Beach, on 13 Feb 2022 (Dave Howes and Scott Brooks; UBR 2022/015). Within the New Zealand region, black noddies breed only on the Kermadec Islands (Veitch *et al*. 2004). There are seven previous accepted records from the mainland (Miskelly *et al*. 2021).

Sooty tern (*Onychoprion fuscata*)
One at Rangatira Island, Chatham Islands, on 3 Feb 2021 (Alan Tennyson, Graeme Taylor, Erin Patterson, and Rachel Hufton; UBR 2021/011) was the first record from the Chatham Islands. One at Black Reef, Cape Kidnappers, on 4 Jan 2022 (Alan Tennyson; UBR 2022/120); one at Pukerua Bay, Wellington, on 5 Feb 2022 (Oscar Thomas and eight others; UBR 2022/007, images on NZBO); one dead on Muriwai Beach, west Auckland, on 26 Mar 2022 (UBR 2022/076; Auckland Museum specimen LB16103). Within the New Zealand region, sooty terns breed only on the Kermadec Islands, with at least 14 previous records from elsewhere in the region (Veitch *et al*. 2004; Miskelly *et al.* 2021).

Eastern rockhopper penguin (*Eudyptes filholi*)
One north of Ashburton River mouth on 24 Feb 2022 (Georgie Archibald and Noah Fenwick; UBR 2022/052); one at Nugget Point, Catlins, on 20 Apr 2022 (Oscar Thomas, Ela Hunt, and Nick Beckwith; UBR 2022/046). These are the third and fourth accepted South Island records, as most earlier records did not differentiate between the three species of rockhopper penguins (Miskelly *et al.* 2015, 2019).

Erect-crested penguin (*Eudyptes sclateri*)
One at Goughs Bay, Banks Peninsula, on 5 Mar 2016, with another there on 20 Feb 2021 (Philip Crutchley and Sandi Stewart; UBRs 2021/017 & 2021/023); one at Claverly Beach, Hundalees, on 19 Feb 2021 (Stephen Hill and Nora Kahler; UBR 2021/031); one at Onuku, Banks Peninsula, on 30 Jan 2022 (John Davey, Oliver Davey, and Katy Leeds; UBR 2022/010). Erect-crested penguins breed on the Bounty and Antipodes Islands, with at least one bird reported moulting on the east coast of the South Island and on the Chatham Islands during January–March most years (Miskelly *et al.* 2019, 2021).

Grey-headed albatross (*Thalassarche chrysostoma*)
One off Whiritoa Beach, Coromandel, on 7 Jun 2021 (Russell Cannings and eight others; UBR 2021/042). This species is frequently found dead on mainland beaches (Powlesland 1985); however, this is the first live sighting from coastal waters accepted by the RAC.

Chatham Island albatross (*Thalassarche eremita*)
Two east of the Poor Knights Islands on 17 Oct 2020 (images on NZBO), with one there on 30 Oct 2021, two on 23 Oct 2022, one on 1 Nov 2022, and one on 10 Dec 2022 (Scott Brooks and 26 others; UBRs 2022/036, 2022/037, 2022/090, 2022/104 & 2022/105). There are six earlier records from New Zealand mainland coastal waters in the RAC database, and at least 10 earlier unreported records (Miskelly *et al.* 2019). These recent records suggest that the species is regularly present off north-eastern New Zealand during October to December.

Grey-backed storm petrel (*Garrodia nereis*)
One east of the Poor Knights Islands on 24 Jul 2021 (Scott Brooks and eight others; UBR 2022/034; images on NZBO). Grey-backed storm petrel is reportable north of Cook Strait. This is the first northern record accepted by the RAC. For earlier northern records, see Gaskin & Baird (2005) and Miskelly (2006).

Black-bellied storm petrel (*Fregetta tropica*)
One east of the Poor Knights Islands on 6 Nov 2019 (Bruce Wedderburn; UBR 2022/021). Black-bellied storm petrel is reportable north of Banks Peninsula. This is the second northern record accepted by the RAC (Miskelly *et al.* 2011).

White-headed petrel (*Pterodroma lessonii*)
One east of the Poor Knights Islands on 6 Oct 2019 (Scott Brooks and six others; UBR 2022/026); one off Whiritoa Beach, Coromandel, on 7 Jun 2021 (Russell Cannings and at least five others; UBR 2021/039). White-headed petrel is no longer a reportable species.

Kermadec petrel (*Pterodroma neglecta*)
One east of the Poor Knights Islands on 31 Jan 2022 (Dave Howes, Scott Brooks, and at least six others; UBR 2022/005). Within the New Zealand region, Kermadec petrels breed only on the Kermadec Islands (Veitch *et al*. 2004). This is the fourth accepted record from coastal waters around New Zealand's main islands (Miskelly *et al.* 2019).

Soft-plumaged petrel (*Pterodroma mollis*)
At least 18 off Whiritoa Beach, Coromandel, on 7 Jun 2021 (Russell Cannings and seven others; UBR 2021/040). Soft-plumaged petrel is reportable north of Cook Strait. This is the seventh northern record accepted by the RAC (Miskelly *et al.* 2019).

Mottled petrel (*Pterodroma inexpectata*)
One off Whiritoa Beach, Coromandel, on 7 Jun 2021 (Russell Cannings, Johannes Fischer, and five others; UBR 2021/041); one east of the Poor Knights Islands on 1 Nov 2020, with three there on 30 Oct 2021 (Scott Brooks and ten others; UBRs 2022/031 & 2022/032). Mottled petrel is no longer a reportable species.

White-naped petrel (*Pterodroma cervicalis*)
One east of the Poor Knights Islands on 17 Feb 2020, with two there on 20 Feb 2021 (Scott Brooks and 11 others; UBRs 2022/024 & 2022/027, image on NZBO). There are ten previous records from coastal waters off the mainland (CMM, *unpubl. data*).

Broad-billed prion (*Pachyptila vittata*)
One off Kaikoura on 13 Dec 2020 (Fraser Gurney, Luke Richards, and Marissa McDonald; UBR 2021/066). Although commonly found dead on New Zealand beaches (Powlesland 1989), live broad-billed prions are reportable north of Banks Peninsula. This is the second northern record accepted by the RAC (Miskelly *et al.* 2019).

Antarctic prion (*Pachyptila desolata*)
One south-west of the Kermadec Islands on 27 Mar 2021 (Fraser Gurney, Kermadec pelagic; UBR 2022/083, images on NZBO); two east of Poor Knights Islands on both 10 & 30 Jul 2022 (Scott Brooks and 13 others; UBRs 2022/093 & 2022/094). Although commonly found dead on New Zealand beaches (Powlesland 1989), live Antarctic prions are reportable north of Banks Peninsula. There was one previous northern record accepted by the RAC (Miskelly *et al.* 2019).

Wedge-tailed shearwater (*Ardenna pacifica*)
Singles east of the Poor Knights Islands on 17 Feb 2020 and 17 Dec 2022 (Scott Brooks and 12 others; UBRs 2022/028 & 2022/112); one in the outer Bay of Plenty on 26 March 2021 (Fraser Gurney, Kermadec pelagic; UBR 2022/085). Within the New Zealand region, wedge-tailed shearwaters breed only on the Kermadec Islands (Veitch *et al*. 2004). There was one previous live record from coastal waters off the mainland accepted by the RAC (Miskelly *et al.* 2013), and several others have been found dead (Checklist Committee 2022).

Subantarctic little shearwater (*Puffinus elegans*)
Three off Otago on 4 Oct 2022 (Oscar Thomas, Graeme Loh, Ela Hunt, Nicholas Winterle Daudt, and Will Rayment; UBR 2022/088). This is the first record of this species accepted by the RAC. Within the New Zealand region, this species breeds at the Chatham and Antipodes Islands (Checklist Committee 2022).

Otago shag (*Leucocarbo chalconotus*)
One at Port Levy, Banks Peninsula, on 29 Oct 2020 (Andrew Crossland; UBR 2021/033). Note that Otago shags are no longer reportable south of Banks Peninsula on the South Island (see Crossland 2021 and Miskelly *et al.* 2021, and also Miskelly, Forsdick *et al.* 2022 for taxonomy and nomenclature).

***Leucocarbo* shag (*Leucocarbo* sp.)**
A pied morph *Leucocarbo* shag at Akaroa Head, Banks Peninsula, on 10 Jul 2021 (Nicholas Allen and Fraser Gurney; UBR 2021/047) was likely either an Otago shag (*L. chalconotus*) or a king shag (*L. carunculatus*).

Nankeen night heron (*Nycticorax caledonicus*)
One at Dannevirke on 25 Sep 2021 (Steve Bowie and family; UBR 2021/056). A few nankeen night herons breed along the Whanganui River; they are rarely reported away from there (Miskelly *et al.* 2015; Frost 2022)

Galah (*Eolophus roseicapilla*)
One at Fleming Wetland, Catlins, on 12 Nov 2021 (Myrene Otis, Franny Cunninghame, and Petra Simpson; UBR 2021/068). The only known wild galah population in New Zealand is in South Auckland, centred on Ponui Island, Mangatawhiri, Bombay, and Clevedon (Checklist Committee 2022).

Red-crowned parakeet (*Cyanoramphus novaezelandiae*)
One at Otatara, Invercargill, on 17 Oct 2021 (Megan Parkinson; UBR 2021/059). There are numerous records of this species between Riverton and Bluff on eBird. Following an illegal release by a local breeder, red-crowned parakeets have established at several sites in coastal Southland where mammalian predators are controlled (Pete McClelland *pers. comm*. to CMM, 17 Mar 2023).

Records not accepted, or held in suspense
Some of the following records may have been genuine, but were insufficiently documented to be accepted by the Records Appraisal Committee. At least 11 were considered to be misidentifications.

Chestnut teal (*Anas castanea*)
A pair with ducklings photographed at St Anne's Lagoon, Cheviot, on 16 Dec 2022 were considered to be grey teal (*A. gracilis*) with stained plumage (UBR 2022/113).

***Anas* sp.**
An unusual teal photographed at Saltwater Creek, Timaru, on 3 Jun 2022 (UBR 2022/086) was considered likely to be a hybrid, possibly between a mallard (*A. platyrhynchos*) and a grey teal.

Northern shoveler (*Spatula clypeata*)
One reported at Lake Hakanoa, Huntly, on 16 Jul 2021 (UBR 2021/045).

Oriental cuckoo (*Cuculus optatus*)
One reported at Prince of Wales Park, Mt Cook, Wellington, on 13 Jan 2021 (UBR 2021/009).

Cuckoo sp.
A "long-beaked Australian cuckoo" reported from Otaki Beach on 20 Mar 2021 was considered unidentifiable (UBR 2021/025).

Fork-tailed swift (*Apus pacificus*)
One reported at Shakespear Park, Whangaparaoa, on 28 Nov 2022 (UBR 2022/100). Two other records from Otago were identified from photographs as being of welcome swallows (*Hirundo neoxena*) (UBRs 2022/062 & 2022/073), and a flock of at least 20 reported from Raumati South, Kapiti coast, on 9 Feb 2021 (UBR 2021/030) was also considered likely to have been welcome swallows.

Grey plover (*Pluvialis squatarola*)
One reported at Otaki River mouth on 21 Nov 2022 (UBR 2022/099).

Greater sandplover (*Charadrius leschenaultii*)
One reported at Ashley estuary, Canterbury, on 18 Dec 2012 (UBR 2021/073).

American whimbrel (*Numenius hudsonicus*)
A whimbrel photographed at Māhia Peninsula, Hawke's Bay, on 17 Feb 2020 (UBR 2022/056) was considered to be a Eurasian whimbrel (*N. phaeopus*).

Black noddy (*Anous minutus*)
One reported off Lyttelton Harbour mouth on 4 Mar 2021 (UBR 2021/021).

Pacific gull (*Larus pacificus*)
A report of an immature Pacific gull on Dargaville Beach in January 2010 that was initially accepted by the Records Appraisal Committee (UBR 2010/003; Miskelly *et al*. 2013) has been reviewed and now rejected. The species has been removed from the New Zealand list (Miskelly, Forsdick *et al*. 2022).

Bridled tern (*Onychoprion anaethetus*)
One reported dead on Muriwai Beach, west Auckland (UBR 2022/054), was identified from measurements and photographs as being a sooty tern (UBR 2022/076, *q.v.*).

Common tern (*Sterna hirundo*)
One photographed at Te Raekaihau Point on the Wellington south coast (UBR 2022/071), was probably a white-fronted tern (*Sterna striata*).

Unidentified tern
An unidentified tern photographed at Waikanae estuary, Kapiti coast, on 21 Jan 2015 was reassessed and considered to possibly be a black tern (UBR 2015/060; see also Miskelly *et al*. 2017).

Red-tailed tropicbird (*Phaethon rubricauda*)
UBR 2021/061 (Rakahuri River, Canterbury) was withdrawn when the submitter realised it was a misidentification of a common species.

Tropicbird sp. (*Phaethon* sp.)
A report of 12 tropicbirds at Bethlehem, Tauranga, on 24 Aug 2021 (UBR 2021/052) was considered likely to be of a flock of terns.

Snares crested penguin (*Eudyptes robustus*)
A crested penguin photographed at Claverly Beach, Hundalees, Canterbury, on 19 Feb 2021 (UBR 2021/018) was assessed as being an erect-crested penguin.

Chatham Island albatross (*Thalassarche eremita*)
An albatross photographed in Foveaux Strait on 9 Jan 2021 (UBR 2021/001) was assessed as being a Salvin's albatross (*T. salvini*).

Australian white-faced storm petrel (*Pelagodroma marina dulciae*)
A report of a possible Australian white-faced storm petrel photographed east of the Poor Knights Islands on 1 Nov 2020 (UBR 2021/046) has been held in suspense.

Great-winged petrel (*Pterodroma macroptera macroptera*)
One photographed at the Star of Bengal Banks, south of the Kermadec Islands, on 3 Apr 2021 (UBR 2022/009).

Antarctic prion (*Pachyptila desolata*)
One photographed at New Brighton Beach, Christchurch, on 20 May 2021 (UBR 2021/043).

Bulwer's petrel (*Bulweria bulwerii*)
One south of Weka Reef, Port Adventure, Stewart Island, on 7 Jan 2020 (UBR 2021/007).

Great frigatebird (*Fregata minor*)
One reported near Stephenson Island, off Whangaroa Harbour, on 14 Feb 2022 (UBR 2022/018) is considered more likely to have been a skua.

Masked booby (*Sula dactylatra*)
Two at Paekakariki, Kapiti Coast, on 16 Mar 2021 (UBR 2021/024), and one at Waipatiki Beach, Hawke's Bay, on 9 Dec 2021 (UBE 2021/071).

Nankeen night heron (*Nycticorax caledonicus*)
A 'night heron' photographed at Parua Bay, Whangarei Heads, on 3 Sep 2021 (UBR 2021/053) was identified as an Australasian bittern (*Botaurus poiciloptilus*).

Heron sp.
An unidentified heron reported from Rangitumau, Masterton, on 7 Jun 2021 (UBR 2021/038) was considered likely to have been a cattle egret (*Bubulcus ibis*).

Barn owl (*Tyto alba*)
One heard at Matangi (east of Hamilton) on 31 Mar 2020 (UBR 2021/044).

Black falcon (*Falco subniger*)
Dark falcons reported at Melrose, Wellington, on 13 Feb 2021 (UBR 2021/013) and Khandallah, Wellington on 28 Feb 2021 (UBR 2021/013A) were considered likely to have been juvenile New Zealand falcons (*F. novaeseelandiae*).

South Island kokako (*Callaeas cinerea*)
Single birds reported at North Bank, Wairau Road, Marlborough, on 1 Aug 2020 (UBR 2021/055) and west of Flanagan's corner, Heaphy track, on 16 Mar 2022 (UBR 2022/074).

Hihi (*Notiomystis cincta*)
Two reported at Wairere Falls, Waikato on 12 Jan 2021 (UBR 2021/036) and several birds at Redwood, Tawa, Wellington, on 3 Jun 2021 (UBR 2021/037) were considered to be tomtits (*Petroica macrocephala*) and goldfinches (*Carduelis carduelis*) respectively.

Whitehead (*Mohoua albicilla*)
One reported on the Bridle Path, Lyttelton, on 5 Jan 2022 (UBR 2022/002).

North Island piopio (*Turnagra tanagra*)
One reported on the Coromandel Coastal Walkway west of Stoney Bay on 22 Apr 2021 (UBR 2021/035).

Satin flycatcher (*Myiagra cyanoleuca*)
One reported from Mahurangi River, North Auckland, on 2 Dec 2022 (UBR 2022/118) was identified from a photograph as being a welcome swallow.

Australian tree martin (*Petrochelidon nigricans*)
One reported from Otaki beach, Kapiti coast, on 6 Apr 2022 (UBR 2022/060) was considered likely to have been a juvenile welcome swallow.

DISCUSSION

The Records Appraisal Committee received 199 Unusual Bird Reports between January 2021 and December 2022, at an average rate of 8.3 per month. This was the second highest reporting rate in the history of the reporting scheme (9.2 per month were received during 2017–18; Miskelly *et al*. 2019). A total of 160 UBRs were accepted (80.4%), which was similar to the acceptance rate of 79.9% for 847 submissions over the previous decade (Miskelly *et al*. 2013, 2015, 2017, 2019, 2021).

A feature of the 2021–22 reporting period was the large number of submissions arising from pelagic sea-birding trips off the north-east coast of Northland, including 30 UBRs from east of the Poor Knights Islands, and 10 from a single voyage to the Kermadec Islands. Together, these trips were the source of about 20% of submitted UBRs, and 24% of accepted UBRs. The trips (all organised by Scott Brooks) are changing our understanding of seabird distribution in northern pelagic waters. In addition to numerous records of species rarely seen in New Zealand, the trips have revealed that several petrel species from distant breeding sites are regularly present in northern coastal waters. As a result, white-headed petrel and mottled petrel are no longer considered reportable species, and white-naped petrel is now only reportable south of the Bay of Plenty.

Common tern was the most reported species during the 2-year period of 2021–22, with eight UBRs received (and seven accepted). However, this reporting rate was slightly lower than the average of 6 per annum for this species over the previous 4 years (Miskelly *et al*. 2019, 2021). Species reported (and accepted) in exceptional numbers in 2021–22 included five each of South Polar skua and Gould's petrel, and four whiskered terns. The first two species were mainly reported during the increased pelagic sea-birding effort off the east coast of Northland and near the Kermadec Islands. The high reporting rate for whiskered tern was the most notable, as the rate of 2 per annum was 6.8 times higher than the reporting rate of 0.3 per annum during 1977 to 2020 (13 previous accepted records). The four recent records were spread over time and distance, although it is possible that the bird seen at New River estuary in June and July 2022 was the same individual that was at nearby Waituna Lagoon in January 2022.

The most notable records during 2021–22 were the addition of black tern, black-naped tern, and Matsudaira's storm petrel to the New Zealand list. All three were found on the west coast of the North Island, between January and May 2022. Black tern was the most unexpected find, as New Zealand is a long way from its usual range. The nominate subspecies breeds from Europe across Russia to western Asia, and migrates to western and southern Africa (del Hoyo *et al*. 1996; Thomas & Hunt 2023), making the New Zealand bird at least 12,000 km beyond its usual range. There are three accepted records of black tern from Australia and one from Papua New Guinea (Finch 1986; Menkhorst *et al.* 2017). The Australian birds are all considered to have been of the American subspecies *C. n. surinamensis*, while the Papua New Guinea bird (an adult in breeding plumage in May 1985) and the New Zealand bird are thought to have been of the nominate subspecies (Finch 1986; Higgins & Davies 1996; Menkhorst *et al.* 2017; information in this report).

Black-naped tern breeds on the Great Barrier Reef and in New Caledonia, and also further afield in the tropical south-west Pacific and Indian Ocean (Higgins & Davies 1996; Menkhorst *et al.* 2017). The black-naped tern from the Auckland west coast was found during Cyclone Dovi. This Category 4 severe tropical cyclone passed through New Caledonia before hitting New Zealand during 12–14 February. It apparently brought several tropical seabirds with it, including the black-naped tern, New Zealand's second bridled tern, and at least one each of great frigatebird, lesser frigatebird, brown noddy, and black noddy, all of which were observed north of Auckland during 13–18 Feb 2022 (UBRs cited herein).

Matsudaira's storm petrel breeds on islands south-east of Japan, and migrates to the tropical Indian Ocean during the non-breeding season (Harrison *et al*. 2021). It is a regular but uncommon visitor to pelagic waters north-west of Australia during July to December (Menkhorst *et al.* 2017); there are no accepted records from eastern Australia (BirdLife Australia Rarities Committee website, viewed 21 Mar 2023). The New Zealand record was approximately 4,400 km south-east of its usual range and was found in late May, when breeding adults would be caring for chicks approximately 7,800 km away (breeding timetable from Harrison *et al*. 2021).

The addition of black tern, black-naped tern, and Matsudaira's storm petrel increases the number of bird species recorded naturally from New Zealand since AD 1800 to 358 (Checklist Committee 2022). Of these, 16 are considered extinct. In addition, 35 introduced species are currently considered established in the wild in New Zealand, making the current avifauna 377 species (including 25 migrant species that breed elsewhere, and 140 vagrant species; see Townsend *et al*. 2008 for definitions).

Of the 54 vagrant species accepted by the RAC in 2021–22, 17 species (31.4%) were Arctic breeding migrants (9 Eurasian, 3 North American, 5 either), 11 species (20.4%) were likely from Australia, 9 species (16.7%) were probably from the tropical Pacific, four species were from Asia, four from subantarctic islands beyond New Zealand, three from Antarctica, three from Chile, and one each from Lord Howe Island (providence petrel), the south Atlantic (great shearwater) and Eurasia (black tern). This continues the pattern of Arctic-breeding migratory species, followed by Australian species, being the main sources of vagrant bird records in New Zealand (Miskelly *et al*. 2019). A notable change during 2021–22 was the increase in the number of tropical Pacific seabirds reported, up from four species (7.5%) in 2019–20. This increase was due to increased pelagic seabird search effort in northern waters, and tropical cyclones (particularly Cyclone Dovi in February 2022) bringing birds south.

ACKNOWLEDGEMENTS

We thank the many Birds NZ members and associates and interested members of the public who submitted records for assessment. Particular thanks to Susan Anderson, Scott Brooks, Hayden Pye, Oscar Thomas, and Duncan Watson for kindly granting permission to reproduce their images, and to adjunct RAC member Paul Sagar, who contributed to assessments of 13 UBRs submitted by RAC members and reported here. We also thank Ricky-Lee Erickson for details of three bird specimens acquired by Tāmaki Paenga Hira Auckland War Memorial Museum. This manuscript was improved by comments received from Warwick Allen, Oscar Thomas, and an anonymous reviewer.

LITERATURE CITED

Barlow, M.L. 1979. Many Antarctic petrels around Foveaux Strait. *Notornis 26*: 329.

Beauchamp, A.J. 2019. Australasian little grebe (*Tachybaptus novaehollandiae*) breeding on Whangarei sewerage wetlands, New Zealand, 2015–2017. *Notornis 66*: 16–22.

Bull, P.C. 1943. The occurrence of *Pterodroma leucoptera* in New Zealand. *Emu 42*: 145–152.

Checklist Committee (B.J. Gill, convenor) 2010. *Checklist of the birds of New Zealand, Norfolk and Macquarie Islands, and the Ross Dependency, Antarctica*. Fourth edition. Wellington, Ornithological Society of New Zealand & Te Papa Press. 500 pp.

Checklist Committee (C.M. Miskelly, convenor) 2022. *Checklist of the birds of New Zealand*. Fifth edition. Wellington, Ornithological Society of New Zealand. 334 pp.

Cook, W.A.; Cooper, D.; Foes-Lamb, P.; Foes-Lamb, J.; Gdanitz, J.; Davies, G.; Field, C.; Field, P.; Melville, D.S. 2016. First and second breeding of Australian wood duck (*Chenonetta jubata*) in New Zealand. *Notornis 63*: 105–108.

Crossland, A.C. 2021. Northward expansion of the non-breeding range of Otago shag (*Leucocarbo chalconotus*) along the Canterbury coast towards Banks Peninsula, eastern South Island, New Zealand. *Notornis 68*: 167–170.

del Hoyo, J.; Elliott, A.; Sargatal, J. (*eds*) 1996. *Handbook of the birds of the world.* Vol. 3. Barcelona, Lynx Edicions. 821 pp.

Dowding, J.E. 2020. Changes in the number and distribution of northern New Zealand dotterels (*Charadrius obscurus aquilonius*): results of four censuses undertaken between 1989 and 2011. *Notornis 67*: 717–728.

Fennell, J.F.M. 1986. Annual report of the OSNZ Rare Birds Committee. *OSNZ News 39*: 3.

Finch, B.W. 1986. Black tern *Chlidonias niger* at Moitaka settling ponds, Central Province – first record for the New Guinea Region. *Muruk 1*: 26–28 (reprinted in 1990 with page numbers 27–29).

Frost, P.G.H. 2022. Nankeen night heron | Umu kōtuku. *In*: Miskelly, C.M. (*ed.*) *New Zealand Birds Online*. www.nzbirdsonline.org.nz. Viewed: 17 Mar 2023.

Gaskin, C.; Baird, K. 2005. Observations of black and white storm petrels in the Hauraki Gulf, November 2003 – June 2005: were they of New Zealand storm petrels? *Notornis 52*: 181–194.

Harrison, P.; Perrow, M.R.; Larsson, H. 2021. *Seabirds; the new identification guide*. Barcelona, Lynx Edicions. 600 pp.

Heather, B.D. 1987. The chestnut-breasted shelduck in New Zealand 1983–1986. *Notornis 34*: 71–77.

Heather, B.D.; Jones, E.B. 1979. The whiskered tern in New Zealand – first records. *Notornis 26*: 185–195.

Higgins, P.J.; Davies, S.J.J.F. (*eds*) 1996. *Handbook of Australian, New Zealand and Antarctic birds*. Vol. 3, snipe to pigeons. Melbourne, Oxford University Press. 1028 pp.

Imber, M.J.; Jenkins, J.A.F. 1981. The New Caledonian petrel. *Notornis 28*: 149–160.

Imber, M.J.; Merton, D.V.; West, J.A.; Tennyson, A.J.D. 1991. Juan Fernandez petrels prospecting at the Chatham Islands. *Notornis 38*: 60–62.

Jacques, S.; Rees, G.; Rhodes, P.; Bliss, J.; Roberts, J.; McClelland, P. 2023. First and second breeding of gull-billed tern (*Gelochelidon nilotica macrotarsa*) in New Zealand. *Notornis 70*: 45–48.

Medway, D.G. 2002. Rare Birds Committee – 6 monthly report. *Southern Bird 10*: 5–6.

Medway, D.G. 2004. Rare Birds Committee – Six monthly report. *Southern Bird 18*: 12.

Menkhorst, P.; Rogers, D.; Clarke, R.; Davies, J.; Marsack, P.; Franklin, K. 2017. *The Australian bird guide*. London, Bloomsbury, Christopher Helm. 566 pp.

Miskelly, C.M. 2006. An unprecedented influx of grey-backed storm petrels (*Garrodia nereis*) in the Hauraki Gulf, northern New Zealand. *Notornis 53*: 317–318.

Miskelly, C.M.; Bester, A.J.; Bell, M. 2006. Additions to the Chatham Islands' bird list, with further records of vagrant and colonising bird species. *Notornis 53*: 215–230.

Miskelly, C.M.; Crossland, A.C.; Sagar, P.M.; Saville, I.; Tennyson, A.J.D.; Bell, E.A. 2013. Vagrant and extra-limital bird records accepted by the OSNZ Records Appraisal Committee 2011–2012. *Notornis 60*: 296–306.

Miskelly, C.M.; Crossland, A.C.; Sagar, P.M.; Saville, I.; Tennyson, A.J.D.; Bell, E.A. 2015. Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2013–2014. *Notornis 62*: 85–95.

Miskelly, C.M.; Crossland, A.C.; Sagar, P.M.; Saville, I.; Tennyson, A.J.D.; Bell, E.A. 2017. Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2015–2016. *Notornis 64*: 57–67.

Miskelly, C.M.; Crossland, A.C.; Sagar, P.M.; Saville, I.; Tennyson, A.J.D.; Bell, E.A. 2019. Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2017–2018. *Notornis 66*: 150–163.

Miskelly, C.M.; Crossland, A.C.; Sagar, P.M.; Saville, I.; Tennyson, A.J.D.; Bell, E.A. 2021. Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2019–2020. *Notornis 68*: 253–265.

Miskelly, C.M.; Elliott, G.P.; Parker, G.C.; Rexer-Huber, K.; Russ, R.B.; Taylor, R.H.; Tennyson, A.J.D.; Walker, K.J. 2020. Birds of the Auckland Islands, New Zealand subantarctic. *Notornis 67*: 59–151.

Miskelly, C.M.; Forsdick, N.J.; Gill, B.J.; Palma, R.L.; Rawlence, N.J.; Tennyson, A.J.D. 2022. Amendments to the 2010 Checklist of the birds of New Zealand. *Ornithological Society of New Zealand Occasional Publication No. 2*. Wellington, Ornithological Society of New Zealand. 69 pp.

Miskelly, C.M.; Purdie, A.; Spencer, A.; Szabo, M.J. 2022. Adelie penguins (*Pygoscelis adeliae*) in New Zealand. *Notornis 69*: 264–266.

Miskelly, C.M.; Scofield, R.P.; Sagar, P.M.; Tennyson, A.J.D.; Bell, B.D.; Bell, E.A. 2011. Vagrant and extra-limital bird records accepted by the OSNZ Records Appraisal Committee 2008–2010. *Notornis 58*: 64–70.

Petch, S.; Hill, C.; Allen, N. 2002. First record of a long-toed stint (*Calidris subminuta*) in New Zealand. *Notornis 49*: 182–184.

Petyt, C. 1999. First record of northern pintail (*Anas acuta*) in New Zealand. *Notornis 46*: 298–299.

Powlesland, R.G. 1985. Seabirds found dead on New Zealand beaches in 1983 and a review of albatross recoveries since 1960. *Notornis 32*: 23–41.

Powlesland, R.G. 1987. Seabirds found dead on New Zealand beaches in 1985 and a review of *Pterodroma* species recoveries since 1960. *Notornis 34*: 237–252.

Powlesland, R.G. 1989. Seabirds found dead on New Zealand beaches in 1986 and a review of *Pachyptila* species since 1960. *Notornis 36*: 125–140.

Scofield, R.P. 2006. Rare Birds Committee report for the year to 31st July 2006. *Southern Bird 27*: 8–9.

Scofield, R.P. 2008. Rare Birds Committee report for the two years to 31st July 2008. *Southern Bird 36*: 5.

Taylor, G.A.; Parrish, G.R. (compilers). 1991. Classified summarised notes, North Island, 1 July 1989 to 30 June 1990. *Notornis 38*: 267–314.

Thomas, O.J.W.; Hunt, E.K.S. 2023. Year of the tern: the first record of black tern (*Chlidonias niger*) from New Zealand. *Notornis 70(2)*: 93-95.

Townsend, A.J.; de Lange, P.J.; Duffy, C.A.J.; Miskelly, C.M.; Molloy, J.; Norton, D.A. 2007. *New Zealand Threat Classification System manual*. Wellington, Department of Conservation. 35 pp.

Veitch, C.R.; Miskelly, C.M.; Harper, G.A.; Taylor, G.A.; Tennyson, A.J.D. 2004. Birds of the Kermadec Islands, south-west Pacific. *Notornis 51*: 61–90.

Notornis, 2023, Vol. 70: 74-82
0029-4470 © The Ornithological Society of New Zealand Inc.

Wing areas and wing loadings of New Zealand land birds

B.J. GILL*
Auckland War Memorial Museum#, Auckland, New Zealand

Abstract: Wing areas and wing loadings of New Zealand land birds are poorly documented in the literature. I therefore report measured wing areas of 84 individual birds belonging to 27 species, with calculated wing loadings. Plotting the data graphically allows some ecological inferences. Heavier New Zealand land birds achieve greater wing loadings than lighter species, as is the case for birds generally. For flying birds, small passerines had the lowest wing loadings (0.12 g/cm^2 for the New Zealand fantail) and heavier non-passerines the highest wing loadings (0.88 g/cm^2 for the pukeko). I expected non-migratory, forest-dwelling, endemic song-birds with weak dispersal abilities to have very high wing loadings but this was not the case. Instead, native and introduced song-birds of similar size tended to have fairly similar wing loadings. Wing loading was slightly elevated in the North Island saddleback and North Island kokako but the whitehead was normal. The tui, a vigorous flier, had a much lower wing loading than expected for its mass. Data for three flightless species suggest that while high wing loading is an important correlate of flightlessness, it is not the only factor.

Gill, B.J. 2023. Wing areas and wing loadings of New Zealand land birds. *Notornis 70(2)*: 74–82.

Keywords: wings, body weight, flying ability, passerines

INTRODUCTION

The ability to fly, and morphological adaptations for flight, are prominent characteristics of birds. Wing loading is the ratio of body mass to wing area (Pennycuick 1985). Livezey (1992) regarded it as probably the most direct measure of flight-related morphology in birds. The relative wing loading of different species of birds correlates with their evolutionary history and their ecological niche.

Warham (1977) measured wing areas of New Zealand procellariiform seabirds and found that wing loading in petrels, as in birds generally, increased with increasing body size and correlated with aspects of the birds' ecology. Similar details have not been available for New Zealand land birds. While working as a museum curator I had an opportunity to rectify this by tracing onto paper the wing outlines of land birds from the northern North Island region that were handed in dead to Auckland Museum.

I measured mostly native passerines, but I included a small selection of introduced song birds and native non-passerines for comparison. The samples are small but permit a preliminary overview of the subject. Pennycuick (1985) noted that collections of wing areas were worth publishing, provided that explicit details of the methods of measurement were given.

Received 30 December 2022; accepted 6 May 2023
*Correspondence: *adiantum@outlook.co.nz*
#retired

Loss of flying ability is a distinctive feature of the New Zealand avifauna (Wilson 2004: 63–66). My expectation was that some of the native passerines in endemic genera that seem to be weak fliers, like the whitehead (*Mohoua albicilla*), North Island kokako (*Callaeas wilsoni*), and saddleback (*Philesturnus rufusater*), would show increased wing loading compared to strong fliers like the tui (*Prosthemadera novaeseelandiae*). This would be consistent with the idea that for some of the non-migratory land birds that live exclusively within forest and scrub, a long evolutionary history in an environment free of mammalian predators had allowed them to reduce their energetic investment in strong flight.

METHODS

From the 1980s to the early 2000s I examined land birds that were received dead by Auckland War Memorial Museum before they were processed into museum specimens. While they were fresh, or after they had defrosted (if received and stored frozen), and while their wings were flexible, I traced the outline of one wing onto millimetre-ruled graph paper using a pencil. I placed the graph paper on a table, and, with the bird on its back, I extended one wing over the graph paper making the wing's leading edge as straight as possible (Mendelsohn *et al*. 1989). This makes the wing fully open, as in flight, and standardises the wing shape. I measured only full-sized (usually adult) wings that did not have moulting flight feathers.

I counted the graph squares within the traced wing outline to estimate the wing area in mm^2, and divided by 100 to convert the number to cm^2. Wing loading (or mass loading) can be expressed as body mass per unit of wing area (g/cm^2), or as wing area per unit of mass (cm^2/g). I used the former, following Clark (1971), Warham (1977), and Mendelsohn *et al*. (1989). I calculated wing loading as body mass (g) divided by twice the area of one wing (cm^2). Some authors include in the wing area an estimate of the area of the body between the wings (e.g. Pennycuick 1985), but I followed Warham (1977) and Mendelsohn *et al*. (1989) by ignoring the body.

Individual body masses for most of the museum birds were recorded at examination, but I found that these were usually below the average masses given by Heather & Robertson (1996). This was presumably because birds dried out to some degree before they were found in the field and brought to the museum, and/or during subsequent storage in a deep-freezer (sometimes for many years) before examination. To avoid the bias that these low individual masses would introduce in calculating wing loading, I instead used the average masses that Heather & Robertson (1996) provided. If Heather & Robertson (1996) listed separate masses for males and females, I kept the sexes as separate samples. If a bird of a sexually dimorphic species was unsexed I used the average of the mean male and female masses to calculate wing loading.

In total I traced the outlines of 60 fresh wings belonging to 15 species. To increase the total sample to 84 wings of 27 species I also calculated the areas of 21 dry wings in Auckland Museum's spread-wing collection, and three dry wings in the collection of Museum of New Zealand Te Papa Tongarewa (Wellington). I chose spread wings that had been prepared with a straight leading edge. The sample included three flightless species, i.e. weka (*Gallirallus australis*), South Island takahe (*Porphyrio hochstetteri*), and kakapo (*Strigops habroptila*).

RESULTS

General

Measured areas of single wings vary between 18.4 cm^2 for a grey warbler (*Gerygone igata*) to 646.9 cm^2 for a kakapo (Appendix 1). Wing loadings calculated for each of the 27 species considered (in taxonomic order), with sexes separated for the species dimorphic in mass, are summarised in Table 1.

Representative wing loadings for 24 volant species of New Zealand land birds vary between 0.12 g/cm^2 for New Zealand fantail (*Rhipidura fuliginosa*) and 0.88 g/cm^2 for pukeko (*Porphyrio melanotus*) (Fig. 1). Small passerines have the lowest wing loadings, and heavier non-passerines the highest wing loadings. The long-tailed cuckoo (*Eudynamys taitensis*), the only long-distance migrant in the sample, has an intermediate wing loading (0.39 g/cm^2). Figure 2 (seven non-passerines and 17 passerines) and Figure 3 (17 passerines only) plot wing loadings as a function of mass. These show that heavier New Zealand land birds achieve greater wing loadings than lighter species. Figure 2 has an inverted j-shaped curve, because wing loading increases steeply with increasing mass and then levels out.

Taxonomic

Wing loadings of volant non-passerines vary between 0.38 g/cm^2 for the red-crowned parakeet (*Cyanoramphus novaezelandiae*) (a strong flier) and 0.39 g/cm^2 for the long-tailed cuckoo (which relies on strong flight for its long-distance migration), to 0.88 g/cm^2 for the pukeko (which flies reluctantly with rather laboured flight). For passerines, wing loadings vary from 0.12 g/cm^2 for the New Zealand fantail (an acrobatic flier that hawks insects) to 0.62 g/cm^2 for the North Island kokako (a weak flier). The non-passerines, mostly being heavier than the passerines, tend to have higher wing loadings (Fig. 2).

Table 1. Summary of wing loadings calculated for 27 species of New Zealand land birds. Sexes (and unsexed birds) are combined ("all") in species that are sexually monomorphic in mass. For samples with $n = 1$, the wing loading is shown in the range column. The data marked with a superscript "F" (^{F}) are used to represent the species in Figs 1–3.

Species	Sex	Mean	S.D.	*n*	Range
New Zealand pigeon (kererū)	♀	0.674^F	0.00880	2	0.67–0.68
long-tailed cuckoo	all	0.391^F	0.0378	3	0.37–0.44
banded rail	♂	–	–	1	0.56^F
weka	♂	–	–	1	1.19
pukeko	♂	–	–	1	0.88^F
South Island takahe	♂	–	–	1	2.98
New Zealand dotterel	?	–	–	1	0.58^F
kakapo	♂	–	–	1	1.62
kaka	?	–	–	1	0.59^F
red-crowned parakeet	♀	0.379^F	0.0412	2	0.35–0.41
red-crowned parakeet	?	–	–	1	0.37
rifleman	?	–	–	1	0.16^F
bellbird	♂	–	–	1	0.35
bellbird	♀	0.371^F	0.0764	3	0.31–0.46
tui	♂	0.312^F	0.0691	2	0.26–0.36
tui	?	–	–	1	0.24
grey warbler	all	0.164^F	0.0175	2	0.15–0.18
North Island kokako	♂	–	–	1	0.62^F
North Island saddleback	?	0.528^F	0.0523	7	0.45–0.62
North Island saddleback	♂	0.532	0.0557	3	0.49–0.59
stitchbird	♂	0.317^F	0.0450	3	0.28–0.36
stitchbird	♀	0.272	0.0305	2	0.25–0.29
stitchbird	?	–	–	1	0.31
whitehead	♂	0.278^F	0.0615	3	0.21–0.33
whitehead	♀	0.234	0.0163	3	0.22–0.24
whitehead	?	–	–	1	0.29
New Zealand fantail	all	0.118^F	0.0130	5	0.10–0.13
tomtit	♂	0.197^F	0.0222	8	0.17–0.23
North Island robin	all	0.334^F	0.0427	13	0.26–0.41
welcome swallow	all	0.178^F	0.0222	4	0.15–0.20
silvereye	♂	–	–	1	0.28^F
Eurasian blackbird*	♂	–	–	1	0.43^F
song thrush*	?	–	–	1	0.48^F
house sparrow*	♂	–	–	1	0.35^F
European goldfinch*	?	–	–	1	0.21^F

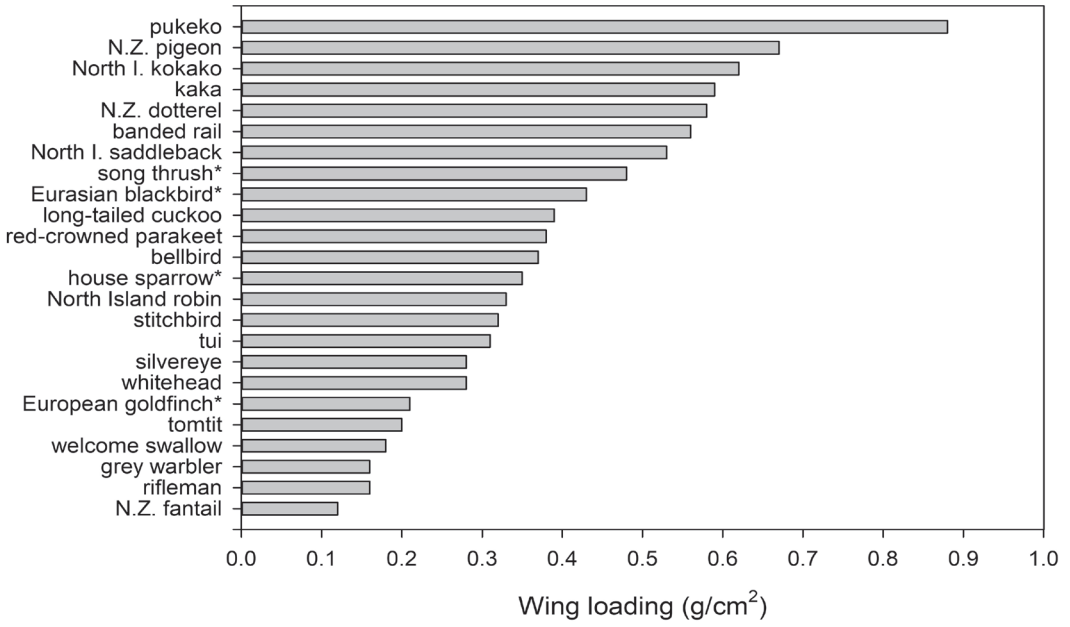


Figure 1. Wing loadings (g/cm^2) of 24 species of volant land birds from New Zealand. Bars show means or single values (see Table 1). Introduced species are marked with an asterisk (*).

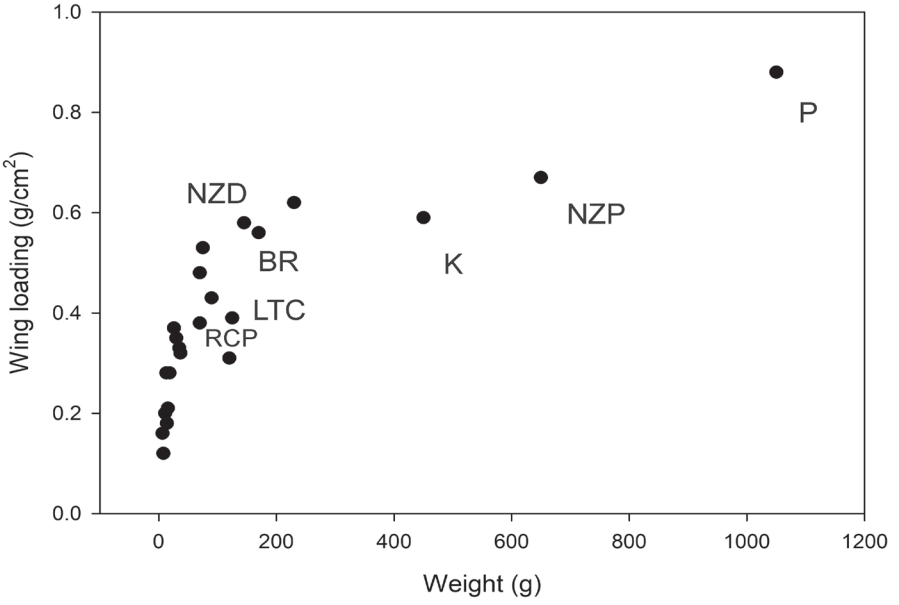


Figure 2. Wing loading (g/cm^2) as a function of mass (g) for 24 New Zealand volant land bird species. Plotted points are means or single values (see Table 1). Non-passerines are labelled: banded rail (BR), kaka (K), long-tailed cuckoo (LTC), New Zealand dotterel (NZD), New Zealand pigeon (NZP), pukeko (P), red-crowned parakeet (RCP). Unlabelled points are for passerines, shown separately in Fig. 3.

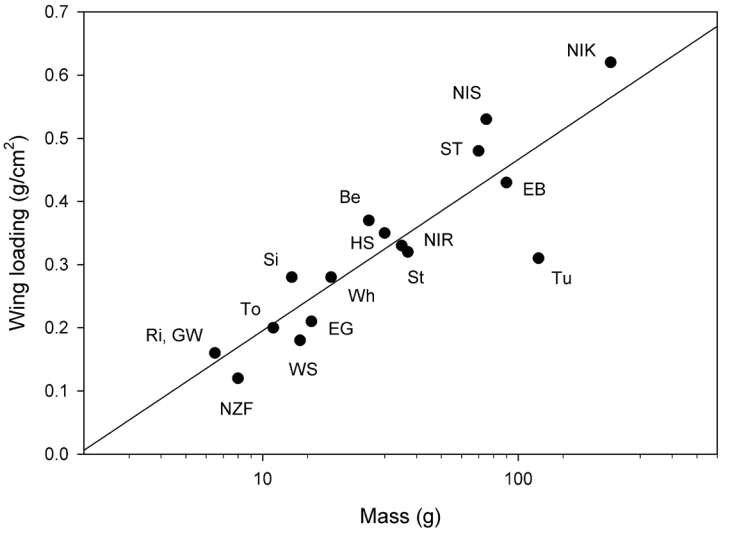


Figure 3. Semi-log plot of wing loading (g/cm²) as a function of mass (g) for 17 New Zealand passerine species (see Table 1): bellbird (Be), Eurasian blackbird* (EB), European goldfinch* (EG), grey warbler (GW), house sparrow* (HS), New Zealand fantail (NZF), North Island kokako (NIK), North Island robin (NIR), North Island saddleback (NIS), rifleman (Ri), silvereye (Si), song thrush* (ST), stitchbird (St), tomtit (To), tui (Tu), welcome swallow (WS), whitehead (Wh). Introduced species are marked with an asterisk (*).

The highest wing loadings for passerines (>0.4 g/cm²) are held by the heavier species (North Island kokako, North Island saddleback, song thrush *Turdus philomelos*, Eurasian blackbird *T. merula*; Fig. 3). The tui seems to have a much lower wing loading than expected for its mass and the North Island kokako and saddleback a slightly greater wing loading than expected (Fig. 3). In general, the native passerines in the study have wing loadings that are similar to those of similar-sized introduced song-birds, e.g. tomtit (*Petroica macrocephala*) and European goldfinch (*Carduelis carduelis*), bellbird (*Anthornis melanura*) and house sparrow (*Passer domesticus*) (Fig. 3).

Flightlessness

The weka is flightless at a wing loading of 1.19 g/cm², the kakapo at 1.62 g/cm² and the South Island takahe at 2.98 g/cm² (Table 1). The wing area of the takahe specimen is 503.3 cm², while that of a pukeko, its close relative, is similar at 594.5 cm². However, the takahe is about three times heavier than the pukeko, giving the flightless bird the greatly elevated wing loading.

DISCUSSION

Wing loading is difficult to quantify accurately, as it varies for individual birds with daily and seasonal changes in their body masses (e.g. fullness of the stomach, development or regression of the gonads, state of fatness in connection with migration) and wing areas (e.g. wear and moult of the remiges; Warham 1977). Wing area is difficult to measure (Mendelsohn *et al*. 1989) and it varies with slight changes in how far the wing is spread. Wing loadings calculated for single birds (as for many species in Table 1) are indicative rather than definitive, and we need more measurements of wing areas to provide more reliable data based on the averages of good samples. This study is therefore a preliminary foray into the wing loadings of New Zealand land birds.

The data show that wing loading in New Zealand land birds increases with body size as is the case in birds generally (Warham 1977). The lowest wing loadings in the study are for small passerines with strong powers of flight (Fig. 1). The New Zealand fantail (0.12 g/cm²) flies acrobatically, and the welcome swallow (*Hirundo neoxena*) (0.18 g/cm²) extremely rapidly, to catch insects on the wing. The grey warbler (0.16 g/cm²) is able to hover to glean insects from the outermost leaves of twigs and branches. The tomtit (0.20 g/cm²) catches insects by sallying forth quickly from a perch. Durmuş (2022) confirmed that birds with higher wing loadings tend to perform unpowered flight styles such as soaring and gliding, while birds with lower wing loadings tend to have powered flight styles, such as flapping and hovering.

Wing loadings compiled by Poole (1938) for numerous North American birds (and which I re-calculated in g/cm^2) varied between 0.11 for both the golden-crowned kinglet (*Regulus satrapa*) and Leach's storm petrel (*Hydrobates leucorhous*), to 1.89 for the long-tailed duck (*Clangula hyemalis*). Bird (1999: 249) gave wing loadings for 44 volant Northern Hemisphere species, mostly land birds. When re-calculated in g/cm^2 the wing loadings varied between extremes of 0.11 for Leach's storm petrel and 0.14 for the barn swallow (*Hirundo rustica*) to 2.01 for the Canada goose (*Branta canadensis*). In procellariiforms, Warham (1977) showed that wing loading varied between 0.15 g/cm^2 for the least storm petrel (*Hydrobates microsoma*) to 1.75 g/cm^2 for the southern royal albatross (*Diomedea epomophora*). Wing loadings were 0.21–1.09 g/cm^2 in 66 species of African raptors (Mendelsohn *et al*. 1989). The volant New Zealand land birds reported here all have wing loadings within the range known for other comparable birds.

I predicted that some of the endemic New Zealand song-birds, being non-migratory, living within the forest and scrub, and having had a long evolutionary history without mammalian predation, would show high wing loadings that suggested they were on the path towards flightlessness. The weak-flying North Island kokako had the highest wing loading (0.62 g/cm^2) of any passerine in this study, but it was also the heaviest passerine and the wing loading was not extremely high.

Similarly, the North Island saddleback "bounds from branch to branch rather than flies" (Heather & Robertson 1996) and was ranked by Innes *et al*. (2022) as moderately gap limited in terms of its ability to cross gaps between forest fragments. From wing loadings it showed a small tendency towards flightlessness, with a value of about 0.53 g/cm^2, the second-highest of the passerines recorded in this study. However, the saddleback's wing loading is only slightly higher than for the song thrush and Eurasian blackbird (Fig. 3) which are birds of a similar size.

When studying whiteheads on Little Barrier Island (Gill & McLean 1992) I noticed that they fly quite weakly, often losing height if they are forced to fly more than a few tens of metres across open ground between trees. Innes *et al*. (2022) ranked the whitehead as strongly gap limited. Yet there is no exaggeration of the whitehead's wing loading, with a value similar to that of the strong-flying silvereye (Fig. 3). The tui, with a wing loading of about 0.31 g/cm^2, has a much lower wing loading that expected for its mass. This is consistent with it being a strong flier, that makes long and fast trips between food sources and often flies high above the forest canopy.

In the New Zealand flying species studied, the wing loadings of up to 0.88 g/cm^2 (pukeko) gave no strong indication that any of these species have seriously constrained flying ability. Meanwhile, the weka, kakapo and South Island takahe are flightless at wing loadings of 1.19–2.98 g/cm^2 (Table 1). However, the highest wing loadings for Northern Hemisphere flying birds listed by Bird (1999: 249) are 1.56 g/cm^2 for great bustard (*Otis tarda*), 1.70 for mute swan (*Cygnus olor*), 1.76 for whooper swan (*C. cygnus*), 1.79 for great northern diver (*Gavia immer*) and 2.01 for Canada goose. Meunier (1951) gave a wing loading of 2.5 g/cm^2 as a threoretical maximum that still permits flight.

The kakapo is the world's most massive parrot with the smallest relative wing size of any parrot (Livezey 1992). In the absence of wing area measurements for the kakapo, Livezey (1992) made estimates based on a regression line for other parrots and predicted wing loadings of 1.89 g/cm^2 for male kakapo and 1.17 g/cm^2 for females. The current study now provides the first measured wing loading for a male kakapo (1.62 g/cm^2) and it is close to Livezey's estimate. Livezey (2003) estimated the takahe's wing loading with the suggestion that it would exceed Meunier's "threshold of flightlessness". This is now confirmed by my measured wing loading of 2.98 g/cm^2 in that species.

The takahe is a flightless bird that has passed Meunier's threshold, but the weka and kakapo are flightless well below it. Wing loading is clearly not the only determinant of flightlessness and flightless birds can retain large wings for purposes other than flight, such as display. Rails are a family in which reduction of pectoral musculature is critical to flightlessness (Livezey 2003). Similarly, Livezey (1992) showed that the kakapo's pectoral skeleton had reduced (with regard to adaptations for flight, like size of the sternal keel) compared with that of the kea (*Nestor notabilis*).

New Zealand birds show extremes of high and low dispersal ability. In line with this, Sheard *et al*. (2020) found that New Zealand was one of several regions of the world in which birds had highly variable hand-wing indices, an expression of the wing's aspect ratio that correlates with dispersal ability. The large range of wing loadings for New Zealand land birds – between 0.12 for the New Zealand fantail and 2.98 for the South Island takahe – also reflects the great variation in dispersal ability of New Zealand birds.

Since Word War II, New Zealand museums have relied on the salvage of dead birds to augment their collections and this paper shows the value of the biological information that can be gleaned from salvaged birds.

ACKNOWLEDGEMENTS

I thank the many members of the public, university personnel and professional field workers who found dead birds and took the trouble to collect

them, label them and deliver them to Auckland Museum. I thank Tim Lovegrove for tracing one of the saddleback wings on my behalf, and Colin Miskelly for tracing three wings (weka, kakapo, kokako) in the collection of Museum of New Zealand Te Papa Tongarewa. For suggestions to revise and improve the paper I am grateful to Craig Symes and an anonymous referee.

LITERATURE CITED

Bird, D.M. 1999. *The bird almanac. The ultimate guide to essential facts and figures of the world's birds*. Buffalo, NY, Firefly Books.

Clark, R.J. 1971. Wing-loading—a plea for consistency in usage. *Auk 88*: 927–928.

Durmuş, S. 2022. Investigation of wing forms through mass and wing area chart. *Turkish Journal of Nature and Science 11(2)*: 107–112.

Gill, B.J.; McLean, I.G. 1992. Population dynamics of the New Zealand whitehead (Pachycephalidae)—a communal breeder. *Condor 94*: 628–635.

Heather, B.D.; Robertson, H.A. 1996. *The field guide to the birds of New Zealand*. Auckland, Viking.

Innes, J.; Miskelly, C.M.; Armstrong, D.P.; Fitzgerald, N.; Parker, K.A.; Stone, Z.L. 2022. Movements and habitat connectivity of New Zealand forest birds: a review of available data. *New Zealand Journal of Ecology 46(3481)*: 1–21.

Livezey, B.C. 1992. Morphological corollaries and ecological implications of flightlessness in the kakapo (Psittaciformes: *Strigops habroptilus*). *Journal of Morphology 213*: 105–145.

Livezey, B.C. 2003. Evolution of flightlessness in rails (Gruiformes: Rallidae): Phylogenetic, ecomorphological and ontogenetic perspectives. *Ornithological Monographs 53*: 1–654.

Mendelsohn, J.M.; Kemp, A.C.; Biggs, H.C.; Biggs, R.; Brown, C.J. 1989. Wing areas, wing loadings and wing spans of 66 species of African raptors. *Ostrich 60*: 35–42.

Meunier, K. 1951. Korrelation und Umkonstruktion in den Grössenbeziehungen zwischen Vogelflügel und Vogelkörper. *Biologia Generalis 19*: 403–443.

Pennycuick, C.J. 1985. Flight. Pp. 218–223. *In*: Campbell, B.; Lack, E. (*eds*) *A dictionary of birds*. Calton, Staffordshire, T. & A.D. Poyser.

Poole, E. 1938. Weights and wing areas in North American birds. *Auk 55*: 511–517.

Sheard, C.; Neate-Clegg, M.H.C.; Alioravainen, N.; Jones, S.E.I.; Vincent, C.; Bregman, T.P.; Claramunt, S.; Tobias, J.A. 2020. Ecological drivers of global gradients in avian dispersal inferred from wing morphology. *Nature Communications* 11(2463).

Warham, J. 1977. Wing loadings, wing shapes, and flight capabilities of Procellariiformes. *New Zealand Journal of Zoology 4*: 73–83.

Wilson, K.-J. 2004. *Flight of the huia. Ecology and conservation of New Zealand's frogs, reptiles, birds and mammals*. Christchurch, Canterbury University Press.

Appendix 1. Wing areas (cm^2) of New Zealand land birds reported in this study, showing the Latin names of the species. Three wing specimens were in the Te Papa collection (NMNZ); all others have Auckland Museum registration (or taxidermy) numbers assigned to them. Areas are of one extended wing, excluding the adjacent body. Sex is given where known. If there are subspecies, all birds (except weka) are from the North Island subspecies. Dried spread-wings are marked with an asterisk (*); all other wings were fresh when measured.

Species	Wing area (cm^2)
COLUMBIDAE	
New Zealand pigeon *Hemiphaga novaeseelandiae*	477.7 (Tax. 02-028, ♀). 486.6 (Tax. 02-030, ♀).
CUCULIDAE	
Long-tailed cuckoo *Eudynamys taitensis*	143.7 (LB11809, imm). 168.2 (LB14020*, ad ♂). 170.1 (LB8981*, ad ♀).
RALLIDAE	
Banded rail *Gallirallus philippensis*	152.6 (LB7758*, ♂).
Weka *Gallirallus australis*	418.8 (NMNZ OR24133*, ♂).
Pukeko *Porphyrio melanotus*	594.5 (LB1543*, ♂).
South Island takahe *P. hochstetteri*	503.3 (LB8980, ♂).
CHARADRIIDAE	
New Zealand dotterel *Charadrius obscurus*	125.2 (LB3664).
STRIGOPIDAE	
Kakapo *Strigops habroptila*	646.9 (NMNZ OR25733*, ♂).
Kaka *Nestor meridionalis*	381.6 (Tax. 98-032).
PSITTACULIDAE	
Red-crowned parakeet *Cyanoramphus novaezelandiae*	85.8 (LB3588, ♀). 100.1 (LB7763*, ♀). 101.1 (Tax. 00-002).
ACANTHISITTIDAE	
Rifleman *Acanthisitta chloris*	20.3 (LB1633*).
MELIPHAGIDAE	
Bellbird *Anthornis melanura*	28.4 (LB3594, ♀). 37.8 (LB3589, ♀). 41.6 (LB9439, ♀). 49.2 (LB9168, ♂).
Tui *Prosthemadera novaeseelandiae*	166.4 (LB6798*, ♂). 215.9 (LB13208*). 228.3 (LB13209*, ♂).
ACANTHIZIDAE	
Grey warbler *Gerygone igata*	18.4 (LB10851). 21.4 (LB14075*, ♂).
CALLAEIDAE	
North Island kokako *Callaeas wilsoni*	186.7 (NMNZ OR30770*, ♂).
North Island saddleback *Philesturnus rufusater*	60.8 (LB11771). 66.7 (LB10837). 67.3 (Tax. 94-066, ♂). 69.8 (LB9845). 71.8 (LB11073). 73.8 (Tax. 98-207). 74.8 (reg. no. uncertain). 78.0 (LB10722, ♂). 82.0 (LB8610, ♂). 83.4 (reg. no. uncertain).

Appendix 1. *continued*

Species	Wing area (cm²)
NOTIOMYSTIDAE	
Stitchbird *Notiomystis cincta*	50.7 (LB7087*, ♂). 51.1 (LB3618, ♀). 53.3 (LB10357). 59.6 (LB7086*, ♂). 59.9 (LB12952, ♀). 67.1 (LB10748, ♂).
MOHOUIDAE	
Whitehead *Mohoua albicilla*	27.8 (LB13949, ♂). 28.0 (LB9846). 29.8 (LB1575*, ♀). 29.8 (LB10194, ♀). 31.8 (LB10838, ♂). 33.7 (LB3597, ♀). 43.7 (LB3596, ♂).
RHIPIDURIDAE	
New Zealand fantail *Rhipidura fuliginosa*	30.3 (LB11817). 31.7 (LB1558*, ♂). 32.9 (LB8432, ♂). 37.7 (Tax. 92-063). 39.3 (Tax. 98-076).
PETROICIDAE	
Tomtit *Petroica macrocephala*	23.6 (LB3671, ♂). 24.4 (LB11800, ♂). 26.6 (LB7844, ♂). 29.7 (LB12682, ♂). 29.9 (LB9292, ♂). 30.1 (LB12085, ♂). 30.2 (LB7843, ♂). 31.6 (LB12864, ♂).
North Island robin *P. longipes*	42.3 (LB7121*). 46.1 (LB7765). 47.1 (LB11095, imm). 48.4 (LB9293). 48.9 (LB7762). 50.3 (LB12039). 52.4 (LB12728). 56.2 (LB3666). 56.7 (LB11790). 57.9 (LB12039). 58.2 (LB9192). 60.8 (LB1666). 66.7 (LB11810).
HIRUNDINIDAE	
Welcome swallow *Hirundo neoxena*	35.1 (LB5811*, ♂). 36.7 (Tax. 97-197). 40.6 (LB12396). 46.9 (LB3592).
ZOSTEROPIDAE	
Silvereye *Zosterops lateralis*	22.9 (LB1544*, ♂).
TURDIDAE	
Eurasian blackbird *Turdus merula*	105.8 (LB1560*, ♂).
Song thrush *T. philomelos*	73.6 (LB1545*).
PASSERIDAE	
House sparrow *Passer domesticus*	42.3 (LB1563*, ♂).
FRINGILLIDAE	
European goldfinch *Carduelis carduelis*	36.1 (LB1566*).

Notornis, 2023, Vol. 70: 83-85
0029-4470

SHORT NOTE

First records of eastern cattle egret (*Bubulcus ibis coromandus*) in the Solomon Islands

SCOTT C. BUTCHER
Pacific Planning and Community Development Solutions, 31a Bay View Road, Atawhai, Nelson 7010, New Zealand

ANDREW C. CROSSLAND*
Parks Biodiversity Team, Parks Unit, Christchurch City Council, PO Box 73011, Christchurch 8154, New Zealand

PHILIP CRUTCHLEY
Regional Parks Team, Parks Unit, Christchurch City Council, PO Box 73014, Christchurch 8154, New Zealand

NIALL D. MUGAN
Keystone Ecology, 326 Halswell Rd, Halswell, Christchurch 8025, New Zealand

The cattle egret (*Bubulcus ibis*) is a medium-sized heron that has greatly expanded its global range over the last century and is now found on six continents (Ahmed 2011; Scofield 2013). While some authorities split cattle egret into two species (Rasmussen & Anderton 2012), Birds New Zealand recognises three sub-species of which the eastern cattle egret (*B. i. coromandus*) of Asia and Australia is the sub-species found in New Zealand and the Pacific Islands (Checklist Committee OSNZ 2022). Within the South-West Pacific region, cattle egrets began appearing in both New Zealand and the island of New Guinea as non-breeding migrants from the 1960s onwards (Gill *et al.* 2010; Pratt & Beehler 2015). The species has not established a breeding population in New Zealand to date, but has recently been discovered breeding in Papua New Guinea (Dutson 2019). Elsewhere in the region, cattle egrets have been recorded as vagrants in the Bismarck Archipelago, Manus Island, New Caledonia, Fiji, and some of the Micronesian island groups (Dutson & Wattling 2007; Dutson 2011; van Perlo 2011; Tarburton 2021).

Recent reviews of the Solomon Islands avifauna by Doughty *et. al* (1999) and Tarburton (2021) did not include cattle egret, but Dutson (2011) added the species on the basis of an undated report of a

Received 10 June 2021; accepted 1 March 2023
*Correspondence: *andrew.crossland@ccc.govt.nz*

vagrant reported from Guadalcanal. This record is a single individual observed and photographed amongst cattle by a Birdquest tour group at the Betikama Wetlands (09°26.40'S, 160°02.06'E) east of Honiara, Guadalcanal on or around 5 October 2009 (Dutson *in litt*. February 2023). This sighting was listed in the company's trip report (van Beirs 2009), with the annotation that "A nice patch of marsh held an Eastern Cattle Egret (probably a first for the islands!), I am not aware of any previous records in the Solomon Islands."

There appear to be no further records of cattle egret in the Solomon Islands until 28 April 2014 when SCB observed a single cattle egret in flight close to the entrance of the Seventh Day Adventist College near Betikama Wetlands. Three months later on 9 July 2014, at least one cattle egret (precise number not specified) was reported at Betikama Wetlands by a visiting overseas birder (Hottola 2014). On 19 October 2014 SCB observed three cattle egrets at the same location. These were feeding in a receding water-lily swamp, with two great egrets (*Ardea alba*) and purple swamphens (*Porphyrio melanotus*). A few months later from 26 February to 4 March 2015 we surveyed wetland birds in the lowlands east and west of Honiara (Crossland *et al*. 2016). We actively searched for egret species on various grassland, wetland, coastal, and riverine habitats to ascertain whether any more were present in the wider area. Our only cattle egret sighting was of two birds on 26 February 2015, flushed from the roadside and flying into trees near Betikama Adventist College. Habitat in the immediate environs comprised pasture and market gardens, with the Betikama Wetlands approximately 800 m to the south.

Subsequent reports of cattle egret in and around Betikama Wetlands included three on 5 July 2015 (Van Beirs 2015; Petersson 2015), three on 6–7 July 2017 (Davies 2017a; 2017b), and eight observed in the non-specific "Honiara city and hills" eBird hotspot on 12 July 2018 (Perrins 2018). To date there appear to be no records from other parts of Guadalcanal, nor from any other island in the Solomons chain, including Bougainville (Hadden 1981, 2004; Tarburton 2021). While residing in Choiseul Province for two years SCB never recorded cattle egrets on visits to the north and south coast of Choiseul or from monthly wetland counts on Taro Island.

The records of cattle egret in the Solomon Islands from 2009 to the present, suggest the occurrence of a single bird at Betikama Wetlands on Guadalcanal in 2009 (fate unknown), then three birds at the same location from 2014–2017, followed by the arrival of more birds to a maximum of 8 in July 2018. There have been no subsequent reports, but COVID-19 travel restrictions since early 2020 likely means that numbers of visiting ornithologists are few. The cluster of sightings at just one site, Betikama Wetlands, seems coincidental, but it is probably an artefact of very limited open grassland habitat in the country, the relatively large size and intactness of Betikama compared to other wetlands on Guadalcanal (Scott 1993; Butcher *et al.* 2018), and strong observer bias to this fairly easily accessible site close to the country's only sizable city and international airport (Dutson 2011; Hotolla 2014).

ACKNOWLEDGEMENTS

Our thanks to the editor of Notornis, Guy Dutson, and Paul Scofield for comments and suggested improvements on this manuscript.

LITERATURE CITED

Ahmed, R. 2011. Subspecific identification and status of Cattle Egret. *Dutch Birding 33*: 294–304.

Butcher, S.; Crossland, A.C.; Crutchley, P.; Mugan, N.D. 2018. First records of little black cormorant (*Phalacrocorax sulcirostris*) for the Solomon Islands. *Notornis 65*: 109–112.

Checklist Committee (OSNZ). 2022. *Checklist of the Birds of New Zealand* (5th edition). Ornithological Society of New Zealand Occasional Publication No.1. Wellington, Ornithological Society of New Zealand.

Crossland, A.C.; Butcher, S.; Crutchley, P.; Mugan, N.D. Kake, J. 2016. A survey of waders on part of Guadalcanal and The Florida Group, Solomon Islands. *Stilt 69–70:* 47–55.

Davies, C. 2017a. *Betikama Wetlands, Guadalcanal, Solomon Islands*. Ebird Field Checklist. Online at https://ebird.org/checklist/S38437751

Davies, C. 2017b. *Betikama Wetlands, Guadalcanal, Solomon Islands*. Ebird Field Checklist. Online at https://ebird.org/checklist/S38437860

Doughty, C.; Day, N.; Plant, A. 1999. *The Birds of the Solomons, Vanuatu and New Caledonia*. London, Christopher Helm.

Dutson, G. 2011. *Birds of Melanesia: Bismarcks, Solomons, Vanuatu and New Caledonia*. New Jersey, Princeton University Press.

Dutson, G.; Watling, D. 2007. Cattle egrets (*Bubulcus ibis*) and other vagrant birds in Fiji. *Notornis 54*: 54–55.

Dutson, G. 2019. *Royal Port Moresby Golf Club.* Ebird Field Checklist. Online at https://ebird.org/checklist/S62208144.

Gill, B.J. (Convener); Bell, B.D.; Chambers, G.K.; Medway, D.G; Palma, R.L.; Scofield, R.P.; Tennyson, A.J.D.; Worthy, T.H. 2010. *Checklist of the Birds of New Zealand, Norfolk and Macquarie Islands, and the Ross Dependency, Antarctica.* 4th edition. Wellington, Ornithological Society of New Zealand and Te Papa Press.

Hadden, D. 1981, Birds of the North Solomons, Wau, Wau Ecology Institute.

Hadden, D. 2004. *Birds and Bird Lore of Bougainville*

and the North Solomons. Alderley, Dove Publications Pty Limited.

Hottola, P. 2014, *Guadalcanal, Solomon Islands, in July 2014*. Online at https://www.club300.se/media/9443/guadalcanal.pdf. Accessed: 28 March 2021.

Perrins, N.D. 2018. *Honiara City and Hills. Guadalcanal, Solomon Islands. ebird Field Checklist.* Online at https://ebird.org/checklist/S47248144.

Petersson, L. 2015. Eastern Cattle Egret image. Online at https://www.larsfoto.se/en/gallery/bird-images-from-foreign-trips/solomon-islands/9258-eastern-cattle-egret Accessed: 28 March 2021.

Pratt, T.K.; Beehler, B.M. 2015. *Birds of New Guinea, 2nd edition*. Princeton NJ, Princeton University Press.

Rasmussen, P.C.; Anderton, J.C. 2012. *Birds of South Asia: The Ripley Guide.* 2nd edition. Washington D.C. and Barcelona, Smithsonian Institution and Lynx Edicions.

Scofield, R. 2013. Cattle egret [updated 2022]. *In*: Miskelly, C.M. (*ed.*) *New Zealand Birds Online*. Online at www.nzbirdsonline.org.nz. Accessed: 10 February 2023.

Scott, D.A. 1993. *A Directory of Wetlands in Oceania*. Kuala Lumpur, The International Waterfowl and Wetlands Bureau (IWRB) and Asian Wetland Bureau (AWB).

Tarburton, M.K. 2021. *Bird Checklists for 672 Melanesian Islands: Island Checklists*. Online at https://birdsofmelanesia.net/ Accessed: 9 June 2021.

Van Beirs, M. 2009. *The Solomon Islands 2–26 September 2009 Tour Report*. Online at http:// birdquest-tours.com/pdfs/report/SOLOMONS%20REP%20091.pdf Accessed: 28 March2021.

Van Beirs, M. 2015. *The Solomon Islands 3–29 July 2015 Tour Report*. Online at https://www.birdquest-tours.com/wp-content/uploads/2019/06/SOLOMONS-REP-15-ebook.pdf Accessed: 28 March 2021.

Van Perlo, B. 2011. *Birds of Hawaii, New Zealand, and the Central and West Pacific*. Princeton NJ, Princeton University Press.

Keywords: cattle egret, Solomon Islands, range extension, Betikama wetland

Notornis, 2023, Vol. 70: 86-88
0029-4470

SHORT NOTE

Swamp harrier (*Circus approximans*) predation of white-fronted tern (*Sterna striata*) chicks on the Noises Islands, New Zealand

MATT J. RAYNER*
Auckland Museum, Private Bag 92018, Auckland 1141, New Zealand
School of Biological Sciences, University of Auckland, 3A Symonds Street, Auckland, PB 92019, New Zealand

ROD NEUREUTER
21B Taylor Road, Papamoa 3118, New Zealand

SUE NEUREUTER
1047J Purangi Road, RD1 Whitianga, New Zealand

ZOE NEUREUTER
905 Purangi Road, RD1 Whitianga, New Zealand

The white-fronted tern (*Sterna striata*) is a small (160 g) native seabird with breeding colonies found the length of the New Zealand archipelago. The species nests colonially in a range of habitats from shingle riverbeds, and estuarine and coastal beaches, to offshore coastal cliffs, rock stacks, and islands. Birds maintain pair bonds throughout the year, though the degree of lifetime monogamy is uncertain. Breeding occurs between October and January and birds lay 1–2 eggs (rarely 3) in a scrape nest, and provision chicks through a chick rearing period of 29–35 days (Mills 2013).

Received 16 March 2021; accepted 27 January 2023
*Correspondence: *mrayner@aucklandmuseum.com*

Populations of white-fronted terns have declined over the past 40 years and the species is currently listed under the New Zealand threat classification scheme as 'at risk/declining' (Robertson *et al.* 2017). Recent surveys in the North East of New Zealand, including the Hauraki Gulf, have indicated this decline is acute in this region (Frost 2017), though the driving factors are uncertain.

Predation is one factor likely driving population declines. Introduced mammals, including cats (*Felis catus*), mustelids (stoats *Mustela erminea*, ferrets *Mustela furo,* and weasels *Mustela nivalis*), rats (Norway rats *Rattus norvegicus,* and ship rats *R. rattus*) and possums (*Trichosurus vulpecula*) are predators of white-fronted tern adults, chicks, and

eggs (Taylor 2000). Southern black-backed gull (*Larus dominicanus*), hereafter referred to simply as 'black-backed gull', is a known avian predator (Miskelly 2013). However, to our knowledge, predation by swamp harriers (*Circus approximans*) on white-fronted tern chicks has not been previously documented.

The Noises are a group of islands, islets, and rock stacks centred at 36.693°S, 174.970°E on the outer edge of the inner Hauraki Gulf, approximately 20 km northeast of Auckland city. The islands have been pest free since 2002 following the eradication of Norway rats, and are home to a regionally significant seabird community of at least ten breeding species (Cunningham & Moors 1985; Mackay *et al.* 2007; MJR *pers. obs.*), including the white-fronted tern. White-fronted terns breed at seven sites on the Noises, but no more than three sites are used in a season as birds shift each year. Similar to the trend in the wider Hauraki Gulf region, colony sizes of white-fronted terns at the Noises have declined significantly over the past 50 years (RN, SN, ZN, *pers. obs.*). Breeding sites are typically shared with small numbers of breeding red-billed gulls (*Larus novaehollandiae*) and/or single pairs of black-backed gulls.

Since the mid-1970s we have made annual observations of white-fronted tern breeding efforts concurrently with summer visits to the Noises for field work and family holidays between November and February. Since 2013 we have observed seasonal predation of white-fronted tern chicks by swamp harrier, something that was not observed prior to 2013. Attacks typically begin with a single harrier harassing the tern colony, circling and diving, which brings adult terns into the air to defend their nests. During white-fronted tern incubation, larger red-billed and/or black-backed gulls that nest close to tern colonies aid in driving the harriers away. At times, these confrontations are violent. For example, this summer we witnessed a resident adult male black-back gull receive severe cuts about the head whilst defending its nest from harrier attack. However, both gull species breed earlier than white-fronted terns at the Noises, and as the gull chicks begin to fledge their parents are less inclined to harass or attack harriers. Subsequently, the terns, which are typically feeding chicks at this stage, are unable to drive off an attacking harrier. Once the harrier has put adult terns into the air, it is able to swoop down to snatch a single tern chick and fly off to nearby vegetation to consume it. Since 2013, during the period December to February, we have observed successful attacks on tern chicks up to twice daily, with at least 40 successful attacks witnessed overall.

Swamp harriers are adaptable and opportunistic predators which take a broad range of vertebrate prey including seabirds (Wilcox & Spotswood 2011; Ismar *et al.* 2012). In New Zealand, harriers are known predators of black-fronted terns (*Chlidonias albostriatus*) in South Island river catchments (Steffens *et al.* 2012; Bell 2017) but to our knowledge there are no published accounts of the species taking white-fronted tern chicks. Despite a long history of making seasonal observations of white-fronted tern colonies on the Noises we had not observed attacks by harriers prior to 2013. A possible explanation for this change in harrier behaviour could relate to prey availability. Harriers frequently move between the Noises and the larger nearby islands of Rakino (146 ha), Motutapu (1,510 ha), and Rangitoto (2300 ha) which are part of their home range. These islands are now free of mammal pests following 2011 eradications of rats (*R. rattus, R. norvegicus*), rabbits (*Oryctolagus cuniculus*) and hedgehogs (*Erinaceus europaeus*), the 1997 eradication of possums and brush-tailed rock wallaby (*Petrogale penicillata*) from Motutapu and Rangitoto, and the 2002 eradication of Norway rats from Rakino. For the harriers that visit the Noises, these eradications within their wider home range present a significant loss of prey types and overall prey availability, and are likely a major factor in prey switching as observed previously in this species, further illustrating its dietary flexibility (Pierce & Maloney 1989; Haselmayer & Jamieson 2001).

Given the frequency of observed successful attacks we believe chick predation by harriers may be having a significant impact on breeding productivity of white-fronted terns at the Noises. What role these attacks are playing in the long-term declines in tern numbers at the Noises is unclear, especially given that tern numbers appear to have declined regionally as a result of ecosystem-level effects related to prey availability. Further empirical studies are required to investigate this phenomenon, and we would be interested to hear of other observations of harrier predation on white-fronted terns.

LITERATURE CITED

Bell, M. 2017. Population size, breeding success and predators of black-fronted tern (*Chlidonias albostriatus*) in the Upper Clarence River catchment, New Zealand. *Notornis 64*: 154–161.

Cunningham, D.M.; Moors, P.J. 1985. The birds of the Noises Islands, Hauraki Gulf. *Notornis 32*: 221–243.

Frost, P.G.H. 2017. *Population status and trends of selected seabirds in northern New Zealand* (Project No. INT 2016-04). New Zealand Department of Conservation. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/

reports/pre-2019-annual-plans/status-and-trends-non-procellariform-seabirds-final.pdf

Haselmayer, J.; Jamieson, I.G. 2001. Increased predation on pukeko eggs after the application of rabbit control measures. *New Zealand Journal of Ecology 25*: 89–93.

Ismar, S.M.H.; Taylor, G.; Gaskin, G.; Rayner, M.J. 2012. First breeding report of black-winged petrel (*Pterodroma nigripennis*) on Burgess Island, Mokohinau group, Hauraki Gulf. *Notornis 59*: 167–170.

Mackay, J.W.B.; Russell, J.C.; Anderson, S.H. 2007. Birds of Motuhoropapa I, Noises Group, Hauraki Gulf, North Is, New Zealand. *Notornis 54*: 197–200.

Mills, J.A. 2013 [updated 2022]. White-fronted tern | tara. *In*: Miskelly, C.M. (*ed*.) *New Zealand Birds Online*. www.nzbirdsonline.org.nz.

Miskelly, C.M. 2013 [updated 2022]. Southern black-backed gull | karoro. *In*: Miskelly, C.M. (*ed*.) *New Zealand Birds Online*. www.nzbirdsonline.org.nz

Pierce, R.J.; Maloney, R.F. 1989. Response of harriers in the Mackenzie basin to the abundance of rabbits. *Notornis 36*: 1–12.

Robertson, H.A.; Baird, K.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Miskelly, C.M.; McArthur, N.; O'Donnell, C.F.J.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2017. Conservation status of New Zealand birds, 2016. *New Zealand Threat Classification Series 19*. Wellington, New Zealand Department of Conservation.

Steffens, K.E.; Sanders, M.E.; Gleeson, D.M.; Pullen, K.M.; Stowe, C.J. 2012. Identification of predators at black-fronted tern *Chlidonias albostriatus* nests, using mtDNA analysis and digital video recorders. *New Zealand Journal of Ecology 36(1)*: 38–55.

Taylor, G. 2000. Action plan for seabird conservation in New Zealand, part a: threatened seabirds. *Threatened Species Occasional Publication 16*. Wellington, NZ, New Zealand Department of Conservation.

Wilcox, R.; Spotswood, E. 2011. Introduced predators and seabird predation on Mo'orea, French Polynesia. *Notornis 58*: 39–42.

Keywords: swamp harrier, seabird declines, white fronted tern chicks, Hauraki Gulf, The Noises

Notornis, 2023, Vol. 70: 89-92
0029-4470 © The Ornithological Society of New Zealand Inc.

SHORT NOTE

Polynesian traditions explain why some birds are red or black

RAPHAEL RICHTER-GRAVIER
Te Tumu – School of Māori, Pacific & Indigenous Studies, University of Otago, Dunedin 9016, New Zealand

In Polynesia, narratives were passed on orally from generation to generation for centuries before they got recorded in writing and published from the end of the 18th century, mostly by ethnographers, travellers, government officials and missionaries.[1] On almost every Polynesian island, these oral stories featured the same central characters, such as Māui, Sina/Hina/Hine and Tinilau/Tinirau, or Tāwhaki, who were talked about in "hero-cycles" (Luomala 1940). Birds appear in hundreds of these stories (Richter-Gravier 2019), some of which account for the physical characteristics of a given species, thereby showing that Polynesians' own bodies of belief explained a bird's appearance. This was especially the case with some species' red or black feathers, bill, or legs.

People throughout Polynesia placed great value on the colour red, which was considered sacred; the word *kura* 'red' and its cognates *kula*, *'ura*, *'ula*, *ku'a* conveyed on many Polynesian islands "meanings connoting excellency and sacredness" (Handy 1927). Interest in this colour is apparent in the many stories that explain why some species of birds have a red plumage, a red bill, or red legs. For instance, the red colour of the bill and frontal shield of the pūkeko (*Porphyrio melanotus*) was accounted for by Māori in various narratives, all of which revolve around blood and involve culture heroes such as Tāwhaki or Māui.

One such tradition (from Te Tai Tokerau/ Northland) has it that Tāwhaki, on his long journey

[1] For an overview of the history of the recording of oral traditions in Polynesia from the late 18th century to the present, see Craig (2004). A list of publications containing traditional Polynesian narratives was furnished by Kirtley (1971).

Received 19 December 2022; accepted 20 February 2023
Correspondence*: rrg2@pm.me*

up to the heavens, met the pūkeko coming down (Keene 1963). The bird brushed against him with his wings in a very rude fashion. Outraged, Tāwhaki seized him by the bill (of a dull, nondescript colour), which he pinched so hard that it bled. It has been of a brilliant red colour ever since.

Another tradition uses blood to account for both the red bill of the pūkeko and the red spots on the head of the kākāriki *(*red-crowned parakeet, *Cyanoramphus novaezelandiae*) (Ariki-Tama-Kiniti 1927). While she was bathing in the sea, Māui's wife was sexually assaulted by Tuna-rua, a giant eel. She then told Māui, who decided to devise a plan to kill it. Accordingly, she went back to the spot where she was assaulted, and lured the creature to the shore while Māui hid nearby. As soon as it was out of the water, he rushed out upon it and attacked it with his *toki* (axe). He cut off its tail and threw it into the forest, then he cut off its head and threw it into the sea, before rolling its huge trunk into a stream. A pūkeko, frightened at the noise of the fight, ran away, but in passing, his bill and legs got splashed by the creature's blood. The blood also splashed onto a kākāriki sitting in a tree nearby, staining his head, which has remained red to this day.

Similarly, in a Moriori story (from Rēkohu/Chatham Islands), blood stained the bill of another species of bird, the parea (Chatham Island pigeon, *Hemiphaga chathamensis*). When the culture heroine Hine was pregnant, her husband Tinirau forced her to stay in a house throughout her pregnancy (Shand 1896). When she went into labour, the fog settled, and with it came a flock of parea, who helped Hine deliver her child and got stained by her blood in the process, hence their red bill.

In a story that explains how the birds of Taumako (a Polynesian Outlier in the Solomon Islands) acquired their distinctive markings, it is not the blood of a woman in labour or that of an eel that is smeared on birds, but that of a pig (Davenport 1968). Taumako was home to a man-eating pig named Vailape, and a *pakola* (ogress), who ate so many people that the survivors decided to leave the island altogether. However, a woman named Kahiva, who happened to be pregnant, was left behind. She dug a hole to be safe from Vailape and the *pakola*, gave birth to twin boys, Lauvaia and Hemaholuaki, and raised them in the hole. The two boys eventually ventured out of the hole and managed to kill the *pakola*, and then the pig, which they butchered before carrying its meat back home for their mother to cook.

The boys then called all the birds of Taumako and ordered them to fly to Pileni (another Polynesian Outlier in the Solomon Islands, about 100 km west of Taumako) and tell the people of Taumako who lived there that Vailape and the *pakola* were now dead. First, they chose the bat (*peka*) as their messenger, putting the pig's bristles on his back so that it would be recognised, and told him to fly right inside the house where men gathered and to answer their questions by fluttering his wings to answer yes, and by staying still to answer no. However, the bat soon got tired and returned to Taumako. Then, the two boys chose the *mihi* (cardinal myzomela, *Myzomela cardinalis*), whom they smeared with the pig's blood; they gave him the same instructions. He went further than the bat, but became tired and returned. Next, they selected the *lenga* (palm lorikeet, *Vini palmarum*), whose legs they painted with the pig's cooked blood. The *lenga* went further than the *mihi*, but also tired and returned. The same happened with all the different species of birds of Taumako. Finally, Lauvaia and Hemaholuaki asked the *vili* (coconut lorikeet, *Trichoglossus haematodus*), and smeared his bill with dark blood. He flew straight to the men's house belonging to the Taumako people in Pileni. They understood that both Vailape and the *pakola* were dead and that Kahiva wanted them to return to Taumako. They all went back to their island.

In contrast, according to a tradition from West Futuna (a Polynesian Outlier in Vanuatu), the head of the cardinal myzomela was tainted red not by pig blood smeared on him, but by the blood of an ogre's anus (Keller & Kuautonga 2007). An ogre (*ta pasiesi*) had eaten all the people on the island, except for a few children that he saved for later meals. Led by the culture hero Majihjiki, the children eventually escaped and were pursued by the ogre. As the ogre was trying to climb up a tree to reach his victims high in the branches, he fell to his death. The children, however, were too scared to climb down, so they sent various animals to check if the ogre was really dead, including a black ant which bit him on the legs, arms and eyes, but the ogre did not make a move. A fly buzzed in his ears, but again the ogre stayed motionless. Still unconvinced, the children sent all the other animals, until only one animal was left, the *manumea* (cardinal myzomela).[2] The black bird told the children that he would find out for sure whether the ogre was dead or still alive, and he flew into his mouth. When his head emerged from the ogre's anus, it was all red. This is why the head of the *manumea* is red today, unlike the rest of his body which is still black. Incidentally, the children now truly believed that the ogre was dead, so they climbed down the tree, and resettled their original villages. A similar story is found in neighbouring Tanna (of a distinct Melanesian culture) (Guiart 1956).

[2] In West Futuna the *manumea* is the cardinal myzomela, whereas in Sāmoa this name designates the tooth-billed pigeon (*Didunculus strigirostris*).

In Mugaba/Rennell Island (a Polynesian Outlier in the Solomon Islands), the culture heroine Sina was rubbing her turmeric (*ango*) when the birds came, asking her to colour their feathers with it (Elbert & Monberg 1965). First came the *suusuubagu* (Rennell white-eye, *Zosterops rennellianus*), but Sina declined his request. He nonetheless stood there and some turmeric spilled on him, so his skin turned yellow. Then came the *baghigho* (cardinal myzomela); Sina took him in her hand, so he became red. She took hold of the legs of the *gupe* (Pacific imperial pigeon, *Ducula pacifica*), and they became red as well. She grabbed the abdomen of the *higi* (silver-capped fruit dove, *Ptilinopus richardsii*), and it turned red. After grating her turmeric, Sina rubbed a tapa with the cord of the turmeric. The *sibigi* (yellow-bibbed lory, *Lorius chlorocercus*) came and had his body rubbed with it by Sina (for a study of the aesthetic, cosmetic and ritual uses of the pigment produced from the roots of this ancient cultivar in the Polynesian Outliers, and of the connection between turmeric and sexuality, see Bayliss-Smith 2012). She removed her morinda (*Morinda citrifolia*) flower necklace and put it on the lory's neck. Then, she mixed water with resin to tattoo the *ligobai* (barred cuckooshrike, *Coracina lineata*). She also tattooed the *manutangionge* (shining cuckoo, *Chrysococcyx lucidus*), the *kaageba* (long-tailed cuckoo, *Eudynamys taitensis*) and the *taba* (brown goshawk, *Accipiter fasciatus*). Finally, the *ghaapilu* (Rennell starling, *Aplonis insularis*, or singing starling, *Aplonis cantoroides*) came, but Sina did not tattoo him: she chose to cover him in black, which is how he acquired that colour. After being coloured thus by Sina, all the birds flew away.

Finally, other stories explain how Māui was responsible for inflicting red or black marks on some birds when he was trying to make fire: in Hawai'i, he rubbed the top of the head of the *'alae* (common gallinule, *Gallinula galeata*) with a fire stick, and in Manihiki (Northern Cook Islands), he singed the corners of the eyes of the *kakavai* (white tern, *Gygis alba*) with it.

The *'alae* were the keepers of the fire in Hawai'i (Forbes 1879). Every time they saw Māui-mua approaching them, they put out the fire and flew away. Māui-mua and his three brothers could only see the fire when they were out at sea fishing; by the time they reached the shore it had been put out. Knowing that there were four of them, the birds would only light the fire when they could see four men in the canoe. Māui-mua instructed his brothers to put a tall calabash in his place in the canoe, which fooled the birds, who then proceeded to light their fire to roast bananas. Māui-mua leapt on one *'alae* with the intention of killing him because the birds had been hiding the fire from him, but the *'alae* promised to let him have the fire if he spared his life; otherwise the secret of fire would die with him. He then told Māui-mua that the fire was in the leafstalk of the *'ape* (giant taro, *Alocasia macrorrhizos*), and then in the leafstalk of the *kalo* (taro, *Colocasia esculenta*), but when Māui-mua rubbed the leafstalks with a stick no fire came out. Then the bird told Māui-mua that he would find the fire in a dry stick, with which Māui-mua eventually made a fire. But, angry with the bird for the deception, he rubbed the top of the head of the *'alae*, which became red with blood.

In Manihiki, Māui-pōtiki asked his grandfather Tangaroa-tuhi-mata ('Tanga roa-with-the-tattooed-face') to give him fire so he could cook food (Kauraka 1988). Tangaroa called two *kakavai*, his pets, to press down the fire-making stick, which he rubbed with another stick. When fire was produced, he gave the stick with the fire to Māui, but Māui put it out and asked for another stick. Tangaroa made fire again with two sticks, but Māui singed the corners of the two terns' eyes with the hot end of the stick, so the birds flew away, never to come back again. The descendants of these birds, with their distinctive black stripe extending from the eye to the nape, have been called *kakavai Māui* (*Sterna sumatrana*) in Manihiki ever since.

As is illustrated by these examples, traditional Polynesian narratives were used to explain the appearance of all the birds of the same species in terms of a given ancestor's behaviour. These stories recount events that brought about a change in a bird's appearance that became permanent.

ACKNOWLEDGEMENTS

This research was undertaken with the financial support of the University of Otago and its School of Māori, Pacific and Indigenous Studies (Te Tumu), and of the Université de la Polynésie française and its laboratoire EASTCO.

LITERATURE CITED

Ariki-Tama-Kiniti 1927. Ancient Maori beliefs: Maui Potiki. *Weekly Press* (Christchurch), 10 March, p. 5.

Bayliss-Smith, T.P. 2012. Taro, turmeric, and gender. pp. 109–138 *In*: Feinberg, R.; Scaglion, R. (*eds*) *Polynesian Outliers: the state of the art.* Pittsburgh, University of Pittsburgh.

Craig, R.D. 2004. *Handbook of Polynesian mythology*. Santa Barbara, ABC-CLIO.

Davenport, W. 1968. Social organization notes on the northern Santa Cruz Islands, the Duff Islands (Taumako). *Baessler-Archiv 16:* 137–206.

Elbert, S.H.; Monberg, T. 1965. *From the two canoes: oral traditions of Rennell and Bellona*. Copenhagen/Honolulu, Danish National Museum/University of Hawaii Press.

Forbes, A.O. 1879. Hawaiian tradition of the origin of fire. *Hawaiian Almanac and Annual for 1879:* 59–60.

Guiart, J. 1956. *Un siècle et demi de contacts culturels à Tanna, Nouvelles-Hébrides*. Paris, Musée de l'Homme.

Handy, E.S.C. 1927. *Polynesian religion*. Honolulu, Bernice P. Bishop Museum.

Kauraka, K. 1988. *Manihikian traditional narratives in English and Minihikian: na fakahiti o Manihiki, stories of the Cook Islands*. Papatoetoe, Te Ropu Kahurangi.

Keene, F. 1963. *O te raki: Maori legends of the North*. Auckland/Hamilton, Paul's Book Arcade.

Keller, J.D.; Kuautonga, T. 2007. *Nokonofo kitea: we keep on living this way. A hkai ma a tagi i Futuna, Vanuatu: myths and music of Futuna, Vanuatu*. Honolulu, University of Hawai'i Press.

Kirtley, B.F. 1971. *A Motif-index of traditional Polynesian narratives*. Honolulu, University of Hawaii Press.

Luomala, K. 1940. Notes on the development of Polynesian hero-cycles. *Journal of the Polynesian Society 49(195)*: 367–374.

Richter-Gravier, R. 2019. Manu narratives of Polynesia: a comparative study of birds in 300 traditional Polynesian stories. Unpubl. PhD thesis, University of Otago, Dunedin, New Zealand, and Université de la Polynésie française, Tahiti, French Polynesia. Available at: https://ourarchive.otago.ac.nz/handle/10523/9739

Shand, A. 1896. The Moriori people of the Chatham Islands: their traditions and history. Chap. IX, Moriori stories. *Journal of the Polynesian Society 5(3)*: 131–141.

Keywords: oral traditions, Polynesian birds, aetiological narratives, animal stories, Polynesian mythology, ethnozoology

Notornis, 2023, Vol. 70: 93-95
0029-4470

SHORT NOTE

Year of the tern: the first record of black tern (*Chlidonias niger*) from New Zealand

OSCAR J.W. THOMAS*
ELA K.S. HUNT
Department of Zoology, University of Otago, Dunedin 9016

The black tern (*Chlidonias niger*) is a small marsh tern predominantly found in the Northern Hemisphere. The preferred nesting habitat of the species comprises freshwater and brackish wetlands, but outside of this they also frequent lakes, rivers, wastewater ponds, and estuaries, rarely travelling far inland (Higgins & Davies 1996). There are two distinct subspecies – the Eurasian black tern (*C. n. niger*) breeds sparsely across Europe eastwards to Mongolia in central Asia, wintering in Egypt and along the west African coast. The American black tern (*C. n. surinamensis*) breeds widely across North America, and migrates south to the Central and South American coasts. The species is extremely rare in the Australasian region (Menkhorst *et al.* 2017), with only four previous confirmed records – three from Australia, and one from Papua New Guinea (the sole record of a bird in breeding plumage; Finch 1986).

On 21 January 2022, OJWT was notified through the 'New Zealand Bird Identification' Facebook page that local birder Elizabeth Taylor had posted a photo of an unusual tern at Waikanae Estuary (39.874°S, 175.001°E) in Wellington, the week before. It appeared to be much smaller than the white-fronted terns (*Sterna striata*) it was roosting with, and unlike them it had black earmuff markings on its head, as well as mottled grey upperwings. To our knowledge, all field marks pointed towards white-winged black tern (*Chlidonias leucopterus*), so we revised our plans and visited the site to see if it was still present. It was darker than we expected it to be, and EKSH pointed out that it should have redder legs, but they were almost black in colour. Back in Wellington OJWT circulated the photographs among birding-related groups and forums, and it was not long before the more experienced (and optimistic) pointed out that the bird did not resemble a typical white-winged black tern at all.

Received 13 September 2022; accepted 28 March 2023
*Correspondence: *thoos290@student.otago.ac.nz*

In comparison, the black earmuff markings were matte and more extensive, grey upperparts much darker and more mottled, the bill much longer and legs darker, the rump grey, and most importantly bold grey shoulder tabs were present – diagnostic for black tern. Now accepted by the Records Appraisal Committee, this is the first record of the species for New Zealand. In addition, this bird was further identified as immature due to the bold black carpal bar, and of the Eurasian subspecies owing to the clean white underwings, solid dark cap markings and relatively small shoulder tabs (Fig. 1).

Two weeks later the bird was still present, having relocated to join a white-fronted tern flock on the Plimmerton coast (41.078°S, 174.862°E; *c.* 26 km south of the original sighting), and joined intermittently by migrating black-fronted terns (*Chlidonias albostriatus*) and common terns (*Sterna hirundo*). Inexplicably, a sooty tern (*Onychoprion fuscatus*), normally a tropical species, was simultaneously observed *c.* 6 km north at Pukerua Bay (41.028°S, 174.889°E). At the same time, a white-winged black tern and a whiskered tern (*Chlidonias hybrida*) were reported from Waituna Lagoon in Southland (46.564°S, 168.637°E), completing the rare *Chlidonias* marsh tern sweep for New Zealand. In addition to all the above, this summer also yielded cyclone driven vagrant black noddies (*Anous minutus*), brown noddies (*Anous stolidus*), New Zealand's first living bridled tern (*Onychoprion anaethetus*), and first ever recorded black-naped tern (*Sterna sumatrana*) to the upper North Island (Miskelly *et al.* 2023). Twenty of the 21 species of noddy or tern ever recorded in

Figure 1. Immature Eurasian black tern (*Chlidonias niger niger*) at Waikanae Estuary Spit on 21 January 2022; (a) roost with white-fronted terns (*Sterna striata*) in the background, and (b) in flight showing diagnostic grey shoulder tabs. (Photographs: OJWT).

New Zealand were reported throughout the year, the one missing being crested tern (*Thalasseus bergii*) (Miskelly *et al.* 2023).

The black tern was first discovered at Waikanae Estuary, Kapiti Coast on 14 January 2022 and continued to be reported there until 22 January, before turning up on the Plimmerton coast on 31 January and staying until 10 February. One additional record came from Pukerua Bay on 15 February. Due to the extreme rarity and close proximity, all sightings are assumed to be of the same individual. With the highly dispersive and migratory nature of terns, increased birder presence and experience nationwide, and changing global climatic conditions, 2022 can truly be regarded as the 'Year of the Tern' for New Zealand.

ACKNOWLEDGEMENTS

We thank Elizabeth Taylor for the initial recognition of the bird as something unusual and worth sharing on social media, Sunita Singh for accompanying us to Waikanae, as well as Russell Cannings, Ian 'Sav' Saville, and John Graff for first questioning the identification. Thanks also to Zohara Rafi and editor Craig Symes for their assistance and comments on drafts of this manuscript.

LITERATURE CITED

Finch, B.W. 1986. Black tern *Chlidonias niger* at Moitaka settling ponds, National Capital District – first record for the New Guinea Region. *Muruk 1*: 26–28 (reprinted in 1990 with page numbers 27–29).

Higgins, P.J.; Davies, S.J.J.F. (*Eds*) 1996. *Handbook of Australian, New Zealand & Antarctic birds. Volume 3: Snipe to Pigeons*. Oxford University Press, Melbourne.

Menkhorst, P.; Rogers, D.; Clarke, R.; Davies, J.; Marsack, P.; Franklin, K. 2017. *The Australian bird guide*. Clayton, Victoria, Australia, CSIRO Publishing.

Miskelly, C.M.; Crossland, A.C.; Saville, I.; Southey, I.; Tennyson, A.J.D.; Bell, E.A. 2023. Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2021–2022. *Notornis 70(2)*: 60-73.

Keywords: Black tern, *Chlidonias niger*, first record, vagrant, Waikanae

LETTER TO THE EDITOR

20 March 2023

The Editor
Notornis

Sir,

In their Short Note "Kākā (*Nestor meridionalis*) investigate and depredate kakaruai (South Island robin *Petroica australis australis*) eggs" (*Notornis 70(1)*: 42–44), published in March 2023, the authors state that "To our knowledge, there are only two other known observations of kaka destroying the eggs of other birds". Apart from there being unlikely to be records of "unknown" observations, one of those observations was a personal communication on 24 October 2022 of an observation made in 1999. The other record was in a non-refereed publication.

The authors are apparently unaware of yet another observation made in 2000: "Egg predation by South Island kaka (*Nestor meridionalis*). *Notornis 52(2)*: 106–108 (2005)". This note records the consumption of eggs from an open nest of unknown songbird in forest on the St Arnaud Range in Nelson Lakes National Park. The note expands on the basic observation and provides estimates of the nutrients gained by the kaka in less than 10 minutes. Department of Conservation workers at St Arnaud engaged in kaka research "were not surprised" by that observation: one of them may have been the source of the personal communication of 24 October 2022.

This raises a couple of issues. First, a significant behaviour by a threatened New Zealand bird was known to people researching that species but apparently they had not thought that the information was worth making available to others, at least not until questioned 23 years after the event. Then, the person making the comment in 2022 seems not to have been aware of the observation published in 2005 that involved one of their banded birds fitted with a radio transmitter. Secondly, the authors of the March 2023 note – and their reviewer(s) – missed a previous published record in a rather obvious place to begin looking. A search on the *Notornis* online database with the keyword "kaka" identified the 2005 note in a few seconds.

Yours, etc.

Richard N. Holdaway
Palaecol Research Ltd

OFFICERS 2023

Please refer to the Birds New Zealand website (www.birdsnz.org.nz/contact/) for up-to-date contact details and email addresses.

President:	BRUCE McKINLAY
Vice-President:	NATALIE FORSDICK
Secretary:	LYNNE ANDERSON
Treasurer:	PAUL GARNER-RICHARDS
Council Members:	MEL GALBRAITH
	COLIN MISKELLY
	ELEANOR GUNBY
	KEITH WOODLEY
	JOSIE GALBRAITH
	IAN ARMITAGE

EXECUTIVE OFFICER INGRID HUTZLER

EDITORS

NOTORNIS	CRAIG T. SYMES
NOTORNIS (Assistant)	JAMES SAVAGE & ZOHARA RAFI
Birds New Zealand:	MICHAEL SZABO
Book Reviews:	TRISH WELLS

CONVENORS & ORGANISERS

Beach Patrol:	IAN ARMITAGE
Moult Records:	MICAH SCHOLER
Nest Records:	ROGER SHARP
Records Appraisal Committee:	COLIN MISKELLY
Scientific Committee:	GRAEME TAYLOR
Banding Liaison Officer:	JOHN STEWART
Checklist Convenor:	COLIN MISKELLY
Membership Secretary:	KURIEN (KOSHY) YOHANNAN
Wader Counts:	ANDREW CROSSLAND
	ADRIAN RIEGEN
Web Support Officer:	ROGER SHARP

LIBRARIANS

Books & Journals:	TRINA SMITH
Publications purchasing:	PAUL CUMING

REGIONAL REPRESENTATIVES 2023

Please refer to the Birds New Zealand website (www.birdsnz.org.nz/contact/) for up-to-date contact details and email addresses.

Far North:	VACANT
Northland:	Ilse Corkery Ph: 027 343 5884 *birds.northland@birdsnz.org.nz*
Auckland:	Ian McLEAN Ph: 021 535 121 *imclean@southernworld.com*
South Auckland:	Sue FROSTICK Ph: 09 267 2495 *birds.sth.auckland@birdsnz.org.nz*
Waikato:	Bruce POSTILL Ph: 07 849 1944 or 027 849 1944 *brucepostill@gmail.com*
Bay of Plenty / Volcanic Plateau:	Paul CUMING Ph: 07 571 5125 *birds.bop.volcanic@birdsnz.org.nz*
Gisborne / Wairoa:	Geoff FOREMAN Ph. 06 868 8826 *gaforeman@xtra.co.nz*
Taranaki:	Peter FRYER Ph. 027 271 4150 *pj.fryer@xtra.co.nz*
Manawatu:	Phil BATTLEY Ph: 021 072 1216 *p.battley@massey.ac.nz*
Whanganui:	Peter FROST Ph: 06 343 1648 *birds.whanganui@birdsnz.org.nz*
Hawke's Bay:	Bernie KELLY Ph: 06 870 0837 *birds.hawkesbay@birdsnz.org.nz*
Wairarapa:	Oliver DRUCE Ph: 06 304 9854 or 027 334 5705 *birds.wairarapa@birdsnz.org.nz*
Wellington:	Johannes FISCHER Ph: 022 134 6676 *birds.wellington@birdsnz.org.nz*
Nelson:	Paul GRIFFITHS Ph: 021 029 93509 *birds.nelson@birdsnz.org.nz*
Marlborough:	Patrick CROWE Ph: 027 258 3101 *birds.marlborough@birdsnz.org.nz*
Canterbury / West Coast:	Don GOODALE Ph: 027 224 4441 *birds.canterbury@birdsnz.org.nz*
Otago:	Mary THOMPSON Ph: 03 464 0787 *birds.otago@birdsnz.org.nz*
Southland:	Phil RHODES Ph: 02 723 14953 *birds.southland@birdsnz.org.nz*

Abbreviated Instructions to Authors

Please consult the full instructions at *http://osnz.org.nz*

Submission of manuscripts: Manuscripts may be submitted by e-mail to the Managing Editor, Dr Craig Symes *Notornis.Editor@gmail.com*. The submission should be in MS Word format. To facilitate the review process, a single document should be submitted, with Tables and Figures (preferable .jpg format) included in the document, but following the main text and references. Large embedded files should be compressed sufficiently so that the final document size is no larger than 10MB, yet image quality is retained. Should the manuscript be accepted, the Editor will request separately submitted files for images in the relevant format and in suitable resolution. Consult a recent issue for general formatting procedures. A brief covering letter must accompany the submission, confirming that the paper or material in it has not been published previously and is not under consideration with another publication. If the manuscript contains information provided to the author as a personal communication, confirmation that the author has permission to publish this information is required. Authors are strongly advised to have their manuscript read, and critically reviewed, by friends or colleagues. Although this is not a formal requirement of the journal, it may influence the treatment of the manuscript. Complying with any administrative requirement of the author's workplace or supporting agency is a matter between those parties; such matters are not checked by the editors and OSNZ accepts no responsibility in case of any dispute.

Ethics: Papers reporting experimental work on animals should include a reference to the code of practice adopted and relevant animal ethics approval. While the review process may highlight certain issues in this regard it is the responsibility of the author/s to ensure that the relevant procedures are followed and acknowledged when, 1) working on and handling animals, and 2) accessing land where permission is required.

Editorial process: All manuscripts are acknowledged upon receipt. The Managing Editor will make an initial assessment of the manuscript to confirm its subject, content, scope, and quality are appropriate for the journal. The Managing Editor will approach potential referees to review the paper; two reviewers for an original paper, and one reviewer for a short note. The Managing Editor will decide on acceptance for publication following receipt of the reviewers' reports.

Manuscript styles:

Full papers: The main sections of the manuscript should be: 1) Title page containing the title, authors' names, affiliation/s, a suggested short title, and corresponding authors contact e-mail. The title should be as short as possible while still reflecting the content of the paper. 2) Abstract (~150 words) that provides a succinct summary of the main findings of the study, followed by up to seven Keywords. 3) The major parts (Introduction, Materials and Methods, Results, Discussion, Acknowledgments, Literature cited) should follow continuously. Avoid footnotes. *Headings:* There are three levels of headings. First level is **BOLD CAPITALS**; second level is **Bold initial capitals**; third level is *Italic capitals and lower case*. If necessary, a fourth level of *Capitals and small capitals* can be invoked. Text continues on the same line for third and fourth level headings. Use only those levels that are appropriate: main sections are first level headings.

Short notes: These are generally of <2,000 words and report a single item of ornithological interest. The text is without subdivision with results and discussion combined and the only first level headings used are 'Acknowledgements' and 'Literature cited'. Authors' names and affiliation/s are placed at the beginning and keywords at the end of the manuscript.

Book reviews: Publishers of books are invited to contact the Managing Editor in this regard.

Editorial conventions: The most recent edition of the *Checklist of New Zealand birds* should be taken as the prime reference of taxonomy and nomenclature for both scientific and common names of bird species in the New Zealand region (see: *http://nzbirdsonline.org.nz/*). Use a similar authoritative source for other regions. Use of other nomenclature can be adopted where necessary, as in taxonomic papers or where explained or justified in the text. At first mention, both the common and the scientific names (italicised and in brackets) of a species must be given; thereafter one or other may be used, but not both. Subspecific names should be given only if relevant to the content of the paper. Authorities for species names are not required, unless dictated by the subject matter.

Literature cited: Authors are responsible for the accuracy of all references. All citations in the text must be on the list of references; all on the list must be cited. Cite references in the text chronologically and list alphabetically in full at the end of the paper. In the text, names of two authors should be linked by '&'; for three or more, the first author's name should be followed by '*et al.*' Use of transitory reference sources, e.g. web sites, is not encouraged. Journal titles or titles of other periodicals or series must be cited in full.

Tables: Each table should begin on a separate page, numbered in Arabic numerals in the order as referred in the text, and accompanied by a title at the top. Horizontal lines should appear only between the title and the table body, and below the last line of tabulated data. In some instances, clarity may be improved by short horizontal lines over column heads that are logically linked. Do not use vertical lines anywhere in the table.

Figures: Check image quality and legibility by photocopying at the necessary reduction. Lettering should be in sans-serif type (e.g. Helvetica or Arial), not bold, and only initial letters of axis labels capitalised. The preferred symbols are those that are readily available on word processor packages. Photographs must be sharp and of good contrast. Identify necessary details with appropriate labelling. Colour photographs can be printed, but please enquire before submitting. Maps should be simple enough to present the relevant context of the study. Avoid copying poor quality and/or over-detailed images from, for example, Google Earth or institutional reports, etc. Captions should be prefaced by Figure in bold and referenced sequentially in the text by Fig. 1, etc. (not Figure). Provide appropriate legends, or list the meanings of shading or other details in the caption. Captions should contain enough information to explain the figures without reference to the text.

Page charges: There are currently no page charges for authors.

Revised and updated December 2018

NOTORNIS

Journal of the Ornithological Society of New Zealand Inc.

Volume 70, Part 2, June 2023

CONTENTS

Papers

Identifying northern Buller´s albatross (*Thalassarche bulleri* subsp.) in offshore waters of southern Perú	**Quiñones, J.; Zavalaga, C.; Robertson, C.J.R.**	**49**
Vagrant and extra-limital bird records accepted by the Birds New Zealand Records Appraisal Committee 2021–202	**Miskelly, C.M.; Crossland, A.C.; Saville, I.; Southey, I.; Tennyson, A.J.D.; Bell, E.A.**	**60**
Wing areas and wing loadings of New Zealand land birds	**Gill, B.J.**	**74**

Short notes

First records of eastern cattle egret (*Bubulcus ibis coromandus*) in the Solomon Islands	**Butcher, S.C.; Crossland, A.C.; Crutchley, P.; Mugan, N.D.**	**83**
Swamp harrier (*Circus approximans*) predation of white-fronted tern (*Sterna striata*) chicks on the Noises Islands, New Zealand	**Rayner, M.J.; Neureuter, R.; Neureuter, S.; Neureuter, Z.**	**86**
Polynesian traditions explain why some birds are red or black	**Richter-Gravier, R.**	**89**
Year of the tern: the first record of black tern (*Chlidonias niger*) from New Zealand	**Thomas, O.J.W.; Hunt, E.K.S.**	**93**
Letter to the Editor	**Holdaway, R.N.**	**96**