Australian Field Ornithology 2026, **43**, 31–37
http://dx.doi.org/10.20938/afo43031037

Ship-assisted displacement of a Great Cormorant *Phalacrocorax carbo* and vagrant birds of subantarctic Macquarie Island

Milan Sojitra[1]*, Jaslyn Allnutt[1] and Helen Achurch[2]

[1]Institute for Marine and Antarctic Studies, University of Tasmania, Battery Point TAS 7004, Australia
[2]Australian Antarctic Division, Department of Climate Change, Energy, the Environment and Water, Kingston TAS 7050, Australia
*Corresponding author. Email: milan.sojitra@utas.edu.au

Abstract. Birds are known to use ships opportunistically as refuges during their migrations at sea, although detailed studies on these occurrences are limited. This study records the ship-assisted displacement of a Great Cormorant *Phalacrocorax carbo* from offshore south-east of Tasmania to the subantarctic Macquarie Island. Observations over a 3-day period aboard a resupply vessel showed the Cormorant used the ship as a resting platform, resulting in passive transport over 1260 km. To our knowledge, Macquarie Island is the southernmost location where this species has been recorded, and this sighting documents one of the possible pathways for vagrancy. We report detailed sightings of vagrant Great Cormorants on Macquarie Island and provide an updated list of vagrant non-marine waterbird and landbird species observed there since 2001. We discuss the role of human activities in influencing bird distribution and possible consequences of vagrant birds on remote ecosystems.

Introduction

Many records exist of vagrant birds typically driven by two complex mechanisms: active movements, controlled by the animal, or passive movements, controlled by external factors (Dufour *et al.* 2024). These mechanisms include natural processes influenced by external factors such as wind drift and extreme weather, intrinsic factors like errors in the vagrant's internal compass (Lees & Gilroy 2021; Dufour *et al*. 2024), or anthropogenic factors like displacement by ships. Ship-assisted displacement of both terrestrial and marine birds is a phenomenon where birds utilise vessels for temporary refuge during their at-sea dispersal, including migration. This behaviour may be driven by fatigue, adverse weather conditions, disorientation, artificial lights, and the search for food (de Brum *et al.* 2018; Hernandez *et al.* 2022; Sarà *et al.* 2022; Albanus & Amar-Singh 2023).

When birds are displaced to new territories, outside their natural distribution or habitat, they may be classed as vagrant birds (Scholander 1955; Dufour *et al.* 2024). Oceans act as natural barriers for landbirds and non-marine waterbirds, limiting their ability to disperse across vast marine expanses. Vagrant birds can establish themselves in new regions if they find suitable conditions for survival and breeding and manage to avoid competition for resources and predation from native species (Frenot *et al.* 2005; Lees & Gilroy 2021). However, vagrant birds also pose risks to native species by introducing new diseases, parasites, and vascular plant species to the new habitat (Barnes *et al.* 2006; Kalwij *et al.* 2019).

In the Southern Hemisphere, vagrant birds sometimes travel from temperate habitats to remote subantarctic islands in the Southern Ocean and the Antarctic continent through natural processes and ship-assisted displacements (Lees & Gilroy 2021). For example, non-marine birds such as Least Seedsnipe *Thinocorus rumicivorus*, Eastern Cattle Egret *Ardea coromanda*, Barn Swallow *Hirundo rustica* and House Sparrow *Passer domesticus* have been documented as ship-assisted to Antarctic and subantarctic regions (Burger *et al.* 1980; Montalti *et al.* 1999; Korczak-Abshire *et al.* 2011; Marin 2014; Petersen *et al.* 2015). There are also cases of ship-assisted displacement of subantarctic and Antarctic birds to other places, as with Snowy Sheathbills *Chionis albus* (de Brum *et al*. 2018; Lin *et al.* 2018). However, to our knowledge, there are no reports of ship-assisted vagrancy in the Great Cormorant *Phalacrocorax carbo*.

The Great Cormorant is a large waterbird belonging to the Phalacrocoracidae family. Its extensive distribution spans the coasts of the north-western Atlantic, and coasts and wetlands of Europe, Asia, Africa, Australia and New Zealand (BirdLife International 2025). Although persecution and habitat changes have historically impacted its distribution, over recent decades there have also been significant range and population expansions (Hatch *et al.* 2020; BirdLife International 2025). Northern populations typically migrate southward in winter, but in Australia their movements are complex and largely linked with availability of water and food in freshwater wetlands (Marchant & Higgins 1990). Two-way dispersal has been documented between Australian and New Zealand populations (Hatch *et al.* 2020).

This study documents the ship-assisted displacement of a Great Cormorant from offshore south-east of Tasmania to the subantarctic Macquarie Island. It also details all sightings of vagrant Great Cormorants on Macquarie Island, as well as providing an updated list of vagrant birds observed on the island since 2001.

Method

Observation at sea

Observations were conducted aboard *L'Astrolabe* (a French icebreaker) during a resupply voyage travelling from Hobart, Tasmania, to Dumont D'Urville Station,

Antarctica, in early December 2023. The vessel's course and environmental conditions were recorded, alongside detailed notes on the Cormorant's behaviour and interactions with the vessel.

Vagrant bird data

Vagrant bird species on Macquarie Island are recorded opportunistically by Tasmania Parks and Wildlife Service (PWS) staff, researchers, and other personnel residing on or visiting the island. Expeditioners are encouraged to report sightings and photograph any unusual bird species encountered during their travels around the island. PWS staff and other researchers often travel to remote areas of the island, whereas expeditioners are largely limited to the station (in the north of the island) and marked tracks leading to field huts positioned around the island. Some areas of the island are rarely visited. During the summer, vagrant species are occasionally observed by staff or passengers on tourist-ship visits. Those observations are reported to the PWS rangers, who collate, validate and provide the details to the Macquarie Island Wildlife Monitoring Program administered through the Department of Natural Resources and Environment Tasmania through monthly reports and an annual wildlife program report.

Results and discussion

Observations of the ship-assisted Great Cormorant

On 7 December 2023, at *c*. 0900 h, a juvenile Great Cormorant was observed approaching the bow of *L'Astrolabe* from the west (Figure 1a). Sea conditions were moderate, with air temperature around 10°C and good visibility despite occasional light showers. Initially reluctant to land on the vessel, the Cormorant was observed spending the first day circling and occasionally resting on the sea (Figure 1b). By the second day (8 December), it had become familiar with the ship, using the guard rail at the ship's stern to rest for most of the day and making only short periodic flights before returning (Figure 1c). Roosting on the vessel that night was likely, as it was observed perched on the guard rail at dawn the following morning but feeding behaviour could not be confirmed during the ship-assisted displacement. The vessel maintained an average speed of 13–15 knots, reaching Macquarie Island on 9 December, at *c*. 0700 h. At *c*. 0900 h, the Cormorant flew towards the island while resupply operations were underway.

From the initial sighting at 45.02764°S, 149.22984°E in the Tasman Sea south of Hobart to Buckles Bay, Macquarie Island (54.50420°S, 158.94250°E), the bird travelled

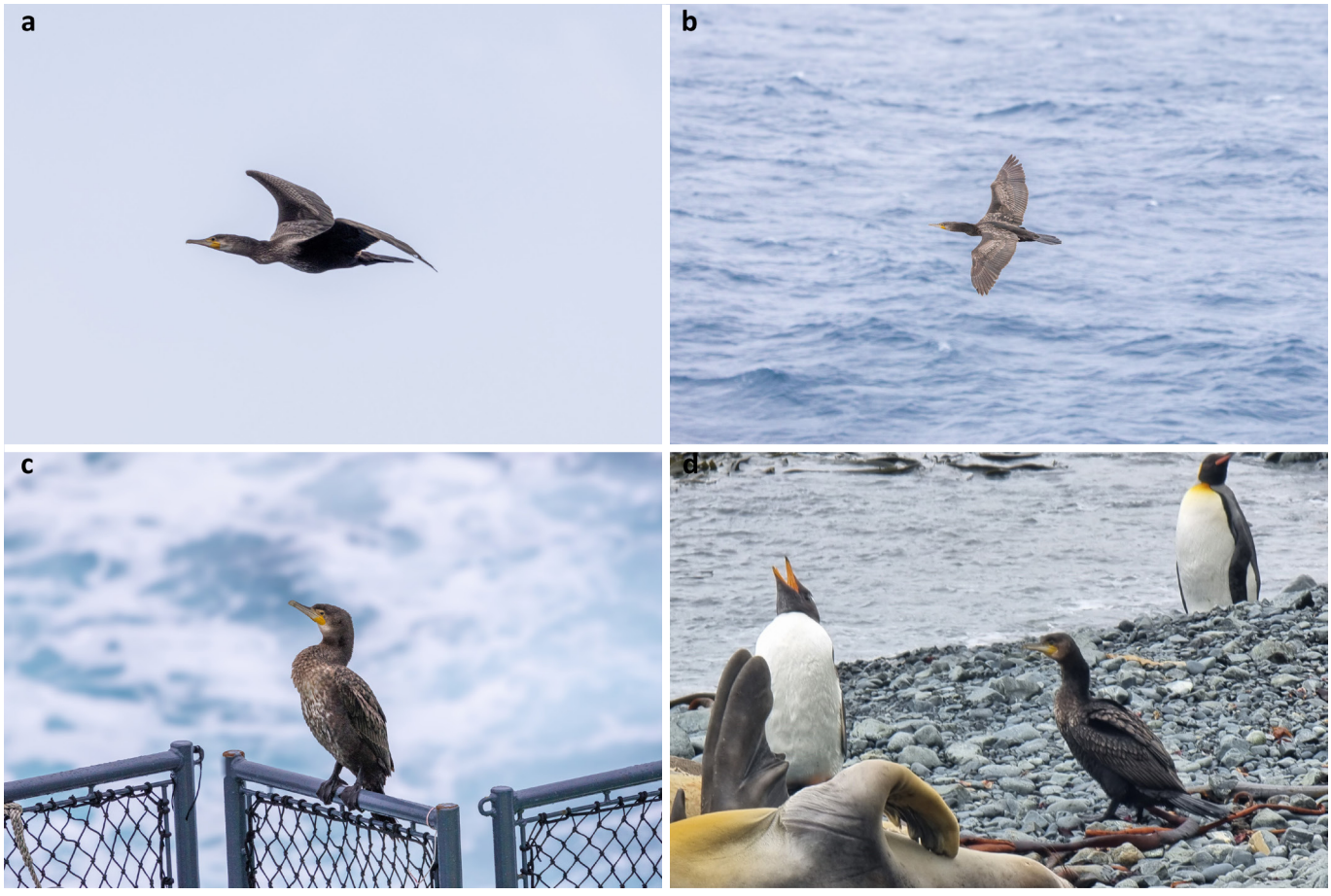

Figure 1. Photographs of a juvenile Great Cormorant throughout its ship-assisted displacement: (a) the first sighting of the bird, (b) the cormorant circling the vessel, (c) resting on guard rail at the ship stern, and (d) a Great Cormorant among native wildlife of Macquarie Island. The bird in photograph (d) may not be the same ship-assisted bird as in the other photographs. Photos: (a–c) Milan Sojitra, (d) Helen Achurch

Table 1. Records of Great Cormorants observed on Macquarie Island from when monitoring began in 1912 until the 2023–2024 austral summer. The table presents the number of individuals observed each month, with the number of separate sighting events provided in parentheses.

Year	*Number of individuals (and number sighting events) recorded in a month*											
	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*Jun.*	*Jul.*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
1952			2 (1)									
1957										1 (1)	2 (1)	
1976										3 (2)	43 (19)	90 (20)
1977	63 (20)	48 (6)	40 (4)	4 (2)	1 (1)					8 (3)	1 (1)	5 (3)
1978	1 (1)	1 (1)	24 (9)									
1979											1 (1)	
1992	2 (1)											
2023											5 (4)	35 (5)
2024	5 (5)	3 (3)										

~1262 km in *c.* 48 hours (Figure 2). The observations made during this study highlight how birds may utilise ships as temporary refuges, illustrating one potential pathway for vagrancy facilitated by indirect (i.e. ship-assisted) human intervention. Use of ships in this way may enable landbirds or waterbirds to travel further than they may otherwise do. Vagrancy by this means may have broad implications for the native ecosystem where the birds end up, especially in regions where shipping is increasing (Grant *et al.* 2021; McCarthy *et al.* 2022) and, therefore, the opportunity for movement of species may also be increasing.

Vagrant Great Cormorants on Macquarie Island

Since monitoring began in 1912, 114 Great Cormorant sighting events (388 individual birds) have been recorded

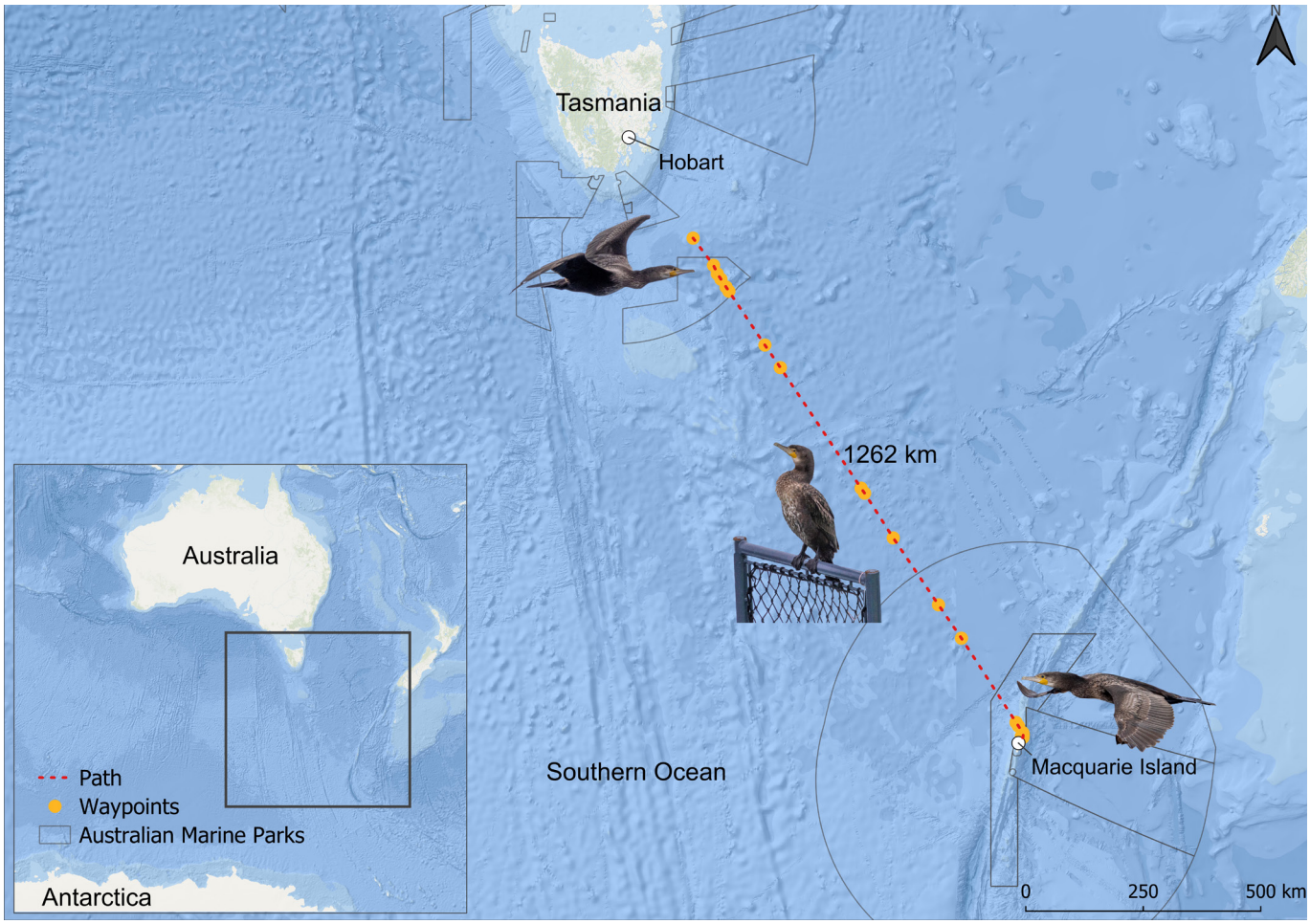

Figure 2. The journey of the ship-assisted Great Cormorant in December 2023 from its initial sighting offshore south-east of Tasmania to its final sighting in Buckles Bay, Macquarie Island. The yellow circles indicate waypoints of sightings, and the broken red line traces the cormorant's path. Black polygons represent Australian Marine Parks.

on the island, with the first sighting in 1952 (Table 1). These records include observations of both living and dead birds.

Sightings were usually of individuals (Figure 1d) or pairs, but occasionally large flocks were observed (maximum 30 on 25 December 1976 and on 8 December 2023). Peaks in the number of sightings were in 1976–1979 and 2023. These apparent episodic influxes may in fact be repeat sightings of the same individuals as a flock disperses and individuals are observed across the island in subsequent months. Without being able to ascertain whether records are of the same individuals, it is challenging to determine definitive patterns or drivers of arrival and departure for this species on Macquarie Island. Nonetheless, the presence of large flocks, such as those recorded in 1976 and 2023, indicates that under certain conditions significant numbers of Great Cormorants can reach and possibly survive in the harsh environment of Macquarie Island. Generally, most individuals arriving after such long journeys often appear to be in poor health and likely die on the island, often becoming prey for, or scavenged by, native Brown Skuas *Stercorarius antarcticus*, Southern Giant Petrels *M. giganteus* or Northern Giant Petrels *Macronectes halli*.

Other vagrant bird species

From 1901 to 2000, 56 non-breeding vagrant species, 11 rare and exotic species with small established breeding populations, and four species with unverified identification were recorded on Macquarie Island (Copson & Brothers 2008). Since 2001, excluding offshore seabird sightings, a total of 22 species considered vagrant at the time of recording have been detected on the island (Table 2). Of these, there are ten waterbird species, three penguins, and three unusual pelagic seabirds that were detected on the island itself (Table 2). This represents only a small amount of diversity recorded on the island: for example, including data from the period 1912–2001, there have been 32 waterbird species detected on Macquarie Island that were considered vagrants at the time of recording (Copson & Brothers 2008).

Here, we report four new vagrant bird species that have been observed on the island from 2001 to the 2023–2024 austral summer (Table 2). One is an Australian landbird (Dusky Woodswallow *Artamus cyanopterus*), with one individual seen near the station in September 2020. Two are arguably pelagic seabirds, which were unusual sightings in that they were observed on the island itself (two Sooty Terns *Onychoprion fuscatus* seen together in June 2016 and a South Polar Skua *Stercorarius maccormicki* in December 2021); both these species range widely across the world's oceans, with the Sooty Tern mainly in tropical waters. The fourth is an Australian waterbird Chestnut Teal *Anas castanea*, which was recorded in September 2007 and 2008 (single birds) and four times in 2013–2014 (one individual in August, 22 in September and 10 in November 2013; and 28 in February 2014). These additions update the total number of non-breeding bird species recorded on Macquarie Island to 60 (including pelagic species seen on the island), building upon a previous list (compiled by Copson & Brothers 2008). The recording of vagrant species on the island is heavily influenced by the number of expeditioners, the extent of island coverage by observers, information being passed on to rangers by visitors on tourist ships, and the observation and identification skills of observers. These factors vary substantially within a year (typically there is better island coverage during summer) and between years: for example, there was far more extensive observer coverage across the island in the period 2006–2014 during an intense and successful pest-eradication program (Springer 2016).

Some species that were initially recorded as vagrants to the island have now successfully established breeding populations, and these include Mallard *Anas platyrhynchos*, Cape Petrel *Daption capense,* Common Starling *Sturnus vulgaris* and Redpoll *Acanthis flammea* (Copson & Brothers 2008). Recently, Song Thrush *Turdus philomelos* has been recorded in increasing numbers, with some evidence of breeding detected in summer 2023–2024 (JA pers. obs). These examples illustrate how vagrant birds can transition from occasional visitors to established residents. All the birds mentioned above (except the one seabird, Cape Petrel) are Eurasian or Holarctic species that have been introduced to New Zealand and become common there, so New Zealand is the likely source of those species on Macquarie Island. Three of them (Mallard, Common Starling and Song Thrush) have also been introduced to Australia, but only one of these (Common Starling) has become common there, and Redpolls have never become established in Australia (although there are records of vagrants on offshore islands, presumably from New Zealand) (Falla 1937; Norman 1987; Copson & Brothers 2008). Hence Australia is not a likely source of any of these landbirds on Macquarie Island. Australia is the only likely source of the Chestnut Teal and Dusky Woodswallow, and at least some of the Great Cormorants, as confirmed by our observations of the ship-assisted bird.

Although colonisation by vagrant birds can occur, it is uncommon and can have varying impact on native wildlife and vegetation. They typically arrive in small numbers, encounter unsuitable habitats, and die or move elsewhere before they can reproduce. On Macquarie Island, native predators such as Brown Skuas, Northern and Southern Giant Petrels have been noted to prey or scavenge on vagrant bird species, as has been recorded on other subantarctic islands (Burger *et al.* 1980; Copson & Brothers 2008). For example, remains of vagrant Antarctic Petrels *Thalassoica antarctica* and Great Cormorants have been discovered in skua territories, and skuas and Kelp Gulls *Larus dominicanus* have been observed harassing vagrant Masked Lapwings *Vanellus miles* on Macquarie Island (HA pers. obs.). However, some established self-introduced species, such as Redpoll and Common Starling, can exert significant pressure on native macro-invertebrates and vegetation (Raymond *et al.* 2011), possibly occupying part of the niche left by the extinct Macquarie Island Red-fronted Parakeet *Cyanoramphus novaezelandiae erythrotis*.

Additionally, the potential passive transport of pathogens and parasites that could be passed on to native species, or the incidental transport of non-native plant species (seeds) by vagrant birds to new locations, remains a significant concern (Kalwij *et al.* 2019; Ellis *et al.* 2023). The recent outbreak of H5N1 high pathogenicity avian influenza virus (HPAI) in subantarctic and Antarctic regions demonstrates how disease can be spread by migratory species and result in substantial mortality of seabirds and marine mammals (Bennison *et al.* 2023; Leon *et al.* 2024). Potential pathways for the introduction of HPAI into Australia include migratory

Table 2. Vagrant bird species recorded on Macquarie Island from 2001 until 2024. * denotes a species newly recorded as a vagrant since 2001, based on the list compiled by Copson & Brothers (2008). Scientific names follow AviList v 2025 and common names follow BirdLife Australia Working List v 4.3.

Species	*No. of years with observations (since 2001)*	*Maximum group size*	*Years reported*	*Notes*
Australian Shelduck *Tadorna tadornoides*	3	55	2006, 2014, 2018	Large flock seen multiple times at some lakes in north of island in December 2006. Small groups in November 2014 and November 2018.
Chestnut Teal *Anas castanea**	4	28	2007, 2008, 2013, 2014	Usually on lagoons in north-west of island, in spring and summer. Breeding detected in 2013.
Eurasian Coot *Fulica atra*	1	1	2014	Lone bird on a lagoon in north-west in January.
Australian Pied Oystercatcher *Haematopus longirostris*	1	1	2019	On isthmus in December.
Masked Lapwing *Vanellus miles*	3	2	2013, 2022, 2023	Predation by skua observed. Sightings in August/September.
Ruddy Turnstone *Arenaria interpres*	1	1	2014	Lone bird, non-breeding plumage, seen only once, in January.
Unidentified sandpiper	1	1	2008	In north-west. Seen twice, in January and September.
South Polar Skua *Stercorarius maccormicki**	1	1	2021	In north-west in December.
Sooty Tern *Onychoprion fuscatus**	1	2	2016	Landed at isthmus in June, 1 bird found dead the next morning.
Adélie Penguin *Pygoscelis adeliae*	4	1	2013, 2014, 2021, 2023	Reported twice from isthmus area, once from Bauer Bay, and once from Brothers Point. In October–December each time.
Chinstrap Penguin *Pygoscelis antarcticus*	9	1	2008, 2013, 2014, 2015, 2017, 2019, 2020, 2022, 2023	Only ever 1 bird seen, often moulting. Observed in summer, once in March.
Erect-crested Penguin *Eudyptes sclateri*	4	1	2017, 2018, 2020, 2023	Most sightings from north of island; one in south found 2 days after it was seen in north. Sightings in late December–March.
Antarctic Petrel *Thalassoica antarctica*	3	2	2013, 2014, 2016	All found dead in August–October.
Great Cormorant *Phalacrocorax carbo*	2	30	2023, 2024	See text and Table 1.
White-faced Heron *Egretta novaehollandiae*	3	1	2016, 2017, 2021	Seen in different locations each time during spring/summer.
Plumed Egret *Ardea plumifera*	1	1	2008	South of island in June.
Eastern Cattle Egret *Ardea coromanda*	5	8	2008, 2014, 2015, 2021, 2023	Small flock in 2008, otherwise only individual birds (often dead). Sightings April–August.
White-throated Needletail *Hirundapus caudacutus*	1	1	2018	In north of island in January.
Fork-tailed Swift *Apus pacificus*	1	1	2017	In north of island in November.
Dusky Woodswallow *Artamus cyanopterus**	1	1	2020	Resting on rock stack at isthmus, in September.
Welcome Swallow *Hirundo neoxena*	3	1	2007, 2014, 2015	Seen in winter in all years. Found dead in 2015; possibly the same bird found alive in 2014.
Song Thrush *Turdus philomelos*	7	4	2014, 2017, 2018, 2019, 2020, 2023, 2024	Frequently seen and heard in north of island, all year round, breeding observed in 2023–2024.
Common Blackbird *Turdus merula*	1	1	2014	One bird seen briefly in August.

routes, particularly via returning migratory waterbirds, shorebirds, and certain seabirds (Klaassen & Wille 2023), and potentially via vagrant birds. Some vagrant bird species recorded on Macquarie Island over the years also belong to these high-risk groups. This underscores the potential for vagrant species to impact remote subantarctic ecosystems. The remoteness of the island and density of native biodiversity makes it particularly vulnerable to the introduction of diseases and invasive species, highlighting the necessity for rigorous monitoring and reporting of populations of vagrant birds.

These findings underscore the need for further research into the mechanisms driving movement of vagrant species, including both natural processes and anthropogenic influences. Understanding the factors that enable vagrant birds to survive and establish in new territories is crucial for predicting, potentially preventing, and managing the impacts of these species on native ecosystems. The role of human activities, particularly as maritime traffic increases (Morley *et al.* 2020; Grant *et al.* 2021), in facilitating such movements must be carefully considered in conservation and management strategies for pristine remote subantarctic islands and Antarctica.

Acknowledgements

The data were obtained through the Macquarie Island Wildlife Monitoring Program administered through the Department of Natural Resources and Environment Tasmania and supported by the Australian Antarctic Science Project #4619. Sightings were collected and collated by various Tasmania Parks and Wildlife rangers with the help of Australian Antarctic Division expeditioners on Macquarie Island, and we are grateful for their support in data collection and access. We thank the crew of *L'Astrolabe* for their assistance and cooperation during the observations at sea. We also acknowledge the numerous researchers, volunteers, expeditioners, station personnel, and ship crews who have recorded data on vagrant species on Macquarie Island over the years. Finally, we thank the anonymous reviewers and the handling editor for their constructive feedback, which greatly improved the quality of this manuscript. We declare that we have no conflict of interest.

References

Albanus, M, & Amar-Singh, H. (2023). Birds on migration and interaction with ships. *Malaysian Bird Report* **3**, 5–11.

Barnes, D.K.A., Hodgson, D.A., Convey, P., Allen, C.S. & Clarke, A. (2006). Incursion and excursion of Antarctic biota: Past, present and future. *Global Ecology and Biogeography* **15**, 121–142.

Bennison, A., Byrne, A.M., Reid, S.M., Lynton-Jenkins, J.G., Mollett, B., Silva, D.D., Peers-Dent, J., Finlayson, K., Hall, R. & Blockley, F. (2023). Detection and spread of high pathogenicity avian influenza virus H5N1 in the Antarctic region. *Nature Communications* https://www.nature.com/articles/s41467-024-51490-8.

BirdLife International (2025). Species factsheet: *Phalacrocorax carbo* https://datazone.birdlife.org/species/factsheet/great-cormorant-phalacrocorax-carbo 9 (accessed 16 June 2025).

Burger, A.E., Williams, A.J. & Sinclair, J.C. (1980). Vagrants and the paucity of land bird species at the Prince Edward Islands. *Journal of Biogeography* **7**, 305–310.Copson, G. & Brothers, N. (2008). Notes on rare, vagrant and exotic avifauna at Macquarie Island, 1901–2000. *Papers and Proceedings of the Royal Society of Tasmania* **142**, 105–115.

de Brum, A.C., Benemann, V.R.F., Bezerra, A.L., Corrêa, L.L.C. & Petry, M.V. (2018). Record of ship-assisted displacement of *Chionis albus* (Gmelin, 1789) (Aves: Chionidae) from Antarctica to South America. *Oecologia Australis* **22**, 89–92.

Dufour, P., Lees, A.C., Gilroy, J. & Crochet, P.-A. (2024). The overlooked importance of vagrancy in ecology and evolution. *Trends in Ecology & Evolution* **39**, 19–22.

Ellis, V.A., Ciloglu, A., Yildirim, A. & Bensch, S. (2023). Host shift and natural long-distance dispersal to an oceanic island of a host-specific parasite. *Biology Letters* **19**, 20220459

Falla, R.A. (1937). *Birds, Volume 2.* In: Johnston,T.H. (Ed.) British, Australian, and New Zealand Antarctic Research Expedition, 1929–1931: Reports, Series B (Zoology and Botany). British, Ausrtralian, and New Zealand Research Expedition Committee, Hassell Press, Adelaide.

Frenot, Y., Chown, S.L., Whinam, J., Selkirk, P.M., Convey, P., Skotnicki, M. & Bergstrom, D.M. (2005). Biological invasions in the Antarctic: Extent, impacts and implications. *Biological Reviews of the Cambridge Philosophical Society* **80**, 45–72.

Grant, S.M., Waller, C.L., Morley, S.A., Barnes, D.K.A., Brasier, M.J., Double, M.C., Griffiths, H.J., Hughes, K.A., Jackson, J.A., Waluda, C.M. & Constable, A.J. (2021). Local drivers of change in Southern Ocean ecosystems: Human activities and policy implications. *Frontiers in Ecology and Evolution* **9**, 624518.

Hatch, J.J., Brown, K.M., Hogan, G.G., Morris, R.D., Orta, J., Garcia, E.F.J., Jutglar, F., Kirwan, G.M. & Boesman, P.F.D. (2020). Great Cormorant (*Phalacrocorax carbo*), version 1.0. In: Billerman, S.M. (Ed.). *Birds of the World.* Cornell Lab of Ornithology, Ithaca, New York, USA. https://doi.org/10.2173/bow.grecor.01

Hernandez, M.M., Pretelli, M.G., Webb, J. & Pon, J.P.S. (2022). Vessels as an opportunity to track vagrant non-marine birds in the southwestern South Atlantic. *Wilson Journal of Ornithology* **134**, 327–333.

Kalwij, J.M., Medan, D., Kellermann, J., Greve, M. & Chown, S.L. (2019). Vagrant birds as a dispersal vector in transoceanic range expansion of vascular plants. *Scientific Reports* **9**, 4655.

Klaassen, M. & Wille, M. (2023). The plight and role of wild birds in the current bird flu panzootic. *Nature Ecology & Evolution* **7**, 1541–1542.

Korczak-Abshire, M., Lees, A.C. & Jojczyk, A. (2011). First documented record of barn swallow (*Hirundo rustica*) in the Antarctic. *Polish Polar Research* **32**, 355–360.

Lees, A.C. & Gilroy, J.J. (2021). *Vagrancy in Birds*. Bloomsbury Publishing. Christopher Helm, London.

Leon, F., Le Bohec, C., Pizarro, E.J., Baille, L., Cristofari, R., Houstin, A., Zitterbart, D.P., Barriga, G., Poulin, E. & Vianna, J. A. (2024). Highly pathogenic avian influenza a (H5N1) suspected in penguins and shags on the Antarctic peninsula and West Antarctic coast. *bioRxiv*, 2024.2003. 2016.585360.

Lin, D.-L., Tsai, Y.-L., Ting, T.-C., Chan, F.-T., Lin, K.-H. & Tsai, C.-F. (2018). The first wildlife rescue case of a Snowy Sheathbill (*Chionis albus*) from the Antarctica. 國立臺灣博物館學刊 **71**, 19–26.

Marchant, S. & Higgins, P.J. (Eds) (1990). *Handbook of Australian, New Zealand & Antarctic Birds, Volume 1A: Ratites to Petrels*. Oxford University Press, Melbourne.

Marin, M. (2014). Unusual bird records from the Antarctic Peninsula. *Notornis* **61**, 215–218.

McCarthy, A.H., Peck, L.S. & Aldridge, D.C. (2022). Ship traffic connects Antarctica's fragile coasts to worldwide ecosystems. *Proceedings of the National Academy of Sciences of the United States of America* **119**, e2110303118.

Montalti, D., Orgeira, J.L. & Di Martino, S. (1999). New records of vagrant birds. *Polish Polar Research* **20**, 347–354.

Morley, S.A., Abele, D., Barnes, D.K.A., Cárdenas, C.A., Cotté, C., Gutt, J., Henley, S.F., Höfer, J., Hughes, K.A., Martin, S.M., Moffat, C., Raphael, M., Stammerjohn, S.E., Suckling, C.C., Tulloch, V.J.D., Waller, C.L. & Constable, A.J. (2020). Global drivers on Southern Ocean ecosystems: Changing physical environments and anthropogenic pressures in an Earth System. *Frontiers in Marine Science* **7**, 547188.

Norman, F.I. (1987). *The Ducks of Macquarie Island. ANARE Research Notes Volume 42.* Antarctic Division, Department of Science, Kingston, Tas.

Petersen, E.D.S., Rossi, L.C. & Petry, M.V. (2015). Records of vagrant bird species in Antarctica: New observations. *Marine Biodiversity Records* **8**, e61.

Raymond, B., McInnes, J., Dambacher, J.M., Way, S. & Bergstrom, D.M. (2011). Qualitative modelling of invasive species eradication on subantarctic Macquarie Island. *Journal of Applied Ecology* **48**, 181–191.

Sarà, M., Firmamento, R., Cangemi, G., Pagano, L., Genovese, M., Romeo, T. & Greco, S. (2022). Welcome aboard: Are birds migrating across the Mediterranean Sea using ships as stopovers during adverse weather conditions? *Ibis* **165**, 328–339.

Scholander, S.I. (1955). Land birds over the western North Atlantic. *Auk* **72**, 225–239.

Springer, K. (2016). Methodology and challenges of a complex multi-species eradication in the sub-Antarctic and immediate effects of invasive species removal. *New Zealand Journal of Ecology* **40**, 273–278.

Received 10 July 2025, accepted 1 December 2025, published online 19 February 2026