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Port Stephens Estuary Shorebird Site Action Plan

Prepared by

BirdLife Australia

for

Hunter Local Land Services

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More information on the National Migratory Shorebird Conservation Action Plan:
<http://birdlife.org.au/mscap> (Contact: shorebirds@birdlife.org.au)



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Native Title Recognition

We acknowledge the Awabakal and Worimi 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.

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The Port Stephens 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
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

“Port Stephens Estuary to the north of Stockton Bight supports the largest internationally significant population of Eastern Curlew (Weller et al. 2019) as well as one of the largest breeding colonies of Little Tern in New South Wales. This plan is aimed at supporting migratory shorebirds currently utilising this site and outlines actions to improve habitat conditions and availability for migratory shorebirds to help secure the role they play in global shorebird conservation.”

This document sets out a combined Migratory Shorebird Site Action Plan for Port Stephens in New South Wales. As 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 Port Stephens is highly important. This plan identifies (1) the actions to be taken to ensure that Port Stephens remains intact and is improved as a secure site for shorebird species, and (2) the stakeholders that will be involved in implementing 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 (Weller and Lee 2017), which offers a framework for the conservation of migratory shorebirds that regularly visit Australia. 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 Port Stephens Shorebird Site Action Plan is to protect, conserve and improve key roosting and feeding habitat at this site for long-term use by shorebirds. The plan is structured around the following objectives:

- (1) monitor and increase knowledge of migratory 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 shorebirds in Port Stephens 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 this site and the people connected to it plays 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 (Weller and Lee 2017).

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.

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 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 ([Appendix A](#), 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 the 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 SAPs 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 SAP 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 change and sea level rise
- 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 and many species have high site fidelity. 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 positively affect 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.



Figure 2. Panoramic view of Nelson Bay from Mount Tomaree lookout, Nelson Bay, NSW. *Credit: Kanwar Plaha*

Port Stephens Shorebird Site Action Plan

Site description

Port Stephens is approximately 145 kilometres north of Sydney within the NSW North Coast Bioregion. The area is an extensive estuarine system covering 24,300 hectares with over 1904 hectares of mangroves, 1439 hectares of seagrass and 1063 hectares of saltmarsh (Creese et al. 2009). Beach dunes support coastal scrubs succeeding into swamp forests and floodplain forest. Freshwater swamps occur between the outer barrier dunes and terrestrial dunes. Port Stephens has 11 shorebird count areas, which includes the internationally recognised Ramsar site of Myall Lakes and nationally important wetlands of Port Stephens Estuary and Salt Ash Air Weapons Range (Weller et al. 2019) (**Figure 3**).

Port Stephens is made up of several smaller foreshore villages including Nelson Bay, Shoal Bay, Tanilba Bay, Salamander Bay and Karuah. The natural values of Port Stephens attract large volumes of tourists every year and it is the fastest growing tourist destination in the lower Hunter region (Port Stephens and Myall Lakes Estuary Management Plan 2000). The estuary is valued for its scenic coastlines and supports a range of recreational activities, including boating and fishing. Port Stephens also supports a large aquaculture industry, made up primarily of oyster farmers. Land use surrounding the estuary is primarily agricultural and also includes the nearby RAAF base and Williamstown Airport.

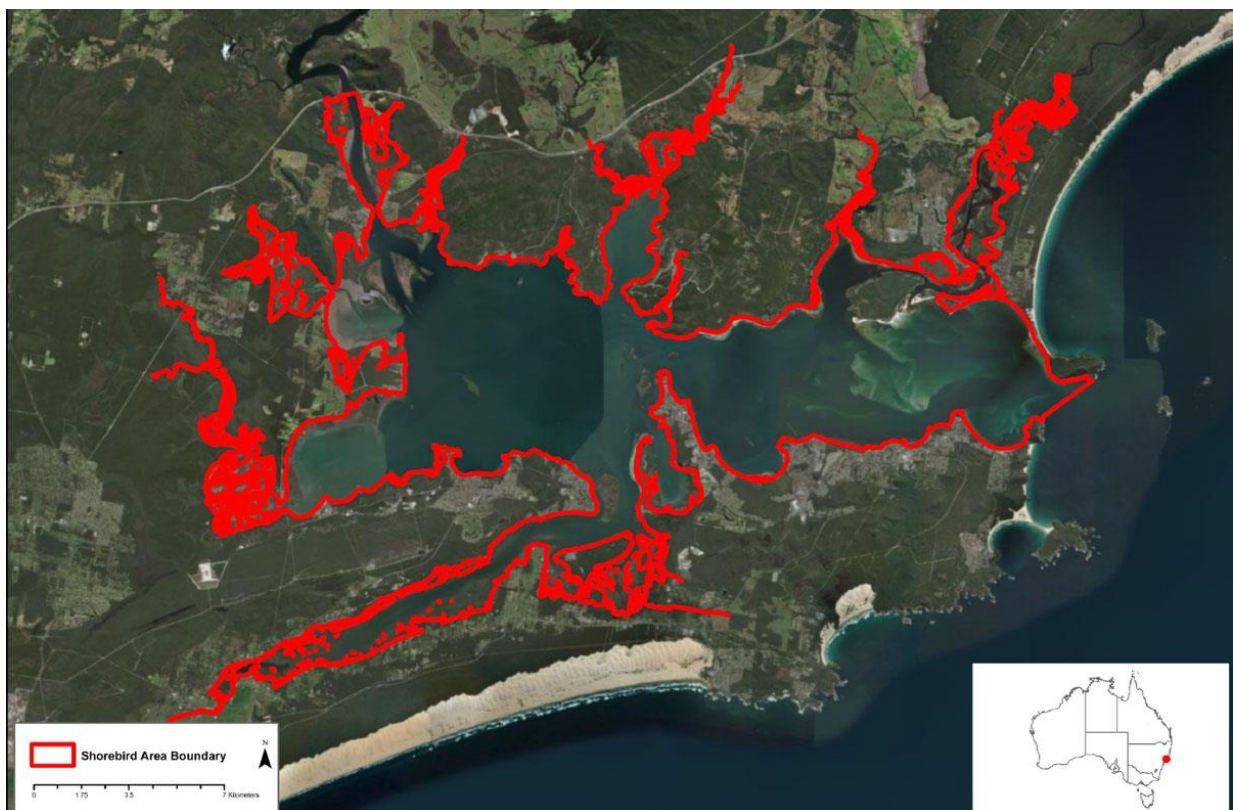


Figure 3. Map of Port Stephens Estuary from BirdLife Australia's Directory of Important Migratory Shorebird Habitat.



This unique estuary supports:

- internationally significant populations Eastern Curlew (*Numeniensis madagascariensis*) and
- nationally significant populations of Bar-tailed Godwit (*Limosa lapponica*), Whimbrel (*Numenius phaeopus*), Sharp-tailed Sandpiper (*Calidris acuminata*), Grey-tailed Tattler (*Tringa brevipes*) and Double-banded Plover (*Charadrius bicinctus*) (**Table 3**, see [Appendix A](#) for count data)
- one of the largest breeding colonies of endangered Little Tern (*Sterna albifrons*) in NSW

Table 1. State and Commonwealth conservation status of internationally and nationally significant migratory shorebird species in Port Stephens Estuary.

Species	NSW Conservation Status	Commonwealth Conservation Status
Eastern Curlew <i>Numeniensis madagascariensis</i>	Not listed	Critically endangered
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Grey-tailed Tattler <i>Tringa brevipes</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Whimbrel <i>Numenius phaeopus</i>	Not listed	Migratory (CAMBA, JAMBA, ROKAMBA)
Double-banded Plover <i>Charadrius bicinctus</i>	Not listed	Migratory
Little Tern <i>Sterna albifrons</i>	Endangered	Marine and migratory (CAMBA, JAMBA, ROKAMBA)

In addition to the above migratory species, Port Stephens is also one of the most important sites in NSW for breeding Little Tern (*Sterna albifrons*) and Pied Oystercatcher (*Haematopus longirostris*), listed as endangered in NSW, and Beach Stone-curlew (*Esacus magnirostris*), listed as critically endangered. Biannual boat surveys of Port Stephens are currently undertaken by the HBOC in January and July as part of BirdLife Australia's National Shorebird Monitoring program. The HBOC also conduct monthly surveys of the largest high tide roost in the estuary, Swan Bay.



Overview of objectives

The Port Stephens Site Action Plan aims to ensure that these three sites remain available and their habitat features are improved as roosting and feeding sites for migratory shorebirds over the long-term. This will be achieved by implementing the actions set out in this Site Action Plan that minimise threats through implementing an on-ground focused management plan and increasing public awareness.

This Site Action Plan sets out the following objectives to protect the roosting and feeding habitat of shorebirds in Port Stephens:

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

Under each objective, a list of strategies, issues and their corresponding actions and intended outcomes are provided. These actions will be implemented by various key stakeholders through the formation of two working groups (see [Appendix C](#) for list of stakeholders).

Note: We acknowledge that Port Stephens 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 additional management actions, particularly where nesting birds are concerned.

Action prioritisation

Actions identified for the Shorebird Site Action Plan for Port Stephens 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 migratory shorebirds.

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

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



Objectives, strategies & actions – Port Stephens

Objective 1: Monitor and increase knowledge of migratory shorebird populations

1.1 STRATEGY: Increase scientific knowledge about migratory shorebirds in Port Stephens

Conservation efforts to mitigate threats facing migratory shorebirds are often hampered by significant knowledge gaps in migratory 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. Standardised monitoring is the core activity for comprehensive understanding of seasonal migratory shorebird demographics at important feeding and roosting sites. Furthermore, the data collected are the foundation of research that is crucial for increasing the currently limited scientific knowledge about migratory shorebirds. This understanding has not been reached at Port Stephens 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 shorebird conservation in Port Stephens 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 data on the movement of shorebirds within the estuary and exchange with other shorebird sites in NSW (in particular Hunter Estuary, Worimi Conservation Lands and Manning River Estuary) during and outside of migration periods. Current survey methods do not provide evidence of interchange.
- Limited knowledge of roosting and feeding sites, particularly at night-time. Current survey methods are constrained by daylight hours, tides and boat access. Need to focus on interspecific variation in day- and night-time roosting and feeding locations.
- Lack of understanding of the diversity of feeding needs across species and the resource 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 and predict which species will be impacted most negatively by beach erosion and sea level rise.
- Limited knowledge of the impacts of predation and predation rates. Presence of predators (i.e. foxes) on Corrie Island is known but not the extent and intensity of predation on migratory shorebirds.
- 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 shorebirds, and which species will be most affected. Need to undertake climate change modelling specific to migratory shorebird habitat to identify priority areas for future planning measures.
- Lack of understanding about the impacts of mangrove encroachment and other weeds on shorebird roosting and feeding sites. Need to understand if mangrove vegetation is protecting current shorebird sites by providing a buffer to erosion and other potential impacts of climate change-induced sea level rise.

1.1.1 ACTIONS

1. Continue biannual surveys by boat facilitated by HBOC in February and July, and monthly high tide counts of Swan Bay.
Priority: high
2. Identify and quantify levels of disturbance of and threats to shorebirds at roosting and foraging sites they use.
Priority: high
3. Undertake a comprehensive literature review of migratory shorebird behavioural ecology in Port Stephens. As part of the literature review, collate and analyse existing survey data, identify key data gatherers, and facilitate information and data sharing by initiating data sharing agreements.
Priority: high
4. Create an online research hub to facilitate sharing of information, data, resources and educational materials used for community engagement and shorebird management to motivate conscientious social behaviour change toward shorebirds.
Priority: high
5. Undertake research into spatial and temporal distribution of interspecific shorebird foraging and roosting behaviour using planned MOTUS radio telemetry network and bird banding program. Include substrate analysis to understand how Port Stephens supports and maintains species diversity. Compare these data with sites in the Hunter and Manning River Estuaries.
Priority: high
6. Collaborate with researchers to undertake comprehensive vegetation mapping to predict high quality roosts/foraging areas for shorebirds, including a historical assessment of changes to mangrove distribution to identify potential encroachment issues.
Priority: medium



7. Work with Council to implement a community engagement program to educate the community about the value of Port Stephens estuary as an important migratory shorebird site.
Priority: medium
8. Organise a collaboration between key stakeholders and researchers to create forecast maps of potential changes to mudflat, saltmarsh and mangrove habitat distributions due to climate change induced sea level rise and discuss mapping and modelling that has been done already. Include research into the role of mangroves in providing protection to shorebird habitat from erosion.
Priority: medium

1.2 STRATEGY: Recruit and train of diverse 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. Volunteers from the HBOC currently coordinate biannual boat surveys of Port Stephens, which are broken up into 6 transects all conducted on the same day. Survey monitoring participants are limited by boat capacity (2 pax + skipper) and HBOC currently have more volunteers wanting to participate than can be accommodated.

However, there is a view to expand surveys to include more sites with more frequent monitoring. The HBOC do not actively recruit volunteers and although initial interest is high, retention rates are low, and monitoring relies on long-term volunteers to donate their spare time. Therefore, an active recruitment process is required to achieve this.

1.2.1 ACTIONS

1. Explore opportunities with indigenous ranger groups for the creation of a Beach Warden role on Corrie Island to oversee monthly surveys and monitoring of disturbance, predation and Little Tern breeding colony.
Priority: high
2. 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
3. Facilitate shorebird identification and data collection training workshops 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

4. Provide training for current volunteers on how to mentor new volunteers in the field to gain confidence with shorebird identification and monitoring.

Priority: medium

5. Reach out to university students looking for fieldwork and Work Integrated Learning (WIL) opportunities.

Priority: low

1.3 Outcomes

- Birdlife Australia's National Monitoring Program has substantial support from local stakeholders. The number of shorebird counters from the local community has increased.
- 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 and land managers.
- Scientific research is translated 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

Port Stephens is a growing tourist destination with increasing residential and urban development. As such, recreational use of the estuary is high. Issues of concern include people walking on the beach, dogs off leash, 4WDs and recreational vehicles on the beach, quad bikes at Swan Bay, recreational fishing, swimming, illegal camping on Dowadee Island, jet skiing, boating, drones and light aircraft. The intensity of these disturbances is higher during peak holiday seasons (October long weekend, Christmas, New Years, Easter). Nearby Williamtown Airport and the RAAF base also cause overhead disturbances from commercial and military aircraft. Proposed dredging near Corrie Island also has potential to cause disturbance to the Little Tern breeding colony from deposition of sand at the end of Jimmy's Beach for renourishment / erosion protection and will provide people with easier access to the island. These disturbances may interact and cause compounded issues that pose a threat to roosting and feeding migratory and breeding resident shorebirds.

2.1.1 ACTIONS

1. Expand current surveys of Port Stephens to include measures of disturbance. Quantify the types, levels and sources of recreational disturbance and the effects they have on migratory shorebirds and Little Terns at the two main roosting sites of Swan Bay and Corrie Island. Use these data as the basis for prioritising actions to minimise disturbance at key roosting and feeding sites.
Priority: high
2. Implement temporary exclusion zones for Little Terns on Corrie Island with signage and fencing during their breeding season.
Priority: high
3. Discuss with NPWS the potential to increase ranger presence on Corrie Island and Winda Woppa Spit through a Beach Warden Program.
Priority: high
4. Facilitate compliance and limit illegal vehicle access by increasing signage at boat ramps and estuary entrance points at Swan Bay, Corrie Island and Winda Woppa Spit to educate the local community, visitors and waterway users about disturbance to migratory shorebirds. Explore options with NPWS to prevent vehicle access with fencing or other measures.
Priority: medium



5. Collaborate with the HBOC and indigenous ranger groups to establish a Dog's Breakfast program at Corrie Island to educate visitors on the importance of keeping their dog on a leash to protect shorebirds during peak holiday periods.

Priority: medium

6. Increase distribution of educational shorebird outreach materials by utilising existing tourism industry networks (e.g. Visitor's Centre, marinas, dolphin / whale tour operators, ferry drivers, etc.). Explore opportunities for a shorebird exhibition at the Visitor's Centre and boat tour guides to include shorebirds.

Priority: low

2.2 STRATEGY: Reduce impacts from pest animals

Pest animals present a threat to migratory shorebirds through habitat modification, disturbance and possible predation. Pest animal species present at Port Stephens include feral cat (*Felix catus*), European red fox (*Vulpes vulpes*) and brown and black rats (*Rattus norvegicus* and *Rattus rattus*). Increasing populations of feral deer are also a problem as they alter shorebird habitat by grazing on saltmarsh and mangroves, and trample resident shorebird nests. A successful fox baiting program has been implemented, however, the impacts of these pest species on migratory shorebirds is unknown.

Native predators that are an issue for nesting Little Terns and other resident shorebird species include Gull-billed Terns, ravens, lace monitors and various raptors.

2.2.1 ACTIONS

1. Continue fox control program on Winda Woppa and Corrie Island. Discuss potential to expand fox trapping to include Swan Bay. Employ professional for ground shooting when needed to target problem individuals and avoid non-target dingo fatalities.

Priority: medium

2. Redress legislation to include feral cat control in collaboration with the HLLS Australasian Bittern Project. Investigate the impact of cats and foxes on shorebirds and bitterns using camera traps at shorebird roost sites and utilising the MOTUS network to track pest species with radio telemetry tags. Use these data to identify which species are having the greatest impacts on bird populations in Port Stephens to direct future control measures.

Priority: medium

3. Explore non-lethal methods of control for wild dogs and dingoes.

Priority: low



4. Train and upskill volunteers to collect data on native and pest predatory species when monitoring shorebirds. Expand Birddata surveys to include predation and vegetation assessment fields.

Priority: low

5. Educate recreational and commercial fishers about attracting predators to key shorebird sites.

Priority: low

2.3 STRATEGY: Minimise impact of vegetation encroachment

Port Stephens is experiencing vegetation encroachment from the spread of weeds including spiny rush (*Juncus acutus*), bridal creeper (*Asparagus asparagoides*), pasture grasses, Bitou bush (*Chrysanthemoides monilifera*), invasive exotic perennials and ground asparagus (*Asparagus aethiopicus*). These plants do not currently impact on shorebirds in Port Stephens but have the potential to reduce the amount of available habitat for shorebirds to feed and roost.

2.3.1 ACTIONS

1. Undertake weed control measures if pest weed species are identified as an issue in key areas where they have the potential to impact on shorebird feeding and roosting sites.

Priority: low

2.4. Outcomes

- Behaviour of migratory shorebirds are regularly monitored and responses to recreational disturbance are assessed.
- Presence of foxes and deer are minimised and where possible, eliminated from the surroundings of Port Stephens. The impacts of other pest species are monitored and control measures are put in place.
- Vegetation encroachment is monitored and halted before it has an impact on shorebird roosting and feeding sites, and areas of open water habitat remain or increase in extent.



Objective 3: Maintain and protect key habitat values

3.1 STRATEGY: Improve and monitor hydrological regimes

Port Stephens has a long history of altered hydrological regimes due to agriculture and increasing development and urbanisation. Periods of high rainfall decrease water quality due to sediment and nutrient runoff into the estuary from Karuah. Acid sulfate soils have been identified as an issue at Anna Bay and Tilligerry Creek, as have *E. coli* and faecal coliforms. Potential contamination may also be an issue at Taylors Beach, which used to be an important shorebird site but is no longer. Anecdotal evidence of reduced benthos and unpleasant smell suggest further research is needed to establish why this is the case. Further, per- and poly-fluoroalkyl substances (PFAS) used in fire-fighting chemicals from the nearby Williamstown RAAF base have caused groundwater contamination in some parts of Port Stephens.

Hydrology at the Swan Bay and Gir-um-bit shorebird roosting sites have also been altered by draining to limit mosquito populations becoming a problem for nearby residents. This has resulted in a reduction in saltmarsh habitat and in increase in acid-sulfate soils. Last, high boating and fishing activity in the port has led to issues with marine debris, and fuel and holding tank spills.

3.1.1 ACTIONS

1. Investigate areas that can be set aside for conservation of saltmarsh through acquisition, incentives to modify title, conversion to saltmarsh, fencing, weed removal and other tools.
Priority: high
2. 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: medium
3. Investigate potential to offset the shorebird roosting site at Swan Bay and rehabilitate the saltmarsh through removal of drainage channels. Need to ensure that any changes do not disrupt existing conditions that favour roosting.
Priority: medium
4. Undertake analysis of pollution levels, and benthos diversity and abundance at Taylors Beach compared to other shorebird sites within Port Stephens to understand the impacts of agricultural run-off, boating and fishing on shorebird prey species.
Priority: medium



5. Continue marine debris clean-up programs at priority sites and continue to submit collection data to Tangaroa Blue. Expand marine debris clean-ups to include community members (e.g. local 4WD clubs).
Priority: medium
6. Incorporate rubbish removal education campaign into community engagement strategy. Consider installation of fishing line bins to encourage appropriate disposal of fishing line.
Priority: medium
7. Explore potential for stakeholders to collaborate with researchers and oyster farmers to extend current research identifying sources of waterway pollutants (e.g. brighteners in washing powder, faecal coliforms) to include shorebird prey species.
Priority: low

3.2 STRATEGY: Future planning for potential impacts of climate change

Climate change has the potential to affect migratory shorebirds and their habitats by reducing 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. At present there is limited understanding of how climate change will affect migratory shorebirds in Port Stephens. Expected impacts include changes to erosion and sedimentation due to sea level rise, and limited range for shorebird habitat migration.

Areas considered most vulnerable to sea level rise in Port Stephens include the intertidal zone around Swan Bay where extensive saltmarsh habitat exists, Corrie Island and the low mudflats against rocky shorelines along the northern shore of Soldier's Point as there is no room for these habitats to migrate. Increased frequency of inundation due to storm surge is also an issue for nesting Little Terns on Corrie Island. Therefore, long-term planning for rising sea level from climate change is needed.

3.2.1 ACTIONS

1. Continue efforts to map predictions for sea level rise as part of the Port Stephens Coastal Management Plan. Extend predictions to account for potential limits on habitat migration for coastal saltmarsh and intertidal mud flats due to residential and commercial infrastructure.
Priority: medium



2. Discuss potential for future collaboration with oyster farmers to expand on already existing oyster reefs to be used as artificial roost sites for shorebirds

Priority: low

3. Limit clearing of vegetation (i.e. mangroves, woodland and dry forest) on higher beach areas that may provide a buffer to shorebird roosting and feeding sites.

Priority: low

3.3 Outcomes

- High water quality is maintained through monitoring and support of private landholders to manage agricultural nutrient runoff.
- Amount and connectivity of saltmarsh remains intact or is expanded through acquisition, conversion, or other means to provide roosting and feeding habitat for migratory shorebirds.
- Marine debris is minimised through regular clean-up activities and community engagement.
- Shorebird roosting and feeding habitat is 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 coordination across responsible agencies can be a challenge for effective environmental management. Protection of migratory shorebirds and their habitat in Port Stephens critically depends on support by all stakeholders and people using the area. Without support from the stakeholders involved in managing the site and from the local community of the locals, it will not be possible to protect migratory shorebirds in Port Stephens.

4.1.1 ACTIONS

1. Identify land authorities and owners, with emphasis on who has jurisdiction over each area.
Priority: high
2. Establish a working group for migratory shorebirds modelled on Manning BNB Working Group to discuss and implement actions from this plan, including a communications strategy.
Priority: high
3. 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.
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 indigenous values in the area when undertaking any management actions for migratory shorebirds.
Priority: medium

4.2. STRATEGY: Identify and manage conflicts of land use

Port Stephens is a growing tourist destination and supports commercial oyster fishing. Activities associated with tourism, industry and recreation 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 shorebirds or because areas are zoned to keep different user groups apart, which can result in a larger area being impacted.



A recent land use conflict identified in Port Stephens was a case of illegal land clearing and subsequent sediment run-off caused by a private land holder at Fame Cove that resulted in the loss of extensive areas of seagrass. Three attempts for an expansion approval have also been made by the local marina at Soldier's Point that may arise again. Further, many shorebirds and waterbirds roost on abandoned infrastructure from past oyster leases, which are scheduled to be removed. It is unclear if there is alternative roosting habitat available for these birds. Development on low-lying areas that may be crucial for habitat migration with sea level rise is also of concern.

4.2.1 ACTIONS

1. Work with BirdLife Australia to have Port Stephens listed as a Key Biodiversity Area.
Priority: high
2. Review the value of abandoned oyster leases for shorebirds. Liaise with Port Stephens Council during the upcoming review of the Port Stephens Coastal Management Plan.
Priority: medium
3. Continue to monitor developments around the marina expansion at Soldier's Point and aquaculture proposal.
Priority: low

4.2 Outcomes

- Land managers and site boundaries are identified, and roles and responsibilities are agreed on.
- Response Management strategy for important feeding and roosting sites is implemented in a timely manner.



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

5.1. STRATEGY: Create and implement an effective CEPA strategy

Many threats to migratory shorebirds can be effectively addressed by raising awareness. To achieve this objective, a range of community education, participation and awareness (CEPA) activities will need to be implemented. Existing information about migratory shorebirds can be difficult to access and restricted to stakeholders with specialist knowledge. Community engagement efforts in Port Stephens are currently opportunistic rather than coordinated and strategic. A strategic communications plan will unify and focus efforts to maximise positive results for migratory shorebirds in Port Stephens.

5.1.1 ACTIONS

1. Develop a regional shorebirds communications strategy in line with current efforts between stakeholder groups to provide educational resources and community engagement.
Priority: high
2. Utilise existing social and local media (i.e. radio, newspapers) channels to develop and implement a targeted campaign that promotes awareness of migratory shorebirds to visitors and residents of the estuary. Provide a regular bulletin from the working group to update the community of recent actions for shorebirds in Port Stephens.
Priority: medium
3. Use the working group and online hub to collate and distribute existing education materials. Continue to create new resources with stakeholder and community groups to raise the profile of migratory shorebirds (e.g. distribution of Shorebird ID booklets to local schools, community groups and Council).
Priority: medium
4. Collaborate with Hunter Wetlands Centre Australia and Wetlands and Awabakal Environmental Education Centre to engage schools with migratory shorebirds through the Discovery Rangers program.
Priority: low
5. 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 changes behaviour that result in less disturbance to migratory and resident shorebirds.



Summary of Key Knowledge Gaps – Port Stephens

Knowledge gaps relevant to shorebird conservation in Port Stephens 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 data on the movement of shorebirds within the estuary and exchange with other shorebird sites in NSW (in particular Hunter Estuary, Worimi Conservation Lands and Manning River Estuary) during and outside of migration periods. Current survey methods do not provide evidence of interchange.
- Limited knowledge of roosting and feeding sites, particularly at night-time. Current survey methods are constrained by daylight hours, tides and boat access. Need to focus on interspecific variation in day- and night-time roosting and feeding locations.
- Lack of understanding of the diversity of feeding needs across species and the resource 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 and predict which species will be impacted most negatively by beach erosion and sea level rise.
- Limited knowledge of the impacts of predation and predation rates. Presence of predators (i.e. foxes) on Corrie Island is known but not the extent and intensity of predation on migratory shorebirds.
- 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 shorebirds, and which species will be most affected. Need to undertake climate change modelling specific to migratory shorebird habitat to identify priority areas for future planning measures.
- Lack of understanding about the impacts of mangrove encroachment and other weeds on shorebird roosting and feeding sites. Need to understand if mangrove vegetation is protecting current shorebird sites by providing a buffer to erosion and other potential impacts of climate change-induced sea level rise.



Summary of Actions – Port Stephens

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 Link
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Continue biannual surveys by boat facilitated by HBOC in February and July, and monthly high tide counts of Swan Bay.	Action 1.1.1-1
Objective 2: Reduce, or eliminate human and introduced threats	Discuss with NPWS the potential to increase ranger presence on Corrie Island and Winda Woppa Spit through a Beach Warden Program.	Action 2.1.1-3
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 modelled on Manning BNB Working Group to discuss and implement actions from this plan, including a communications strategy.	Action 4.1.1-2
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Identify and quantify levels of disturbance of and threats to shorebirds at roosting and foraging sites they use.	Action 1.1.1-2
	Undertake a comprehensive literature review of migratory shorebird behavioural ecology in Port Stephens. As part of the literature review, collate and analyse existing survey data, identify key data gatherers, and facilitate information and data sharing by initiating data sharing agreements.	Action 1.1.1-3
	Undertake research into spatial and temporal distribution of interspecific shorebird foraging and roosting behaviour using planned MOTUS radio telemetry network and bird banding program. Include substrate analysis to understand how Port Stephens supports and maintains species diversity. Compare these data with sites in the Hunter and Manning River Estuaries.	Action 1.1.1-5
	Explore opportunities with indigenous ranger groups for the creation of a Beach Warden role on Corrie Island to oversee monthly surveys and monitoring of disturbance, predation and Little Tern breeding colony.	Action 1.2.1-1
Objective 2: Reduce, or eliminate human and introduced threats	Expand current surveys of Port Stephens to include measures of disturbance. Quantify the types, levels and sources of recreational disturbance and the effects they have on migratory shorebirds and Little Terns at the two main roosting sites of Swan Bay and Corrie Island. Use these data as the basis for prioritising actions to minimise disturbance at key roosting and feeding sites.	Action 2.1.1-1



	Implement temporary exclusion zones for Little Terns on Corrie Island with signage and fencing at key breeding times of the year.	Action 2.1.1-2
	Continue fox baiting and trapping program on Winda Woppa and Corrie Island. Discuss potential to expand fox trapping to include Swan Bay. Employ professional for ground shooting when needed to target problem individuals and avoid non-target dingo fatalities.	Action 2.2.1-1
Objective 3: Maintain and protect key habitat values	Investigate areas that can be set aside for conservation of saltmarsh through acquisition, incentives to modify title, conversion to saltmarsh, fencing, weed removal and other tools.	Action 3.1.1-1
Objective 4: Develop fast tracked management responses	Work with BirdLife Australia to have Port Stephens listed as a Key Biodiversity Area.	Action 4.2.1-1
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Develop a regional shorebirds communications strategy in line with current efforts between stakeholder groups to provide educational resources and community engagement.	Action 5.1.1-1

Medium Priority

Objective	Action	Reference Link
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Create an online research hub to facilitate sharing of information, data, resources and educational materials used for community engagement and shorebird management to motivate conscientious social behaviour change toward shorebirds.	Action 1.1.1-4
Objective 3: Maintain and protect key habitat values	Investigate potential to offset the shorebird roosting site at Swan Bay and rehabilitate the saltmarsh through removal of drainage channels. Need to ensure that any changes do not disrupt existing conditions that favour roosting.	Action 3.1.1-3
	Continue marine debris clean-up programs at priority sites and continue to submit collection data to Tangaroa Blue. Expand marine debris clean-ups to include community members (e.g. local 4WD clubs).	Action 3.1.1-5
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
	Ensure the protection of indigenous values in the area when undertaking any management actions for migratory shorebirds.	Action 4.1.1-5
Objective 5: Increase Communication, Education, Participation and Awareness	Utilise existing social and local media (i.e. radio, newspapers) channels to develop and implement a targeted campaign that promotes awareness of migratory shorebirds to visitors and residents of the estuary. Provide a regular bulletin from the working group to update the community of recent actions for shorebirds in Port Stephens.	Action 5.1.1-2



Programme (CEPA) about migratory shorebird conservation	Use the working group and online hub to collate and distribute existing education materials. Continue to create new resources with stakeholder and community groups to raise the profile of migratory shorebirds (e.g. distribution of Shorebird ID booklets to local schools, community groups and Council).	Action 5.1.1-3
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Collaborate with researchers to undertake comprehensive vegetation mapping to predict high quality roosts/foraging areas for shorebirds, including a historical assessment of changes to mangrove distribution to identify potential encroachment issues.	Action 1.1.1-6
	Work with Council to implement a community engagement program to educate the community about the value of Port Stephens estuary as an important migratory shorebird site.	Action 1.1.1-7
	Organise a collaboration between key stakeholders and researchers to create forecast maps of potential changes to mudflat, saltmarsh and mangrove habitat distributions due to climate change induced sea level rise, and discuss mapping and modelling that has been done already. Include research into the role of mangroves in providing protection to shorebird habitat from erosion.	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 1.2.1-2
	Facilitate shorebird identification and data collection training workshops 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 1.2.1-3
	Provide training for current volunteers on how to mentor new volunteers in the field to gain confidence with shorebird identification and monitoring.	Action 1.2.1-4
Objective 2: Reduce, or eliminate human and introduced threats	Facilitate compliance and limit illegal vehicle access by increasing signage at boat ramps and estuary entrance points at Swan Bay, Corrie Island and Winda Woppa Spit to educate the local community, visitors and waterway users about disturbance to migratory shorebirds. Explore options with NPWS to prevent vehicle access with fencing or other measures.	Action 2.1.1-4
	Collaborate with the HBOC and indigenous ranger groups to establish a Dog's Breakfast program at Corrie Island to educate visitors on the importance of keeping their dog on a leash to protect shorebirds during peak holiday periods.	Action 2.1.1-5
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 3.1.1-2
	Incorporate rubbish removal education campaign into community engagement strategy. Consider installation of fishing line bins to encourage appropriate disposal of fishing line.	Action 3.1.1-6
	Continue efforts to map predictions for sea level rise as part of the Port Stephens Coastal Management Plan. Extend predictions to account for potential limits on habitat	Action 3.2.1-1



	migration for coastal salt marsh and intertidal mud flats due to residential and commercial infrastructure.	
Objective 4: Develop fast tracked management responses	Create an online hub to act as a centralised location for storing and disseminating information from the working group.	Action 4.1.1-4
	Review the value of abandoned oyster leases for shorebirds. Liaise with Port Stephens Council during the upcoming review of the Port Stephens Coastal Management Plan.	Action 4.2.1-3
Objective 5: Increase Communication, Education, Participation and Awareness Programme (CEPA) about migratory shorebird conservation	Collaborate with Hunter Wetlands Centre Australia and Wetlands Environmental Education Centre to engage schools with migratory shorebirds through the Discovery Rangers program.	Action 5.1.1-4
	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 5.1.1-5
Objective 2: Reduce, or eliminate human and introduced threats	Redress legislation to include feral cat control in collaboration with the HLLS Australasian Bittern Project. Investigate the impact of cats and foxes on shorebirds and bitterns using camera traps at shorebird roost sites and utilising the MOTUS network to track pest species with radio telemetry tags. Use these data to identify which species are having the greatest impacts on bird populations in Port Stephens to direct future control measures.	Action 2.2.1-2
Objective 3: Maintain and protect key habitat values	Undertake analysis of pollution levels, and benthos diversity and abundance at Taylors Beach compared to other shorebird sites within Port Stephens to understand the impacts of agricultural run-off, boating and fishing on shorebird prey species.	Action 3.1.1-4

Low Priority

Objective	Action	Reference Link
Objective 1: Monitor and increase knowledge of migratory shorebird populations	Reach out to university students looking for fieldwork and Work Integrated Learning (WIL) opportunities.	Action 1.2.1-5
Objective 2: Reduce, or eliminate human and introduced threats	Increase distribution of educational shorebird outreach materials by utilising existing tourism industry networks (e.g. Visitor's Centre, marinas, dolphin / whale tour operators, ferry drivers, etc.). Explore opportunities for a shorebird exhibition at the Visitor's Centre and boat tour guides to include shorebirds.	Action 2.1.1-6
	Train and upskill volunteers to collect data on native and pest predatory species when monitoring shorebirds. Expand Birdata surveys to include predation and vegetation assessment fields.	Action 2.2.1-4
Objective 3: Maintain and protect key habitat values	Explore potential for stakeholders to collaborate with researchers and oyster farmers to extend current research identifying sources of waterway pollutants (e.g. brighteners in washing powder, faecal coliforms) to include shorebird prey species.	Action 3.1.1-7
	Discuss potential for future collaboration with oyster farmers to expand on already existing oyster reefs to be used as artificial roost sites for shorebirds	Action 3.2.1-2



	Limit clearing of vegetation (i.e. mangroves, woodland and dry forest) on higher beach areas that may provide a buffer to erosion caused by sea level rise.	Action 3.2.1-3
Objective 4: Develop fast tracked management responses	Continue to monitor developments around the marina expansion at Soldier's Point and aquaculture proposal.	Action 4.2.1-4
Objective 2: Reduce, or eliminate human and introduced threats	Explore non-lethal methods of control for wild dogs and dingoes.	Action 2.2.1-3
	Educate recreational and commercial fishers about attracting predators to key shorebird sites.	Action 2.2.1-5
	Undertake weed control measures if pest weed species are identified as an issue in key areas where they have the potential to impact on shorebird feeding and roosting sites.	Action 2.3.1-1

Conclusion and Next Steps

This Site Action Plan for shorebirds provides a framework for a coordinated approach to shorebird conservation in Port Stephens. Regular population monitoring at these sites as part of the 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 shorebirds face in Port Stephens. If this plan is successful in (1) ongoing monitoring and increasing knowledge of migratory shorebird populations; (2) reducing, or eliminating human and introduced threats; (3) protecting key habitat values; (4) developing fast tracked management responses; (5) and increasing Communication, Education, Participation and Awareness Programmes for shorebird conservation, then the situation for shorebirds in Port Stephens will be substantially and sustainably improved in the mid- to long-term.

The issues identified for Port Stephens make it necessary to achieve broad collaboration amongst all stakeholders. They include problems such as lack of ongoing monitoring, human disturbance, pest animals, vegetation encroachment, altered hydrological regimes, and lack of communication strategy. All have been identified as playing a role in for the area. This list is likely incomplete and will be refined and extended in the future as new issues emerge and unforeseen aspects surface.



Appendices

A. Site Account

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

Site Name: Port Stephens

Ramsar Site: Myall Lakes

Directory of Important Wetlands:

REFCODE	Wetland Name
NSW034	Port Stephens Estuary
NSW178	Salt Ash Air Weapons Range

Wetland Types: A2, A6, A7, A8, A9, B13, B14, B10, B9, B4

Flyway Network Site: NA

Key Biodiversity Area: NA

Land Tenure: Crown land, freehold land, national park, Zone 5a-Defense Special Purposes and 7a-Environmental Protection. The surrounding area consists of freehold land, national park and crown land.

Biogeographic Region: NSW North Coast

Geographical Coordinates: -32.700413, 152.047749

Total Area: 24,300 hectares

Number of Count Areas: 11

International Significance Criteria:

Species Criteria:

Species	Threshold (1%)	Max count	Date of max count	Number of surveys meeting threshold	Number of surveys meeting national threshold	Data source
Eastern Curlew	350	406	17/02/2007	4	269	Shorebirds 2020, Birddata (2004 - 2016), Eremaea Birds, eBird, AWSG/Shorebirds 2020

This directory compared with previous assessment (Bamford et. al. 2008): Numbers of Eastern Curlew markedly lower.

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
Bar-tailed Godwit	325	1,366	10/02/2008	21	Shorebirds 2020, Birdata (2004 - 2016), AWSG/Shorebirds 2020
Grey-tailed Tattler	70	143	18/02/2007	4	Shorebirds 2020
Whimbrel	65	431	26/02/2006	17	Shorebirds 2020, Birdata (2004 – 2016), AWSG/Shorebirds 2020, Birdata
Sharp-tailed Sandpiper	85	120	26/02/2006	1	Shorebirds 2020
Double-banded Plover	19	74	20/07/2012	14	Shorebirds 2020, Birdata (2004 – 2016), Birdata

Species Abundance:

Threshold	Max Count	Date of max count	Number of surveys meeting threshold	Data source
2,000	2,497	18/02/2007	5	Shorebirds 2020

Species Diversity:

Threshold	Max Count	Date of max count	Number of surveys meeting threshold	Data source
15	21	07/07/2014	1	Birdata



B. List of Relevant Local Management Plans

Port Stephens and Myall Lakes Estuary Management Plan, Umwelt (Australia) Pty Limited (2000). Available at: <https://www.portstephens.nsw.gov.au/grow/land-environment-and-heritage/environmental-plans-and-strategy/port-stephens-and-myall-lakes-estuary-management-plan>

Jimmys Beach Coastal Zone Management Plan, Great Lakes Council (2016). Available at: <https://www.midcoast.nsw.gov.au/Environment/Coastal-River-Management/Coastal-Management>

C. Stakeholders

Below is a list of stakeholders relevant to the implementation of this Site Action Plan in the Hunter Estuary, Worimi Conservation Lands and Port Stephens. This list of 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

EcoNetwork

Hunter Bird Observers Club

Hunter Local Land Services

Hunter Regional Landcare Network

Lower Hunter Landcare

MidCoast Council

MidCoast to Tops Landcare Connection

Myall Koala and Environment Group

North Arm Cove Community Association

NSW Department of Primary Industries – Fisheries

NSW Department of Primary Industries and Environment

NSW National Parks and Wildlife Service

Ocean and Coastal Care Initiatives

Port Stephens Council

University of Newcastle

Water Research Lab



D. Workshop Attendees

Name	Organisation
Adrienne Ingram	Myall Koala and Environment Group
Alan Stuart	HBOC
Alissa Rogers	Hunter LLS
Andrea Griffin	University of Newcastle
Ann Woods	Myall Koala and Environment Group
Boyd Carney	NSW NPWS
Brian Hughes	Hunter LLS
Christophe Tourenq	DPIE
Daintry Gerrand	Hunter LLS, Regional Landcare
Deanne Phillips	NSW NPWS, Worimi Ranger
Helen Kemp	MidCoast to Tops Landcare Connection
Henrietta Mooney	Hunter Regional Landcare Network
Janine Reid	North Arm Cove Community Association
Jeannie Lawson	OCCI
Jennifer Lewis	Hunter LLS
Jessica Lek	MidCoast to Tops Landcare Connection
Jim Cutler	NSW NPWS
Judy Little	HBOC
Laura Rhodes	BirdLife Australia
Mathew Bell	MidCoast Council
Nadine Russell	NSW NPWS, Worimi Ranger
Nigel Dique	Ramsar Working Group
Peggy Svoboda	Hunter LLS
Reegan Walker	Hunter LLS
Rye Gollan	Hunter LLS
Susanne Callaghan	NSW NPWS



Local Land
Services



National
Landcare
Program



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birds are in our nature

