SHOREBIRD CONSERVATION ACTION PLAN 2023/24 SURVEYS AND ASSESSMENT

SUNSHINE COAST

Prepared for
Sunshine Coast Council

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Date: 01/06/2024

Dr Penn Lloyd
Principal Ecologist and Director

EXECUTIVE SUMMARY

BACKGROUND

Sunshine Coast Council (SCC) has developed a Shorebird Conservation Action Plan to raise awareness and educate the public around shorebirds, to manage and protect shorebird habitat, and to provide management solutions for shorebird conservation, with a particular focus on important habitat for migratory and resident shorebirds that gather in large numbers on the sandbanks and mudflats of the lower Maroochy River and the Caloundra Banks on the northern Pumicestone Passage.

Three key objectives of the Shorebird Conservation Action Plan are to:

- Identify current migratory and resident shorebird habitats within the SCC local government area (LGA);
- Identify species and abundance of migratory and resident shorebirds in those habitats; and
- Determine the main threats to migratory and resident shorebirds in the SCC LGA and incorporate site management needs and recommendations.

STUDY APPROACH

This study aims to implement the key objectives of the Shorebird Conservation Action Plan through a combination of:

- Review and analysis of shorebird survey data for the SCC LGA collected by the Queensland Wader Study Group (QWSG); and
- Conducting shorebird surveys of the lower Maroochy River and the Caloundra Banks to determine current shorebird distribution and habitat, identify which shorebird species are present, and determine the type and extent of disturbance.

KEY RESULTS

Lower Maroochy River

Tidal flats along the lower Maroochy River supported an average of 164 and a maximum of 196 migratory shorebirds in 2023/24 compared to averages of 109 and 119 and maxima of 146 and 173 in 2020/21 and 2022/23 respectively. The tidal flats supported an average of 15 and a maximum of 23 resident shorebirds in 2023/24, similar to an average of 9 and maxima of 15 to 16 resident shorebirds in 2020/21 and 2022/23. Four migratory shorebird species dominated the counts: Pacific Golden Plover, Eurasian Whimbrel, Bar-tailed Godwit and Far Eastern Curlew. Numbers of critically endangered Far Eastern Curlew decreased from an average of 8 (maximum 13) in 2020/21 to an average of 4.5 (maximum 6) in 2022/23 and an average of 4.0 (maximum 5) in 2023/24. Numbers of vulnerable Bar-tailed Godwit decreased from an average of 21 (maximum 35) in 2020/21 to an average of 10.5 (maximum 21) in 2022/23 but increased again to an average of 17.8 (maximum 52) in 2023/24. The most important tidal flat area for foraging migratory shorebirds was consistently MR06 on the eastern side of Goat Island, which supported an average of 113 and a maximum of 167 migratory shorebirds at low tide in 2023/24. Other important tidal flats were MR04 and MR07, both on the western side of Goat Island.

Analyses of data for the period 2011 to 2022 found a significant decline in the total migratory shorebird count at low tide during both the summer (October-February) and winter periods. However, the 2023 shorebird year counts recorded a larger average total migratory shorebird count in both summer and winter than previously recorded.

Five main roost sites used by shorebirds and other waterbirds occur in the lower Maroochy River: Goat Island (MRGI); Nojoor Road (MRNR); north shore (MRNS); sand bar (MRSB); and tree roost (MRTR). During the four surveys in 2023/24, shorebirds were recorded roosting at only MRGI (all surveys) and MRTR (one survey: 42 Eurasian Whimbrel and 11 Grey-tailed Tattler on 30/10/2023); no birds were recorded at MRNR or MRNS. The average numbers of roosting birds in 2023/24 were similar to the overall averages over the period 2020/21 to 2022/23. Analysis of Queensland Wader Study Group (QWSG) data shows that the north shore (MRNS) was the most important migratory shorebird roost site in the lower Maroochy River area up until 2004. Thereafter, Goat Island (MRGI) became increasingly used by shorebirds for roosting due to increasing disturbance along the north shore. Over the past four summer seasons, migratory shorebirds have only used Goat Island and MRTR for roosting.

Caloundra

Four main areas of tidal flat feeding habitat occur in the northern Pumicestone Passage at Caloundra that have been subject to monitoring during this study and by the QWSG since 1993: a large tidal flat on the eastern side of the passage along the north-western tip of Bribie Island (SBN1); a large tidal flat on the western side of the passage opposite Golden Beach (SBN2); a small tidal flat connected to SBN2 opposite Pelican Waters (PEWA); and several small patches of tidal flat at Bell's Creek (BECK). The configuration of SBN2 has continued to change following the creation of a new channel to the sea that broke through the northern tip of Bribie Island in January 2022. A new area of tidal flat (SBN3) has formed on the south side of the new opening into Pumicestone Passage where sediment has gradually built up on the outer southern side of the new entrance.

The tidal flat areas of SBN1 and SBN2 (including PEWA) remained the most important feeding areas for migratory shorebirds in 2023/24, particularly for the critically endangered Far Eastern Curlew, vulnerable Bar-tailed Godwit, Eurasian Whimbrel and Pacific Golden Plover. Five other migratory shorebird species were recorded occasionally in smaller numbers, with small numbers of four resident shorebird species. In 2023/24, the combined area of tidal flats supported an average combined total of 194 and a maximum of 232 migratory shorebirds and an average of 27 and maximum of 65 resident shorebirds during the summer season. The average numbers of shorebirds recorded foraging at low tide during summer in 2023/24 were generally greater than the averages over the previous three years.

Six known shorebird roost sites occur at Caloundra. Five of these roost sites (CBAR, SBN1, SBN2, BCTR, NTBI) were surveyed during the 2023/24 season, including NTBI that was identified as a new roost on the coastal shoreline of the northern tip of Bribie Island during 2021/22. A further new roost has formed on a sand bank (SBN3) on the southern bank of the new entrance channel to Pumicestone Passage. An average of 224 (range 181 to 308) migratory shorebirds used roost sites at Caloundra during the four high tide surveys in 2023/24, including up to 38 critically endangered Far Eastern Curlew, 135 vulnerable Bar-tailed Godwit, 96 Eurasian Whimbrel and 48 Pacific Golden Plover. The average numbers of shorebirds recorded roosting during summer (October-February) in 2023/24 were generally greater than the averages over the previous three years. The formation of the new entrance to Pumicestone Passage increased the availability of suitable alternative roost sites, with suitable roosting habitat now present on a broad sandy beach at SBN3 and the area of roosting habitat on SBN2 having increased following the increased deposition of sand at this location. This increase in suitable roosting habitat areas may be responsible for the increase in roosting shorebird numbers observed in 2023/24, particularly the increased frequency of roosting by Pacific Golden Plover and Bar-tailed Godwit at the Caloundra roost sites.

RECOMMENDATIONS

This report identifies the most important areas for shorebirds along the Lower Maroochy River and at Caloundra and existing levels of disturbance to shorebirds in these areas. This disturbance pressure is predicted to continue to increase as the region becomes more developed.

Consequently, there is a need for proactive management of disturbance to shorebirds at the important roosting and feeding habitats along the Lower Maroochy River and at Caloundra.

Recommended approaches for reducing disturbance to feeding and roosting shorebirds include a combination of:

- Site-specific information signage to raise awareness of the presence of shorebirds in the area and the importance of the key habitat areas for shorebirds, particularly migratory shorebirds;
- Other approaches to raising public awareness of how the migration and feeding ecology of shorebirds are impacted by disturbances to try to change public awareness of, and attitudes towards, disturbing shorebirds, particularly among dog-owners that exercise their dogs along foreshore areas;
- Planning to ensure suitable dog-walking facilities such as dog-off leash areas are situated in locations convenient and attractive to the public but separated from important shorebird foreshore habitats;
- Planning to limit access to important feeding or roosting areas by people and/or dogs; and
- Effective enforcement of access restrictions and dog on-leash areas, given that compliance to access restrictions or on-leash laws is strongly dependent on the extent of enforcement.

Given the high dependency of migratory shorebirds on a single roost site in the lower Maroochy River estuary, namely the sandbank on the eastern side of Goat Island, proactive management of disturbance to this location is recommended. Since Goat Island is part of the Maroochy River Conservation Park and managed by the Queensland Parks and Wildlife Service (QPWS), a collaborative approach involving QPWS is recommended.

Similarly, proactive management of disturbance to shorebirds at the important roosting and feeding habitats at Caloundra is recommended. Site-specific signage that clearly indicates the locations of the most frequently used high tide roosting areas to be avoided within the SBN1, SBN2, SBN3 and NTBI roost sites, together with an explanation of why disturbance to flocks of roosting birds should be avoided would be particularly useful in this context.

SHOREBIRD CONSERVATION ACTION PLAN SURVEYS AND ASSESSMENT 2023/24

SUNSHINE COAST

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Table of Terms and Abbreviations

BAAM	Biodiversity Assessment and Management Pty Ltd
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
LGA	Local government area
NC Act	Queensland *Nature Conservation Act 1992*
QWSG	Queensland Wader Study Group
SCC	Sunshine Coast Council

1.0 INTRODUCTION

1.1 BACKGROUND

Sunshine Coast Council (SCC) has developed a Shorebird Conservation Action Plan to raise awareness and educate the public around shorebirds, to manage and protect shorebird habitat, and to provide management solutions for shorebird conservation, with a particular focus on important habitat for migratory and resident shorebirds that gather in large numbers on the sandbanks and mudflats of the lower Maroochy River and the Caloundra Banks on the northern Pumicestone Passage.

Three key objectives of the Shorebird Conservation Action Plan are to:

- Identify current migratory and resident shorebird habitats within the SCC local government area (LGA);
- Identify species and abundance of migratory and resident shorebirds in those habitats; and
- Determine the main threats to migratory and resident shorebirds in the SCC LGA and incorporate site management needs and recommendations.

During 2020/21 to 2022/23, BAAM completed several surveys at both low tide (surveying shorebird use of feeding habitat) and high tide (surveying shorebird use of roost sites) in the lower Maroochy River and at Caloundra in the northern Pumicestone Passage. Since these surveys were undertaken, SCC has implemented strategies to manage disturbance to shorebirds on the lower Maroochy River, while the configuration of shorebird habitats has been substantially altered at Caloundra after a new entrance channel to Pumicestone Passage formed when heavy seas associated with Cyclone Seth broke though the northern coastline of Bribie Island in January 2022. The new entrance has gradually widened since then; consequently, SCC requested a further four monitoring events of shorebird use of roost sites at high tide and foraging habitat at low tide during the summer period in the lower Maroochy River and at Caloundra.

1.2 OBJECTIVES OF THIS STUDY

This study aims to implement the key objectives of the Shorebird Conservation Action Plan identified in **Section 1.1** above through a combination of:

- Conducting four high tide surveys and four low tide surveys at each of the lower Maroochy River and the Caloundra Banks to monitor current shorebird distribution and habitat, identify which shorebird species are present, and determine the type and extent of disturbance; and
- conducting an updated analysis of trends in shorebird use of high tide roost sites and low tide feeding habitat areas based on the additional season of data since the analysis of 2022/23 reported by BAAM (2023), combining the survey data with historical data for the SCC LGA collected by the Queensland Wader Study Group (QWSG).

The QWSG is a special interest group of the Queensland Ornithological Society Incorporated that monitor shorebird populations in Queensland and conducts regular shorebird surveys of different parts of the Queensland coast that have large shorebird populations. The QWSG maintains a database of these shorebird survey data that is updated on a monthly basis. The surveys and review of count data supplied by the QWSG aims to provide information on the following:

- Shorebird statistics: total abundance; species observed; and species abundance;
- Shorebird behaviour: activity (roosting/foraging); and spatial data of foraging locations; and
- Frequency and type of disturbance observed.

2.0 STUDY APPROACH

The QWSG has historical data for roost sites and feeding areas monitored at both Caloundra and the lower Maroochy River and still currently undertakes monthly monitoring of many of these sites. Therefore, the study approach combined an analysis of updated QWSG high tide and low tide data for the study area with field surveys of shorebirds using roost sites at high tide and tidal flat feeding habitats at low tide, as outlined in more detail below. Updated QWSG data were provided free of charge on the basis of a data sharing agreement with the QWSG, whereby the raw data collected by the BAAM surveys are also provided to the QWSG for incorporation into the long-term QWSG database. This ensures that the shorebird assessment is based on the best and most comprehensive available data, and that data collected with SCC support contributes to appropriate and well curated long-term datasets.

2.1 HIGH TIDE SURVEYS

Four high tide surveys were conducted once a month from November 2023 to February 2024 at each of the lower Maroochy River and in the northern Pumicestone Passage at Caloundra. All surveys were conducted using a small, motorised boat, which facilitated access to roosting habitats throughout the relatively large survey areas, including on the northern tip of Bribie Island. The surveys aimed to start on the rising tide to develop a better understanding of the movements of shorebirds to mid-tide and high-tide roosts from tidal flat feeding areas during the transition between high tide and low tide. However, the counting of shorebirds at the roost sites was conducted within the 3-hour period 1.5 hours either side of high tide, when all previously known roost sites at each locality were visited. The surveys determined the total number of individuals of each species present, to enable assessment of site and habitat importance, and collected spatial data of the area used by shorebirds for roosting to facilitate mapping of roost site extents.

2.2 LOW TIDE SURVEYS

Four low tide surveys of tidal flat feeding habitat were conducted once a month from November 2023 to February 2024 at each of the lower Maroochy River and in the northern Pumicestone Passage at Caloundra. The surveys combined observations conducted from a boat with observations from the shoreline. The use of a boat allowed the surveys to be conducted over a shorter period of time and allowed access to areas that are problematic to survey from the shoreline due to the width of the open water channels. The low tide surveys of the lower Maroochy River covered the full length and width of the lower Maroochy River from 1 km upstream of the Sunshine Motorway bridge through to the river mouth. The low tide surveys at Caloundra covered the tidal flats on both sides of Pumicestone Passage from the Caloundra Bar south to Bell's Creek.

2.3 GENERAL SURVEY METHODS

The summer surveys included two surveys in the December-January school holidays to get a better understanding of the amount of disturbance associated with this period. The surveys were conducted in accordance with migratory shorebird survey guidelines (Commonwealth of Australia 2015); specifically:

- The surveys for foraging shorebirds were conducted as close to the time of low tide as practicable and at a maximum of no more than two hours either side of low tide;
- The surveys for roosting shorebirds were conducted as close to the time of high tide as practicable and at a maximum of no more than two hours either side of high tide;
- The surveys were not undertaken during periods of high rainfall or strong winds;
- The surveys determined the total number of individuals of each species present, to enable assessment of site and habitat importance; and
- The surveys collected spatial data of the area used by shorebirds for roosting and feeding to facilitate mapping of roosting and foraging habitat.

Shorebirds were surveyed using a combination of a high-powered spotting telescope mounted on a secure tripod (on land) and high quality 10x40 binoculars (on the boat). Sources of actual or potential disturbance observed within or close to each survey site (close enough to cause disturbance) were recorded as a count of people, dogs on leash, dogs off leash, and watercraft during a single observation sweep of the survey site to provide a snapshot in time as per the approach of Stigner *et al*. (2016). Disturbance is an event that causes birds to cease foraging or resting activities to become alert, start walking away from the source of disturbance or take flight in response to the disturbance.

The surveys were undertaken by Dr Peter Driscoll (a shorebird specialist) with the assistance of Dr Simone Bosshard (Senior Coastal Conservation and Planning Officer, SCC). The surveys were not undertaken during periods of high rainfall or strong winds.

2.4 Additional Surveys by SCC Staff

SCC staff, under the supervision of Dr Simone Bosshard, conducted additional shorebird surveys of the lower Maroochy River and at Caloundra. These surveys included two winter low tide surveys of tidal flats on the lower Maroochy River and at Caloundra (June and July 2023), and several low tide and high tide surveys of rocky headlands between Coolum and Caloundra. These surveys were conducted in accordance with the general survey methods outlined in **Section 2.3** above.

2.5 Tracking Shorebirds of the Sunshine Coast

As part of the Shorebird Conservation Action Plan, SCC aims to better understand how migratory and resident shorebirds use their habitats and move around the Sunshine Coast and adjacent areas. The regular monitoring of shorebird abundance and disturbance at the two primary shorebird areas on the Sunshine Coast, namely northern Pumicestone Passage and Lower Maroochy River has highlighted the challenges of managing shorebirds, including threatened species at these locations. These challenges include that most habitats used by shorebirds occur outside SCC's jurisdiction in either Marine Parks, Conservation Parks or intertidal areas. Little is known about the movements of shorebirds that prefer rocky headland habitats, such as the Sooty Oystercatcher (*Haematopus fuliginosus*) and Wandering Tattler (*Tringa incana*).

Wandering Tattler is one of the least well-known migratory shorebirds in Australia (Higgins and Davies 1996) and considered uncommon. Queensland is a stronghold for the species in Australia, despite the small numbers occurring. No studies of the species in Australia have been attempted so little is known of the species home ranges, site fidelity or migratory habits. Wandering Tattlers are more common in North America, breeding in Alaska and Canada, but small numbers do breed in Siberia (Higgins and Davies 1996). Studies have shown the importance of breeding areas to the threats that different populations of migratory shorebirds face (Morrick et al. 2021). Consequently, identifying the breeding areas of Wandering Tattlers that visit Australia requires investigation. Within Australia the species prefers rocky habitats that are increasingly under pressure for recreational use so further knowledge on the habits and movements of this species would be beneficial in understanding their needs.

Sooty Oystercatcher, a resident shorebird of rocky shorelines has been better studied in Australia and is known to be sedentary, but with the ability to move large distances within Australia (Hansen et al. 2014). Yet, knowledge of this species in Queensland is significantly lacking in terms of their ecology and the threats they face.

SCC has teamed up with the QWSG to undertake a collaborative project starting in 2024 to fit satellite tracking devices to shorebirds, focused on Sooty Oystercatcher and Wandering Tattler, to improve understanding of their habitat usage, local movements, and migratory pathways to address some of these knowledge gaps, provide valuable data for use locally in education and to better inform management decisions in locations where these species occur.

3.0 RESULTS AND DISCUSSION

3.1 BACKGROUND ON SHOREBIRD ECOLOGY

Most shorebirds live on or near the coast, on beaches, reefs and tidal mudflats, though some also visit, or are largely confined to, freshwater habitats (Colwell 2010). Most coastal species feed on flat, tidal shores with extensive muddy or sandy intertidal areas (hereafter referred to as tidal flats). Most species are gregarious, wary and fly strongly and swiftly (Geering *et al*. 2007; Colwell 2010). A large proportion of Australia's shorebird species are migratory, spending their non-breeding season (the Austral summer) in Australia and migrating up to 13,000 km north along the East Asian–Australasian Flyway to breeding grounds in eastern Siberia and western Alaska (most species, Bamford *et al*. 2008) or south to New Zealand (Double-banded Plover (*Charadrius bicinctus*), Pierce 1999).

On their non-breeding grounds in Australia, coastal migratory shorebirds have a daily activity pattern driven largely by the tidal cycle, roosting in flocks at sites above the high-water mark at high tide and moving to tidal flat feeding areas once they become exposed as the water recedes (Colwell 2010). They are capable of feeding during both the day and night. Shorebirds feed on a wide variety of benthic invertebrates, including crustaceans, molluscs and polychaete worms that are taken either on the surface of tidal flats or extracted from soft, muddy or sandy sediments by probing with bills, which are elongated in many species. Different shorebird species specialise on different prey, prey sizes and feeding styles depending on their evolved bill morphology and body size (Lifjeld 1984; Baker 1989; Barbosa and Moreno1999; Durell 2000). Species with long, slender bills like the Far Eastern Curlew that depend on deep probing of sediments for locating prey tend to prefer feeding in softer sediments with less resistance to bill probing (Finn *et al*. 2008).

Coastal shorebirds also depend on roosting areas near their feeding areas that allow them to rest (during times when their feeding habitat is inundated at high tide) without losing too much energy to disturbance (Colwell 2010). Migratory shorebirds select roost sites on the basis of: distance from feeding areas (preferring sites close to feeding areas since that reduces their energy expenditure flying between roosting and feeding sites); distance from tall cover (preferring sites with little cover to ensure a clear view of approaching predators); climate (preferring sites at the water's edge to stay cool); height of the tide (whether the site will be inundated); and background colour of the roost site (providing camouflage against predators) (Rogers *et al*. 2006a). There is also some evidence that feeding site selection is influenced by distance from available roost sites (Rogers *et al*. 2006a), since energy expended flying between feeding and roosting sites reduces the birds' ability to store fat for migration (Rogers 2003). As a result of these requirements, both feeding and roosting habitats are essential to migratory shorebirds.

Migratory shorebirds are particularly sensitive to disturbance at roost sites since they are often concentrated into small areas at roost sites that may be quite distant from the nearest suitable alternative. Ongoing urban development and population growth in south-east Queensland is resulting in steadily increasing disturbance pressure on shorebirds at both roost sites and tidal flat feeding habitats sites (Fuller *et al.* 2021).

3.2 SURVEY TIMING AND CONDITIONS

The survey dates and survey conditions during the surveys of the lower Maroochy River and Caloundra are summarised in **Appendix 1**. All surveys were conducted during conditions that were suitable for conducting a shorebird survey.

3.3 LOWER MAROOCHY RIVER

3.3.1 Low tide surveys

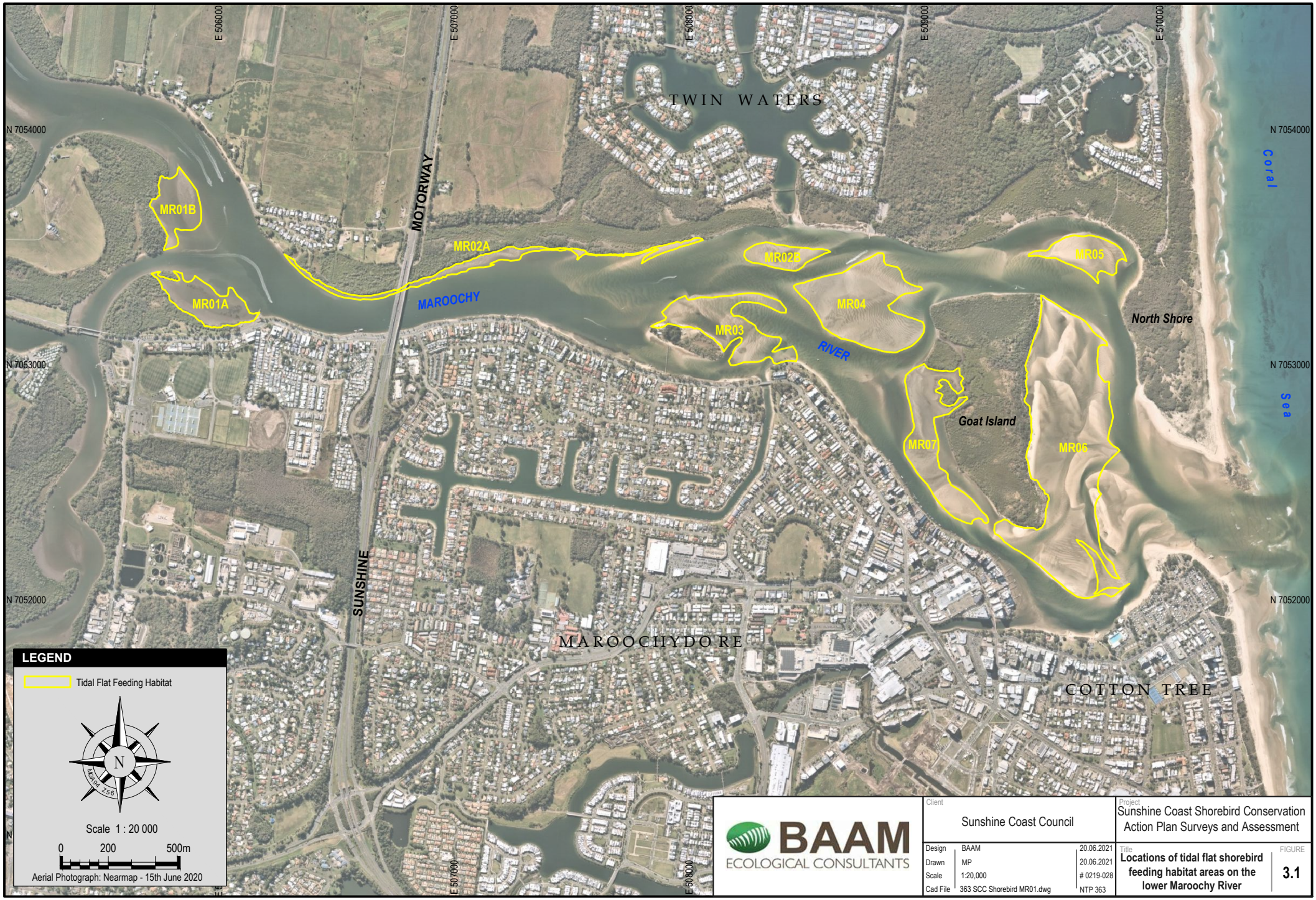
The four summer surveys of foraging shorebirds covered seven different areas of tidal flat exposed at low tide. The locations of these areas are shown in **Figure 3.1**. **Table 3.1** summarises

the summer-season survey results for the three seasons 2020/21 to 2023/24 seasons. Tidal flats along the lower Maroochy River supported an average of 164 and a maximum of 196 migratory shorebirds in 2023/24 compared to averages of 109 and 119 and maxima of 146 and 173 in 2020/21 and 2022/23 respectively. The tidal flats supported an average of 15 and a maximum of 23 resident shorebirds in 2023/24, similar to an average of 9 and maxima of 15 to 16 resident shorebirds in 2020/21 and 2022/23. Four migratory shorebird species dominated the counts: Pacific Golden Plover, Eurasian Whimbrel, Bar-tailed Godwit and Far Eastern Curlew. Numbers of critically endangered Far Eastern Curlew decreased from an average of 8 (maximum 13) in 2020/21 to an average of 4.5 (maximum 6) in 2022/23 and an average of 4.0 (maximum 5) in 2023/24. Numbers of vulnerable Bar-tailed Godwit decreased from an average of 21 (maximum 35) in 2020/21 to an average of 10.5 (maximum 21) in 2022/23 but increased again to an average of 17.8 (maximum 52) in 2023/24 (**Table 3.1**).

The most important tidal flat area for foraging migratory shorebirds was consistently MR06 on the eastern side of two vegetated sand islands (Channel Island and Goat Island, hereafter referred to collectively as Goat Island), which supported an average of 113 and a maximum of 167 migratory shorebirds at low tide in 2023/24 (**Table 3.1**). Other important tidal flats were MR04 and MR07, both on the western side of Goat Island. The statistics for MR05 in 2022/23 were inflated by a single count of 42 Pacific Golden Plover in November 2022 that had likely been displaced from MR06 by a person walking a dog off leash in MR06.

The large numbers of other waterbirds observed at MR06 in all three seasons (**Table 3.1**) were mostly a variety of terns roosting in large flocks at low tide. They included up to 2,500 Common Tern and 462 Little Tern that are both listed as migratory species under the EPBC Act.

SCC staff conducted two low tide surveys in winter, the results of which are summarised in **Table 3.2**.



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Title: **Locations of tidal flat shorebird feeding habitat areas on the lower Maroochy River**

FIGURE **3.1**

Table 3.1. Summary of shorebird species and the average ± 1 standard deviation and maximum (in brackets) numbers recorded in each of the seven low tide survey areas (MR01 to MR07) during summer season surveys of the lower Maroochy River in 2020/21 (top row, 5 surveys), 2022/23 (middle row, 4 surveys) and 2023/24 (bottom row, 4 surveys).

Common name	EPBC*	NCA*	MR01	MR02	MR03	MR04	MR05	MR06	MR07	Total
Far Eastern Curlew	M, CE	E	0 0 0	1±1.2 (3) 0 0.3±0.5 (1)	0.2±0.4 (1) 0 0	1.2±1.3 (3) 0.5±0.6 (1) 0.5±0.6 (1)	0 0.3±0.5 (1) 0	4.4±2.7 (8) 2.8±1.3 (4) 2.8±0.5 (3)	1.2±0.8 (2) 1.0±1.2 (2) 0.5±0.6 (1)	8.0±3.7 (13) 4.5±1.3 (6) 4±0.8 (5)
Eurasian Whimbrel	M	S	0.4±0.9 (2) 0.8±1.0 (2) 0	0.6±0.5 (1) 1.0±0.8 (2) 1±1.4 (3)	0.2±0.4 (1) 1.0±1.4 (3) 1.5±1.7 (3)	7.0±2.5 (9) 7.0±2.9 (11) 11.5±10.7 (27)	1.2±1.3 (3) 0 1±0.8 (2)	22.4±5.3 (29) 36.5±24.1 (72) 27.5±5.9 (32)	3.4±3.2 (8) 6.5±3.7 (9) 8.3±3.1 (11)	35.2±8.5 (46) 52.8±21.3 (82) 50.8±14.5 (71)
Bar-tailed Godwit (W Alaskan)	M, V	V	0 0 0	1±1.4 (3) 0 0	0.6±1.3 (3) 0 0.5±1 (2)	13.4±6.1 (23) 3.0±2.4 (5) 7.3±7.3 (17)	0 0.3±0.5 (1) 0	4.2±2.5 (6) 4.0±6.2 (13) 10±15.6 (33)	1.8±2.7 (6) 3.3±3.9 (8) 0	21.0±9.0 (35) 10.5±8.2 (21) 17.8±22.9 (52)
Pacific Golden Plover	M	S	0 0.3±0.5 (1) 0	0 1.5±3.0 (6) 0	0 0.3±0.5 (1) 0	4.8±6.7 (14) 10.5±15.6 (33) 13.8±24.3 (50)	0 11.5±20.4 (42) 0	36.6±24.1 (58) 22.5±36.3 (76) 72.3±56.1 (133)	2.8±6.3 (14) 3.5±7.0 (14) 2.3±4.5 (9)	44.2±20.8 (65) 50.0±52.1 (111) 88.3±60 (138)
Greater Sand Plover	M, V	V	0 0 0	0 0 0	0 0 0	0.4±0.9 (2) 0 0	0 0 0	0 0 0	0 0 0	0.4±0.9 (2) 0 0
Great Knot	M, V	E	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0.4±0.9 (2) 0 0	0 0 0	0.4±0.9 (2) 0 0
Grey-tailed Tattler	M	S	0 0 0	0 0 0	0 0 0	0 0 0	0 1.3±2.5 (5) 0	0 0 0	0 0.3±0.5 (1) 2.8±3.8 (8)	0 1.5±2.4 (5) 2.8±3.8 (8)
Pied Oystercatcher		LC	0.8±1.1 (2) 0 0	0 0 1±1.2 (2)	0 0.5±1.0 (2) 0.3±0.5 (1)	0.2±0.4 (1) 0.5±1.0 (2) 0.8±1.5 (3)	0 0 0	1.8±0.8 (3) 1.8±2.4 (5) 2.8±1 (4)	1.6±1.8 (4) 3.0±1.6 (5) 1.5±1 (2)	4.4±1.9 (7) 5.8±3.0 (10) 6.3±3.3 (11)
Masked Lapwing		LC	1.4±1.3 (3) 0.8±1.5 (3) 3±4.8 (10)	0 0 0.3±0.5 (1)	0 0 0.8±1.5 (3)	0 0 0	0 0 0	0.4±0.9 (2) 0.5±1.0 (2) 0	0 0 0	1.8±1.8 (4) 1.3±2.5 (5) 4±6.2 (13)
Red-capped Plover		LC	0 0 0	0 0 0	0 0 0	0 0 0	0 1.0±2.0 (4) 0.5±1 (2)	3.2±4.7 (11) 1.0±1.2 (2) 1.8±1.5 (3)	0 0 0	3.2±4.7 (11) 2.0±2.8 (6) 2.3±2.2 (5)
Beach Stone Curlew		V	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0.3±0.5 (1) 0.8±1.5 (3)	0 0 0	0 0.3±0.5 (1) 0.8±1.5 (3)
Pied Stilt		LC	0 0 2±2.2 (5)	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 2±2.2 (5)

Common name	EPBC*	NCA*	MR01	MR02	MR03	MR04	MR05	MR06	MR07	Total
Total migratory shorebirds			**0.4±0.9 (2) 1.0±1.2 (2) 0**	**2.6±2.3 (5) 2.5±2.4 (6) 1.3±1.5 (3)**	**1±2.2 (5) 1.3±1.3 (3) 2±.2.4 (5)**	**26.8±10 (35) 21.0±14.6 (42) 33±20.3 (63)**	**1.2±1.3 (3) 13.3±22.6 (47) 1.3±1.0 (2)**	**68±29.8 (96) 65.8±44.7 (115) 113±48.6 (167)**	**9.2±9.4 (25) 14.5±10.8 (27) 13.8±9.6 (28)**	**109.2±36.3 (146) 119.3±42.4 (173) 164.3±47.8 (196)**
Total resident shorebirds			**2.2±1.5 (4) 0.8±1.5 (3) 5±5 (11)**	**0 0 1.3±1.5 (3)**	**0 0.5±1.0 (2) 1±1.4 (3)**	**0.2±0.4 (1) 0.5±1.0 (2) 0.8±1.5 (3)**	**0 1.0±2.0 (4) 0.5±1 (2)**	**5.4±4.8 (13) 3.5±4.0 (7) 5.3±2.4 (7)**	**1.6±1.8 (4) 3.0±1.6 (5) 1.5±1 (2)**	**9.4±5.6 (16) 9.3±5.1 (15) 15.3±7.5 (23)**
Total other waterbirds			6.6±7.5 (18) 5.3±7.1 (15) 6.8±9.2 (20)	4.6±3.8 (9) 7.5±2.4 (10) 34.8±49.8 (109)	3.4±7.6 (17) 3.5±3.9 (9) 21±33.9 (71)	19.4±9.2 (32) 24.3±23.5 (50) 8.5±11.8 (25)	3.6±8 (18) 1.0±2.0 (4) 3.8±5.7 (12)	722.8±699.2 (1754) 506.8±638.7 (1463) 1654.5±1046.6 (2691)	20.2±11.6 (36) 29.8±7.9 (41) 36±22.5 (63)	780.6±689.2 (1805) 578.0±639.5 (1537) 1765.3±1016.5 (2805)

* Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) or Queensland *Nature Conservation Act 1992* (NCA): CE = critically endangered; E = endangered; LC = least concern; M = migratory; S = special least concern (migratory); V = vulnerable.

Table 3.2. Results of two winter low tide surveys of the lower Maroochy River (MR02b to MR07) conducted by SCC staff.

Common name	14/06/2023	11/07/2023
Eurasian Whimbrel	20	17
Bar-tailed Godwit (W Alaskan)	3	3
Pacific Golden Plover	12	19
Double-banded Plover	8	7
Grey-tailed Tattler	0	1
Pied Oystercatcher	11	7
Masked Lapwing	0	11
Red-capped Plover	6	2
Beach Stone Curlew	1	1
Pied Stilt	3	6
Total migratory shorebirds	**43**	**47**
Total resident shorebirds	**21**	**27**
Total other waterbirds	170	318

The QWSG has undertaken regular low tide surveys of shorebirds feeding on the tidal flats of the lower Maroochy River (including areas MR02 to MR07) since the 2011 shorebird year. Combining the QWSG (including only counts within two hours of either low tide or high tide) and BAAM survey data, **Figure 3.2** shows the average total count of migratory shorebirds each summer (October to mid-March) and winter (May to August) season. Analyses of data for the period 2011 to 2022 found a significant decline in the total migratory shorebird count at low tide during both the summer and winter periods (Lloyd *et al*. 2024). However, the 2023 shorebird year counts recorded a larger average total migratory shorebird count in both summer and winter than previously recorded (**Figure 3.2**). In years in which surveys at both low tide and high tide were undertaken, the average abundance of migratory shorebirds was generally greater at low tide than at high tide, suggesting that at least some of the birds that feed on the tidal flats along the lower Maroochy River do not roost within the lower Maroochy River.

Figure 3.3 shows the long-term trends in the average total counts of the most common migratory and resident shorebirds each summer (October to mid-March: migratory shorebirds excluding Double-banded Plover), winter (May to August: only Double-banded Plover) or throughout the year (resident shorebirds). Exploratory data analysis showed no seasonal trends in the counts of resident shorebird species. Analyses of data for the period 2011 to 2022 found a significant decline in the counts for Pacific Golden Plover (summer) and Double-banded Plover (winter; Lloyd *et al*. 2024). However, the 2023 data suggest a recovery in these species (**Figure 3.3**). The abundance of other species in the 2023 shorebird year was consistent with that recorded in recent years (**Figure 3.3**).

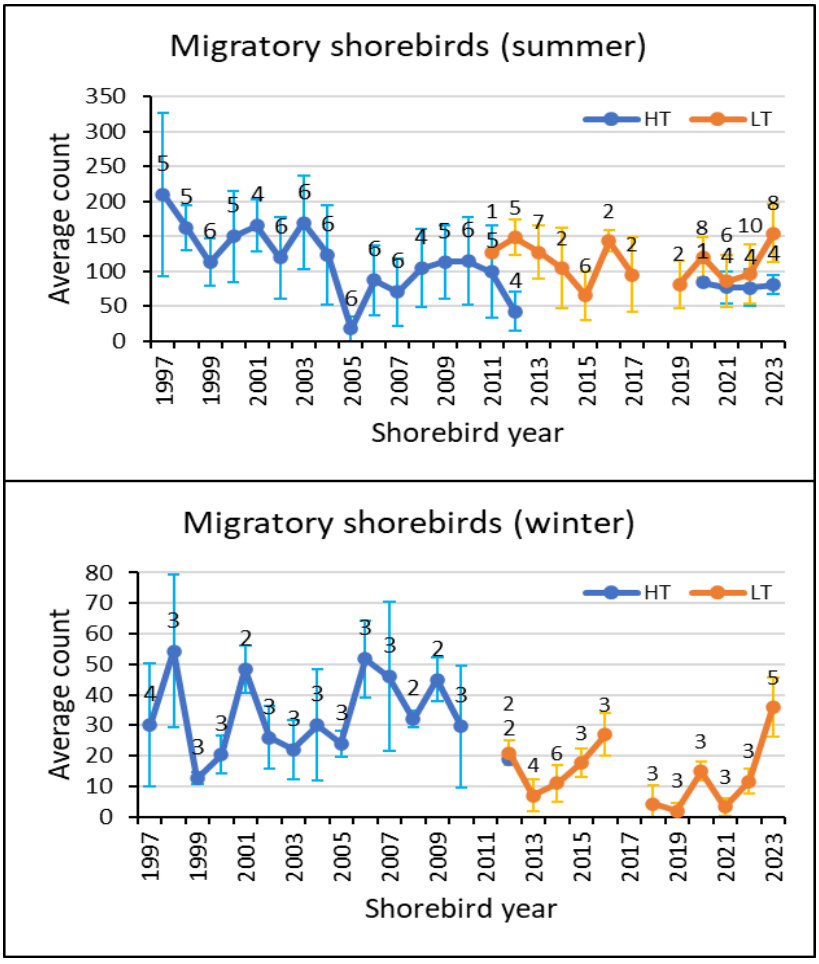

Figure 3.2. Average (±1 standard deviation) total migratory shorebirds recorded roosting at high tide (HT) and feeding at low tide (LT) in the lower Maroochy River each summer (October to mid-March) and winter (May to August) season based on QWSG data and this study. Number of counts each year shown above each point.

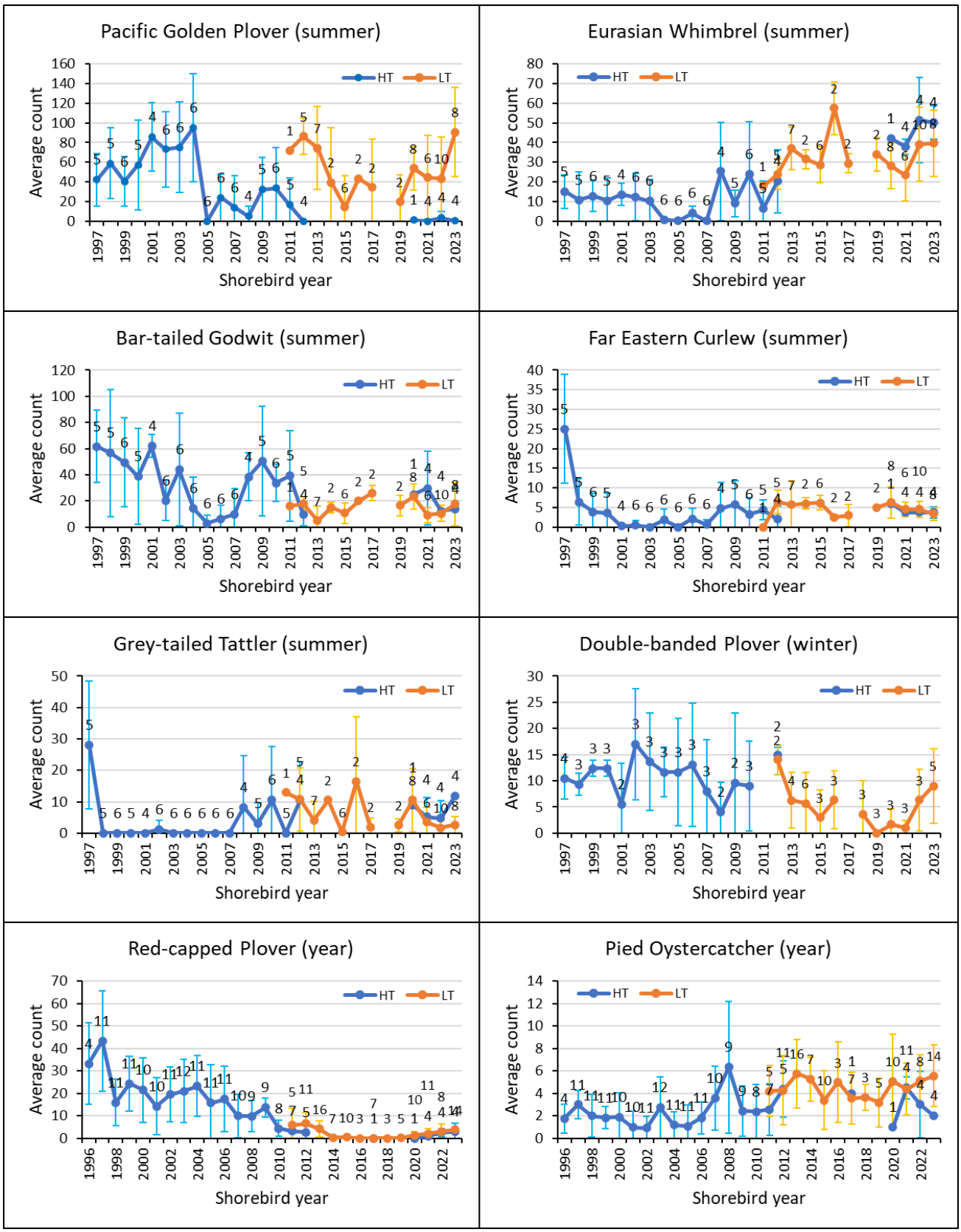

Figure 3.3. Average (±1 standard deviation) total count of different shorebird species recorded roosting at high tide (HT) and feeding at low tide (LT) in the lower Maroochy River each summer (October to mid-March), winter (May to August) or throughout the year based on QWSG data and this study. Number of counts each year shown above each point.

3.3.2 High tide surveys

Five main roost sites used by shorebirds and other waterbirds occur in the lower Maroochy River (see **Figure 3.4** for their current locations): Goat Island (MRGI); Nojoor Road (MRNR); north shore (MRNS); sand bar (MRSB); and tree roost (MRTR). During the four surveys in 2023/24, shorebirds were recorded roosting at only MRGI (all surveys) and MRTR (one survey: 42 Eurasian Whimbrel and 11 Grey-tailed Tattler on 30/10/2023); no birds were recorded at MRNR or MRNS. The results of the high tide surveys are presented in **Table 3.3**, compared to the averages of surveys over the period 2020/21 to 2022/23 for comparison. MRGI is the main roost site; some Eurasian Whimbrel and Grey-tailed Tattler appear to move between roosting at MRTR and MRGI. The average numbers of roosting birds in 2023/24 were similar to the overall averages over the period 2020/21 to 2022/23 (**Table 3.3**).

Table 3.3. Summary of the total numbers of shorebird species and other waterbirds roosting at the MRGI and MRTR roost sites in the lower Maroochy River during summer high tide surveys in 2023/24 compared to the average over the previous seasons 2020/21 to 2022/23.

Common name	Species	EPBC*	NCA*	30/10/2023	13/12/2023	15/01/2024	11/02/2024	2023/24 Average ±1SD	2020-2023 Average ±1SD
Far Eastern Curlew	*Numenius madagascariensis*	M, CE	E	3	2	5	5	3.8±1.5	4.0±1.0
Eurasian Whimbrel	*Numenius phaeopus*	M	S	44	56	42	59	50.3±8.5	44.4±15.2
Bar-tailed Godwit (W Alaskan)	*Limosa lapponica baueri*	M, V	V	36	13	3	4	14±15.3	21.4±19.4
Pacific Golden Plover	*Pluvialis fulva*	M	S	1	0	0	0	0.3±0.5	1.6±4.3
Red-necked Stint	*Calidris ruficollis*	M	S	0	1	0	0	0.3±0.5	0.6±1.3
Grey-tailed Tattler	*Tringa brevipes*	M	S	11	12	12	12	11.8±0.5	5.4±5.2
Beach Stone-curlew	*Esacus magnirostris*		V	0	0	2	3	1.3±1.5	0.2±0.4
Pied Oystercatcher	*Haematopus longirostris*		LC	2	2	2	2	2±0	3.4±2.2
Sooty Oystercatcher	*Haematopus fuliginosus*			0	0	0	0	0±0	0.2±0.7
Red-capped Plover			LC	8	4	0	0	3±3.8	1.6±1.9
Total migratory shorebirds				95	84	62	80	80.3±13.7	77.4±21.3
Total resident shorebirds				10	6	4	5	6.3±2.6	5.4±3.6
Total other waterbirds				106	90	12	58	66.5±41.5	347.9±641.6

* Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) or Queensland *Nature Conservation Act 1992* (NCA): CE = critically endangered; E = endangered; LC = least concern; M = migratory; S = special least concern (migratory); V = vulnerable.

Beach Stone-curlew, a vulnerable resident shorebird, was observed occasionally on Goat Island at both high tide and low tide. The other waterbirds roosting on Goat Island were mostly Silver Gulls and several species of tern, the latter occasionally in large numbers. The main roosting area at MRGI is a raised sandbank on the eastern side of Goat Island. The MRTR roost site appears to be used occasionally by small numbers of Grey-tailed Tattler and Whimbrel when they don't roost at MRGI.

Four of the Maroochy River roost sites (MRGI, MRNR, MRNS and MRSB) were regularly monitored by the QWSG from 1997 to 2012.

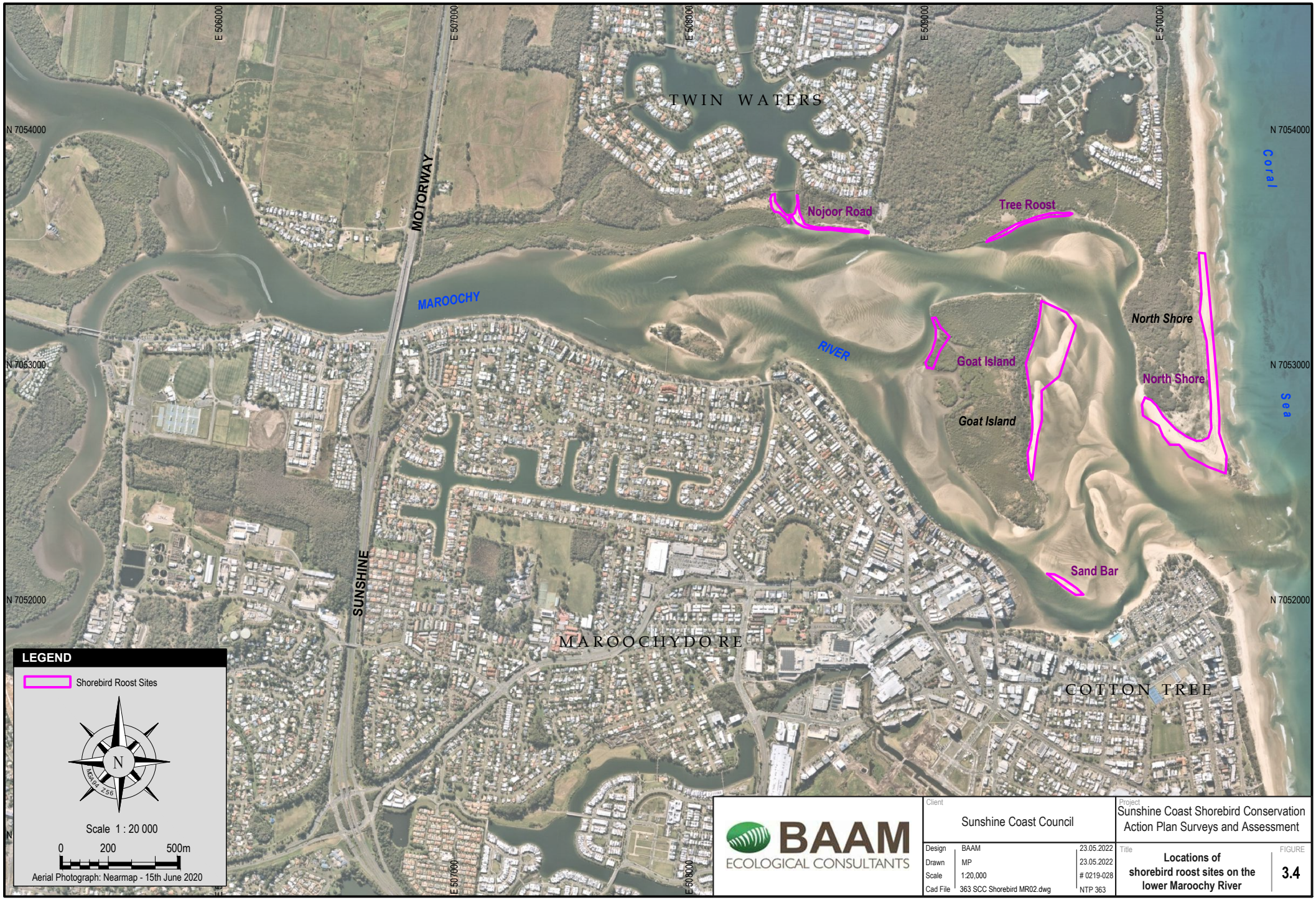

Figure 3.5 shows the average annual summer-season (October to mid-March) count of migratory shorebirds at each of the four roost sites that monitoring of high tide roost sites has been undertaken since 1998. The north shore (MRNS) was the most important migratory shorebird roost site in the lower Maroochy River area up until 2004 (**Figure 3.5**). After the north shore became a gazetted dog off-leash area, use of the north shore by shorebirds declined and Goat Island (MRGI) became increasingly used by shorebirds for roosting. The QWSG discontinued monitoring of roost sites on the lower Maroochy River after 2012 due to increasing levels of disturbance affecting the counts. Based on QWSG data, the north shore has experienced the highest frequency of disturbance across all categories, including the presence of dogs (see **Section 3.3.3** below). Over the past four summer seasons, migratory shorebirds have only used Goat Island for roosting, with no birds observed using the north shore (MRNS), Nojoor Road (MRNR) or sand bar (MRSB) roost sites (**Figure 3.5**). Whereas migratory shorebirds regularly used all four roost sites in earlier years, they now appear to rely almost exclusively on Goat Island for roosting, probably due to increased disturbance at the alternative roost sites. The restriction of birds to using a single roost site reduces the resilience of shorebirds to disturbance since there are fewer alternative roost sites available should disturbance cause them to leave a particular roost site.

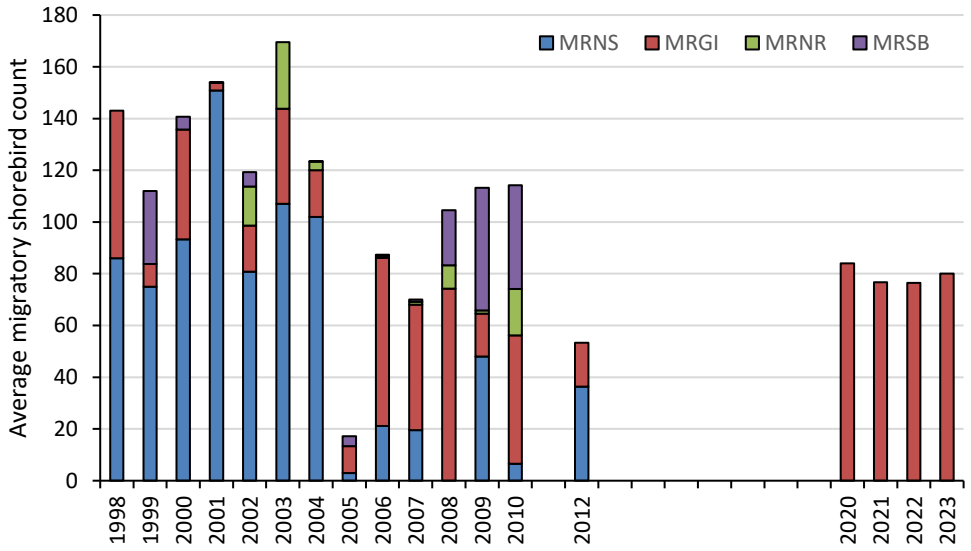

Figure 3.5. Average annual summer-season (October to mid-March) count of migratory shorebirds at high tide (within 2 hrs either side of high tide) at each of four roost sites in the lower Maroochy River since 1998 based on QWSG data and this study. Counts at MRTR are included within MRGI.

Analyses of data for the period 2011 to 2022 found that abundance at roost sites at high tide through the summer period had declined significantly for Pacific Golden Plover, Bar-tailed Godwit, Far Eastern Curlew and Red-capped Plover, but increased significantly for Eurasian Whimbrel and Pied Oystercatcher whereas there had been no trend in Grey-tailed Tattler and Double-banded Plover (Lloyd et al. 2024); the 2023 data were consistent with these trends (**Figure 3.3**). During the previous surveys in 2022/23 (BAAM 2023), observations were made on 2/11/22 of shorebird movements between high tide and low tide as the tide rose to cover the tidal flats. A large flock of 75 Pacific Golden Plovers that had been feeding on tidal flat sites MR05 and MR04 gathered on MR05 as the tide rose. At approximately 12:00, most of the flock (about 60) flew up and left the Maroochy River heading in the direction of 32 degrees north; the remainder left about 15 minutes later in a more northerly direction. Between 15:45 and 16:45, mowed grass areas around the Novotel Resort and the southern end of the airport runway, as well as the beach front were checked to see if the birds had moved there to roost; however, no Pacific Golden Plovers were observed at those locations. Pacific Golden Plover used to regularly use the north shore for roosting (**Figure 3.3**). Although Pacific Golden Plover were present foraging on the tidal flats in relatively large numbers, their substantially reduced counts at high tide relative to low tide since 2011 (**Figure 3.3**) indicates that they have shifted to roosting at an unknown location(s) to the north.

3.3.3 Disturbance

Shorebird roost sites and tidal flat feeding habitat areas in the lower Maroochy River are subject to multiple sources of potential disturbance to roosting or feeding shorebirds, including people using the area for recreation, dogs being walked on and off-leash, and various watercraft. The intensity of potential sources of disturbance and observations of actual disturbances recorded during the surveys is summarized in **Table 3.4**, with additional information collected by SCC staff for the North Shore summarised in **Table 3.5**. Despite the high intensity of potential sources of disturbance along the North Shore beach and spit, including walkers and dogs both on- and off-leash, breeding by Red-capped Plovers was confirmed by the observation of small, recently hatched downy chicks and older juveniles (**Table 3.5**). Shorebird species like Red-capped Plovers can persist in nesting in foredune areas above the high-water mark, adapting to moderate levels of disturbance; however, the flightless young are particularly vulnerable to predation or injury by off-leash dogs for a month after hatching (Dowling and Weston 1999, Baudains and Lloyd 2007, Weston and Elgar 2007).

QWSG survey data on disturbance are not captured in a format that allows examination of temporal trends in disturbance with sufficient rigour. However, the data do allow comparison of the relative frequency of different sources of potential or actual disturbance between sites. These data confirm that the North Shore has experienced the highest disturbance pressure, particularly from people and dogs walking along the shoreline at all tides (**Table 3.6**).

Table 3.6. Percentage of surveys in which people, dogs, boats or jetskis were recorded as potential or actual sources of disturbance to roosting or feeding birds at sites in the lower Maroochy River.

Site	Surveys	People	Dogs	Boats	Jetskis
Goat Island (MRGI)	299	45%	18%	33%	14%
Nojoor Rd (MRNR)	304	55%	27%	27%	22%
North shore (MRNS)	303	72%	64%	36%	29%
Sandbank (MRSB)	312	45%	30%	29%	14%

Table 3.4. Summary of the numbers of people, dogs and watercraft observed in the vicinity of roosts at high tide and tidal flats at low tide during the surveys of the lower Maroochy River estuary.

Date	Tide	People	Dogs	Boats/kayaks /boards	Jetskis	Observations
30/10/2023	HT	22	5	6		Most people & dogs on MRNS. Two people got out of tinny & put main flock roosting on MRGI to flight; stayed on site for 10min but birds did not move far and eventually settled again when they left in their boat. A sea kayak came within 30m of roosting birds on MRGI but they were not obviously affected. Similarly, a paddleboard moved within 60m of roosting birds on MRGI but they did not take flight.
30/10/2023	LT	188	8	2		Most people and dogs on beaches opposite MR05 and MR06 (Cotton Tree).
13/12/2023	HT	8	2			People and dogs on MRNS or on beach to the east of MRTR; no direct disturbance observed.
13/12/2023	LT	182	6	24		12 people on MR06; 10 people on MR07.
15/01/2024	HT				2	Jetskis were well away from roosting birds.
15/01/2024	LT	8	2	1		People and dogs on MRNS or on beach to the east of MRTR; 1 person walked across MR06 but away from birds and no direct disturbance observed.
11/02/2024	HT	16		1		Most people on beach opposite MR06 (Cotton Tree); 2 fishers moving noisily about in flooded mangroves of MRTR where the Whimbrel usually roost but this time they wouldn't land due to the disturbance despite making several passes over the site.
11/02/2024	LT	83	3	23		4 people on MR05 fishing or netting precluding use by any shorebirds; 15 kite-boards working the mouth of the estuary opposite MR06 but no disturbance noted.

Table 3.5. Summary of observations by Sunshine Coast Council staff conducting surveys along Maroochy River North Shore spit and beach.

	Disturbance sources at North Shore spit				Disturbance sources on North Shore beach				Shorebird observations
Date	Walkers	People with Dogs	Sunbathers	Other	Walkers	People with Dogs	Sunbathers	Other	
31/10/2023	0	7	2	0	0	10	3	0	3 Red-capped Plovers
7/11/2023	12	6	0	0	2	24	0	5	2 Red-capped Plovers
16/11/2023	1	6	0	0	0	14	0	0	8 Red-capped Plovers
21/11/2023	0	5	0	0	0	20	0	0	7 Red-capped Plovers, including 2 downy chicks and 1 juvenile; 1 Pied Oystercatcher.
13/12/2023	0	4	0	1	NA	NA	NA	NA	4 Red-capped Plovers, including 2 juveniles.
13/12/2023	3	8	4	2	NA	NA	NA	NA	none
15/01/2024	0	2	0	0	NA	NA	NA	NA	none
24/01/2024	3	8	0	0	4	11	0	0	5 Red-capped Plovers

3.4 CALOUNDRA

3.4.1 Low tide surveys

Four main areas of tidal flat feeding habitat occur in the northern Pumicestone Passage at Caloundra and have been subject to monitoring by the QWSG since 1993 (see **Figure 3.6** for locations):

- a large tidal flat on the eastern side of the passage along the north-western tip of Bribie Island (SBN1);
- a large tidal flat on the western side of the passage opposite Golden Beach (SBN2);
- a small tidal flat connected to SBN2 opposite Pelican Waters (PEWA); and
- several small patches of tidal flat at Bell's Creek (BECK).

SBN2 and the area nearby was found to have changed substantially following the creation of a new channel to the sea that broke through the northern tip of Bribie Island in January 2022. A high bank has established between the southern end of the isolated northern tip of Bribie Island and Golden Beach. The bank runs westwards to within about 150m of the Golden Beach shoreline and at low tide people can cross a channel here and walk along this bank in close proximity to feeding birds. Birds are using existing and new feeding areas that are still referred to as SBN2, and they are able to roost here now on all high tides because the top of the bank does not usually become submerged. Because the high bank is an integral part of this feeding area, it is included within SBN2. Birds were observed feeding on both SBN1 and SBN2 at low tide and readily retreat to the high parts of SBN2 at the peak of the high tide, providing they are not disturbed. However, many people now regularly traverse this bank at low tide because they can cross over to the now isolated northern tip of Bribie Island at low tide. People also come onto the bank by boat, kayak or paddleboard, including at high tide.

Sandbank No 3 is a new area of tidal flat on the south side of the new opening into Pumicestone Passage where sediment has gradually built up on the outer southern side of the new entrance. Observations suggest that shorebirds are increasingly feeding on this new area of tidal flat. It is not currently accessed by people except by watercraft.

The results of the four summer-season surveys by this study as well as one winter-season survey by SCC staff are summarised in **Table 3.7** below. The tidal flat areas of SBN1 and SBN2 (including PEWA) were important feeding areas for migratory shorebirds, particularly for the critically endangered Far Eastern Curlew, vulnerable Bar-tailed Godwit, Eurasian Whimbrel and Pacific Golden Plover. Five other migratory shorebird species were recorded occasionally in smaller numbers, with small numbers of four resident shorebird species.

In 2023/24, the combined area of tidal flats supported an average combined total of 194 and a maximum of 232 migratory shorebirds but an average of 27 and maximum of 65 resident shorebirds during the summer season. The average numbers of shorebirds recorded foraging at low tide during summer (October-February) in 2023/24 were generally greater than the averages over the previous three years (**Table 3.8**). Long-term trends in shorebird use of tidal flats in the Pumicestone Passage at Caloundra were presented in previous reports (BAAM 2022, 2023). The dramatic changes in the distribution of tidal flats over the past two years have meant that there is now uncertainty in how the areas subject to ongoing QWSG monitoring relate to the areas monitored by the BAAM surveys, which makes direct comparisons between the BAAM and QWSG data problematic. Consequently, this report does not present an analysis of long-term trends in shorebird use of the area at low tide.

During the survey of 14/12/23 a Red-capped Plover was observed incubating two eggs in a nest on the foreshore dunes above the high-water mark. The results of additional surveys of rocky headlands between Coolum and Caloundra north of the old Pumicestone Passage entrance are presented in **Table 3.12**.

BAAM ECOLOGICAL CONSULTANTS

Client: Sunshine Coast Council

Project: Sunshine Coast Shorebird Conservation Action Plan Surveys and Assessment

Design	BAAM	28.04.2023
Drawn	MP	28.04.2023
Scale	1:25,000	# 0219-028
Cad File	363 SCC Shorebird C03.dwg	NTP 469

Title: **Locations of tidal flat shorebird feeding habitat areas at Caloundra**

FIGURE: **3.6**

Table 3.7. Summary of shorebird species recorded during four summer surveys (this study) and one winter survey (SCC staff) at Caloundra in 2023/24 at low tide on each of five tidal flat areas: Sandbank No. 1 to 3 (SBN1, SBN2, SBN3), including Pelican Waters (PEWA); Bells Creek (BECK); and Northern Tip of Bribie Island (NTBI). NS = not surveyed.

Common name	EPBC*	NCA*	Summer				Winter
			01/11/23	14/12/23	16/01/24	10/02/24	13/06/23
SBN1							
Far Eastern Curlew	M, CE	E	17	1	4	12	
Eurasian Whimbrel	M	S	26	24	19	12	
Bar-tailed Godwit (W Alaskan)	M, V	V	27	22	41	70	
Pacific Golden Plover	M	S	3			51	
Pied Oystercatcher		LC			3	1	6
Masked Lapwing		LC					5
Pied Stilt		LC		12	21		13
Total migratory			***73***	***47***	***64***	***145***	***0***
Total resident			***0***	***12***	***24***	***1***	***24***
SBN2+PEWA							
Far Eastern Curlew	M, CE	E	10	39	7	23	
Eurasian Whimbrel	M	S	32	67	18	35	
Bar-tailed Godwit (W Alaskan)	M, V	V	38	48	1		
Pacific Golden Plover	M	S	14	25	4	1	
Double-banded Plover	M	S					22
Red Knot	M,V	E	1				
Curlew Sandpiper	M, CE	E	12				
Red-necked Stint	M	S	1	4			
Grey-tailed Tattler	M	S	15				
Pied Oystercatcher		LC		2	2	1	2
Pied Stilt		LC	5		11		22
Red-capped Plover		LC	4	3	3	1	4
Total migratory			***123***	***183***	***30***	***59***	***22***
Total resident			***9***	***5***	***16***	***2***	***28***
SBN3							
Far Eastern Curlew	M, CE	E		1		1	
Eurasian Whimbrel	M	S			2	3	1
Bar-tailed Godwit (W Alaskan)	M, V	V			18		
Pacific Golden Plover	M	S		1			
Masked Lapwing		LC					1
Pied Stilt		LC			2		9
Red-capped Plover		LC				2	
Total migratory			***NS***	***2***	***20***	***4***	***1***
Total resident			***NS***	***0***	***2***	***2***	***10***
BECK							
Far Eastern Curlew	M, CE	E			1	5	
Eurasian Whimbrel	M	S			1	3	2
Bar-tailed Godwit (W Alaskan)	M, V	V			10		
Masked Lapwing		LC			1	7	
Pied Stilt		LC			8		34
Total migratory			***NS***	***0***	***12***	***8***	***2***
Total resident			***NS***	***0***	***9***	***7***	***34***
NTBI							
Far Eastern Curlew	M, CE	E			1	3	
Pied Oystercatcher		LC			4	3	
Pied Stilt		LC			10		
Total migratory			***NS***	***NS***	***1***	***3***	***NS***
Total resident			***NS***	***NS***	***14***	***3***	***NS***

* Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) or Queensland *Nature Conservation Act 1992* (NCA): CE = critically endangered; E = endangered; LC = least concern; M = migratory; S = special least concern (migratory); V = vulnerable.

Table 3.8. Comparison of the average, standard deviation (SD, a measure of variability) and maximum counts of migratory and resident shorebirds foraging at low tide at Caloundra between the summer of 2023/24 (4 surveys) and 2020/21 to 2022/23 (8 surveys).

Season			2023/24			2020/21 to 2022/23		
Date	**EPBC***	**NCA***	**Average**	**SD**	**Maximum**	**Average**	**SD**	**Maximum**
Bar-tailed Godwit	M, V	V	68.8	2.5	70	61.4	33.4	123
Common Sandpiper	M	S	0.0	0.0	0	0.6	1.7	5
Curlew Sandpiper	M, CE	CE	3.0	6.0	12	0.2	0.7	2
Eurasian Whimbrel	M	S	60.5	21.7	91	43.1	24.1	78
Far Eastern Curlew	M, CE	E	31.3	14.2	44	25.7	11.7	35
Greater Sand Plover	M, V	V	0.0	0.0	0	0.2	0.7	2
Grey-tailed Tattler	M	S	3.8	7.5	15	0.2	0.7	2
Pacific Golden Plover	M	S	24.8	20.3	52	38.7	28.6	70
Red Knot	M, V	E	0.3	0.5	1	0	0	0
Red-necked Stint	M	S	1.3	1.9	4	0.8	1.7	5
Masked Lapwing		LC	2.0	3.4	7	4.3	5.7	17
Pied Oystercatcher		LC	4.0	3.9	9	5.7	4.6	14
Pied Stilt		LC	17.3	23.7	52	2.9	7.6	23
Red-capped Plover		LC	3.3	0.5	4	0.7	1.3	4
Beach Stone-curlew		V	0	0	0	0.2	0.7	2
Total migratory			***193.5***	***46.8***	***232***	***170.9***	***68.9***	***241***
Total resident			***26.5***	***25.9***	***65***	***13.8***	***15.4***	***53***

* Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) or Queensland *Nature Conservation Act 1992* (NCA): CE = critically endangered; E = endangered; LC = least concern; M = migratory; S = special least concern (migratory); V = vulnerable.

3.4.2 High tide surveys

Seven shorebird roost sites are currently recognised at Caloundra (see **Figure 3.7**):

- Caloundra bar (CBAR), a sand bank at the Pumicestone Passage entrance;
- Northern tip of Bribie Island (NTBI, part of Bribie Island National Park), along the beach between the old and new entrances to Pumicestone Passage (prior to the 2021/22 season, the northern portion of this site was included in CBAR);
- Sandbank 1 (SBN1), including a sandbank in the passage (used on the rising tide and neap high tides), a sandbank on the north-western shoreline of Bribie Island and an adjoining area of saltmarsh on the shoreline of Bribie Island;
- Sandbank 2 (SBN2), two raised portions of sandbank on the northern side of the new entrance to Pumicestone Passage;
- Sandbank 3 (SBN3), a new sandbank on the southern side of the new entrance to Pumicestone Passage that was first seen used by shorebirds for roosting in February 2023;
- A mangrove tree roost (BCTR) on the opposite side of Pumicestone Passage from Bell's Creek; and
- Wickham Point (WICK), a rock platform on the mainland coastline north of the Pumicestone Passage entrance, where small numbers of shorebirds regularly roost.

A high bank has established between the southern end of the isolated northern tip of Bribie Island and Golden Beach. The bank runs westwards to within about 150m of the Golden Beach shoreline. Birds are able to roost here now on most high tides because the top of the bank does not usually become submerged. This high bank is now treated as an extension of SBN2. All roost sites except Wickham Point were surveyed during the 2023/24 season (**Table 3.9**).

BAAM ECOLOGICAL CONSULTANTS

Client	Sunshine Coast Council	Project	Sunshine Coast Shorebird Conservation Action Plan Surveys and Assessment
Design	BAAM	28.04.2023	
Drawn	MP	28.04.2023	
Scale	1:25,000	# 0219-028	
Cad File	363 SCC Shorebird C03.dwg	NTP 469	
Title	**Locations of shorebird roost sites at Caloundra**	FIGURE	**3.7**

Table 3.9. Summary of shorebird species recorded in each of the four summer high tide surveys at Caloundra in 2023/24 at each of five roost sites: Sandbank No. 1 to 3 (SBN1, SBN2, SBN3); Bells Creek Tree Roost (BETR); and Northern Tip of Bribie Island (NTBI).

Common name	EPBC*	NCA*	01/11/23	14/12/23	16/01/24	10/02/24
SBN1						
Far Eastern Curlew	M, CE	E	5			
Eurasian Whimbrel	M	S	6			
Pied Oystercatcher		LC		2	4	2
Pied Stilt		LC	30	70	90	
Total migratory			***11***	***0***	***0***	***0***
Total resident			***30***	***72***	***94***	***2***
SBN2						
Far Eastern Curlew	M, CE	E	27	33	3	35
Eurasian Whimbrel	M	S	90	45		42
Bar-tailed Godwit (W Alaskan)	M, V	V	135	70	8	60
Red Knot	M,V	E	3			
Red-necked Stint	M	S		2		
Pied Oystercatcher		LC	3	1		2
Pied Stilt		LC			20	
Red-capped Plover		LC	4	7		6
Total migratory			***252***	***148***	***11***	***137***
Total resident			***7***	***8***	***20***	***8***
SBN3						
Far Eastern Curlew	M, CE	E		2	35	
Eurasian Whimbrel	M	S		1	32	
Bar-tailed Godwit (W Alaskan)	M, V	V			49	
Pacific Golden Plover	M	S	33	48	26	37
Curlew Sandpiper	M, CE	CE	9	2		
Pied Oystercatcher		LC			2	2
Red-capped Plover		LC	4		3	3
Total migratory			***42***	***53***	***142***	***37***
Total resident			***4***	***0***	***5***	***5***
BCTR						
Eurasian Whimbrel	M	S		18	27	13
Total migratory			***0***	***18***	***27***	***13***
Total resident			***0***	***0***	***0***	***0***
NTBI						
Far Eastern Curlew	M, CE	E				(27))
Eurasian Whimbrel	M	S			1	(60)
Bar-tailed Godwit (W Alaskan)	M, V	V				(50)
Pied Oystercatcher		LC	2		4	
Total migratory			***0***	***0***	***1***	***(137)***
Total resident			***2***	***0***	***4***	***0***

* Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) or Queensland *Nature Conservation Act 1992* (NCA): CE = critically endangered; E = endangered; LC = least concern; M = migratory; S = special least concern (migratory); V = vulnerable.

An average of 224 (range 181 to 308) migratory shorebirds used roost sites at Caloundra during the four high tide surveys in 2023/24, including up to 38 critically endangered Far Eastern Curlew, 135 vulnerable Bar-tailed Godwit, 96 Eurasian Whimbrel and 48 Pacific Golden Plover (**Table 3.10**). The average numbers of shorebirds recorded roosting during summer (October-February) in 2023/24 were generally greater than the averages over the previous three years (**Table 3.10**). The formation of the new entrance to Pumicestone Passage increased the availability of suitable alternative roost sites, with suitable roosting habitat now present on a broad sandy beach at SBN3 and the area of roosting habitat on SBN2 having increased following the increased deposition of sand at this location. This increase in suitable roosting habitat areas may be responsible for the increase in roosting shorebird numbers observed in 2023/24, particularly the increased frequency of roosting by Pacific Golden Plover and Bar-tailed Godwit at the Caloundra roost sites.

Table 3.10. Comparison of the average, standard deviation (SD, a measure of variability) and maximum counts of migratory and resident shorebirds roosting at Caloundra at high tide between the summer of 2023/24 (n = 4 surveys) and 2020/21 to 2022/23 (n = 12 surveys).

Date	EPBC*	NCA*	2023/24			2020/21 to 2022/23		
			Average	SD	Maximum	Average	SD	Maximum
Bar-tailed Godwit	M, V	V	80.5	36.8	135	48.7	38.5	126
Curlew Sandpiper	M, CE	CE	2.8	4.3	9	0	0	0
Eurasian Whimbrel	M	S	68.8	18.5	96	49.5	32.8	105
Far Eastern Curlew	M, CE	E	35.0	2.4	38	29.3	10.6	48
Pacific Golden Plover	M	S	36.0	9.2	48	7.7	19.8	66
Red Knot	M,V	E	0.8	1.5	3	0	0	0
Red-necked Stint	M	S	0.5	1.0	2	0	0	0
Masked Lapwing		LC	0	0	0	1.8	1.9	5
Pied Oystercatcher		LC	6.0	2.9	10	5.3	2.3	11
Pied Stilt		LC	52.5	47.9	110	0.0	0.0	0
Red-capped Plover		LC	6.8	2.6	9	1.0	2.5	8
Total migratory			***224.3***	***58.5***	***308***	***135.1***	***58.2***	***235***
Total resident			***65.3***	***46.8***	***123***	***8.2***	***4.9***	***20***

* Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) or Queensland *Nature Conservation Act 1992* (NCA): CE = critically endangered; E = endangered; LC = least concern; M = migratory; S = special least concern (migratory); V = vulnerable.

The preferred roost site during 2022/23 was SBN2, but birds also used SBN3 if disturbed from SBN2. On the rising tide, flocks of shorebirds flew in to either SBN2 or SBN3. Due to regular disturbance by people disembarking from watercraft or, in the case of SBN2 people walking across from the mainland, they then moved between the two sites depending on the extent of disturbance at either site. During the survey of 1/11/2023, a flock of 57 Pacific Golden Plover was present on SBN3 during the rising tide but by high tide only 33 remained, the rest having left the monitoring area as they were not found roosting at any of the other sites. The tree roost opposite Bells Creek (BCTR) had between 13 and 27 Eurasian Whimbrel roosting in the mangrove trees on three of the four surveys (**Table 3.9**).

During the survey of 10/02/2024, the birds recorded roosting on SBN2 at high tide were eventually forced off SBN2 by a king spring high tide (the highest spring tide of the year); they flew over to NTBI where they were pressured by people and dogs to move and ended up in a confined space in grass and soft sand to the inside (western side) of the cove on the site, where it was not possible to get an accurate count of any of the species. Due to the silting up of the old entrance channel, the NTBI roost is accessible to people walking across the old channel entrance from Caloundra on most tides. Consequently, there is now usually high disturbance pressure from walkers and dogs at the NTBI roost.

The observations of shorebirds moving between roost sites in response to changing tide conditions and disturbance confirm the importance for shorebirds to have access to a local network of available roost sites so that they can move to an alternative nearby site if they are disturbed or otherwise forced off the preferred site.

3.4.3 Disturbance

Shorebird roost sites and tidal flat feeding habitat areas at Caloundra are subject to multiple sources of disturbance to roosting or feeding shorebirds, including people using the area for recreation, dogs being walked on and off-leash and various watercraft. The intensity of potential sources of disturbance and observations of actual disturbances recorded during the surveys is summarized in **Table 3.11**, with additional information collected by SCC staff for rocky headlands between Coolum and Caloundra summarised in **Table 3.12**.

Table 3.11. Summary of the numbers of people, dogs and watercraft observed in the vicinity of roosts at high tide and tidal flats at low tide during the surveys at Caloundra.

Date	Tide	People	Dogs	Boats/kayaks /boards	Jetskis	Observations
01/11/2023	HT	1				In general, inclement weather meant few sources of potential disturbance were present and no disturbance was recorded. Fisherman on ocean side of NTBI, birds nowhere nearby.
30/10/2023	LT					In general, inclement weather meant few sources of potential disturbance were present.
14/12/2023	HT	7		5	2	Passing jetskis caused a flock of 30 Eastern Curlew to take flight at SBN2. A community group coastal litter clean-up crew arrived on SBN2 and caused all roosting shorebirds to take flight.
14/12/2023	LT	6				No disturbance observed.
16/01/2024	HT	16				6 people on the NTBI roost site; 2 people gutting fish on SBN2 just beyond where the few birds present were roosting.
16/01/2024	LT	4		1		At SBN2, 2 people fishing on edge of outer channel and 2 walked across from mainland shore
10/02/2024	HT	18				At NTBI, 4 people with dogs on leash caused direct disturbance of all 50 whimbrel and later all the godwits. At SBN3, 2 people arrived by canoe and walked around the roost.
10/02/2024	LT	32		5		Shorebirds observed avoiding areas where people were present.

Table 3.12. Summary of observations by SCC staff conducting surveys of rocky headlands between Coolum and Caloundra.

Site	Date	Tide	Total migratory shorebirds	Total resident shorebirds	Total other waterbirds	Dogs on leash	Dogs off leash	People	Floatplane	Observations
Alex Headland	7/11/2023	Low	0	0	0		3	13		
Caloundra Headland	9/11/2023	Low	0	3	4		2	10		3 Sooty Oystercatcher
Coolum - Yaroomba	28/11/2023	Low	0	0	7			2		
Moffat Headland	28/07/2023	Low	0	2	6	5		13		3 Sooty Oystercatcher
Moffat Headland	15/01/2024	Low	1	0	3			2		1 Wandering Tattler
Pt Cartwright	18/07/2023	Low	0	3	2	2	2	34		3 Sooty Oystercatcher
Pt Cartwright	25/10/2023	Low	0	0	55	9		40	1	
Pt Cartwright	30/11/2023	Low	1	7	0	6		18		1 Ruddy Turnstone, 2 Sooty Oystercatcher, 5 Pied Oystercatcher
Pt Cartwright	25/01/2024	Low	0	5	4	1		8		2 Sooty Oystercatcher, 3 Pied Oystercatcher. Notable absence of dogs following recent local law changes
WICK	28/07/2023	Low	0	1	5	2		3		1 Sooty Oystercatcher
WICK	15/01/2024	Low	0	5	0	2	1	4		4 Sooty Oystercatcher, 1 Pied Oystercatcher
Alexandra Headland	25/07/2023	High	0	2	5					2 Sooty Oystercatcher
Alexandra Headland	16/11/2023	High	0	0	0	2	1	13		
Coolum - Yaroomba	21/11/2023	High	0	0	1					
Moffat Headland	7/11/2023	High	0	0	0			3		

The changes to the Pumicestone Passage entrance over the past two years have changed patterns of disturbance to shorebirds. Whereas the CBAR, SBN1 and NTBI roost sites previously experienced low to moderate levels of disturbance (BAAM 2023), the risk of disturbance has increased within the past year. This has largely been due to the silting up of the old entrance channel that allows people to access the northern tip of Bribie Island from Caloundra on most tides. Similarly, the risk of disturbance to shorebirds feeding and roosting on SBN2 has increased. Changes in sediment deposition after the sea broke through the northern end of Bribie Island to create the new entrance has formed a high bank between the southern end of the isolated northern tip of Bribie Island and Golden Beach. The bank, which forms the reconfigured SBN2 roost site runs westwards to within about 150 m of the Golden Beach shoreline and at low tide and most high tides people, including with dogs, can cross a shallow channel here and walk along this bank near feeding and roosting birds.

3.5 SHOREBIRD TRACKING

Two Sooty Oystercatchers were caught in April 2024. Each bird was fitted with a metal band provided by the Australian Bird and Bat Banding Scheme together with an engraved green plastic leg flag, which can be read in the field without recapturing the bird. In addition, platform terminal transmitters (PTTs) were fitted using a leg harness. The transmitters weigh less than 2% of the bird's lean body mass and provide regular position updates via a satellite network. Each bird was also carefully measured and weighed (**Table 3.13**).

Table 3.13. Details of two Sooty Oystercatcher captured and fitted with PTT tracking devices.

	Bird 1	**Bird 2**
Date	13 April 2024	14 April 2024
Age	Adult	Juvenile
Leg flag (left tibia)	ANA (green)	ANB (green)
Band number	101-42509	101-42545
PTT	245451	245452
Weight	665 g	670 g
Wing length	256 mm	285 mm
Tarsus length	54.9 mm	56.5 mm
Bill length	67.0 mm	79.0 mm
Total head length	112.3 mm	127.6 mm

4.0 RECOMMENDATIONS

4.1 LOWER MAROOCHY RIVER

While it was historically one of the most important roost sites for shorebirds on the lower Maroochy River, the north shore (MRNS) has largely been abandoned as a roost site by shorebirds due to the high levels of disturbance by people using the sandy shoreline for recreation and walking dogs off-leash. Consequently, the sandy shoreline and sand bars on the eastern side of Goat Island (MRGI and MRSB) are currently the most important shorebird roost sites, which enjoy a moderate level of protection from disturbance by being accessible at high tide only by watercraft. Nonetheless, boaters with pets on board do regularly come ashore at Goat Island and walk their dogs, often off-leash, despite it being a Conservation Park where dogs are not allowed. The tidal flats on the eastern and western edges of Goat Island (MR06, MR04 and MR07) are also the most important feeding areas on the lower Maroochy River. While the MR04 and MR07 tidal flats are seldom visited by people, people regularly access the MR06 tidal flats via watercraft or wading/swimming across the southern channel at low tide, causing regular disturbance to feeding shorebirds, including by dogs being walked off-leash. The MR05 tidal flat is located close to a well-used sandy beach in a cove on the northern shore of the river. These disturbance pressures are expected to continue to increase as the human population of the region continues to grow. Research has shown that off-leash dogs in particular cause severe disturbance to shorebirds, reducing their use of important habitats (Dhanjal-Adams *et al.* 2016), and are a key threat to migratory shorebirds in Moreton Bay (Fuller *et al.* 2019).

Recommended approaches for reducing disturbance to feeding and roosting shorebirds include a combination of:

- Site-specific information signage to raise awareness of the presence of shorebirds in the area and the importance of the key habitat areas for shorebirds, particularly migratory shorebirds (Antos *et al.* 2006, Williams *et al.* 2009);
- Other approaches to raising public awareness of how the migration and feeding ecology of shorebirds are impacted by disturbances to try to change public awareness of, and attitudes towards disturbing shorebirds, particularly among dog-owners that exercise their dogs along foreshore areas (Antos *et al.* 2006, Williams *et al.* 2009);
- Planning to ensure suitable dog-walking facilities such as dog-off leash areas are situated in locations convenient and attractive to the public but separated from important shorebird foreshore habitats (Stigner *et al.* 2016);
- Planning to limit access to important feeding or roosting areas by people and/or dogs (Weston *et al.* 2012, Stigner *et al.* 2016); and
- Effective enforcement of access restrictions and dog on-leash areas, given that compliance to access restrictions or on-leash laws is strongly dependent on the extent of enforcement (Dhanjal-Adams *et al.* 2016, Stigner *et al.* 2016).

Lloyd *et al*. (2024) outline how, over the past several years, Sunshine Coast Council has worked to increase public awareness of shorebirds through temporary information signage and a variety of other approaches to raising public awareness, including information on Council's website, funding local artists to paint large murals of various shorebird species including interpretive signage on public toilet blocks, and presentations at a variety of community events. Continuation of these activities is encouraged. Given the high dependency of migratory shorebirds on a single roost site in the lower Maroochy River estuary, namely the sandbank on the eastern side of Goat Island, proactive management of disturbance to this location is recommended. Since Goat Island is part of the Maroochy River Conservation Park and managed by the Queensland Parks and Wildlife Service (QPWS), a collaborative approach involving QPWS is recommended.

4.2 CALOUNDRA

The spatial distribution of shorebird habitat, particularly roosting habitat has changed substantially since the formation of the entrance to Pumicestone Passage. The changes have increased the availability of alternative roost sites, with suitable roosting habitat now present on SBN3 and the area of roosting habitat on SBN2 having increased. On the other hand, these changes have also changed patterns of disturbance to shorebirds. Whereas the CBAR, SBN1 and NTBI roost sites previously experienced low to moderate levels of disturbance, the risk of disturbance has increased within the past year. This has largely been due to the silting up of the old entrance channel that allows people to access the northern tip of Bribie Island from Caloundra on most tides. Similarly, the risk of disturbance to shorebirds feeding and roosting on SBN2 has increased. Changes in sediment deposition after the sea broke through the northern end of Bribie Island to create the new entrance has formed a high bank between the southern end of the isolated northern tip of Bribie Island and Golden Beach. The bank, which forms the SBN2 roost site runs westwards to within about 150 m of the Golden Beach shoreline and at low tide and most high tides people, including with dogs, can cross a channel here and walk along this bank near feeding and roosting birds. This recreational disturbance pressure is predicted to continue to increase as the region becomes more developed. Consequently, there is a need for proactive management of disturbance to shorebirds at the important roosting and feeding habitats at Caloundra that are identified above. Approaches for reducing disturbance to feeding and roosting shorebirds are as recommended under **Section 4.1** above. Site-specific signage that clearly indicates the locations of the most frequently used high tide roosting areas to be avoided within the SBN1, SBN2, SBN3 and NTBI roost sites, together with an explanation of why disturbance to flocks of roosting birds should be avoided would be particularly useful in this context.

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APPENDIX 1

Shorebird survey conditions

Table A1.1. Shorebird survey conditions.

Date	Site	LT time	LT ht (m)	HT time	HT ht (m)	Low tide (LT)			High tide (HT)		
						Wind	Cloud	Rain	Wind	Cloud	Rain
14/06/2023	Maroochy River	12:00	0.33			no	no	no			
11/07/2023	Maroochy River	9:40	0.52			no	no	no			
30/10/2023	Maroochy River	17:07	0.33	9:27	2.2	moderate		nil	light	7/8	nil
13/12/2023	Maroochy River	16:37	0.42	9:17	1.96	moderate		nil	light	8/8	nil
15/01/2024	Maroochy River	6:17	0.22	12:07	2.02	moderate	8/8	nil	moderate	8/8	nil
11/02/2024	Maroochy River	17:37	0.23	10:17	2.19	strong	3/8	nil	moderate	8/8	light
13/06/2023	Caloundra	11:59	0.38			light	no	no			
14/07/2023	Caloundra	13:00	0.52			light	no	no			
01/11/2023	Caloundra	18:14	0.66	10:52	2.4	strong	5/8	nil	strong	8/8	nil
14/12/2023	Caloundra	17:04	0.55	9:42	2.57	strong		nil	moderate	6/8	nil
16/01/2024	Caloundra	6:44	0.48	12:32	2.47	light	8/8	light	moderate	4/8	nil
10/02/2024	Caloundra	16:44	0.39	9:12	2.76	moderate	8/8	nil	moderate	8/8	nil
18/07/2023	Pt Cartwright	14:10	0.48			yes	yes	no			
25/07/2023	Alexandra Headland	6:40	0.7	13:04	1.46	light	no	no			
28/07/2023	WICK	9:30	0.63								
28/07/2023	Moffat Headland	9:30	0.63								
25/10/2023	Pt Cartwright	10:57	0.34	17:24	1.8	light	no	no	light	no	no
7/11/2023	Alex Headland	9:36	0.64	16:02	1.48	light	no	no	light	no	no
7/11/2023	WICK	9:46	0.64	16:12	1.48	strong	yes	no	strong	yes	no
7/11/2023	Moffat Headland	9:46	0.64	16:12	1.48	strong	yes	no	strong	yes	no
9/11/2023	Caloundra Headland	11:35	0.54	17:37	1.52	light	no	no	light	no	no
16/11/2023	Alexandra Headland	16:27	0.46	9:35	1.87	light	no	no	light	no	no
21/11/2023	Coolum - Yaroomba	8:12	0.53	14:59	1.69	no	yes	yes	no	yes	yes
28/11/2023	Coolum - Yaroomba	15:03	0.43	8:33	1.96	no	yes	yes	no	yes	yes
30/11/2023	Pt Cartwright	16:36	0.52	9:56	1.87	no	no	no	no	no	no
15/01/2024	Moffat Headland	17:51	0.34	11:16	2.02	strong	yes	yes	strong	yes	yes
15/01/2024	WICK	17:51	0.34	11:16	2.02	strong	yes	yes	strong	yes	yes
25/01/2024	Pt Cartwright	14:39	0.51	8:06	1.92	no	no	no	no	no	no