Best practice guidelines

Managing threatened beach-nesting shorebirds

CMA Sydney Metropolitan Catchment Management Authority

National Parks & Wildlife Service NSW

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Department of Environment & Climate Change NSW

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1 Introduction

About 85% of Australia's 21 million people live within 50 km of the coast (ABS 2003), placing enormous pressure on the country's dynamic and fragile shorelines. As a result, many species of shorebirds that live along these shorelines as either residents or seasonal migrants are threatened by habitat loss and disturbance at feeding, roosting and breeding sites. Breeding species are particularly susceptible to disturbance due to human-induced threats, introduced and native predators and the effects of extreme weather. Five species of shorebird that nest along the NSW coastline are listed as either endangered or vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act).

This guideline draws on knowledge of the biology and ecology of beach-nesting birds and experience gained from successful shorebird recovery programs to provide managers of threatened shorebirds with a toolkit of site management and threat management options.

There can be tremendous benefits for both people and shorebirds from involving the community in shorebird protection. A successful campaign will enable the birds to thrive while allowing people to enjoy the beach by taking part in low impact activities.

The Department of Environment and Climate Change (DECC) and the Sydney Metropolitan Catchment Management Authority (SMCMA) have chosen Towra Point Nature Reserve as a demonstration site (Figure 1) for managing beach-nesting birds. Towra Point lies at the mouth of Georges River on the southern shore of Botany Bay, in the heart of Sydney. DECC and the SMCMA have identified that on this site, used for nesting by little terns and pied oystercatchers, best practice management of threatened bird species is under way. This guideline includes examples of shoreline management at this site.

Photo: George Madani

Figure 1: Shorebirds at Towra Point

1.1 Towra Point Nature Reserve and Aquatic Reserve

Towra Point contains an aquatic reserve and a nature reserve with internationally protected wetlands managed by DECC. Towra Point Nature Reserve, which was gazetted in 1982, comprises 633 hectares of land, including the bed and foreshores of Weeney Bay, land at Quibray Bay, Towra Spit Island and the wetland foreshores along Woolooware Bay. Towra Point Aquatic Reserve, which was declared in 1987, comprises 1400 hectares of estuary which is divided into a sanctuary zone and refuge zone, which have different rules regarding recreation activities, such as fishing.

Towra Point was listed under the Ramsar Convention on Wetlands of International Importance in 1984 because it supports populations of migratory wading birds which roost and feed in and around Botany Bay (Figure 2). The birds are protected by international treaties between Australia, Japan and China. These are the Japan–Australian Migratory Bird Agreement (JAMBA), the China–Australia Migratory Bird Agreement (CAMBA), and the Japan–China Migratory Bird Agreement (JCMBA). Under the three treaties, the participating governments preserve and enhance migratory bird habitats listed under the agreements, engage in joint research programs and share information.

At least 34 of the 80 species of migratory birds protected under the CAMBA and JAMBA visit Towra Point, including the endangered golden plover (*Pluviallis dominica*) and the vulnerable terek sandpiper (*Xenus cinereus*). Some birds migrate over 12,000 kilometres from Siberia, China and Japan. In 1993, the wetlands within Towra Point Nature Reserve were recognised as one of the four most important sites for migratory wading birds in NSW.

As industrial development and human activity in and around Botany Bay have increased, many wetland dependent birds have been displaced from their previous habitat and rely on the Towra Point ecosystem as a sanctuary. Towra Spit Island is the only breeding site in the Sydney region for the endangered migratory species, the little tern (*Sterna albifrons*) (Figure 3), which has nested at Towra Point since 1992. The population has been brought back from the brink of extinction by implementing best practice management.

Photo: D Andrew , DECC

Figure 2: A flock of migratory bar-tailed godwits at Towra Point

2 Shorebirds

2.1 What are shorebirds?

Shorebirds (also sometimes called waders) are birds that feed by wading in shallow water or saturated sand and mud on the shores of lakes, rivers and the sea (Geering et al 2007). While a distinction is often made between shorebirds and seabirds, seabirds that utilise shoreline habitats in NSW for breeding and feeding have also been included as shorebirds for the purpose of these guidelines. Beaches, sand flats and tidal estuaries are favoured places for this diverse group of birds that includes both resident and migratory birds such as sandpipers, curlews, plovers, stilts, snipe, terns, gulls, godwits and oystercatchers.

2.2 Resident shorebirds at Towra Point

Resident shorebirds are present at Towra Point year-round, nesting during the spring and summer, although they sometimes move in groups to follow food resources in the winter. Resident threatened birds at Towra Point include the:

- pied oystercatcher *Haematopus longirostris* (Figure 4), which nests at several locations in Botany Bay, including Towra Point
- sooty oystercatcher *Haematopus fuliginosus* (Figure 5), which forages along rocky shorelines and nests on offshore rocky islands. These birds forage and roost at Towra Point and nest at the nearby Five Islands Nature Reserve off Wollongong.

The red-capped plover *Charadrius ruficapillus*, a more common beach-nesting bird, is also found at Towra Point and often nests with the other species.

2.3 Migratory shorebirds at Towra Point

A much larger group of shorebirds are the migrants, most of which visit Australian shores each summer from their breeding grounds in the northern hemisphere. They begin appearing in August and September and stay until as late as March before returning to the northern hemisphere to breed. The little tern is an exception to the rule, migrating from Asia to Australia each year to breed in summer at the mouths of estuaries.

Seven non-breeding summer migrant species are listed as threatened in NSW under the TSC Act. Of these, regular visitors to Towra Point include the great knot *Calidris tenuirostris*, greater sand-plover *Charadrius leschenaultia*, lesser sand-plover *Charadrius mongolus*, sanderling *Calidris alba*, and terek sandpiper *Xenus cinereus*. Many more species that are not listed as threatened are regular visitors to Botany Bay including the bar-tailed godwit *Limosa lapponica* (Figure 6), eastern curlew *Numenius madagascariensis* (Figure 7), whimbrel *Numenius phaeopus*, grey-tailed tattler *Heteroscelus brevipes*, ruddy turnstone *Arenaria interpres* and sharp-tailed sandpiper *Calidris acuminata*.

2.4 Threatened shorebirds not found at Towra Point

Resident threatened shorebirds that are not present at Towra Point but are the subject of intensive recovery programs in other parts of NSW include the endangered hooded plover *Thinornis rubricollis* (Figure 8) in the south of the state and the beach stone-curlew *Esacus neglectus* (Figure 9) in the north of the state.

Migratory threatened species that rarely visit Towra but are found at a range of other sites along the NSW coast include the black-tailed godwit *Limosa limosa* and the broad-billed sandpiper *Limicola falcinellus*.

2.5 Nesting preferences

Shorebirds are typically ground-nesting birds, laying their eggs in simple shallow scrapes in sand, shingle, shell grit and pebbles, or in shallow depressions lined with grass and other vegetation (Figure 10). Four beach-nesting bird species are recognised as threatened in NSW under the TSC Act, three resident and one migratory species. Of these, the migratory little tern is a colonial nester with dozens of pairs gathering in noisy groups that help to deter the unwanted attention of predators such as ravens and gulls. The resident species – the pied oystercatcher, hooded plover and beach stone-curlew – choose the isolation of individual pairs and rely on the camouflage of nests and eggs and cryptic behaviour to avoid detection. Due to historical declines and ongoing threats, the density of nesting pairs of all these species is low, so much suitable habitat is unoccupied.

Photo: DECC

Figure 3: A little tern's nest reveals how well camouflaged the eggs are. Care must be taken not to tread on eggs (see page 8)

2.6 Foraging and roosting

Shorebirds generally forage between the high and low water mark and feed on small crustaceans, molluscs, insects and other small invertebrates. At high tide, when water covers feeding grounds, shorebirds congregate at roosting sites and large mixed flocks can often be seen. At this time, the birds are in concentrated densities and can be easily surveyed, and species lists and counts can be easily obtained.

2.7 Descriptions of Towra Point shorebirds

Photo: DECC

Figure 4: Little tern *Sterna albifrons*

Little tern

The little tern is the smallest tern found in Australia. This white bird has a bright yellow beak, grey wings and black cap, and can often be seen undertaking aerial acrobatics or hovering above the water's surface before plunging in to catch small fish. It nests on sand spits, islands and beaches at or near estuary openings. When nesting, it carries small pieces of weeds or shells to decorate the nest. Both parents share incubation duties. Intruders to nesting colonies are met with loud vocal cries, swooped on, and pecked in mid air, and may even be mobbed by the flock. When threatened, chicks will freeze in their sand scrape or hide among low vegetation, driftwood or other available cover. Little terns require ongoing recovery actions to ensure their colonies thrive.

Photo: Jodie Dunn

Figure 5: Pied oystercatcher *Haematopus longirostris*

Photo: Jodie Dunn

Figure 6: Sooty oystercatcher *Haematopus fuliginosus*

Photo: Martin Schulz

Figure 7: Bar-tailed godwits *Limosa lapponica*

Pied oystercatcher

One of the most distinctive shorebirds in NSW with their striking black and white plumage, red eyes, bill and legs, and distinctive call, pied oystercatchers are often seen running down the beach behind a receding wave and drilling into the sand for invertebrates and small molluscs. They open pippies and other molluscs with their strong chisel-shaped beaks. Pied oystercatchers nest and roost on ocean beaches, estuary sand spits, islands and estuarine shorelines. At breeding time, they engage in aerial displays and loud vocalisations. If disturbed on or near the nest, they will quietly walk away to conceal the location of their eggs or chicks.

Sooty oystercatcher

The sooty oystercatcher is a large wader, up to 50 cm long. This bird can be distinguished from the pied oystercatcher by its entirely black plumage. Before taking flight, the sooty oystercatcher gives a loud whistling call and a sharp piercing call if intruders approach its nest. Sooty oystercatchers make nests in shell grit, pebbles and rocky areas on off-shore islands.

Red-capped plover

The red-capped plover is one of the more commonly observed beach-nesting birds. Its chestnut-red crown distinguishes it from other small shorebirds and it is often seen in small feeding flocks exhibiting the classic plover behaviour of small runs and pecks at invertebrate prey. It takes advantage of the protection afforded by colonies of little terns and will nest next to and among these avid defenders. Red-capped plovers display an elaborate 'broken wing' routine to lure intruders away from their simple nests and will regularly bob their heads when threatened. The tiny chicks are mobile almost from the day they hatch, resembling a cotton-wool ball on legs, and freeze in depressions in the sand when in danger.

Bar-tailed godwit

Migrating from Siberia and Alaska, the bar-tailed godwit is often seen resting in large crowds on sandspits and other roosts. At Towra Point, godwits regularly roost in lines along old posts and oyster lease frames. When feeding, they wade through the shallows making frequent probes with their long, slightly up-curved bills in the sand and mud for molluscs, crustaceans and worms. These large flocks make short flights to safer spots when disturbed, flying steadily and in unison before landing and fanning out again to feed.

Photo: George Madani

Figure 8: Eastern curlew *Numenius madagascariensis*

Photo: M Weston

Figure 9: Hooded plover *Thinornis rubricollis*

Photo: DECC

Figure 10: Beach stone-curlew *Esacus neglectus*

Eastern curlew

The eastern curlew is the largest shorebird found in NSW. The distinctive, long, down-curved bill easily identifies this bird as a probing shorebird. Eastern curlews may be seen alone or in small groups, probing the sand and mud for marine invertebrates. Like the godwits, with whom they regularly forage, they will fly to a new location when disturbed and resume feeding. Eastern curlews are well-known for their haunting call which is often emitted when the birds are disturbed.

2.8 Other threatened beach-nesting birds

Hooded plover

The hooded plover specialises in cryptic behaviours that make it very difficult to see, such as turning its light grey back to observers and blending in with ocean beaches and sand spits. When feeding, the hooded plover makes short hunched runs, pecking at small insects and crabs on the sand. Nests are simple scapes made in the fore and hind dunes, and are guarded by secrecy and camouflage. When disturbed on the nest, hooded plovers turn and swiftly run along the ground to lead intruders away, frequently bobbing their heads. There are less than 25 breeding pairs along the NSW coast from Jervis Bay south to the Victorian border, while the species also occurs around the south-eastern and south-western Australian coastline.

Beach stone-curlew

Beach stone-curlews are large, striking birds with huge heavy bills and boldly patterned faces, making them impossible to confuse with any other shorebird. They feed mostly on exposed sand flats on crabs, hammering them open with their bills. They nest on sandbanks, spits or islands in estuaries. This bird occurs north from the Manning River in NSW and around northern Australia. It is now very rare in the south-east of its range, with only 4–6 pairs breeding in NSW each summer.

3 Guidelines for shorebird managers

Worldwide, shorebirds are threatened by diminishing habitats that are being lost to land reclamation, development, alteration and pollution. They are also key indicator species for the effects of climate change, as their shoreline habitats will be affected by sea level rise and more extreme weather, such as storms with their resulting floods. In particular, the resident and migratory species that nest on beaches in and around the estuaries of south-eastern Australia face a range of serious threats.

Best practice methods for managing beach-nesting shorebirds have been developed through research and practical programs across Australia and internationally. Many of the methods described below have been implemented successfully along the coast of NSW as part of recovery programs for threatened shorebirds such as the little tern (NPWS 2003), hooded plover and pied oystercatcher (Keating and Jarman 2006). Towra Point Nature Reserve has been a key site in these programs, and local examples from this site are highlighted in the following sections:

- 3.1 Site identification and assessment
- 3.2 Predator management
- 3.3 Nest management
- 3.4 Managing human disturbance
- 3.5 Community awareness
- 3.6 Monitoring.

Licences and approvals

Before commencing management actions on a site, it is important to obtain the appropriate approvals. In NSW, Section 132c licences under the *National Parks and Wildlife Act 1974* (NPW Act) are required to manage and monitor threatened shorebird sites. To apply for a licence, contact your nearest DECC Parks and Wildlife regional office or visit www.environment.nsw.gov.au/wildlifelicences/ScientificResearchLicences.htm.

Approval from the DECC Animal Ethics Committee may also be required for shorebird recovery programs. Contact your nearest DECC Parks and Wildlife regional office (see www.environment.nsw.gov.au/contacts) for more information on how to obtain approval.

3.1 Site identification and assessment

To successfully implement recovery programs for threatened species, locations where the target species occur must be identified, and the threats at those locations must be comprehensively assessed. Strategies to increase breeding success can then be developed by reducing or removing the impact of these threats. Effective management relies on the coordinated effort of many individuals, groups and organisations accurately identifying the main threats and assessing available management options (see 'Threat assessment' below and section 3.2).

Site identification

How easy it is to identify and define a 'shorebird nesting site' varies, depending on the species and the location. For example, there is much predictability about where and when little terns will nest as they return to Australia in late spring each year to regularly used sites. Such sites are easy to locate as the birds nest in noisy colonies on low-lying sand spits and sand islands at or near the mouths of estuaries and coastal lagoons. At the other extreme, individual pairs of hooded plovers rely on camouflage and cryptic behaviour to avoid detection. Consequently, finding their well-guarded nests can take considerable care, time and patience.

Locating nests

Before attempting to locate birds and their nests, consider the following:

- **Carelessness can decrease the chances of finding birds, their nests and their chicks, and can also increase the likelihood of disturbing them while they are nesting.**
- **Shorebird nests are very hard to see.** The colour of the eggs and the simple nest site in the sand are designed to blend into the environment. It is all too easy to destroy well-camouflaged nests by stepping on them (Figure 3).
- **Newly hatched chicks are well camouflaged (Figure 11).** Their only defence is to remain completely still until danger has passed. They too can be easily trodden on.
- **All birds have a 'start distance'.** This refers to the distance they will allow a threat to approach before the bird will take some form of action, such as flying away, attacking, or just getting up and slowly walking away in hope of leading the threat away from a nest.

Photo: DECC

Figure 11: Many chicks, such as those of the little tern, are very hard to see on sandy beaches. Care must therefore be taken when looking for nests

It is very important to disturb the nest as little as possible. When looking for shorebirds, and in particular when looking for nests of cryptic species such as the hooded plover or pied oystercatcher, use the following tips:

- **On sighting your bird, try to establish the 'start distance'.** This may be a useful guide for later designation of a protective buffer area.
- **Observe the bird's behaviour.** Is one bird remaining on a possible nest while the other is feeding? Are they carrying things to decorate or camouflage a nest, or tempt a prospective mate?
- **Do not attempt to locate the nest by walking into the foredune or other suspected nesting area to find the eggs.** If you suspect the birds may have a nest or chicks in the vicinity, withdraw immediately to a suitable vantage point for using binoculars or a spotting scope. Be prepared to be patient.
- **Observe sites from a hiding place.** One of the most useful techniques in locating nests and eggs is to hide in a position from which nest sites can be observed. Once an observer has located the nest, they can leave the hiding place and mark the nest with a tag, stick or other form of marker (in many cases, flotsam and jetsam have been used as markers). The observer can then return to the hiding place for further observations. In this way, disturbance of nesting birds is reduced significantly.
- **Try to identify the nest site by observing over time (perhaps even days) and getting an accurate fix on it.** This may be a map or GPS fix, or the nest may be identified through making detailed notes on its location in relation to features like its distance from a headland or creek opening, beach access point, or buildings and vegetation behind the beach.

Once the exact location of a nest site is established, contact your nearest DECC Parks and Wildlife office to pass on the details and discuss the next steps to be taken.

Site assessment

The position of a nesting site and its proximity to settlement areas can influence the number and magnitude of threats affecting it and influence possible management options. The ownership of the site and the surrounding lands will help identify potential stakeholders. Local government policies such as Companion Animal Management Plans should be consulted – contact your local council to find out what policies may affect your project. Estuary management plans and boating regulations should also be consulted for relevant regulations or restrictions.

There is increased access to nesting areas for people and foxes from both sides of an estuary when the entrance to the estuary is closed. When the entrance is open, people and foxes can only access nesting areas from one side. The proximity of nesting sites to settled areas also influences the number of people that may access an area, and may affect the implementation of predator control programs. On the positive side, proximity to settlement can provide a ready source of volunteers to assist with site protection, monitoring, guarding and public education programs (Figure 12).

Threat assessment

Before deciding on what management actions to implement at a site, identify the active and potential threats and determine the management objectives. Some threats may be easily identifiable on a single visit, whereas others may take several visits before they become apparent. Threats may include predation, natural factors and disturbances associated with human activities.

3.2 Predator management

Shorebirds typically nest on the ground, which exposes them to predation by introduced and native predators. Introduced predators such as foxes, cats and dogs are responsible for significant losses at many shorebird nesting sites. 'Predation by the red fox' is listed as a key threatening process under the TSC Act. The little tern, hooded plover, pied oystercatcher and beach stone-curlew are all identified as priority threatened species for fox control in the approved threat abatement plan *Predation by the red fox* (Vulpes vulpes) (Fox TAP) (NPWS 2001) – visit www.environment.nsw.gov.au/resources/pestsweeds/RedfoxApproved.pdf.

Photo: Natalie Izquierdo

Figure 12: Litter can be a major threat to shorebird habitat on some sites. Here, rubbish that has washed up onshore is being removed from Towra Spit Island

Cats and domestic dogs are occasionally implicated in losses of eggs or chicks, but to a lesser extent. Wild dogs, including dingoes, are responsible for losses in remote coastal areas.

Several native animals also prey on eggs and chicks, with avian predators the most significant in terms of losses. Raven attacks on seabird colonies can result in a high mortality of nestlings and fledglings (Tella et al 1995). On Towra Spit Island, Australian ravens *Corvus coronoides* were responsible for 67 egg losses over four seasons between 1992 and 1995. Of these, 37 eggs were lost in one season alone (Priddel and Ross 1996). Other avian predators including gulls and raptors also target shorebird nesting sites and areas, and may even cause the loss and abandonment of entire little tern breeding colonies. Tree goannas (*Varanus varius*), black rats (*Rattus rattus*) and even long-nosed bandicoots (*Perameles nasuta*) have all been recorded taking shorebird eggs or chicks at various sites throughout NSW.

The threat from predators can be assessed from direct observation and by the presence of tracks in the sand. Surveys for shorebirds often involve walking long stretches of beach. It can be very useful to record predator observations on each beach or section of beach as these surveys are conducted, to save duplicating effort. Some predators, such as foxes, range over large areas, so the absence of prints or other signs in an area should not be taken as an absence of the threat. Repeated visits to a site should be undertaken at different times of the day over a number of days, and possibly a number of seasons, to maximise the likelihood of observing or detecting such predators. Birds like ravens, gulls or raptors are more easily observed and, while not always a direct threat, need to be monitored closely.

Once a nest site or colony is established, a search for all animal signs in the locality should be undertaken. This can help identify potential predators, and can also identify the presence of animals such as kangaroos and livestock that can accidentally trample nests.

Unfortunately, the threat from predation is often not realised until it occurs. If losses do occur, it is important to assess the evidence (prints around nest, shell remains) to attempt to determine the predator responsible, so further losses may be mitigated.

Fox control

The Fox TAP (NPWS 2001) identifies key areas in NSW where fox control is required for protection of threatened shorebirds. To ensure that fox baiting programs are effective, specific best practice guidelines have been developed and should be consulted before baiting programs are implemented (DECC 2008). Where baiting is not permissible, is logistically difficult or is ineffective in removing foxes, other methods such as trapping and shooting can be deployed. It is essential that all control programs are undertaken by trained professionals, there is detailed planning, and careful adherence to strict operating procedures is followed. For example, all shooting operations carried out by DECC staff must be conducted in accordance with the DECC Firearms Management Manual. For more information on the Firearms Management Manual, contact your local DECC Parks and Wildlife office.

Photo: Natalie Izquierdo, DECC

Figure 13: Baits are used at Towra Point to control foxes on shorebird sites

The NSW Fox TAP has identified Towra Spit Island as a priority site for fox control (NPWS 2001). DECC implements an annual baiting program over the breeding season each year between September and March in Towra Point Nature Reserve, including on the island (Figure 13). This fox control program has succeeded in increasing numbers of little tern fledglings. Another program, the Kurnell Peninsula Fox Control Program, involves fox baiting and shooting on public and private lands around Towra Point Nature Reserve. This program is coordinated by DECC in partnership with Sutherland Shire Council, and funded by Sydney Catchment Management Authority.

Avian predator control

Not all gulls, ravens, crows or other birds threaten nesting shorebirds. It should be recognised that shorebirds, particularly communal nesting species such as little terns, have their own defence mechanisms to deal with avian predators, such as mobbing (especially when colony size exceeds 12 nesting pairs). The aim of any culling operation should be the targeted removal of individual predatory birds, including gulls, ravens, crows or gull-billed terns, that have been positively identified as a direct threat to eggs or chicks. Control programs should not be undertaken to remove large numbers of potential predators as a precautionary measure.

Available methods of controlling problem avian predators at threatened shorebird nesting sites include shooting, poisoning and trapping. DECC has developed a protocol to guide programs for the control of avian predators as part of shorebird recovery programs (DEC 2005). All control programs for native predatory birds require licensing approvals from DECC, and depending on the location and method, other State and Commonwealth authorities. Contact your local DECC Parks and Wildlife office for more information.

Insect control

The predation of little tern eggs and chicks by ants is a major issue on Towra Spit Island. Here ants are controlled throughout the little tern breeding season to protect nesting sites from predation. Ants are controlled by applying a perimeter of chemical pesticides (bifenthrin) around the nesting areas once the birds have nested. Baits containing bifenthrin have also been used to control the general ant population on the island, to protect tern chicks once they leave the nest.

Predator exclusion

Electric fences keep animals such as foxes and dogs out of breeding areas. They require a minimum of four strands of electric wire between fibreglass or plastic posts, charged by a 6- or 12-volt battery connected to a pulse charger set at maximum capacity. Electric fences should be installed at least five metres inside temporary people management fences (see section 3.4) to minimise the possibility of people getting accidental electric shocks.

The area fenced off around a nesting site should be as large as possible to reduce disturbance from people passing by. The 'start distance' of the birds (see section 3.1) should be used to determine the minimum distance from the nearest nest to the fence. Importantly, a large area does not draw attention to the exact location of nests. This can be particularly important for nests on long, wide ocean beaches where hooded plovers and pied oystercatchers choose to nest, as fences and signs may attract the attention of predators, particularly ravens and foxes, and the general public. Where pragmatic or logistical constraints limit the area that can be fenced, the largest practical area should be fenced. Fences should be dismantled at the end of the breeding season.

3.3 Nest management

The dynamic nature of the preferred nesting habitats of shorebirds presents further natural challenges and threats. The combination of high tides and big seas is often devastating for birds such as the little tern, hooded plover and pied and sooty oystercatchers that nest near the high tide mark. Inundation along the NSW south coast has destroyed up to 15% of hooded plover eggs and 17% of little tern eggs in a season (Keating and Jarman 2004b, 2006). Nesting on offshore islands may provide protection for sooty oystercatchers from many predators, but storms and big swells in spring are often disastrous. Prolonged or heavy rain can also lead to flooding and rapid rises in coastal rivers and lagoons. Strong winds can be equally devastating for beach-nesting species, with windblown sand covering eggs and newly hatched chicks, forcing adults to abandon them. The potential impact of climate change on sea levels and extreme weather also has serious implications for beach-nesting birds.

Inundation

Flooding of nests by king tides, sea swells and rising lake and river levels can be mitigated in several ways:

- where higher ground is adjacent to a vulnerable nest, eggs can be safely moved at a rate of one to two metres per day (NPWS 2003).
- nests can be elevated by carefully picking up the eggs and replacing them on top of a mound constructed of sandbags or sand filled tyres covered in loose sand. In such instances, it is important to install sandbag 'ramps' to allow the movement of chicks on and off the nest in response to the tides (Keating and Jarman 2006).
- dykes can be constructed around nests vulnerable to storm surge (Keating and Jarman 2006).

Satellite colonies

If the colony is disturbed at the main breeding site, individual pairs may attempt to nest elsewhere. Usually, only one or two pairs will form these satellite colonies. Satellite colonies of less than 12 breeding pairs are unlikely to avoid predation or interference, so the nesting pairs should be encouraged to rejoin the main colony. Sites where satellite colonies are likely to form should be identified and marked out with streamers, similar to those seen around car yards, to dissuade small, easily depredated colonies from establishing. At times, little terns have been prevented from nesting at sites other than Towra Spit Island.

Creating new habitat

Towra Spit Island is a significant breeding site for the endangered little tern. Areas of spinifex, lomandra and acacias have been removed from the island so there are areas of bare sand for little terns to build their nests (Figures 14 and 15). However, as chicks require shelter once they begin to stray from the nest before fledging, vegetation on Towra Spit Island is maintained in a perimeter around the cleared area. A combination of bare sand and refuge vegetation is ideal habitat for little terns. The little tern will generally not nest within three metres of dense, high vegetation such as acacia species.

If attempting to create new habitat, ensure the site is above high tide mark to protect nests from inundation. Also, at shorebird breeding sites largely devoid of vegetative cover, additional protection from predators, adverse weather conditions and humans may be provided for chicks in the form of added shelter. Sandbags, leafy branches and beach washed debris can be strategically scattered near nest sites to encourage chicks to stay within fenced areas.

Photo: Andres Bianchi

Figure 14: Towra Spit Island in its original state

Photo: Natalie Izquierdo

Figure 15: Towra Spit Island after areas of vegetation were removed to provide a more suitable habitat for the little tern

3.4 Managing human disturbance

Shorebirds nesting on the ground with their nests and chicks are vulnerable to acute disturbance from a wide range of beach users. The same ocean beaches, estuaries and coastal lagoons used by the birds for nesting are used by large holiday crowds. Dogs and recreational beach users may disturb roosting shorebirds, causing additional

stress (Blumstein et al 2002). Recent literature has emphasised the loss of shorebird habitat due to increased human activity in sensitive habitat sites (Nebel et al 2008).

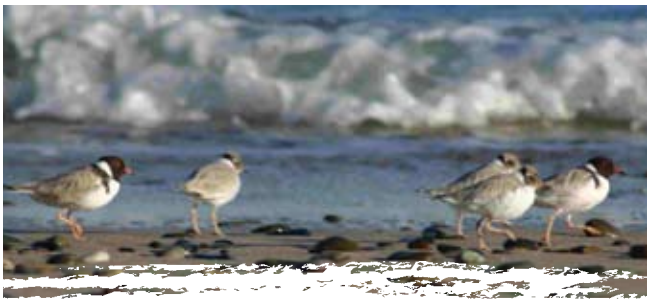

Photo: I. Vandyke

Figure 16: Four-wheel drive vehicles are a threat to birds that prefer open beaches, such as the hooded plover

People easily disturb nesting, roosting and foraging birds, exposing eggs and chicks for extended periods and leaving them vulnerable to predation and overheating in the absence of attentive parents. Four-wheel drive vehicles, which are permitted to drive on ocean beaches in local government areas in the northern half of NSW and other states, have an enormous impact on the suitability of habitat for, and use of habitat by, beach-nesting birds. Pied oystercatchers and hooded plovers and their chicks are particularly vulnerable to injury and death from four-wheel drive vehicles, as they prefer open ocean beaches (Figure 16).

Beaches in Botany Bay are a focus for human recreational activities and also provide good little tern nesting habitat. Despite Towra Spit Island and other habitats for threatened species being off-limits to visitors, little terns come into conflict with swimmers, sunbathers, fishers, picnickers, boaters and divers when they leave the island. DECC signage, brochures, media releases and regular patrols educate the public about Towra Spit Island and help protect the little tern colony. The recreational and educational value of the reserve is maintained by providing day-use access to nearby Towra Beach and shorebird viewing platforms (Figure 17).

Photo: Cheyne Ramsay, DECC

Figure 17: Members of the public can see the shorebirds on the mudflats from Quibray Bay Viewing Platform

At almost all but the most remote shorebird nesting sites, tactics will be needed to reduce the likelihood or impact of human disturbance on shorebirds. Tactics include using signage to notify people of the presence of threatened species, temporary beach closures and fencing off large areas around nesting colonies.

Signage

Signs are an important way of informing beach users of threatened shorebird breeding activities and advise them of ways of acting to minimise disturbance to nesting birds. A range of signs can be used, including temporary signs to alert people to the immediate presence of shorebirds in an area, or larger permanent interpretive signs can be used to give people more detailed information about the birds and their habits.

Temporary signs are used to alert people to the presence of nesting shorebirds on beaches and at estuary openings. These small signs should include a photo or illustration of the birds to assist people in identification, and inform people about the reasons for any restrictions (e.g. 'Beach temporarily closed: endangered little tern nesting area'). The signs need also to give brief instructions on where to go and what to do to avoid disturbing the nesting birds (e.g. 'walk near the high tide mark', 'keep dogs on leads'). Signs can also be used with fencing to reinforce temporary beach closures (see 'Fencing' section below).

Temporary signs should be made as obvious as possible, being large enough to be read from a short distance, and placed well outside fenced areas. They must be sufficiently far away from nesting areas to give ample warning and allow people to react to the notification before the birds are disturbed (Figure 18). A good location for the sign is at the point where the 'start distance' of the birds in question is doubled. When the birds are no longer present or breeding has finished, temporary signage should be removed.

Photo: Natalie Izquierdo

Figure 18: A sign on Towra Spit Island informs any would-be visitors that the area is strictly off limits

Photo: James Dawson, DECC

Figure 19: Sign explaining why an area is off limits to dogs

Photo: James Dawson, DECC

Figure 20: A site on the south coast where fencing and signage are used to keep people away from shorebird nesting sites

Permanent interpretive signs should be considered around high public use areas, such as at boat ramps, car parks or major beach access points near important nesting sites. These large signs should include identification information and information on the biology and seasonal requirements of shorebirds, along with information on how the public can 'share the shoreline' (see section 3.5). In addition, regulatory signs put up by local councils and government authorities also limit the likelihood of threatened shorebirds being disturbed, as they notify people about dog walking regulations, boating restrictions, national park boundaries and 1080 fox-baiting programs (Figure 19).

Fencing

Temporary fences can be used to manage the movement of people around shorebird nesting sites. They can reinforce the message of nearby signs and make people stop before they get too close to nesting areas. These fences can be simple constructions made of tomato stakes and string, but care should be taken to ensure that they are highly visible to avoid accidents. Small signs should also be placed at intervals along the fenceline as a second line of notification and to reinforce the message of why the area is being protected (Figure 20). If birds are nesting near beach access points, the temporary closure of these access points and information on alternate access should be considered.

The area fenced off around a nesting site should be as large as possible. Again, the 'start distance' of the birds should be used as a guide to determine the minimum distance from the nearest nest to the fence, to reduce disturbance from people passing by. See section 3.2 for more information on fencing.

3.5 Community awareness

An overarching objective of any shorebird management program should be to 'share the shoreline'. This message promotes positive, low-impact beach usage that ensures the birds thrive while allowing people to enjoy and learn about the area. It will be necessary in many cases to establish 'no-go' zones for people, dogs, vehicles and boats directly around identified nest sites or areas. However, efforts should always be made to inform beach users about the reason for temporary closures and use the inevitable interactions between people and birds as educational opportunities.

Community awareness and volunteers

Volunteers play an important role in many conservation programs across the country. Recovery plans for threatened species can often only be implemented with the assistance of committed volunteers. Shorebird volunteers carry out essential recovery tasks such as erecting protective fencing, educating other members of the public and assisting with surveys and monitoring, and add greatly to the longevity and strength of projects. Active community involvement ensures that conservation actions become sustainable.

With clear objectives and thorough planning, volunteering provides a unique opportunity to participate in conservation activities and interact with wildlife and its habitats. Volunteers can interact with DECC staff, researchers and other volunteers, as well as gain knowledge and skills across a variety of areas.

Recruiting volunteers

Whether establishing volunteer wardens at a new site or resuming ongoing operations at the start of a new season, new volunteers will be required to assist shorebird programs. Recruitment of volunteers can be achieved by word-of-mouth through existing networks of volunteers, local bird watcher groups and other community groups, but in many cases will require more active methods. Advertisements and articles in local media, including newspapers, and on the radio and even television, will reach a large audience. Council newsletters, letterbox drops and open days are also ways in which the community can be notified and invited to join volunteer recovery efforts. Volunteers need to be supervised and managed to ensure they are operating safely for both themselves and the birds. Formal volunteer agreements are required for volunteers working with DECC.

Responsibilities of volunteers

Volunteers assist with:

- the species being protected – the utmost care must be taken to minimise stress and disturbance to the target species. Close study and monitoring, such as colony walk-throughs and nest inspections, must be regulated and other disturbances must be minimised. Volunteers should be given the contact details of someone who can advise on any aspect of the program before proceeding with an action if there is any doubt.
- the recovery program – as part of shorebird recovery programs in NSW, volunteers are representatives of the organisation employing them and of the recovery program. Shorebird managers should ensure that volunteers are always provided with up-to-date information, and that communication, including feedback, suggestions and problem solving, are all two-way processes. It is everybody's responsibility to ensure that communication is open and flowing.
- the work of other volunteers – all people involved in the program depend on one another for support, assistance and active participation. Procedures, rosters and other plans should all be developed with the welfare of the species in mind, and commitment to them will ensure that project objectives are achieved.

Skills and knowledge of volunteers

Volunteers will need to be trained in the following skills (or where they are too specialised for volunteers, have access to them) when managing beach-nesting birds.

- observation skills – volunteers should familiarise themselves with the nature and behaviour of the target species and the layout of monitoring record sheets so they can accurately identify the birds, be aware of ways in which the species can be monitored with minimum disturbance and make the required observations during their time on-site.
- recording skills – volunteers will need to accurately record observations to provide the data that will be used to analyse the progress of the breeding season.
- wardening skills – some volunteers may act as wardens at key sites and play a major role in protecting the birds from public disturbance. More information on this important role is included in the next section on 'Communicating with the public'.

Photo: Cheyne Ramsay

Figure 21: Volunteers can direct people to locations such as Quibray Bay Viewing Platform in Towra Point Reserve, where they can learn about shorebirds by watching them and reading information about them

- **ambassadorial skills** – as volunteers will often be the first point of contact with the public, they can present conservation messages to a wider-ranging audience which can then flow on through the community.
- **specialised knowledge** – some detailed knowledge of the species will be required to enable accurate information to be passed to the public. This guideline provides some of that knowledge.
- **technical skills** – tasks such as protective and electric fence erection and maintenance form part of the volunteer's role in some places. Banding of adults and chicks may be undertaken under supervision by suitably trained or qualified volunteers. On-site training may be provided where specialist technical skills are required.

Communicating with the public

Beach use by the general public peaks at the same time as the breeding season for many threatened beach-nesting birds. As a result, site managers need to promote the message that the public can be on the site and enjoy the presence of the birds by engaging in activities that do not disturb them. People involved with shorebird programs, including volunteers, therefore need to prevent undesirable activities by informing people of the needs of the birds, the threats facing them and alternative activities they can engage in, all in a positive way.

Volunteers have two basic functions when communicating with the public about the shoreline and the species that inhabit it. The first is to inform and educate the public, and respond to questions (Figure 21). Well-informed volunteers that give clear answers to questions have credibility and quickly gain the respect of other people. Provision of information to take away and read at a later date (e.g. brochures) assists in getting more information across during a short interaction.

The second function is to act in a supervisory role to prevent the birds from being disturbed. This role requires more tact and may require volunteers talking to people in a friendly, positive manner to try and stop an undesirable activity occurring or to divert members of the public to a more suitable location to conduct an activity.

While shorebirds are protected by law, volunteer wardens do not have law enforcement powers and are not expected to act as law enforcers.

For someone whose actions or behaviour are likely to affect the birds, it is important to approach them in a friendly, non-confrontational manner by engaging them in conversation about the birds, the recovery program and the positive ways they can help. Nine out of ten people will be acting out of ignorance and with a little information will respond to a positive approach. It is rare that someone opposed to the relevant authority such as DECC or local council, or opposed to restrictions that are being enforced such as restrictions on dog walking, will attempt to argue or become forceful. If someone does start to behave aggressively, it is best for the volunteer or site officer to state that they are not involved in policy making, and guide them to state their concerns to the appropriate authority.

Volunteers should be provided with the contact details of appropriate people who can enforce the law if other measures do not have the desired result, such as DECC rangers, local council personnel or even the police.

Volunteer needs

Volunteers need to be provided with a safe working environment. When working in summer on exposed beaches and around estuaries, ensure volunteers have:

- protective clothing (e.g. long-sleeved shirt)
- hat and sun screen
- sunglasses
- water or a drink
- a snack.

Ensure someone on-site has a mobile phone (although remote locations may not have coverage) or a two-way radio, and ensure someone records where everyone is working and when they are expected to return to base.

To observe and record what goes on at a site, the following materials will be required, some of which could be supplied by the shorebird manager:

- a map
- binoculars or a spotting scope
- a notebook and writing implement
- information brochures to hand out to the public
- a bird identification book.

Some sites may have special items, such as a sun shelter, that need to be picked up from a central place. Any formal identification, such as a volunteer badge, hat or shirt should also be carried while on-site.

3.6 Monitoring

Monitoring is a critical component of shorebird conservation programs. The ability to accurately determine the numbers of breeding pairs, eggs and chicks, and particularly to record their fate, provides vital information for evaluating the strengths and weaknesses of a program and informing management decisions. Consistent monitoring enables the data collected at an individual site to be incorporated with other data at larger scales to provide regional, statewide or national perspectives.

The key threat of fox predation to beach-nesting birds and the incorporation of 23 shorebird breeding sites in NSW as priority fox control sites under the Fox TAP (see section 3.2 for more information) provide an existing strong monitoring framework. As an overall objective of shorebird recovery programs is to increase recruitment into the adult population, the effectiveness of fox control programs is measured by the numbers of fledglings that have grown to adulthood (NPWS 2001).

Photo: DECC

Figure 22: Monitoring the nests of certain species, such as pied oystercatchers, requires a weekly inspection and observation from a distance

Minimum disturbance monitoring

To maximise the ability of monitoring programs to estimate measures of breeding success and to identify the sources of egg and chick loss, monitoring needs to be undertaken at least weekly and up to three times a week, depending on the target species (NPWS 2001). However, care needs to be taken to ensure that disturbance to nesting birds is minimised. For example, prolonged or repeated excursions into shorebird nesting areas increase the threat of exposure to predators and the elements, particularly in summer. To avoid undesirable impacts, the following procedures should be followed when monitoring.

Little tern nesting colonies

- Site walk-throughs should be undertaken once a week.
- Visits to a colony should be restricted to a maximum of 20 minutes, and there should be no more than two visits a day.
- Sites should never be visited in the rain or when temperatures exceed 29º centigrade.
- Small groups of up to four people help minimise disturbance and reduce the risk of accidentally crushing eggs and chicks.
- Additional monitoring can be undertaken using binoculars or a spotting scope from hides or outside fenced areas. To ensure accuracy of nest identification from outside a fenced area, each nest should be marked at a set distance and bearing from other nests (e.g. 1 metre due north) or other reference points. Short flat stakes or stainless steel pins less than 30 cm high, with an identification number or tag attached, should be used. The number or tag should be oriented toward a suitable vantage point for observation by binoculars or a spotting scope.

Individual pair nesting species

Monitoring nests of non-colonial birds such as the pied oystercatcher, hooded plover and beach stone-curlew requires different procedures. Once the location of a nest site has been identified, there should be a weekly inspection to confirm the continued presence of all eggs. At all other times, it should be sufficient to check for continued incubation by adult birds from a distance with binoculars or a spotting scope. Once chicks have hatched, they are immediately mobile and seek refuge in foredune vegetation or rocky shorelines. Following disturbance, it may take quite some time for hidden chicks to emerge from their refuges to recommence foraging, or for parents to take food to them, at which point they can be counted. In these situations, once the adult birds have been located, observations should be carried out from a suitable distance with binoculars. The fate of chicks that do not reach fledging stage can be difficult to determine, and regular monitoring is required to determine the cause of losses.

Data collection

Each site visit, be it a weekly walk-through or an informal visit, provides an opportunity to collect information. In summary, the minimum information that should be collected each visit includes:

- weather conditions
- a count of adult birds and fledglings
- an estimate or count of new and active nests and egg numbers
- information on the state of protective fences and required maintenance
- information on tracks or other disturbances, including the activity of people at the site
- counts of other bird species, especially shorebirds.

Note birds in breeding or non-breeding plumage and be alert for coloured bands or flags on the legs, making careful notes of the colours and order they occur (e.g. left leg – blue over red) on each leg.

Birds carrying these bands and flags have been captured and banded at other sites from right across Australia and perhaps even internationally (Figure 23). Reporting these findings to the Australian Bird and Bat Banding Scheme (ABBBS) assists in determining the movement patterns of birds throughout their range over time.

Information on the status of nesting and breeding success should be recorded on standard data sheets (see 'Daily shorebird monitoring sheet' in section 5). The information from shorebird monitoring sheets should be collated onto a shorebird summary sheet (see 'End of season site summary sheet' in section 5) for each site at the end of each season and forwarded to DECC's Shorebird Recovery Coordinator or Pest Management Unit. Contact DECC to find out who you should submit your summary sheets to.

Volunteers and monitoring in Botany Bay

The NSW Wader Study Group is a volunteer group that took over the monitoring of shorebirds in Botany Bay following a DECC study in the late 1990s. During this study, a series of sites were selected which are still counted monthly. With the help of DECC, the NSW Wader Study Group conducts monthly surveys to monitor birds in Towra Point Nature Reserve, Towra Point Aquatic Reserve and other sites within Botany Bay. Surveys are conducted by traversing transects within the reserve by boat and recording the abundance of different bird species.

Photo: Richard Major

Figure 23: A white-fronted chat wearing bird bands

4 Summary of threatening processes and their management

Threatening processes	Management of threatening processes
Human disturbance (including domestic dogs)	Educate the public using signage, brochures, media releases Use temporary fences and signage to alert people to nesting areas and direct them away from these areas during the nesting season Communicate with the public about shorebirds on-site and through volunteer wardens Volunteers can act in a supervisory role to prevent disturbance to shorebirds Erect signs defining 'no dogs' areas on national parks and council managed lands Undertake patrols to enforce dog walking regulations
Fox/feral dog predation	Establish an integrated control program for foxes and feral dogs Erect electric fencing Monitor predation of shorebirds
Avian predation	Establish an integrated avian predator control program Monitor predation of shorebirds
Extreme weather and inundation	Incrementally move nests to high ground during king tides Place sandbags around nests to divert storm surge Elevate nests on sandbags during king tides Strategically scatter sandbags, leafy branches or beach washed debris at exposed sites for shelter

5 Standard data sheets for nesting shorebirds

Daily shorebird monitoring sheet

Fields highlighted in blue are those that **must** be completed

Species: _____ Season: _____

Site name: _____

Date: Observer(s):		
Nest no.[1]	Total egg no.[2]	Fate of nest[3]
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Total nest no: [4]		
Total no. of adults at the site: [5]		
Total no. of nests at the site:		
Total no. of eggs at the site:		
Total no. of chicks at the site: [6]		
Total no. of fledglings at the site: [7]		
Additional notes: [8]		

Key:
1 **Nest no:** identified by small numbered wooden stake located about 20 cm north of nest – little tern colonies only.
2 **Total egg no:** total number of eggs in a given nest.
3 **Fate of nest:** fate of each egg in a given nest (i.e. number of eggs which met a particular fate such as being predated on by foxes) as indicated on shorebird summary sheet (see next table).
4 **Total nest no:** the total number of nests located during a site visit.
5 **Total no. of adults**: the total number of adults observed on a site. For little terns, this includes only birds in breeding plumage.
6 **Total no. of chicks**: the number of this season's young which have hatched but cannot yet fly; includes nestlings, pullis and runners.
7 **Total no. of fledglings**: the number of this season's young which have learnt how to fly.
8 **Additional notes:** information on recovery efforts implemented during a site visit (e.g. electric fence installed, six nests elevated) and additional observations (e.g. fox tracks observed within confines of site leading between nests).

End of season site summary sheet

Fields highlighted in blue are those that **must** be completed

Species: _____ Season (year): _____

Site name: _____

Prepared by: Phone number and email address:	
Breeding season commenced (first egg laid)	
Breeding season concluded (last chick fledged)	
Maximum number of adults (breeding plumage)	
Number of breeding pairs	
Number of nests	
Average clutch size	
Total number of eggs (including those lost due to the following reasons):	
• No. of eggs lost to foxes	
• No. of eggs lost to domestic dog(s)	
• No. of eggs lost to silvergull(s)	
• No. of eggs lost to raven(s)	
• No. of eggs lost to Torresian crows	
• No. of eggs lost to raptors (list species and number of eggs lost to each species, if known)	
• No. of eggs lost to unknown avian predator(s)	
• No. of eggs lost to goanna(s)	
• No. of eggs inundated	
• No. of eggs that were covered in sand	
• No. of eggs lost to human interference	
• No. of eggs abandoned/not viable	
• No. of eggs lost to other known fate (state causes and number of eggs lost to each cause)	
• Unaccounted for eggs	
No. of chicks known to have hatched, including those lost due to the following reasons:	
• No. of chicks lost to fox(es)	
• No. of chicks lost to silvergull(s)	
• No. of chicks lost to raven(s)	
• No. of chicks lost to crabs	
• No. of chicks lost to other known fate (state cause(s))	
• Unaccounted for chicks	
Total number of fledglings	

Site protection and management (please write yes or no in each box, depending on whether the activity named to the left of the box was conducted on the site)

'People' fencing		Chick protection		Electric fencing	
Fox control		Interpretive signs		Avian predator control	
Nest elevation		Other			

Community education, awareness and involvement (please write yes or no in each box, depending on whether the activity named to the left of the box was conducted on the site)

Brochures		Talks		Posters	
Media		Newsletters and articles		Community volunteers	

6 Further reading

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