



Local Land
Services



National
Landcare
Program



Manning River Estuary Shorebird Site Action Plan

Prepared by
BirdLife Australia
for
Hunter Local Land Services

June 2020



birds are in our nature



This project is supported by Hunter Local Land Services through funding from the Australian Government's Regional Land Partnerships initiative of the National Landcare Program. We acknowledge our project partners and volunteers for their valuable contribution and ongoing support.



Prepared by Milly Formby, Marta Ferenczi, Lindall Kidd, Dan Weller, Laura Rhodes & Steve Klose

More information on the National Migratory Shorebird Conservation Action Plan:

<http://birdlife.org.au/mscap> (Contact: shorebirds@birdlife.org.au)

Copyright © BirdLife Australia

This document is subject to copyright and may only be used for the purposes for which it was commissioned. The use or copying of this document in whole or part without the permission of BirdLife Australia is an infringement of copyright.

Disclaimer

Although BirdLife Australia has taken all the necessary steps to ensure that an accurate document has been prepared, the organisation accepts no liability for any damages or loss incurred as a result of reliance placed upon the report and its content.

Cover image: Bar-tailed Godwit flock at Manning River by Karen Bettink. Used with permission.

Contents

- Contents 3
- Native Title Recognition..... 5
- Acknowledgements 5
- Abbreviations..... 5
- Preface 6
- Introduction..... 8
 - Migratory Shorebirds 8
 - Resident Shorebirds 10
 - Shorebird Conservation Challenges..... 10
 - Threats 12
 - Why conserve shorebirds? 13
- Manning River Estuary Shorebird Site Action Plan..... 15**
 - Site description 15
 - Overview of objectives 17
 - Action prioritisation 18
 - Objectives, strategies & actions 19
- Objective 1: Monitor and increase knowledge of migratory shorebird populations 19*
 - 1.1 STRATEGY: Identify key knowledge gaps and invest in scientific research into shorebirds in the Manning River Estuary 19
 - 1.1.1 ACTIONS 20
 - 1.2 STRATEGY: Recruit and train a diverse range of shorebird monitoring participants 21
 - 1.2.1 ACTIONS 21
 - 1.3 Outcomes..... 22
- Objective 2: Reduce, or eliminate human and introduced threats 24*
 - 2.1 STRATEGY: Reduce impacts from human disturbance 24
 - 2.1.1 ACTIONS 24
 - 2.2 STRATEGY: Reduce impacts from pest animals 25
 - 2.2.1 ACTIONS 26
 - 2.3 STRATEGY: Minimise impact of vegetation encroachment 26
 - 2.3.1 ACTIONS 26
- Objective 3: Maintain and protect key habitat values 28*
 - 3.1 STRATEGY: Improve and monitor hydrological regimes 28
 - 3.1.1 ACTIONS 28
 - 3.2 STRATEGY: Future planning for potential impacts of climate change 29
 - 3.2.1 ACTIONS 29
 - 3.2 Outcomes..... 30
- Objective 4: Develop fast-tracked management responses 31*
 - 4.1. STRATEGY: Inclusion and coordination of stakeholders 31
 - 4.1.1 ACTIONS 31
 - 4.2. STRATEGY: Identify and manage conflicts of land use..... 31
 - 4.2.1 ACTIONS 32
 - 4.3 Outcomes..... 33

<i>Objective 5: Increase Communication, Education, Participation and Awareness (CEPA) strategies for migratory shorebird conservation.</i>	34
5.1. STRATEGY: Create and implement an effective CEPA strategy	34
5.1.1 ACTIONS	34
5.2 Outcomes.....	36
Summary of Key Knowledge Gaps	37
Summary of Actions	39
<i>High Priority</i>	39
<i>Medium Priority</i>	41
<i>Low Priority</i>	43
Conclusion and Next Steps	44
References and useful links.....	45
Appendices	46
A. Site Account	46
C. Stakeholders	47
D. Workshop Attendees.....	48



Native Title Recognition

We acknowledge the Biripi peoples as Traditional Owners of the land and pay our respects to the Elders past, present and future for they hold the memories, traditions, culture and hope for their people.

Acknowledgements

The Manning River Estuary Shorebird Site Action Plan has benefitted from the expertise, enthusiasm, and commitment of many collaborators in Australia. BirdLife Australia would like to thank all workshop participants (see [Appendix D](#)) for their time and enthusiasm in developing this plan. Special thanks to those participants who have volunteered to assist in reviewing and overseeing the implementation of this plan.

Abbreviations

AWSG	Australasian Wader Study Group
BNB	Beach-nesting Birds
CAMBA	China-Australia Migratory Bird Agreement
CMP	Coastal Management Plan
EAAF	East Asian-Australasian Flyway
EAAFP	East Asian-Australasian Flyway Partnership
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FNS	Flyway Network Site
JAMBA	Japan-Australia Migratory Bird Agreement
MS CAP	Migratory Shorebird Conservation Action Plan
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
SAP	Site Action Plan
WCP	Wildlife Conservation Plan for Migratory Shorebirds



Preface

“Manning River Estuary is nationally significant for four migratory shorebird species and is the only site in NSW significant for Sanderling. The Manning River Estuary also supports the largest breeding colony of Little Terns in NSW and has the only Australian records of Aleutian Tern. This plan is aimed at supporting migratory shorebirds currently utilising available habitats in Manning River Estuary and outlines actions to improve habitat conditions and availability for migratory shorebirds, which will have flow on effects for the conservation of local threatened and non-threatened resident shorebird species.”

This document sets out a Shorebird Site Action Plan for the Manning River Estuary in New South Wales. As migratory shorebird species continue to decline globally and face many threats along the Flyway including in Australia, preserving key roosting and feeding habitat, like those in the Manning River Estuary is highly important. This plan identifies (1) the actions to be taken to ensure that the Manning River Estuary remains intact and is improved as a secure site for migratory shorebird species, and (2) the stakeholders, including the community that will either be involved with or support implementation of those actions.

This Site Action Plan has been prepared by BirdLife Australia with support from Hunter Local Land Services (LLS) through funding from the Australian Government’s National Landcare Program as part of the regional project, *‘Improving Saltmarsh Habitat and Reducing Threats to the Eastern Curlew’*. All actions listed have been developed in consultation with ecologists and representatives from a wide range of groups including volunteers, community groups, academic researchers, and local government and non-government organisations through a local workshop. The plan has substantially drawn from and reflects local workshop outcomes and stakeholder ideas. This plan is supported by the Migratory Shorebird Conservation Action Plan and the SoS Site Plan as companion documents, which offer a framework for the conservation of migratory shorebirds that regularly visit Australia and Little Tern respectively. The overall responsibility to implement the plan is not specific to one agency, group or organisation, and a cross collaborative and coordinated approach will be required to enact individual actions.

The main objective of the Manning River Estuary Shorebird Site Action Plan is to protect, conserve and improve key roosting and feeding habitats for long-term use by migratory and resident shorebirds. The plan is structured around the following objectives:

- (1) monitor and increase knowledge of migratory and resident shorebird populations;
- (2) reduce or eliminate human and introduced threats;
- (3) maintain and protect key habitat values;
- (4) develop fast tracked management responses; and



(5) increase Communication, Education, Participation and Awareness (CEPA) programmes about migratory shorebird conservation.

Taking the actions proposed in this plan will help to improve the situation for migratory and resident shorebirds in the Manning River Estuary through monitoring and research, on-ground activities, applied restriction measures, targeted pest control measures, education and volunteer programs, and regular review of the plan's efficacy.

Achieving the overall objectives outlined in this plan will help to secure the important role that Manning River Estuary and the people connected to it play in global shorebird conservation.



Introduction

Migratory Shorebirds

Migratory shorebirds are the world's most endangered group of bird species. They are often referred to as 'waders' because they are commonly found wading in the shallow waters of swamps, tidal mudflats and beaches to feed. Shorebirds are not seabirds. Unlike seabirds, they lack webbed feet and cannot land on water. They also have precocial young capable of feeding themselves on hatching.

In Australia, there are more than 50 species of shorebirds and 37 of them are migratory. Most migratory shorebirds make an annual return journey of up to 25,000 kilometres between their breeding grounds in the northern hemisphere and their non-breeding grounds in the southern hemisphere. Migratory flight paths are referred to as 'flyways'.

There are eight recognised flyways in the world:

- Pacific Americas
- Central Americas
- Atlantic Americas
- East Atlantic
- Black Sea-Mediterranean
- East Asia-Africa
- Central Asia
- East Asian-Australasian

Australia is part of the East Asian-Australasian Flyway (EAAF), which extends southwards from breeding grounds in the Russian tundra, Mongolia, and Alaska through east and south-east Asia, to non-breeding areas in Indonesia, Papua New Guinea, Australia and New Zealand.

BirdLife Australia's Shorebird Site Action Plans focus on the 37 migratory shorebird species belonging to the EAAF that regularly and predictably visit Australia during their non-breeding season and are thus listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as "migratory species". Thirty-six of these species breed in the northern hemisphere. Only the Double-banded plover (*Charadrius bicinctus*), breeds in New Zealand and migrates to south-eastern Australia during the Austral winter.

Australia's coastal and freshwater wetlands provide important habitat for shorebirds to rest and feed, enabling them to build the energy reserves required to travel the long distance (up to 13,000 kilometres) back to their breeding grounds. In the month or two before migrating, migratory shorebirds need to increase their body mass by up to 70 per cent to sustain their journey. After their first southward migration, juvenile birds often remain in Australia until they reach approximately two years of age when they embark on their first northward migration.

On southward migration, shorebirds that migrate from the northern hemisphere reach 'staging areas', such as Roebuck Bay and Eighty-mile Beach in north-west Western Australia and the Gulf of Carpentaria in Queensland, by September. From these staging areas, the birds disperse across Australia, reaching the south-eastern states by October. Smaller flocks—cumulatively numbering thousands of birds—take advantage of ephemeral wetlands across inland Australia, while others spread along the coastline. Migratory shorebirds are often gregarious, gathering in mixed flocks, but also occur in single-species flocks or feed and roost with resident shorebird species such as stilts, avocets, oystercatchers, and plovers. By March, the birds that have previously dispersed across the country begin to gather at staging areas, once again forming large flocks and feeding virtually round



the clock to accumulate the energy reserves that are required for their northward migration (REF MS CAP).

Resident Shorebirds

In Australia, there are 17 species of resident shorebirds that remain in Australia year-round. These species breed in Australia and do not migrate. However, many of these species are nomadic, moving seasonally between locations within Australia, often with changes in rainfall. Like their migratory cousins, they rely on a wide variety of habitat and wetland types such as open grasslands, rocky shorelines and sandy beaches.

Shorebird Conservation Challenges

Across the globe, migratory shorebird populations are declining rapidly. In the EAAF, significant regional declines have been identified in at least 18 species (Hansen et al. 2016). In May 2015, Eastern Curlew (*Numenius madagascariensis*) and Curlew Sandpiper (*Calidris ferruginea*) were listed as Critically Endangered under the EPBC Act. In May 2016, Bar-tailed Godwit (spp. *menzbieri*) and Great Knot (*Calidris tenuirostris*) were listed as Critically Endangered, Red Knot (*Calidris canutus*) and Lesser Sand Plover (*Charadrius mongolus*) as Endangered and Bar-tailed Godwit (spp. *baueri*) and Greater Sand Plover (*Charadrius leschenaultia*) as Vulnerable.

Note: While several species have two or more recognised subspecies or distinct populations in the EAAF, it is often difficult to identify different subspecies in the field (e.g. Bar-tailed Godwit [Limosa lapponica] ssp. baueri and menzbieri), which makes it very difficult to assign birds at a particular non-breeding site to the 'population' level. The Migratory Shorebird Conservation Action Plan (see below) and the associated Site Action Plans are therefore intended to be applied at the species level.

Conservation of migratory shorebirds in the EAAF is a complex challenge involving a range of stakeholders across political boundaries, as well as cultural, economic, and social interests. Coastal development at staging and non-breeding grounds throughout Asia and Australia poses the most significant threat to the majority of the 37 species that regularly visit Australia. In the Yellow Sea - a bottleneck for migratory shorebirds on northward and southward migration - over 65 per cent of intertidal habitat has been lost over the past 50 years (Murray et al. 2014), significantly reducing the availability of feeding and roosting habitat for shorebirds. Other anthropogenic threats include climate change, pollution, human disturbance, hunting of shorebirds and shorebird prey, and fisheries by-catch.

Australia has implemented numerous measures domestically and with international partners to help support migratory shorebird populations and their habitats. These include:

- The EPBC Act, which includes four Matters of National Environmental Significance (i.e. migratory species, wetlands of international significance, threatened species and ecological communities and world heritage properties)
- The Wildlife Conservation Plan for Migratory Shorebirds (WCP)
- Conservation Advice for individually-listed threatened species
- Bilateral migratory bird agreements with Japan (JAMBA), People's Republic of China (CAMBA) and the Republic of Korea (ROKAMBA)



- Party to international conventions including the Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn Convention), the Ramsar Convention on Wetlands of International Importance and the Convention on Biological Diversity (CBD)
- The East Asian-Australasian Flyway Partnership (EAAFP), including relevant working groups and task forces (Shorebird Working Group, Monitoring Task Force, Far Eastern Curlew Task Force, Yellow-Sea Ecoregion Task Force) and a network of Flyway Network Sites (FNS)

The above agreements aim to conserve migratory shorebirds as an integral part of our ecosystems, to stop their population decline, and reverse the continuing trend of habitat loss. Since this is a transboundary international challenge, it can succeed only by taking appropriate measures both within and beyond Australia's territorial boundaries.

At the national level, the EPBC Act provides a framework for the protection of migratory and resident shorebird species. The WCP lists all the high and very high priority actions and threatening processes relevant to migratory shorebirds in the EAAF. To ensure that the actions are implemented, the Australian National Migratory Shorebird Conservation Action Plan (MS CAP) has been developed as an extension of the WCP by a broad range of stakeholders who are working in shorebird conservation and management across Australia and the EAAF. Led by BirdLife Australia, stakeholders of the MS CAP have developed detailed plans, identified key delivery partners, resourcing opportunities, funding requirements and challenges across four strategies from the WCP:

1. Protection of important habitats throughout the EAAF.
2. Wetland habitats in Australia are protected and conserved.
3. Anthropogenic threats are minimised or eliminated.
4. Knowledge gaps in Australia are identified.

The implementation of the MS CAP is overseen by a Steering Committee made up of representatives from Commonwealth and State Governments, academic institutions, and key conservation bodies.

Important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as internationally or nationally important (see WCP strategy 1. above). The widely accepted and applied approach to identifying internationally important shorebird habitat is based on the criteria adopted from the Ramsar Convention. Further assistance in identifying important habitats and survey guidelines for migratory shorebirds is available in the EPBC Act and is also reiterated in the revised Wildlife Conservation Plan for Migratory Shorebirds. Currently, a site is considered of international importance for migratory shorebirds if it:

- meets or exceeds a threshold of 1% of the total Flyway population for a single species OR
- supports a total abundance of at least 20,000 shorebirds in any one survey

and considered of national importance if it:

- meets or exceeds a threshold of 0.1% of the total Flyway population for a single species OR
- supports a total abundance of at least 2,000 shorebirds in any one survey OR
- regularly supports more than 15 species of migratory shorebirds (Commonwealth of Australia 2015a).



Sites are assessed using these criteria based on revised Flyway population estimates from Hansen *et al.* 2016. A list of Australian habitats that meet international or national significance criteria have been compiled in BirdLife Australia's *National Directory of Important Migratory Shorebird Habitat*. Using the Directory as a starting point, BirdLife Australia has selected a list of key sites in each state for the development of Site Action Plans. The aim of these Site Action Plans will be to identify and implement priority actions outlined in the MS CAP that are relevant at a local level. This means high impact actions can be prioritised and fast-tracked for implementation specific to the important shorebird site in question. The steps in the Site Action Plan process are outlined in **Figure 1** below.



Figure 1. Steps in the Site Action Planning process from data collection to implementation at the local level.

Threats

In Australia and the EAAF, many of the current threats are linked to the changing availability of i) stopover sites during migration, ii) breeding habitat and iii) over-wintering sites in non-breeding locations for immature and other birds that decide not to migrate (MacKinnon *et al.* 2012). The loss of key locations at any point on the migratory pathway will have significant consequences for several



species. In a global review, Sutherland et al. (2012) identify 45 threats facing shorebird populations, including stochastic events, anthropogenic threats, climate change and microplastics.

Key threats to the migration and survival of Australian migratory shorebirds are identified and detailed in the WCP and in the MS CAP, and briefly listed here:

- Habitat Loss
 - Infrastructure / coastal development in Australia
 - Infrastructure /coastal development in staging and stop-over areas, particularly the Yellow Sea
- Habitat Modification
 - Chronic Pollution
 - Acute Pollution
 - Invasive Species
 - Altered Hydrological Regimes
- Anthropogenic disturbance
- Climate variability and change
- Harvesting of shorebird prey
- Fisheries by-catch
- Hunting

The list is not exhaustive but identifies the main threats that are likely to affect shorebird populations significantly and adversely. Additionally, several issues that have indirect but negative effects on migratory shorebird populations include:

- Lack of data sharing and availability
- Limited scientific knowledge
- Lack of coordinated management at and across important habitat sites

The Site Action Planning process identifies and provides strategies for eliminating threats and issues from the above list at the local level for important shorebird habitats.

Why conserve shorebirds?

Shorebirds are one of the most mobile groups of animals on the planet. Their unique natural history attracts and inspires us but also makes these species vulnerable to natural and human-caused perturbations. Recent and future changes to wetland, grassland, beach, and tundra habitats require us to act now. Shorebirds are a visible component of fully functioning ecosystems, which can have a positive effect on human health. Functional grasslands, wetlands, mangroves and estuarine habitats provide livelihoods for people and ecosystem services such as water filtration, flood protection and shoreline stabilisation. Shorebirds can serve as sentinels to changes in the environment—changes, such as climate variability that will ultimately affect human lives. The stories of shorebirds and experiences of seeing these remarkable creatures in their natural environment fulfil human emotional, intellectual and spiritual needs, and it is no surprise that people from around the world gather at critical wetlands to watch the great spectacle of shorebird migration. Indeed, festivals



celebrating the return of the shorebirds now make important contributions to the economies of many communities. For all these reasons, shorebirds need and deserve our attention, and it is only through a flyway-scale approach that we can ensure that a world with shorebirds is passed on to posterity undiminished in value.



Manning River Estuary Shorebird Site Action Plan

Site description

The Manning River Estuary shorebird area is located on the north coast plains of NSW, 34 kilometres north-east of the township of Taree. The estuary is unique as it has two natural ocean entrances: one at Harrington and the other 12km to the south, known as the Farquhar Inlet at Old Bar (**Figure 2**). At Old Bar, the Manning River South Channel and Scotts Creek form an estuary around Cabbage Tree Island before entering the ocean. The environments in both estuaries are characterised by large sandbars intersected by channels and islands surrounded by mudflats covered with saltmarsh and mangroves.

The Manning River Estuary covers an area of approximately 32.3km² made up of a set of complex inter-connecting channels approximately 115km in length. It drains from an extensive and varied catchment in the order of 8,420km². According to Creese et al. (2009), the Manning Estuary incorporates 1.65km² of seagrass, 3.9km² of mangrove and 2.45km² of saltmarsh habitats as well as estuarine lagoons and coastal floodplain forest.

The estuary has an average flushing time of 31.6 days, compared with a state-wide median estuary flushing time of 9 days (Roper et al. 2011). Due to the long residence time of fresh water, the estuary is sensitive to the accumulation of catchment inputs such as sediments, nutrients, pathogens and acid runoff. These freshwater inputs can severely degrade the ecological health of both the catchment and the estuary and as a consequence detrimentally impact shorebird habitat, as well social and economic values.

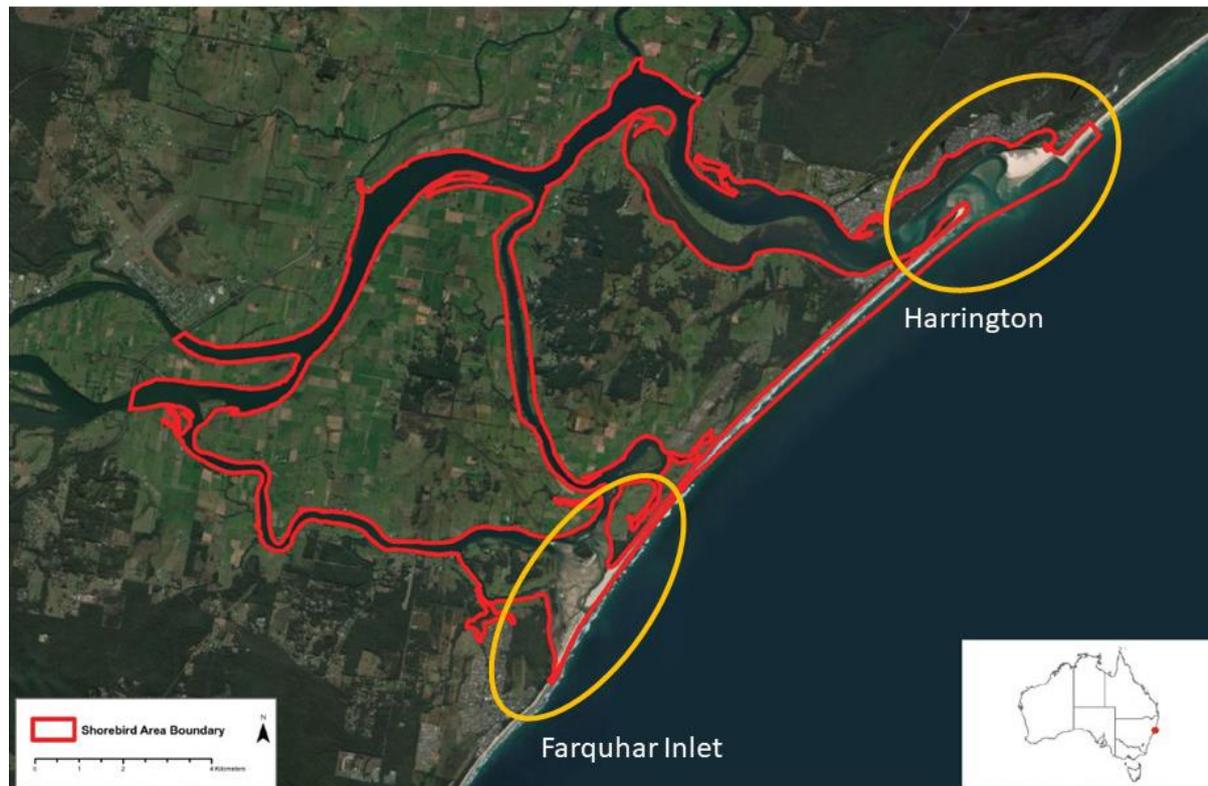


Figure 2. Map of the Manning River Estuary Shorebird Area from BirdLife Australia's Directory of Important Migratory Shorebird Habitat.



Although Manning River Estuary does not rank highly for any particular migratory shorebird species, it hosts:

- nationally significant populations of Eastern Curlew (*Numeniensis madagascariensis*), Sanderling (*Calidris alba*), Pacific Golden Plover (*Pluvius fulva*) and Double-banded Plover (*Charadrius bicinctus*) (**Table 1**, see [Appendix A](#) for count data);
- the largest breeding colony of Little Tern (*Sterna albifrons*) in NSW;
- important habitat for Commonwealth and state-listed threatened resident shorebird species (**Table 2**);
- the only known Australian records for Aleutian Tern (*Onychoprion aleuticus*), which have returned annually to Manning River since 2016 and are likely to have been present long beforehand (Alan Stuart, pers. comm.).

Shorebird and waterbird monitoring have been undertaken in the past by the Hasting Birdwatchers and Hunter Bird Observers Club (HBOC) for BirdLife Australia’s National Shorebird Monitoring Program. However, regular monthly surveys of Manning River Estuary have not been conducted since 2016.

Table 1. State and Commonwealth conservation status of nationally significant migratory species in the Manning River Estuary.

Migratory Species	NSW Conservation Status	Commonwealth EPBC Conservation Status
Eastern Curlew <i>Numeniensis madagascariensis</i>	Not listed	Critically endangered
Sanderling <i>Calidris alba</i>	Vulnerable	Migratory (CAMBA, JAMBA, ROKAMBA)
Pacific Golden Plover <i>Pluvius fulva</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Double-banded Plover <i>Charadrius bicinctus</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Little Tern <i>Sterna albifrons</i>	Endangered	Migratory (CAMBA, JAMBA, ROKAMBA)



Table 2. State and Commonwealth conservation status of threatened resident shorebird species in the Manning River Estuary.

Resident Species	NSW Conservation Status	Commonwealth EPBC Conservation Status
Beach Stone-curlew <i>Esacus magnirostris</i>	Critically endangered	Not listed
Pied Oystercatcher <i>Haematopus longirostris</i>	Endangered	Not listed

Overview of objectives

The Manning River Estuary Site Action Plan identifies the key objectives and actions needed to manage key shorebird habitats, protect roosting and feeding sites and minimise threats to shorebirds in the Manning River Estuary. This will be achieved by implementing an on-ground focused management plan that fosters the community's sense of custodianship of the site and increases public awareness.

The following objectives have been identified specific to the management and protection of shorebirds in the Manning River Estuary:

- (1) monitor and increase local and regional knowledge of migratory and resident shorebird populations;
- (2) reduce, or eliminate human and introduced threats;
- (3) identify, maintain and protect key habitat values;
- (4) develop fast-tracked management responses;
- (5) increase Communication, Education, Participation and Awareness (CEPA) programmes about migratory shorebird conservation.

Under each objective, a list of strategies, issues and their corresponding actions and intended outcomes are provided. To achieve these outcomes, actions will need to be implemented through a cross-collaborative and coordinated approach involving various key stakeholders, groups and organisations (see [Appendix C](#)).

Note: We acknowledge that Manning River Estuary supports a wide diversity of resident shorebirds and waterbirds, many of which rely on these sites for critical breeding habitat. Although some of the objectives outlined in this plan will benefit resident shorebirds and waterbirds, resident species may require a different set of management actions, particularly where nesting birds are concerned.



Action prioritisation

Actions identified for the Shorebird Site Action Plan for Manning River Estuary are described below. It should be noted that some of the objectives are planned for long-term and may only be achieved over several years post publication and implementation of the Site Action Plan. Some of the objectives are planned for short-term and require fast-tracked actions that aim to be achieved in the first wintering season post publication of the Site Action Plan. The actions are also listed separately according to priority ranking in a table at the end of the 'Objectives, Strategies & Actions' section. Priorities assigned to actions should be interpreted as follows:

Priority high: Taking prompt action is necessary to mitigate key threats to shorebirds.

Priority medium: Taking action is desired for the long-term management and protection of shorebirds.

Priority low: Taking action is desirable, but not critical to the management of shorebirds.



Objectives, strategies & actions

Objective 1: Monitor and increase knowledge of migratory shorebird populations

1.1 STRATEGY: Identify key knowledge gaps and invest in scientific research into shorebirds in the Manning River Estuary

Conservation efforts to appropriately manage habitats and mitigate threats facing shorebirds are often hampered by significant knowledge gaps in shorebird ecology. For example, there are significant parts of northern and inland Australia that have either insufficient data for conservation purposes or have not been surveyed at all. There is currently a lack of standardised monitoring and site-specific research data for shorebirds in Manning River Estuary. Without comprehensive baseline knowledge specific to important sites, it will not be possible to assess the ongoing health of migratory shorebird populations.

Knowledge gaps relevant to migratory shorebird conservation in the Manning River Estuary need to be identified to inform avenues for future research. Key knowledge gaps identified through this Site Action Plan process and its consultations include:

- Lack of consistent survey effort and data analysis to identify population trends and changes to habitat over time; incomplete and non-systematic survey methods. Regular monthly surveys of the estuary over a seven-year period ended in 2016 and survey efforts prior to and since have been opportunistic and unstandardised. Surveys are also limited by the need to access large areas of the estuary by boat.
- Lack of data on the movement of shorebirds within the estuary and exchange with other shorebird sites in NSW during and outside of migration periods. Current survey methods do not provide evidence of interchange.
- Limited knowledge of roosting and feeding sites, including night-time roosting. Current survey methods are constrained by short interval surveys, daylight hours, tides and boat availability. Need to focus on interspecific differences in day- and night-time roosting and feeding locations and behavioural ecology.
- Lack of understanding of the diversity of feeding needs across species and the resource availability and limitations at each site. Need to measure diversity, quality and quantity of benthic and aquatic fauna, and feeding substrate. Need to gain knowledge of inter-species variation in feeding substrate, diet selection and feeding behaviours to measure exploitation of different niches within the same habitat.
- Limited knowledge of the impacts of predation and predation rates. Presence of predators is known but not the extent and intensity of predation on migratory shorebirds.



- Lack of understanding how shorebird movement, feeding and roosting, resource availability and habitat is impacted by the opening and closing of the river mouth due to changes in waterflow. Past opening of the river entrance at Farquhar Inlet has been due to notches reaching flood trigger levels.
- Lack of data on the levels of different types of human disturbance and the response of migratory shorebirds to these disturbances at different times of the year.
- Limited understanding of how climate change will affect migratory and resident shorebirds. This includes warming water temperatures, sediment accumulation rates, changes in flow regimes and increasing wildfires. Need to undertake climate change modelling specific to migratory shorebird habitat to identify priority areas for future planning measures.
- Lack of data on community attitudes regarding the importance of Manning River Estuary as an important site for migratory and resident shorebirds and use of these sites in Manning River Estuary.

1.1.1 ACTIONS

1. Establish a regular and standardised monitoring program of shorebirds with key stakeholders (i.e. Hastings Birdwatchers and HBOC) using on-foot and boat-based surveys of the entire estuary at high and low tides to monitor known and identify new shorebird feeding and roosting sites.
Priority: high
2. Develop a hub to facilitate information and data sharing between stakeholders, resources and educational materials used for community engagement and shorebird management to motivate conscientious social behaviour change toward shorebirds.
Priority: high
3. Undertake research into spatial and temporal distribution of interspecific shorebird foraging and roosting behaviour within and among sites relative to tide along with substrate analysis to understand what actions need to be taken to ensure the Manning River Estuary meets and supports the needs of a diverse range of species. Compare these data with data collected in the Hunter Estuary and Port Stephens.
Priority: high
4. Continue collaboration between MidCoast Council and DPIE to predict future distribution of saltmarsh and mangroves under three different sea level rise scenarios. Discuss potential to expand forecast maps to include potential changes to mudflat distributions, sedimentation rates and temperature.
Priority: high



5. Research impacts of permanently opening the river mouth, sand dredging at Farquhar Inlet, creation of a second southern break-wall at Harrington, and disturbance from recreational and other human activity on important shorebird habitat and temporal and spatial distribution within the estuary.
Priority: high
6. Identify and quantify levels of disturbance of and threats to shorebirds at roosting and foraging sites they use.
Priority: high
7. Upgrade existing boating resources for volunteer groups, such as Hastings Birdwatchers, to meet WH&S standards for shorebird monitoring.
Priority: medium
8. Undertake a comprehensive literature review of past migratory shorebird monitoring that has taken place in the Manning Estuary including analysis of existing survey data and key data gatherers.
Priority: medium

1.2 STRATEGY: Recruit and train a diverse range of shorebird monitoring participants

Standardised monitoring of shorebirds can be complicated and requires a high level of expertise. Engaged volunteers are crucial for current monitoring efforts through Birdlife Australia's National Shorebird Monitoring Program. However, there is a need ensure survey participants are adequately trained in shorebird identification and data collection, including the use of equipment and relevant technology. There is also a need for volunteers to be from a range of backgrounds, fitness levels and abilities, and to be available during survey periods.

1.2.1 ACTIONS

1. Promote and recruit for monitoring efforts within local birdwatching groups and to undertake community engagement activities to raise awareness of shorebirds.
Priority: high
2. Collaborate with volunteers from local birdwatching groups (i.e. Hastings Birdwatchers, HBOC) implement a strategy for the coordination of volunteers at Farquhar Inlet and Harrington.
Priority: high
3. Secure funding for procuring shorebird survey equipment (i.e. telescopes, binoculars) and develop a procedure to lend this equipment to volunteers during surveys and retrieve it from them afterwards.
Priority: high



4. Engage a regional (and NSW state-wide if possible) 'Shorebird Monitoring and Community Engagement Coordinator' to ensure consistent data collection is undertaken for migratory and beach-nesting shorebirds at key estuaries across NSW including the training of volunteers and set up of standardised monitoring regimes.
Priority: medium
5. Facilitate two shorebird identification and data collection training workshops annually to recruit new volunteers to BirdLife's National Shorebird Monitoring Program. As part of these workshops, increase the capacity of current volunteers to enter data into BirdLife's online data portal, Birdata, and to collect additional data on threats to migratory shorebirds. Training should include the use of equipment (i.e. telescopes, binoculars) and how to input data records using the Birdata app.
Priority: medium
6. Train current volunteers on how to mentor new volunteers in the field to gain confidence with shorebird identification and monitoring.
Priority: medium
7. Conduct activities that promote monitoring data collected by volunteers, celebrate their contributions to local and regional monitoring programs and show how their contributions are having a positive impact for shorebirds in their local community (e.g. end of season celebration with presentations / information sharing).
Priority: medium
8. Engage university students to contribute to shorebird monitoring opportunities.
Priority: low

1.3 Outcomes

- The number of shorebird counters from the local community has increased through growing involvement in BirdLife Australia's National Shorebird Monitoring Program in the Manning River Estuary.
- There is an increase in the number and diversity of volunteers collecting shorebird population data through Birdlife Australia's National Shorebird Monitoring Program. The biannual shorebird count is completed each year and data are uploaded into Birdata.
- A comprehensive understanding of literature has been achieved and findings are accessible in a format useable by all stakeholders.



- There is a commitment to ongoing data collection to address research needs as they arise. Scientific research is obtained and applied to support the policy and management of the site.
- Data sharing is increased between researchers and managers to ensure that critical uncertainties that are preventing appropriate intervention are addressed.



Objective 2: Reduce, or eliminate human and introduced threats

2.1 STRATEGY: Reduce impacts from human disturbance

Recreational use of the Manning River Estuary is high at both Harrington and Farquhar Inlet, particularly in the beaches and entrance areas. Activities of concern for direct and indirect impacts include dogs off leash, 4WDs, recreational fishing, foraging (i.e. pippies and cockles) and crabbing swimming, camping, kite surfing, boating, jet skiing, horse riding (Old Bar), motorbikes, drone operators, birdwatchers and photographers. The intensity of these activities and thus disturbances is higher during the late spring/summer period to early Autumn (November – February) and peak holiday seasons (October long weekend, Christmas, New Years, Easter) and further disturbance is caused by the New Years Day fireworks at Harrington. These activities are often combined and thus compounded (e.g. people take their 4WD to go fishing and bring their dog) and pose a threat to roosting and feeding migratory and resident shorebirds.

2.1.1 ACTIONS

1. Use data collected on the types, levels and sources of recreational disturbance at Farquhar Inlet and Harrington and the effects they have on migratory shorebirds (Action 1.1.1-6) as the basis for prioritising actions to minimise disturbance at key roosting and feeding sites.
Priority: high
2. Utilise existing networks to coordinate community engagement efforts as a group (i.e. beach warden, Hastings Birdwatchers, Aboriginal rangers, land managers, etc.) at peak times of the year to educate dog owners and other recreational beach goers about the importance of protecting migratory shorebirds and their habitat. Use the community engagement program to promote the conservation values of the estuary on a national and international scale for migratory and resident shorebirds and increase support for environmental protection measures (e.g. letter writing, emails to local members, petitioning, etc.).
Priority: high
3. Train and authorise Aboriginal rangers or Traditional Owner groups as beach wardens to engage beach goers at peak times of the year and assist with compliance. Create a formalised plan to submit to Council to establish compliance capabilities for rangers at key shorebird roosting and feeding sites.
Priority: high
4. Work with MidCoast Council to update and install signage at all appropriate areas at the Harrington beach access point and Farquhar/Mud Bishops Reserve, beach entry points and camping area to assist with compliance.
Priority: high
5. Continue to implement and enforce MidCoast Council driving on beaches policy at both Estuary beaches, which prohibits vehicles from travelling outside of coastal



intertidal zones and allows provision of closure of 4WD access due to safety and/or protection of flora and fauna. Design and install 4WD (and if required (pedestrian exclusion areas to restrict 4WD access from above intertidal limit, saltmarsh and mudflats. Design and install semi-permanent fence at Harrington sandspit and/or the breakwall to restrict 4WD access.

Priority: high

6. MidCoast Council to install signage, fencing and potentially a camera directly in the middle of the break-wall where 4WDs are known to cross and allow rangers to issue infringements.

Priority: medium

7. Explore future implementation of zoning for different types of recreational activities (e.g. kite surfing) based on disturbance analysis.

Priority: medium

8. Engage with 4WD clubs to educate 4WD users about the importance of protecting migratory shorebird habitats and increase awareness about the rules for 4WD access.

Priority: low

9. Train Aboriginal rangers, or Traditional Owners, and others on how to use the Eyewitness app to record number plates of people illegally accessing restricted areas in 4WDs.

Priority: low

10. MidCoast Council, DPIE, Crown Lands and NPWS continue to work with Harrington Chamber of Commerce to ensure disturbance to shorebirds is minimised during annual fireworks display. Investigate alternative options to a fireworks display (e.g. light display) that can bring in a similar amount of money to the community.

Priority: low

2.2 STRATEGY: Reduce impacts from pest animals

Pest animals present a threat to shorebirds through habitat modification, disturbance and predation. Pest animal species present at Manning River Estuary include feral cat (*Felix catus*), European red fox (*Vulpes vulpes*), wild dogs and brown and black rats (*Rattus norvegicus* and *R. rattus*). A fox control program that utilises baiting and soft jaw trapping has been implemented through the SoS Site Management Plan and Fox Threat Abatement Plan (see [Appendix B](#) for links) to minimise the impact of fox predation on breeding resident shorebird species (i.e. Little Terns, Pied Oystercatchers and Beach Stone Curlews). Long-term evidence exists for the taking of resident shorebirds by foxes. However, the impacts of these pest species on migratory shorebirds in particular is unknown.

Several native predators also impact nesting resident shorebirds. These include corvid species, Gull-billed Terns and raptors.



2.2.1 ACTIONS

1. Continue coordinated fox control program across public and private land by MidCoast Council, Aboriginal rangers or Traditional Owner groups, Crown Lands, Hunter LLS and National Parks and Wildlife Service.
Priority: high
2. Implement camera trapping and sand pads to assess the diversity and population size of native and pest predator species, as well as the level of threat they pose to migratory shorebirds and other beach-nesting birds (e.g. gathering evidence for cat/rat predation)
Priority: medium
3. Train and upskill volunteers involved in the National Migratory Shorebird Monitoring Program to collect threat data, including data on predator species.
Priority: medium

2.3 STRATEGY: Minimise impact of vegetation encroachment

Areas within Manning River Estuary are experiencing vegetation encroachment from the spread of weeds like Spiny rush (*Juncus acutus*) in saltmarsh and Bitou Bush (*Chrysanthemoides monilifera*) in fore and hind dunes, both of which limit the availability of roosting and feeding habitat for migratory shorebirds and other species, and provide cover for pest predator species such as foxes and rats. Mangrove encroachment is not considered an issue at this stage. However, a growing number of young mangroves in Farquhar Inlet near Charlie's Island and an increase in mangrove recruitment associated with dredge spoil were identified as potential future issues.

2.3.1 ACTIONS

1. Monitor mangrove encroachment at Farquhar Inlet. Assess the ecological impact of dredging and dredge spoil on changes to mudflats with a focus on changes in mangrove recruitment rates.
Priority: medium
2. Continue weed control efforts at Farquhar Inlet and Harrington sandspit areas as required.
Priority: low
3. Identify, map and manage important sites used by migratory shorebirds where the control of Spiny rush (*Juncus acutus*) is necessary. Work with private land holders to manage infestations.
Priority: low



4. Investigate and monitor the complementary role of hydrological manipulation in preventing encroachment of vegetation.

Priority: low

2.4. Outcomes

- Disturbance to migratory and resident shorebirds is minimised through the assessment and ongoing monitoring of recreational activities and implementation of a community engagement and compliance program.
- The impacts of foxes and other predators in the Manning River Estuary are minimised through a strategic, well-coordinated and cross-tenure approach that uses multiple tools (i.e. baiting, soft-jaw trapping, etc.).
- Vegetation encroachment is monitored and halted, and areas of shorebird roosting and foraging habitat remain intact or increase in extent.



Objective 3: Maintain and protect key habitat values

3.1 STRATEGY: Improve and monitor hydrological regimes

Water quality in the Manning River Estuary was near excellent in 2019. However, this result partly reflected oceanic water conditions due to extended drought within the catchment and estuary. Water quality (nitrogen, phosphorous, turbidity) deteriorates during periods of high rainfall largely due to agricultural nutrient runoff in the catchment and floodplain. Poor water quality was observed in the estuary following high rainfall in sub-catchments that experienced widespread and intense wildfires in late 2019. Issues with black water, acid sulfate soil discharge and pathogens such as *E. coli* have also been identified. Hunter LLS and MidCoast Council are currently working with farmers upstream and in the estuary zone to manage nutrient and sediment runoff on their properties. MidCoast Council is in the process of developing a Manning Catchment and Estuary Management Plan due for completion in June 2021 under NSW Catchment Management Act 2016, which will see a range of management actions implemented to address water quality issues within the Manning. Marine debris at Harrington and Farquhar Inlet was also identified as an issue.

3.1.1 ACTIONS

1. Continue to support catchment and floodplain actions, with a focus on private land holders to minimise the amount of nutrient and sediment runoff flowing into waterways from their properties (i.e. fencing, grazing practices, effluent and drainage management, bank erosion protection) and protect riparian and shorebird saltmarsh feeding areas from grazing.
Priority: high
2. Continue measuring water quality to monitor nutrient runoff and containment to ascertain the efficacy of catchment and floodplain management actions, including the impacts of bushfire and floods.
Priority: medium
3. Encourage private land holders and community groups to monitor shorebirds on their property through inclusion in shorebird training and monitoring workshops.
Priority: medium
4. Investigate areas that can be set aside for conservation of saltmarsh and mudflats through acquisition, incentives to modify title, conversion to saltmarsh, fencing, weed removal and other tools. Use sea level rise mapping to identify future opportunities for offsets.
Priority: medium



5. Assess saltmarsh sites and connectivity in the estuary using GIS to identify high quality sites for re-zoning of land for environmental purposes as part of the Manning River Catchment and Estuary Coastal Management Plan and the Marine Estate Management Strategy.
Priority: medium
6. Continue to conduct marine debris clean ups at Harrington and Farquhar Inlet.
Priority: medium
7. Incorporate rubbish removal education campaign into community engagement strategy. Consider installation of fishing line bins to encourage appropriate disposal of fishing line.
Priority: medium
8. Consider input to Manning River Catchment and Estuary Plan regarding modified freshwater flow and flow regimes in Water Sharing Plans.
Priority: low

3.2 STRATEGY: Future planning for potential impacts of climate change

Climate change has the potential to affect migratory and resident shorebirds and their habitats in a range of ways including changing the extent of coastal and inland wetlands. Climate change projections for Australia suggest likely increased temperatures, rising sea levels and an overall drying trend for much of the continent, together with more frequent and/or intense extreme climate events resulting in likely species loss and habitat degradation. Estuaries are warming and acidifying because of climate change: A recent study by Scanes *et. al.* (2020) shows water temperatures in estuaries along the NSW coastline have warmed more than 2 degrees over the past 12 years and have become more acidic. At present there is limited understanding of how climate change will affect shorebirds in the Manning River Estuary. Expected impacts includes changes to erosion and sedimentation due to sea level rise, and limited range for shorebird habitat migration. The Estuary is also subject to the changes in the catchment due to climate change, which include frequent drought, fire and flood.

3.2.1 ACTIONS

1. Collaborate with research organisations to model and understand the impacts of sea level rise on the estuary to inform planning and estuary management.
Priority: high
2. Incorporate shorebird habitat management with regards to sea level rise in Old Bar / Manning Point Coastal Management Plan.
Priority: medium



3. Research changes to sedimentation, impacts of bushfires and increased storm surge on shorebird habitat.
Priority: medium
4. Explore potential for future collaboration with oyster farmers to establish floating roost sites for shorebirds if necessary, based on modelling outcomes, and to quantify their effectiveness in terms of use by local shorebirds.
Priority: low
5. Undertake a literature review of international actions regarding climate change for shorebird habitat management to incorporate conservation values into sea level modelling and planning.
Priority: low

3.2 Outcomes

- High water quality is maintained through monitoring and support of private landholders to manage agricultural and septic nutrient runoff, and other pollutants.
- Amount and connectivity of saltmarsh remains intact or is expanded through acquisition, conversion or other means to maintain and potentially expand roosting and feeding habitat for migratory shorebirds.
- Marine debris is minimised through regular clean-up activities and community engagement.
- Shorebird roosting and feeding habitat and resources are maximised and/or alternatives explored based on future climate change/sea level rise mapping and modelling of the estuary.



Objective 4: Develop fast-tracked management responses

4.1. STRATEGY: Inclusion and coordination of stakeholders

A lack of communication and coordination across responsible agencies can be a challenge for effective environmental management. Within the Manning Estuary entrances and adjacent lands, this is made somewhat confusing due to complex tenure and management, particularly over land versus mapped water. Protection of shorebirds and their habitat in the Manning River Estuary critically depends on support by all stakeholders and people using the area. Without support from site managers, stakeholders and the local community, it will not be possible to protect migratory and resident shorebirds in the Manning River Estuary now and into the future.

4.1.1 ACTIONS

1. Identify land and water authorities, and owners, with emphasis on who has jurisdiction over each area.
Priority: high
2. Establish a working group for migratory shorebirds for the Manning River Estuary modelled on Manning Beach-nesting Birds Working Group. Discuss potential to build upon existing working group to include migratory shorebirds. Ensure indigenous representation on the working group.
Priority: medium
3. Ensure communications regarding monitoring and breeding, and estuary management actions are distributed to all appropriate stakeholders, relevant private land holders and community groups through the working group once established.
Priority: medium
4. Create an online hub to act as a centralised location for storing and disseminating information from the working group.
Priority: medium
5. Ensure the protection of Aboriginal values in Manning River Estuary and inclusion of Traditional Owners in all decision making when undertaking any management actions for migratory and resident shorebirds.
Priority: medium

4.2. STRATEGY: Identify and manage conflicts of land use

The Manning River Estuary is popular with the local community and is also growing as a tourist destination. Activities associated with tourism, industry and recreation from locals and visitors can all conflict with conservation objectives if they are not managed appropriately. Many conflicts occur



because people are unaware that their activity is harmful to migratory and resident shorebirds. In an attempt to reduce pressures from conflicts of use, issues may arise because areas are zoned to keep different user groups apart, which can result in a larger area being impacted. An urgent major conflict of land use identified in the Manning River Estuary is the proposed permanent opening of the Manning River mouth at Farquhar Inlet, which has the potential to modify existing shorebird habitat substantially.

The Manning River Estuary is a mature barrier estuary, with a wave dominated delta (Roper *et al.* 2011). Farquhar Inlet in the lower southern estuary is a typical estuarine lagoon that is a large open body of saline or brackish water with a relatively narrow permanent or intermittent connection to the sea that operates as an Intermittently Closed and Open Lakes and Lagoon (ICOLL). Opening of the river mouth has been proposed to attract future business investment along the coast, largely for the oyster industry, and allow greater access for recreational boating and fishing. A commonly held perception in the community is that opening the river mouth would also reduce the risks of flooding to nearby properties. The full impacts of how opening the river mouth will change the dynamics of the Estuary is unknown. However, a permanent opening will have several known impacts, such as removing the buffering of the berm while the entrance is closed and significantly change estuary function and ecology. A taskforce initiated by local MP, Stephen Bromhead, assembled in 2020 to review options for providing a permanent entrance to the Manning River.

4.2.1 ACTIONS

1. Continue to monitor the development of plans to move forward with the permanent opening of the river mouth at Farquhar Inlet.
Priority: high
2. Write a submission to the taskforce highlighting the importance of the estuary and habitats for significant EPBC and state-listed migratory and resident shorebird species.
Priority: high
3. Production of a video providing accurate scientific and Aboriginal knowledge about the history and nature of the Estuary, and the importance of maintaining its function as an ICOLL for the conservation of migratory and resident shorebirds and their habitats.
Priority: medium
4. Highlight the economic and social benefits of birds' presence (e.g. Aleutian Terns) to local tourism revenue for the Manning River Estuary.
Priority: low



4.3 Outcomes

- Land managers, tenures and site boundaries are identified, and roles and responsibilities are clarified and agreed upon.
- Communication and coordination of management actions is improved through the establishment of a working group made up of representatives from all stakeholder and community groups that incorporates migratory shorebirds into the existing BNB program.
- A timely submission opposing the opening of the Manning River is put forward to the taskforce by Hunter Local Land Services with support from BirdLife Australia before the end of July. The local community is rallied to support opposition to the river mouth opening and shorebird habitat within the estuary is protected and maintained.



Objective 5: Increase Communication, Education, Participation and Awareness (CEPA) strategies for migratory shorebird conservation.

5.1. STRATEGY: Create and implement an effective CEPA strategy

Many threats to migratory and resident shorebirds can be addressed effectively by raising awareness and therefore should be an integral part of shorebird site management. To achieve this objective, a range of community education, participation and awareness (CEPA) activities will need to be implemented. Existing information about shorebirds can be difficult to access and restricted to stakeholders with specialist knowledge. Community engagement efforts in the Manning River Estuary are currently opportunistic rather than coordinated and strategic. A strategic communications plan will unify and focus to maximise positive results for migratory and resident shorebirds in the Manning River Estuary. A draft communications plan was developed by MidCoast Council in 2018 and shared with HLLS and Manning BNB Working Group. Future communications strategies should therefore be an extension of this.

5.1.1 ACTIONS

1. Develop a regional communications strategy for migratory and resident shorebirds of the Manning River Estuary.
Priority: medium
2. Continue on-beach engagement through beach warden program and volunteers at beach entrance points to encourage behavioural change to reduce disturbance.
Priority: medium
3. Implement a training program for shorebird advocates through the National Shorebird Monitoring Program. Use existing outreach materials to engage beach goers.
Priority: medium
4. Promote shorebird conservation at public events (e.g. RSPCA Paws Walk, New Years Day fireworks, Old Bar Festival).
Priority: medium
5. Continue the Discovery Ranger program for environmental education, visits to schools to include migratory as well as beach-nesting shorebirds. Target caravan parks, tourist visitor centres and tourism bodies/destinations to reach visitors to Manning River Estuary. Promote a clear list of follow-up actions and activities people can undertake following workshops and presentations on migratory and resident shorebirds in the estuary.
Priority: medium



6. Utilise existing social media channels through the working group to develop and implement a targeted social media strategy to promote awareness of shorebirds to visitors and residents of the estuary.
Priority: medium
7. Use the working group and online hub as a means to collate and distribute existing education materials and create new ones to raise the profile of migratory shorebirds (e.g. distribution of Shorebird ID booklets to local schools, community groups and Council).
Priority: medium
8. Provide information on shorebirds at point of sale for beach permits to 4WD users and dog/cat registrations. Distribute information on the importance of keeping your dog on a leash for migratory shorebirds and beach-nesting birds through vet clinics to pet owners (e.g. info postcards) to encourage behavioural change to reduce disturbance.
Priority: low
9. Explore opportunities for community shorebird events as part of ongoing Flyway efforts (e.g. Threatened Species Day, World Migratory Bird Day, sister schools / sister wetlands programs, Welcome/Farewell Shorebirds events, etc.).
Priority: low



5.2 Outcomes

The following outcomes may indicate successful implementation:

- An effective community education and awareness program has been implemented and coordinated.
- The program increases the level of local public awareness about the importance of the estuary for migratory and resident shorebirds on a national and international scale.
- Community engagement leads to positive behaviour changes that result in less disturbance to migratory and resident shorebirds.



Summary of Key Knowledge Gaps

Knowledge gaps relevant to migratory shorebird conservation in the Manning River Estuary need to be identified to inform avenues for future research. Key knowledge gaps identified through this Site Action Plan process and its consultations include:

- Lack of consistent survey effort and data analysis to identify population trends and changes to habitat over time; incomplete and non-systematic survey methods. Regular monthly surveys of the estuary over a seven-year period ended in 2016 and survey efforts prior to and since have been opportunistic and unstandardised. Surveys are also limited by the need to access large areas of the estuary by boat.
- Lack of data on the movement of shorebirds within the estuary and exchange with other shorebird sites in NSW during and outside of migration periods. Current survey methods do not provide evidence of interchange.
- Limited knowledge of roosting and feeding sites, including night-time roosting. Current survey methods are constrained by short interval surveys, daylight hours, tides and boat availability. Need to focus on interspecific differences in day- and night-time roosting and feeding locations and behavioural ecology.
- Lack of understanding of the diversity of feeding needs across species and the resource availability and limitations at each site. Need to measure diversity, quality and quantity of benthic and aquatic fauna, and feeding substrate. Need to gain knowledge of inter-species variation in feeding substrate, diet selection and feeding behaviours to measure exploitation of different niches within the same habitat.
- Limited knowledge of the impacts of predation and predation rates. Presence of predators is known but not the extent and intensity of predation on migratory shorebirds.
- Lack of understanding how shorebird movement, feeding and roosting, resource availability and habitat is impacted by the opening and closing of the river mouth due to changes in waterflow. Past opening of the river entrance at Farquhar Inlet has been due to notches reaching flood trigger levels.
- Lack of data on the levels of different types of human disturbance and the response of migratory shorebirds to these disturbances at different times of the year.
- Limited understanding of how climate change will affect migratory and resident shorebirds. This includes warming water temperatures, sediment accumulation rates, changes in flow regimes and increasing wildfires. Need to undertake climate change modelling specific to migratory shorebird habitat to identify priority areas for future planning measures.



- Lack of data on community attitudes regarding the importance of Manning River Estuary as an important site for migratory and resident shorebirds and use of these sites.

Summary of Actions

Actions are listed under each priority level according to achievability score.

Priority is defined as: **high** = taking prompt action is necessary to mitigate key threats to migratory shorebirds; **medium** = taking action is desired for the long-term management and protection of migratory shorebirds; **low** = taking action is desirable, but not critical to the management of the migratory shorebirds.

Achievability is defined as: **most achievable** = low effort / low cost (dark blue); **moderately achievable** = low cost / high effort OR high cost / low effort (light blue); and **least achievable** = high cost / high effort (white).

High Priority

Objective	Action	Reference
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Establish a regular and standardised monitoring program of shorebirds with key stakeholders (i.e. Hastings Birdwatchers and HBOC) using on-foot and boat-based surveys of the entire estuary at high and low tides to monitor known and identify new shorebird feeding and roosting sites.	Action 1.1.1-1
	Develop a hub to facilitate information and data sharing between stakeholders, resources and educational materials used for community engagement and shorebird management to motivate conscientious social behaviour change toward shorebirds.	Action 1.1.1-2
	Undertake research into spatial and temporal distribution of interspecific shorebird foraging and roosting behaviour within and among sites relative to tide along with substrate analysis to understand what actions need to be taken to ensure the Manning River Estuary meets and supports the needs of a diverse range of species. Compare these data with data collected in the Hunter Estuary and Port Stephens.	Action 1.1.1-3
	Research impacts of permanently opening the river mouth, sand dredging at Farquhar Inlet, creation of a second southern break-wall at Harrington, and disturbance from recreational and other human activity on important shorebird habitat and temporal and spatial distribution within the estuary.	Action 1.1.1-5
	Identify and quantify levels of disturbance of and threats to shorebirds at roosting and foraging sites they use.	Action 1.1.1-6
	Collaborate with volunteers from local birdwatching groups (i.e. Hastings Birdwatchers, HBOC) implement a strategy for the coordination of volunteers at Farquhar Inlet and Harrington.	Action 1.2.1-2
Objective 2: Reduce, or eliminate human and introduced threats	Use data collected on the types, levels and sources of recreational disturbance at Farquhar Inlet and Harrington and the effects they have on migratory shorebirds (Action 1.1.1-6) as the basis for prioritising actions to minimise disturbance at key roosting and feeding sites.	Action 2.1.1-1
	Utilise existing networks to coordinate community engagement efforts as a group (i.e. beach warden, Hastings Birdwatchers, Aboriginal rangers, land managers, etc.) at peak times of the year to educate dog owners and other recreational beach goers about the importance of protecting migratory shorebirds and their habitat. Use the community engagement program to promote the conservation values of the estuary on a national and international scale for migratory and resident shorebirds and increase support for environmental protection measures (e.g. letter writing, emails to local members, petitioning, etc.).	Action 2.1.1-2

	Work with MidCoast Council to update and install signage at all appropriate areas at the Harrington beach access point and Farquhar/Mud Bishops Reserve, beach entry points and camping area to assist with compliance.	Action 2.1.1-4
	Continue to implement and enforce MidCoast Council driving on beaches policy at both Estuary beaches, which prohibits vehicles from travelling outside of coastal intertidal zones and allows provision of closure of 4WD access due to safety and/or protection of flora and fauna. Design and install 4WD (and if required (pedestrian exclusion areas to restrict 4WD access from above intertidal limit, saltmarsh and mudflats. Design and install semi-permanent fence at Harrington sandspit and/or the breakwall to restrict 4WD access.	Action 2.1.1-5
	Continue coordinated fox control program across public and private land by MidCoast Council, Aboriginal rangers or Traditional Owner groups, Crown Lands, Hunter LLS and National Parks and Wildlife Service.	Action 2.2.1-1
Objective 4: Develop fast tracked management responses	Identify land authorities and owners, with emphasis on who has jurisdiction over each area.	Action 4.1.1-1
	Establish a working group for migratory shorebirds for the Manning River Estuary modelled on Manning Beach-nesting Birds Working Group. Discuss potential to build upon existing working group to include migratory shorebirds. Ensure indigenous representation on the working group.	Action 4.1.1-2
	Continue to monitor the development of plans to move forward with the permanent opening of the river mouth at Farquhar Inlet.	Action 4.2.1-1
	Write a submission to the taskforce highlighting the importance of the estuary and habitats for significant EPBC and state-listed migratory and resident shorebird species.	Action 4.2.1-2
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Continue collaboration between MidCoast Council and DPIE to predict future distribution of saltmarsh and mangroves under three different sea level rise scenarios. Discuss potential to expand forecast maps to include potential changes to mudflat distributions, sedimentation rates and temperature.	Action 1.1.1-4
	Secure funding for procuring shorebird survey equipment (i.e. telescopes, binoculars) and develop a procedure to lend this equipment to volunteers during surveys and retrieve it from them afterwards.	Action 1.2.1-3
Objective 2: Reduce, or eliminate human and introduced threats	Train and authorise Aboriginal rangers or Traditional Owner groups as beach wardens to engage beach goers at peak times of the year and assist with compliance. Create a formalised plan to submit to Council to establish compliance capabilities for rangers at key shorebird roosting and feeding sites.	Action 2.1.1-3
	MidCoast Council to install signage, fencing and potentially a camera directly in the middle of the break-wall where 4WDs are known to cross and allow rangers to issue infringements.	Action 2.1.1-6
Objective 3: Maintain and protect key habitat values	Continue to support catchment and floodplain actions, with a focus on private land holders to minimise the amount of nutrient and sediment runoff flowing into waterways from their properties (i.e. fencing, grazing practices, effluent and drainage management, bank erosion protection) and protect riparian and shorebird saltmarsh feeding areas from grazing.	Action 3.1.1-1
	Collaborate with research organisations to model and understand the impacts of sea level rise on the estuary to inform planning and estuary management.	Action 3.2.1-1

Medium Priority

Objective	Action	Reference
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Facilitate two shorebird identification and data collection training workshops annually to recruit new volunteers to BirdLife’s National Shorebird Monitoring Program. As part of these workshops, increase the capacity of current volunteers to enter data into BirdLife’s online data portal, Birdata, and to collect additional data on threats to migratory shorebirds. Training should include the use of equipment (i.e. telescopes, binoculars) and how to input data records using the Birdata app.	Action 1.2.1-5
	Train current volunteers on how to mentor new volunteers in the field to gain confidence with shorebird identification and monitoring.	Action 1.2.1-6
	Promote and recruit for monitoring efforts within local birdwatching groups and to undertake community engagement activities to raise awareness of shorebirds.	Action 1.2.1.1
Objective 3: Maintain and protect key habitat values	Continue measuring water quality to monitor nutrient runoff and containment to ascertain the efficacy of catchment and floodplain management actions, including the impacts of bushfire and floods.	Action 3.1.1-2
	Encourage private land holders and community groups to monitor shorebirds on their property through inclusion in shorebird training and monitoring workshops.	Action 3.1.1-3
	Investigate areas that can be set aside for conservation of saltmarsh and mudflats through acquisition, incentives to modify title, conversion to saltmarsh, fencing, weed removal and other tools. Use sea level rise mapping to identify future opportunities for offsets.	Action 3.1.1-4
	Continue to conduct marine debris clean ups at Harrington and Farquhar Inlet.	Action 3.1.1-6
	Incorporate shorebird habitat management with regards to sea level rise in Old Bar / Manning Point Coastal Management Plan.	Action 3.2.1-2
Objective 4: Develop fast tracked management responses	Ensure communications regarding monitoring and breeding, and estuary management actions are distributed to all stakeholders, relevant private land holders and community groups through the working group once established.	Action 4.1.1-3
	Create an online hub to act as a centralised location for storing and disseminating information from the working group.	Action 4.1.1-4
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Develop a regional shorebirds communications strategy. Develop a regional communications strategy for migratory and resident shorebirds of the Manning River Estuary.	Action 5.1.1-1
	Continue on-beach engagement through beach warden program and volunteers at beach entrance points to encourage behavioural change to reduce disturbance.	Action 5.1.1-2
	Promote shorebird conservation at public events (e.g. RSPCA Paws Walk, New Years Day fireworks, Old Bar Festival).	Action 5.1.1-4
	Continue the Discovery Ranger program for environmental education, visits to schools to include migratory as well as beach-nesting shorebirds. Target caravan parks, tourist visitor centres and tourism bodies/destinations to reach visitors to Manning River Estuary. Promote a clear list of follow-up actions and activities people can undertake following workshops and presentations on migratory shorebirds in the estuary.	Action 5.1.1-5
	Utilise existing social media channels through the working group to develop and implement a targeted social media strategy to promote awareness of migratory shorebirds to visitors and residents of the estuary.	Action 5.1.1-6

	Use the working group and online hub as a means to collate and distribute existing education materials and create new ones to raise the profile of migratory shorebirds (e.g. distribution of Shorebird ID booklets to local schools, community groups and Council).	Action 5.1.1-7
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Upgrade existing boating resources for volunteer groups, such as Hastings Birdwatchers, to meet WH&S standards for shorebird monitoring.	Action 1.1.1-7
	Undertake a comprehensive literature review of past migratory shorebird monitoring that has taken place in the Manning Estuary including analysis of existing survey data and key data gatherers.	Action 1.1.1-8
	Engage a regional (and NSW state-wide if possible) 'Shorebird Monitoring and Community Engagement Coordinator' to ensure consistent data collection is undertaken for migratory and beach-nesting shorebirds at key estuaries across NSW including the training of volunteers and set up of standardised monitoring regimes.	Action 1.2.1-4
	Conduct activities that promote monitoring data collected by volunteers, celebrate their contributions to local and regional monitoring programs and show how their contributions are having a positive impact for migratory shorebirds in their local community (e.g. end of season celebration with presentations / information sharing).	Action 1.2.1-7
Objective 2: Reduce, or eliminate human and introduced threats	Explore future implementation of zoning for different types of recreational activities (e.g. kite surfing) based on disturbance analysis.	Action 2.1.1-7
	Implement camera trapping and sand pads to assess the diversity and population size of native and pest predator species, as well as the level of threat they pose to migratory shorebirds and other beach-nesting birds (e.g. gathering evidence for cat/rat predation)	Action 2.2.1-2
	Train and upskill volunteers involved in the National Migratory Shorebird Monitoring Program to collect threat data, including data on predator species.	Action 2.2.1-3
	Monitor mangrove encroachment at Farquhar Inlet. Assess the ecological impact of dredging and dredge spoil on changes to mudflats with a focus on changes in mangrove recruitment rates.	Action 2.3.1-1
Objective 3: Maintain and protect key habitat values	Assess saltmarsh sites and connectivity in the estuary using GIS to identify high quality sites for re-zoning of land for environmental purposes as part of the Manning River Catchment and Estuary Coastal Management Plan and the Marine Estate Management Strategy.	Action 3.1.1-5
	Incorporate rubbish removal education campaign into community engagement strategy. Consider installation of fishing line bins to encourage appropriate disposal of fishing line.	Action 3.1.1-7
Objective 4: Develop fast tracked management responses	Ensure the protection of indigenous values in the area when undertaking any management actions for shorebirds.	Action 4.1.1-5
	Implement a training program for shorebird advocates through the National Shorebird Monitoring Program. Use existing outreach materials to engage beach goers.	Action 5.1.1-3
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Production of a video providing accurate scientific and Aboriginal knowledge about the history and nature of the Estuary, and the importance of maintaining its function as an ICOLL for the conservation of migratory and resident shorebirds and their habitats.	Action 5.1.1-3

Low Priority

Objective	Action	Reference
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Engage university students to contribute to shorebird monitoring opportunities.	Action 1.2.1-8
Objective 2: Reduce, or eliminate human and introduced threats	Engage with 4WD clubs to educate 4WD users about the importance of protecting migratory shorebird habitats and increase awareness about the rules for 4WD access.	Action 2.1.1-8
	Train Aboriginal rangers, or Traditional Owners, and others on how to use the Eyewitness app to record number plates of people illegally accessing restricted areas in 4WDs.	Action 2.1.1-9
	Continue weed control efforts at Farquhar Inlet and Harrington sandspit areas as required.	Action 2.3.1-2
Objective 3: Maintain and protect key habitat values	Consider input to Manning River Catchment and Estuary Plan regarding modified freshwater flow and flow regimes in Water Sharing Plans.	Action 3.1.1-8
	Undertake a literature review of international actions regarding climate change for shorebird habitat management to incorporate conservation values into sea level modelling and planning.	Action 3.2.1-5
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Provide information on shorebirds at point of sale for beach permits to 4WD users and dog/cat registrations. Distribute information on the importance of keeping your dog on a leash for migratory shorebirds through vet clinics to pet owners (e.g. info postcards) to encourage behavioural change to reduce disturbance.	Action 5.1.1-8
	Explore opportunities for community shorebird events as part of ongoing Flyway efforts (e.g. Threatened Species Day, World Migratory Bird Day, sister schools / sister wetlands programs, Welcome/Farewell Shorebirds events, etc.).	Action 5.1.1-9
Objective 2: Reduce, or eliminate human and introduced threats	MidCoast Council, DPIE, Crown Lands and NPWS continue to work with Harrington Chamber of Commerce to ensure disturbance to shorebirds is minimised during annual fireworks display. Investigate alternative options to a fireworks display (e.g. light display) that can bring in a similar amount of money to the community.	Action 2.1.1-10
	Identify, map and manage important sites used by migratory shorebirds where the control of Spiny rush (<i>Juncus acutus</i>) is necessary. Work with private land holders to manage infestations.	Action 2.3.1-3
	Investigate and monitor the complementary role of hydrological manipulation in preventing encroachment of vegetation.	Action 2.3.1-4
Objective 3: Maintain and protect key habitat values	Research changes to sedimentation, impacts of bushfires and increased storm surge on shorebird habitat.	Action 3.2.1-3
	Explore potential for future collaboration with oyster farmers to establish floating roost sites for shorebirds if necessary, based on modelling outcomes, and to quantify their effectiveness in terms of use by local shorebirds.	Action 3.2.1-4
Objective 4: Develop fast tracked management responses	Highlight the commercial benefits of birds' presence (e.g. Aleutian Terns) to local tourism revenue for Manning River Estuary.	Action 4.2.1-4



Conclusion and Next Steps

This Site Action Plan for shorebirds provides a framework for a coordinated approach to shorebird conservation in the Manning River Estuary. Regular population monitoring at Manning River Estuary as part of BirdLife Australia's National Shorebird Monitoring Program will play a critical role in evaluating the effectiveness of conservation actions undertaken as part of this process.

Managing shorebird habitat can be difficult, but the five main objectives of this Site Action Plan capture the essence of the challenges migratory and resident shorebirds are facing in the Manning River Estuary. If this plan is successful in (1) ongoing monitoring and increasing knowledge of migratory and resident shorebird populations; (2) reducing, or eliminating human and introduced threats; (3) identifying and protecting key habitat values; (4) developing fast tracked management responses; (5) and increasing Communication, Education, Participation and Awareness Programmes for migratory and resident shorebird conservation, then the situation for all shorebirds in the Manning River Estuary will be substantially improved in the mid- to long-term.

The issues identified for the Manning River Estuary make it necessary to achieve broad collaboration amongst all stakeholders. They include problems such as lack of consistent monitoring, human disturbance, pest animals, altered hydrological regimes, and targeted implementation of a communications strategy. This list is likely incomplete and will be refined and extended in the future as new issues emerge and unforeseen aspects surface.



References and useful links

BirdLife Australia Birddata Data Base, available online at: <https://birddata.birdlife.org.au/>

Commonwealth of Australia (2015) EPBC Act Policy Statement 3.21 – Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species. Commonwealth of Australia

Creese, R., Glasby, T.M., West, G. and Callen C. (2009). Mapping the habitats of NSW estuaries. Industry and Investment NSW, Port Stephens Fisheries Institute, Nelson Bay, NSW.

Department of the Environment and Energy (1996) Directory of Important Wetlands in Australia – Information Sheet. Available at: <http://www.environment.gov.au/cgi-bin/wetlands/report.pl>

Hansen, B. D., Fuller, R.A., Watkins, D., Rogers, D.I., Clemens, R.S., Newman, M., Woehler, E.J. and Weller, D.W. (2016) Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species. Unpublished report for the Department of the Environment, BirdLife Australia, Melbourne, Available at:

<https://www.environment.gov.au/system/files/resources/da31ad38-f874-4746-a971-5510527694a4/files/revision-east-asian-australasian-flyway-population-sept-2016.pdf>

MacKinnon, J., Verkuil, Y.I. and Murray, N. (2012). IUCN situation analysis on East and Southeast Asian intertidal habitats, with particular reference to the Yellow Sea (including the Bohai Sea). *Occasional paper of the IUCN species survival commission*, **47**. Available at:

<https://portals.iucn.org/library/efiles/documents/SSC-OP-047.pdf>

National Shorebird Monitoring, Available at: <https://birdlife.org.au/projects/shorebirds-2020/shorebirds-2020-program>

Murray, N. J., Clemens, R.S., Phinn, S.R., Possingham, H.P. and Fuller, R.A. (2014). Tracking the rapid loss of tidal wetlands in the Yellow Sea. *Frontiers in Ecology and the Environment* **12**(5): 267-272.

Shorebird Sister Schools Program, Available at: <https://www.fws.gov/sssp/index.html>

Sutherland, W. J., Alves, J.A., Amano, T., Chang, C.H., Davidson, N.C., Finlayson, C.M., Gill, J.A., Gill Jr., R.E., Gonzalez, P.M., Gunnarsson, T.G., Kleijn, D., Spray, C.J., Szekely, T. and Thompson, D.B.A. (2012). A horizon scanning assessment of current and potential future threats to migratory shorebirds. *Ibis* **154**(4): 663-679.

Weller, D. W., Kidd, L.R., Lee, C.V., Klose, S., Jaensch, R. and Driessen, J. (2019). Directory of Important Habitat for Migratory Shorebirds in Australia – Chapter 2: New South Wales and Australian Capital Territory. Unpublished report prepared for Australian Government Department of the Environment and Energy by BirdLife Australia, Melbourne.

Weller, D. R. & Lee, C. V. (2017) Migratory Shorebird Conservation Action Plan. BirdLife Australia unpublished report, September 2017. Available at: https://birdlife.org.au/documents/SB-Migratory_Shorebird_Conservation_Action_Plan.pdf

World Migratory Bird day, Available at: <https://www.worldmigratorybirdday.org/>



Appendices

A. Site Account

Note: Site account has been directly transferred from the Australian National Directory of Important Migratory Shorebird Habitat.

Site Name: Manning River Estuary

Ramsar Site: NA

Directory of Important Wetlands: NA

Wetland Types: A5, A6, A7, A8

Flyway Network Site: NA

Key Biodiversity Area: NA

Land Tenure: Crown and private land.

Biogeographic Region: Karuah Manning/Macleay Hastings

Geographical Coordinates: -31.90247, 152.611756

Total Area: 4,181 hectares

Number of Count Areas: 2

International Significance Criteria:

Species Criteria: Not met

Species Abundance: Not met

National Significance Criteria:

Species Criteria:

Species	Threshold (0.1%)	Max count	Date of max count	Number of surveys meeting threshold	Data source
Pacific Golden Plover	120	210	02/04/2018	10	Shorebirds 2020, Birdata (2004 - 2016), Birdata
Double-banded Plover	19	123	16/06/2011	61	Shorebirds 2020, Birdata (2004 – 2016), Atlas Record Forms, Birdata, AWSG/Shorebirds 2020
Sanderling	30	73	28/01/2009	5	Shorebirds 2020. Birdata (2004 – 2016)
Eastern Curlew	35	61	26/03/2013	15	Shorebirds 2020, Birdata (2004 – 2016), Eremaea Birds, AWSG/Shorebirds 2020

Species Abundance: Not met

Species Diversity: Not m



C. Stakeholders

Below is a list of stakeholders relevant to the implementation of this Site Action Plan in the Manning River Estuary. This list is not exhaustive and a key aim of this Site Action Plan is to increase the diversity and number of stakeholders involved.

Birdlife Australia

Crown Lands

Hastings Birdwatchers Club

Hunter Bird Observers Club

Hunter Local Land Services

Manning Coastcare

Manning Great Lakes Birdwatchers Inc.

MidCoast Council

MidCoast to Tops Landcare Connection

NSW Department of Primary Industries – Fisheries

NSW Department of Primary Industries and Environment

NSW National Parks and Wildlife Service

Roads and Maritime Services

Taree Indigenous Development and Employment

University of Newcastle

UNSW Water Research Lab



D. Workshop Attendees

Name	Organisation
Alan Stuart	Hunter Bird Observers Club
Andrea Griffin	University of Newcastle
Brian Hughes	Hunter Local Land Services
Jennifer Lewis	Hunter Local Land Services
Jessica Lek	MidCoast to Tops Landcare Connection
Katherine Howard	NSW National Parks and Wildlife Service NPWS
Peggy Svoboda	Hunter Local Land Services
Milly Formby	BirdLife Australia
Anne Rorke	Manning Coastcare
Helen Kemp	Manning Coastcare
Jaimee Vlastuin	Crown Lands
Karen Bettink	MidCoast Council
Nicholas Colman	MidCoast Council
Pedda Cody	Taree Indigenous Development and Employment
Reegan Walker	Hunter Local Land Services
Rye Gollan	Hunter Local Land Services
Silas Darnell	Beach Warden
Peter West	Hastings Birdwatchers
Sue Proust	Hastings Birdwatchers



Local Land Services



National Landcare Program



This project is supported by Hunter Local Land Services through funding from the Australian Government's National Landcare Program.



birds are in our nature

