South Australian Recovery Plan for Eastern Osprey and White-bellied Sea Eagle

SOUTH AUSTRALIA

Government of South Australia
Department for Environment and Water

Contents

Minister's Foreword

Eastern Ospreys and White-bellied Sea Eagles are distinctive, large birds of prey that live mostly along our coasts. They are emblematic, top-order predators and as such indicate the health of coastal environments in our state.

Both species are endangered in South Australia and their populations are under pressure from multiple threats. These threats must be better understood and actions put in place to secure these species for future generations.

As South Australia's Minister for Climate, Environment and Water, and as someone with a long-held passion for seabirds, I am pleased to lend my support to the conservation and recovery of these iconic species.

Eastern Osprey and White-bellied Sea Eagle are charismatic species that capture the imaginations of the local communities where they occur.

The successful conservation and recovery of Eastern Osprey and White-bellied Sea Eagles in South Australia will require the support and assistance of enthusiasts, local communities, Landscape Boards, First Nations communities, local governments and the tourism and fishing industries.

There are a number of actions and projects underway across the South Australia and this Recovery Plan provides a framework for further community-led recovery of coastal raptors in this state. I thank the many people who have contributed to its development.

Susan Close MP
Minister for Climate, Environment and Water

Cover: Eastern Osprey. Photo: Andrew Brooks
Above: Eastern Osprey. Photo Malcolm Stanton

Acknowledgment of Country

We acknowledge and respect the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present. We acknowledge and respect their deep spiritual connection and the relationship that Aboriginal and Torres Strait Islanders people have to Country. We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

Acknowledgements

The Department for Environment and Water (DEW) would like to acknowledge the support of the South Australian Recovery Team for the Eastern Osprey and White-bellied Sea Eagle in developing this Recovery Plan. In particular, DEW would like to acknowledge the input of Terry Dennis, Sharie Detmar, Ian Falkenberg, Peter Wilkins and Stephen Debus to early drafts of the plan.

White-bellied Sea Eagle. Photo: Andrew Brooks

Introduction

The Eastern Osprey (*Pandion haliaetus cristatus*) and White-bellied Sea Eagle (*Haliaeetus leucogaster*) are distinctive, large, South Australian raptors with a mostly coastal distribution. They are emblematic, top order predators of our coastal environments and as such are sentinel species for the health of those environments (e.g. Grove et al. 2009; Helander et al. 2008).

The South Australian populations are disjunct from eastern, western and northern populations and are relatively unique in their use of rocky shores, cliffs and rock-stacks as nesting sites. This is principally owing to the lack of substantial trees in South Australian coastal habitats. Sea eagles in South Australia nest almost exclusively on cliff ledges; ospreys nest predominantly on coastal promontories and rock stacks and occasionally build their nests in trees or on man-made structures.

Both species are considered endangered in the state due to the low numbers of breeding pairs, and have had a decline in the number of occupied territories over the past 50 years (Dennis 2007b; Detmar and Dennis 2018; Dennis and Detmar 2018).

This Recovery Plan describes current knowledge of the two species' distributions, their former and current breeding territories, life histories and ecologies, and the threats that are operating against their long-term survival in South Australia.

The plan's focus is on identifying threats of greatest risk to the species; how best to manage these threats to maintain the current breeding population; and, where additional targeted management can be undertaken to increase breeding success and the number of pairs within the landscape. In the process of developing the plan, key knowledge gaps have been identified and research and monitoring projects to address these questions have been outlined.

White-bellied Sea Eagle. Photo: Andrew Brooks

Eastern Osprey. Photo: Jeffrey Robinson

Part A: Eastern Osprey

Distribution

Eastern Ospreys occur in littoral and coastal habitats as well as terrestrial wetlands of tropical and temperate Australia and on, and around, offshore islands. They are mostly found in coastal areas, but occasionally travel inland along major rivers, particularly in northern Australia, but also along many parts of the rivers of the Murray-Darling Basin (Marchant & Higgins 1993; Dennis and Clancy 2014).

Their distribution in South Australia extends from the western end of the Bunda Cliffs, near the SA/WA border, to the south coast of Kangaroo Island (Fig. 2). In eastern and northern Australia they prefer to nest in tall trees. The lack of coastal forest in South Australia results in the majority of nests being located on coastal headlands and nearshore rock stacks, as confirmed by surveys in the early 2000s (Dennis 2007).

Comprehensive surveys conducted between 2008 and 2010 recorded 58 occupied osprey territories in South Australia (Dennis et al. 2011). These surveys were repeated in 2015-17 when only 43 occupied territories were identified (Detmar and Dennis 2018). This represented an overall decline of 26% in the occupied breeding territories in seven to eight years.

The steepest declines recorded were:

- in the west of the State where the number of occupied territories declined from 33 in 2010 to 22 in 2017, a 33% decline; and,
- on Kangaroo Island where the number of occupied territories dropped from 14 in 2010 to eight (8) in 2015-16, a 43% decline (Detmar and Dennis 2018).

Apart from the numbers of 'abandoned' territories recorded in the 2015-17 surveys, Detmar and Dennis (2018) also recorded a high number of nest relocations (16 of 43, or 37%) within known territories since the 2008-2010 surveys. In addition, Detmar and Dennis (2018) noted six probable 'refugee' pairs that had apparently moved to start new territories. As the authors noted: *"the causes of this population instability and rapid decline are not immediately apparent [and] ... there are likely multiple contributing factors that require further investigation"*.

Cultural Significance

The Eastern Osprey occurs in the land and sea areas of many First Nations peoples. Where known and appropriate, First Nations language group names for, stories about, and cultural significance of, Eastern Ospreys should be documented.

Figure 1. Typical Eastern Osprey nest site location on nearshore rock stack. Photo: Sharie Detmar.

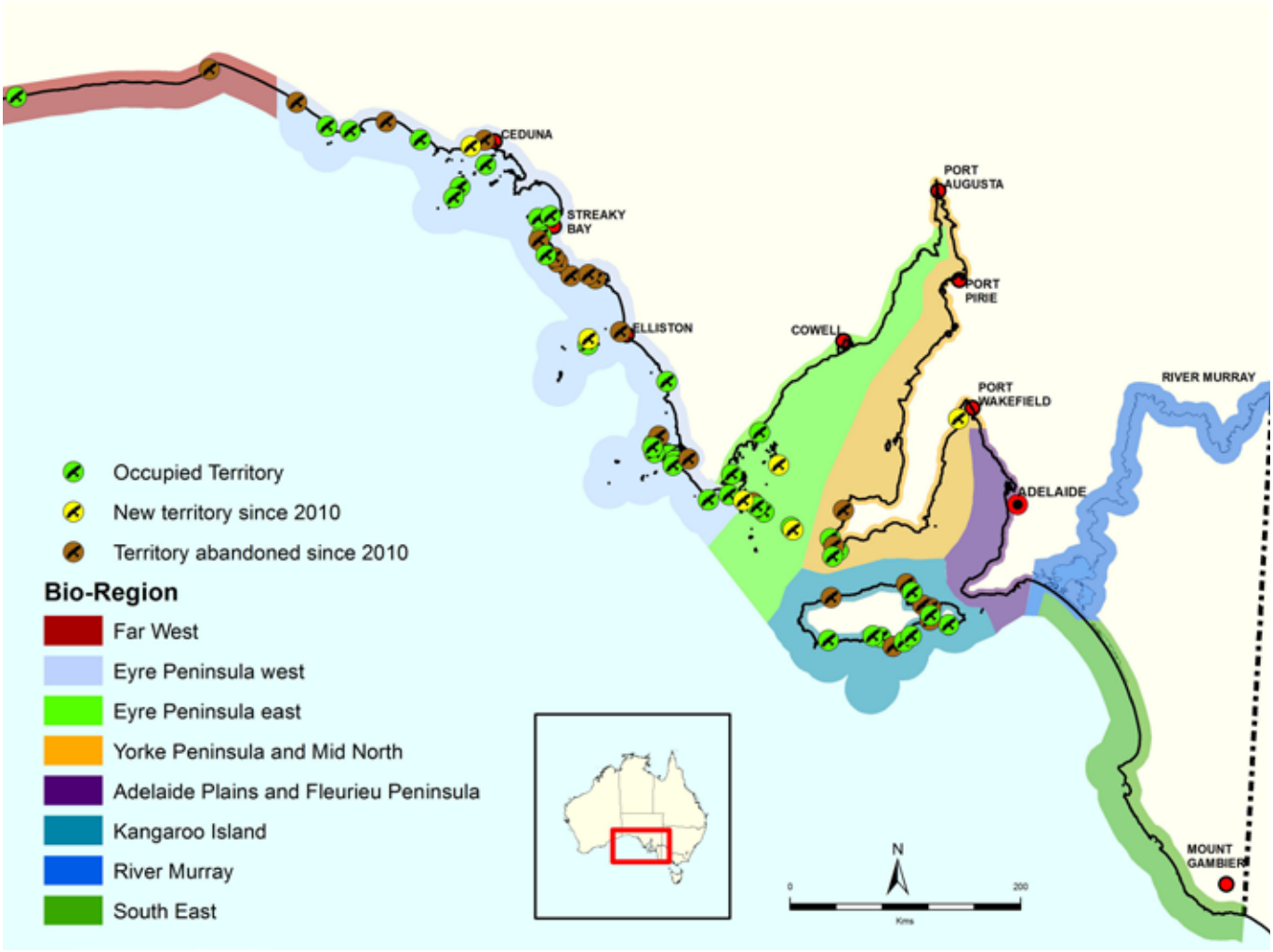


Figure 2. Map of the South Australian coast showing the 2015-17 distribution of Eastern Osprey territories, including new territories since 2010 and the location of territories that were considered abandoned during the later survey (Detmar and Dennis 2018).

Relevant Biology/Ecology

Diet

Eastern Ospreys feed almost exclusively on fish of up to 2 kg in size. They usually forage diurnally but have occasionally been observed foraging at night (Hollands 2003; T. Dennis pers. comm. based on live-stream imagery from 'the barge' nest in Port Lincoln in 2020).

Osprey have large specialised feet with spiny footpads and long razor-sharp talons. They hunt on the wing or from a perch. Hunting involves patrolling above the water searching for schools of fish or scanning from a perch with a clear view of the water then hovering before plunging or diving feet first into the water (Clancy 2005b). They feed on fish near the surface, with dive success rates varying from 40-90% (Poole 1994; Clancy 2005b; Lambert 1943; Maciejewski 1993). Hunting success rates are not known for South Australia.

Captured prey is normally then taken to a feeding perch where it is consumed (Olsen 1995).

Reproductive Biology and Life History

In South Australia, a study on Kangaroo Island found the Eastern Osprey breeding season to be temporally elongated and somewhat variable from year to year. Courtship and nest maintenance commenced in June, with egg-laying/incubation commencing at most nests in September, but ranged from late-August through October, with subsequent late fledging events occurring in February (Dennis 2007a).

Nesting pairs perform courtship aerial dives and swoops at a height of 100–300 m above the nest site. Copulation usually occurs on the nest or close to it. Calls are made during displays but are infrequent at other times (T. Dennis pers. comm.).

Eastern Ospreys typically mate for life, usually returning to the same nest each year (Marchant and Higgins 1993). However, it is important to note the apparent changes in nest site locations within known territories and possible establishment of new territories recorded between 2010 and 2015-17 (Detmar and Dennis 2018).

The nest is a large platform of sticks lined with grasses and seaweed placed on stacks along rocky shores, occasionally in the fork of a large tree, and increasingly on man-made structures and aquaculture infrastructure (e.g. beacons, power poles, channel markers) (T. Dennis pers. comm.).

Clutch size for Eastern Osprey is most often 2–3 and rarely 4, with eggs produced at 2–3 day intervals (Marchant and Higgins 1993). Incubation is typically 35-40 days (Dennis 2007a). Nestlings are fed by the female with the male doing most of the provisioning. Females show variation in their ability to care for their young and to ward off intruder ospreys or other species. Young were found to fledge at 9-10 weeks of age in a study on Kangaroo Island (Dennis 2007a), and are sometimes provided with fish for a further 5-6 weeks by the male.

Age at maturity varies between male and female Eastern Ospreys. Females have been recorded breeding at two years of age and males between four and eight years of age (Kangaroo Island; Dennis 2007a).

Not all osprey pairs breed every year (Detmar and Dennis 2018). A long-term study on Kangaroo Island (Dennis 2007a) and a nest monitoring program in northern New South Wales (Bischoff 2001) found a considerable proportion of pairs (29% and 26% respectively) to be inactive each year. In the context of comparing the number of occupied territories between statewide surveys, it will therefore be important to understand between-year variations in breeding activity across the South Australian population to determine what constitutes 'normal variations' and what constitutes real medium- to longer-term trends.

South Australian Eastern Ospreys have been recorded to live to at least 22 years of age (Dennis 2007a). Longer life spans are possible, given that individuals up to 25 years of age have been recorded amongst breeding populations of ospreys in North America (Spitzer 1980).

Eastern Osprey are long-lived birds and are considered sedentary (Marchant and Higgins 1993). As such, they would not be expected to experience extreme natural fluctuations in population size, extent of occurrence or area of occupancy. Further long-term studies of the South Australian population are needed to understand trends.

Artificial nest platforms

Few raptors, including ospreys, will tolerate human encroachment and disturbance which occurs directly above the nest, as typically occurs in South Australia's open coastal landscapes. The lack of suitable secure nesting sites in otherwise suitable territories may be an important limiting factor to recovering osprey in South Australia.

In remote locations ospreys are sensitive to human activity and will abandon a breeding attempt if disturbance is frequent or prolonged. Interstate and international experience has demonstrated the important role that artificial nest platforms can play in recovering osprey populations.

Artificial nest platforms, recently installed on Kangaroo Island and Yorke Peninsula have been successfully taken up by osprey breeding pairs with nestlings present in 2021.

Artificial osprey nesting platform installed in Bay or Shoals, Kangaroo Island. Photo: Heiri Klein.

Community involvement in recovery

In addition to being sentinel species for the health of our coastal environments, Eastern Osprey and White-bellied Sea Eagle are charismatic species that capture the imagination of the local communities where they occur.

A number of community-led recovery projects are already underway in South Australia, notably on Yorke Peninsula and Eyre Peninsula. These projects include:

- Recovery and Conservation of the Eastern Osprey on Yorke Peninsula, which is an initiative of the Southern Yorke Peninsula Land Care Group Inc. This project has a focus on the installation of artificial nest platforms at key locations and has generated a significant amount of support from a range of local community groups. Construction and installation of the nest platforms has been community-driven.
- The Eastern Osprey satellite tracking, colour banding and community engagement work on Eyre Peninsula being led by the Friends of Osprey Group.

In addition, the community has played an important role in the reporting of incidental sightings and in survey and monitoring across the state for both osprey and sea eagle.

The South Australian Recovery Team for Eastern Osprey and White-bellied Sea Eagle acknowledges the important work being done in the community to recover these iconic species. This Recovery Plan aims to build on this foundation and provide a framework for further community-led recovery.

Ardrossan Men's Shed community members constructing an artificial nest platform for osprey. Photos: Ian Falkenberg

Population mobility and genetic exchange

Based on the Eastern Osprey's past and current distributions and recorded movements of immature birds, genetic exchange is expected to occur among regional osprey populations across Australia (e.g. see Marchant and Higgins 1993). Nevertheless, the South Australian population is relatively isolated from known western and eastern Australian breeding territories (Dennis and Clancy 2014). Genetic studies would be of potential interest in understanding the level of interaction with interstate populations.

Habitat critical for survival

Eastern Osprey require extensive areas of open fresh, brackish or saline water for foraging for their fish prey (Marchant & Higgins 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes (Gosper & Holmes 2002; Johnstone & Storr 1998; Olsen 1995); noting that in the South Australian part of their range, they are primarily associated with coastal habitats.

Nesting sites that have a range of good quality foraging areas within close proximity, and are protected from disturbance, are therefore the most important habitat areas for protection if the state's osprey population is to survive and prosper.

Important populations / occurrences

In South Australia the Eastern Osprey population occurs along the coast of Yorke and Eyre Peninsula and in the Far West regions, as well as on offshore islands including Kangaroo Island. They occur in low density in areas of suitable habitat, with 58 pairs recorded across the state in the period 2008-10 (Dennis et al. 2011a) and 43 breeding pairs recorded in the period 2015-17 (Detmar and Dennis 2018). While Eastern Osprey are known to travel large distances, the South Australian population is largely geographically isolated from populations in other states (Barrett et al. 2003; Blakers et al. 1984; Dennis 2007b; Johnstone & Storr 1998; Dennis and Clancy 2014). The whole South Australian population is therefore geographically important.

A significant reduction in both population size and range, as inferred from historical records and current distribution, occurred in South Australia during the 20th century. Eastern Ospreys were recorded breeding at locations within Spencer Gulf (including Port Germein, Mambray Creek, Port Broughton and Corny Point) in the early to mid-1900s, but these sites have been vacant for more than 50 years. Breeding sites were also previously located along the lower River Murray, with the most recent records of breeding activity from near Waikerie (deserted since 1974; Dennis 2007b) and near Nildottie (deserted since 1980; Robinson 1980 in Dennis et al. 2011).

Of particular concern, further significant declines have occurred across the state over the last decade (Detmar & Dennis 2018).

Many breeding sites on the mainland and Kangaroo Island are considered vulnerable to human disturbance (Dennis 2007b).

Given these circumstances

- investigative research is required to better understand the likely cause(s) of recent population declines.
- breeding pairs / territories located on remote South Australian offshore islands have greatest potential for long-term conservation security;
- currently occupied territories in other coastal parts of the state are in need of conservation protection;
- currently abandoned territories and/or prospective 'new' territories away from major human disturbances afford the greatest opportunities for increasing the overall population size through targeted management: and,
- the provision of artificial nest platforms installed in appropriate locations can provide breeding sites subject to fewer disturbances or other threats, e.g. predation, where these are identified as being likely causes of nest failure or periodic occupancy.

Osprey Habituation

Habituation by definition occurs when animals are exposed to the same stimuli repeatedly, and eventually stop responding to those stimuli. When wild animals no longer see humans as a threat, they allow humans to come very close to them, or in some cases the animal will approach a human.

In many situations on the east coast of Australia, ospreys have chosen a breeding site near or amongst human settlements. These sites often comprises an artificial nest platform or other built infrastructure, i.e. an elevated position far above the human activity, such as on telecommunication towers (as has occurred in recent years at three coastal towns in SA).

Another South Australian example of habituation is the osprey pair that have successfully raised several fledglings over nine years on an old barge near Lincoln Cove marina.

Note that there is a clear behavioural response distinction between osprey that have become habituated to some extent and have chosen to breed in an area that is subject to frequent human activity, versus osprey in remote locations that remain highly sensitive to disturbance. It is recommended that people approach no closer than 500 metres from an osprey breeding site.

Osprey nestlings on an old barge near Lincoln Cove Marina. Photo: Fran Solly.

Part B: White-bellied Sea Eagle

Distribution

The Australian White-bellied Sea Eagle population has been estimated at >5000 pairs (Debus 2017). The majority of these are located in warm-temperate and tropical coastal regions in the north of the continent where there are substantial rivers and broad freshwater or estuarine wetland habitats, often with tall forests adjacent providing nesting sites (Corbett and Hertog 2011; O'Donnell and Debus 2012; DEE 2018). These archetypal habitats are almost completely absent in South Australia, where a population of 70-80 pairs is found sparsely distributed in open coastal landscapes (including islands) with mainly low sclerophyllous and chenopod shrubland vegetation cover, and with only two territories remaining on an inland waterway (Dennis et al. 2011a; Dennis and Detmar 2018: T. Dennis pers. comm 2021).

The distribution of White-bellied Sea Eagles in South Australia extends over roughly 5,500 km of coastline across the coastal areas of the Great Australian Bight, Eyre Peninsula, Yorke Peninsula, Fleurieu Peninsula and Kangaroo Island (Dennis and Detmar 2018).

It is conservatively thought that in the 19th century the White-bellied Sea Eagle population was at least 124 pairs (Dennis and Detmar 2018). The current population, determined by recent surveys, is approximately 73 pairs, showing a decline of roughly 40% (Dennis and Detmar 2018).

The current knowledge of occupied and unoccupied sea eagle nest sites / breeding territories is summarized in Figure 4.

Cultural Significance

The White-bellied Sea Eagle occurs in the land and sea areas of many First Nations peoples. Where known and appropriate, First Nations language group names for, stories about, and cultural significance of, White-bellied Sea Eagles should be documented.

Figure 3. Typical White-bellied Sea Eagle nest location site associated with shallow cave overhang. Photo: Sharie Detmar

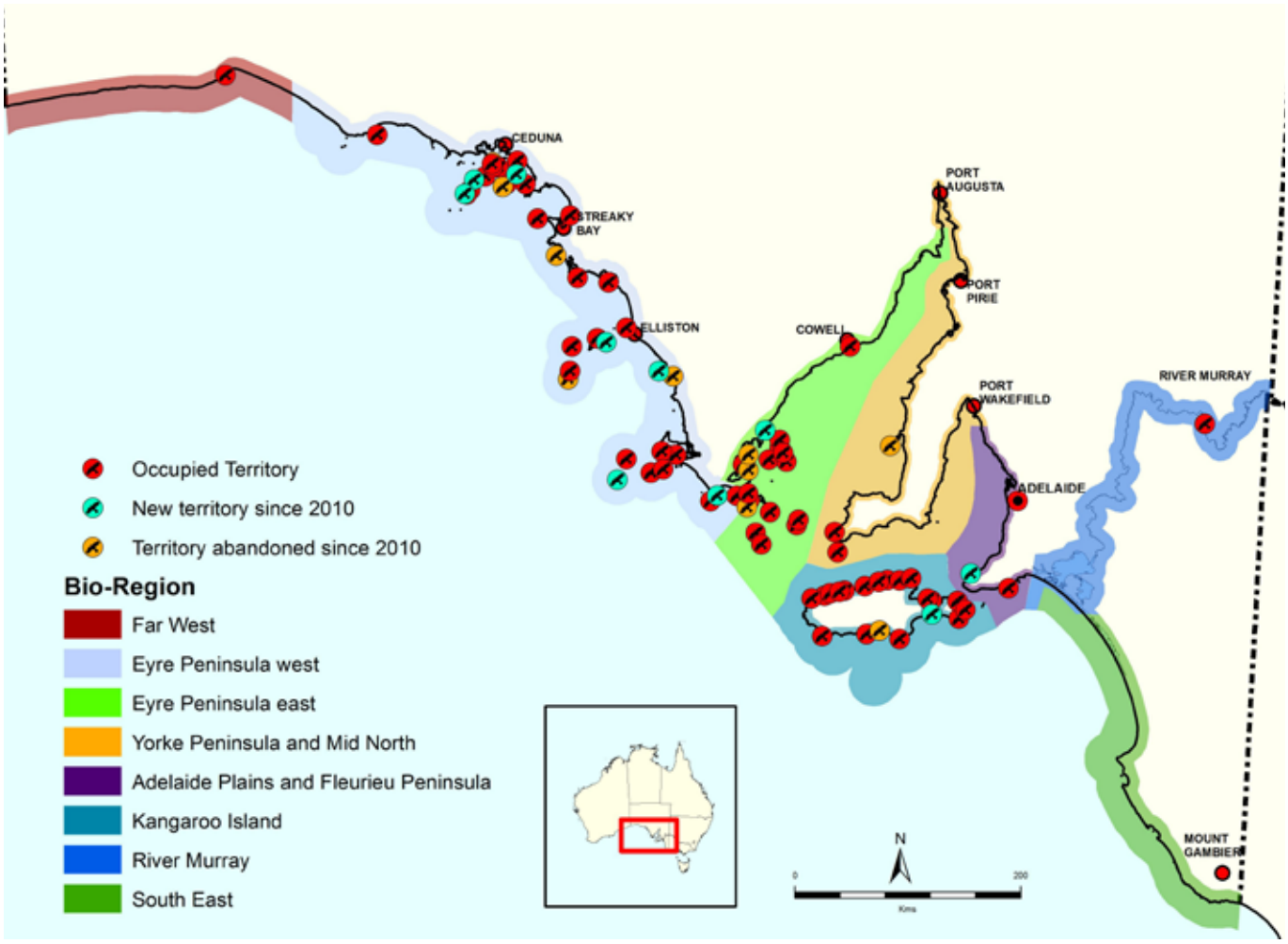


Figure 4: Map of White-bellied Sea Eagle territories in South Australia from the 2017 survey. Red dots indicate occupied territories, green points illustrates new territory and orange points show areas that were occupied in 2010 but have since been vacant (Dennis and Detmar 2018).

Relevant Biology/Ecology

Diet

White-bellied Sea Eagles, relative to the specialist piscivorous osprey, are opportunistic feeders. They consume a variety of fish, birds, reptiles, mammals and also feed on carrion (del Hoyo et al. 1994; Ferguson-Lees & Christie 2001; Marchant & Higgins 1993; Rose 2001; Corbett and Hertog 2011; Debus 2017). They normally hunt from a perch or whilst in flight. Prey is usually carried to a feeding platform or (if small) consumed in flight, but some items are eaten on the ground (Ferguson-Lees & Christie 2001; Marchant & Higgins 1993). In addition to these behaviours, the White-bellied Sea Eagle will sometimes steal prey from seabirds and from other raptors such as ospreys. Sea eagles have also been recorded following fishers and dolphins to feed on flushed prey (del Hoyo et al. 1994; Ferguson-Lees & Christie 2001; Marchant & Higgins 1993).

Reproductive Biology and Life History

In South Australia the breeding season of the White-bellied Sea eagle extends from May to January (and rarely February) (Dennis, Fitzpatrick and Brittain 2012; Marchant & Higgins 1993). As with all *Haliaeetus* spp. White-bellied Sea Eagles pair for life and pair-bonding flights (synchronised soaring) and vocalisation (duetting) displays occur throughout the year (Debus 2017). In South Australia these behaviours become more frequent from mid-April onwards and by mid-May include stick carrying flights and nest repair activity, which continues through June, with pairs spending increasing amounts of time within the core territory and attending the nest each day, irrespective of whether egg-laying follows (Dennis, Fitzpatrick and Brittain 2012). As with most eagle species, it is during this critical early phase of the breeding cycle, preceding egg laying and during incubation, when sea eagles are most sensitive to activity disruption and when disturbance is most likely to cause nest abandonment

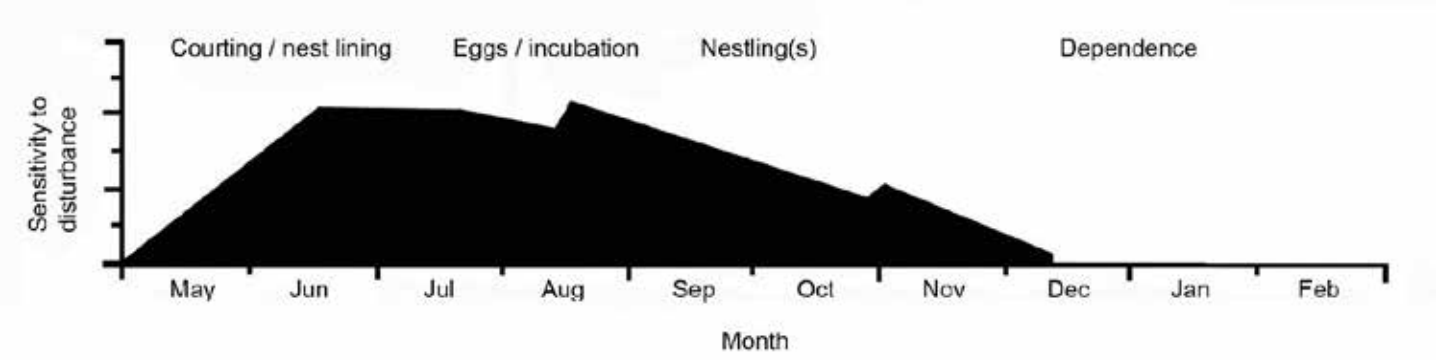


Figure 5. Phases of greatest sensitivity and corresponding risk of nest desertion during the White-bellied Sea-Eagle breeding season in South Australia. Note the risk of desertion increases through the courtship phase and is highest from mid-June to mid-September, and declines following increased parental investment thereafter (adapted from Dennis, Fitzpatrick and Brittain 2012).

(Olsen 1998; Clunie 2003; Threatened Species Section 2006; U.S. Fish and Wildlife Service 2007).

Clutch size for the White-bellied Sea Eagle is usually two (ranging from one to three; Debus 2017); and in South Australia most egg-laying occurs in July and August (Dennis, Fitzpatrick and Brittain 2012). The eggs are incubated for approximately six weeks (Bilney & Emison 1983; Dennis and Lashmar 1996; Debus 2017). Most incubation is done by the female (P. Olsen 2005 pers. comm. cited in Dennis et al. 2012; Debus 2008). Young fledge at around 12 weeks and are fed by the parents for a further two months (Dennis, Fitzpatrick and Brittain 2012; Debus 2017); followed by a series of plumage-phase gradations as sub-adults, reaching full adult plumage with maturity at around five years and breeding commencement at approximately six years of age (Marchant & Higgins 1993; Debus 2017).

The mortality rate is high amongst newly independent young birds, but if juveniles survive to breeding age they may live for up to 30 years (Parks and Wildlife Service Tasmania 2006). Sea eagles breed in solitary and monogamous pairs that mate for life. However, if one member of the pair dies, it is quickly replaced (Clunie 2003; Favaloro 1944; Marchant & Higgins 1993).

Population mobility and genetic exchange

From DNA evidence, high levels of genetic exchange occur among regional White-bellied Sea Eagle populations across Australia (Shephard, Catterall and Hughes 2005). Immature sea eagles are known to disperse widely and the Australian Bird and Bat Banding Scheme database contains examples of movements between states (Marchant and Higgins 1993; Dennis et al. 2011a; Debus 2015). Long-term demographic studies of sea eagles are required to better understand juvenile immigration and emigration within the South Australian population, and between the South Australian population and interstate populations.

Habitat critical for survival

In Northern Australia, the White-bellied Sea Eagle is associated with warm temperate and tropical coastal regions, where there are rivers and other freshwater or estuarine wetlands, often with fringing tall forests which provide nesting sites. These habitats are rare in South Australia where the remnant population is associated with open coastal landscapes and nesting sites are located in coastal areas along cliffs, shallow cave overhangs, rock outcrops or, less often, on low isolated coastal trees or in mangrove forest (Dennis and Detmar 2018). The current distribution of this species, where habitat would otherwise be suitable, is associated with areas of little or no human disturbance and availability of prey (Dennis and Detmar 2018).

In contrast to the forested habitat available and occupied in most other States, in South Australia sea eagles are largely limited to offshore islands or remote coastal cliff sites and associated broken terrain with low heath vegetation cover as breeding territories. This results in most breeding sites having little visual screening and therefore being particularly vulnerable to anthropogenic disturbances (Olsen 1998; Dennis and Detmar 2018). Protection of nesting sites from disturbance is therefore a critical conservation management consideration if the state's population is to survive and prosper. Note that guard-roosts (see terminology) are a critical consideration when assessing the impact of disturbance in South Australia. Mid-cliff nest sites are typical with (elevated) nest guard-roost sites often >500m distant. In these settings, eagles are aware of activity at great distance and flushing reaction (triggered by the non nest-attending bird) occurs earlier than in forested landscapes (Dennis et al. 2011b).

Important sub-adult and transient sea eagle foraging habitat locations

Sub-adult sea eagles and, less frequently, solitary adults, have been recorded or reported by various observers from many areas away from known breeding habitats (Dennis and Detmar 2018). Dennis and Detmar (2018) identify the following important areas for sub-adult and transient sea eagles:

- the lower lakes and River Murray delta, including the upper Coorong region;
- the upper River Murray floodplain complex in the Bookmark Biosphere Reserve and Chowilla area, particularly when coincident with periodic controlled flood simulation events;
- Gulf St Vincent, particularly from Outer Harbor to the Light River outflow, and over the tidal creeks in mangrove forest near Port Clinton and Price;
- upper Spencer Gulf, from Port Broughton to Port Davis; and
- Coffin Bay and Boston Bay on southern Eyre Peninsula.
- Venus Bay, Baird Bay, Denial Bay and nearby Tourville Bay on western Eyre Peninsula.

These areas are considered vitally important foraging locations for sub-adult and non-paired/transient eagles, as each area has abundant prey and is clear of potential spatial conflicts with territorial adults known to occur during the breeding season (Dennis and Detmar 2018).

Important populations

White-bellied Sea Eagle populations in South Australia are geographically isolated. The extent of the South Australian population is about 450 km from the nearest known territory in Western Australia, about 400 km away from the nearest known territory in coastal Victoria, and about 110 km from the nearest territory along the Murray-Darling system (Dennis and Detmar 2018). The whole South Australian population is therefore geographically important.

Given these circumstances:

- breeding pairs / territories located on remote South Australian offshore islands have greatest potential for long-term conservation security. This includes the more remote stretches of coastline on Kangaroo Island where about 26% of the total breeding population in South Australia occurs (Dennis and Detmar 2018). Eighty one per cent (81%) of South Australia's sea eagle pairs breed on offshore islands including Kangaroo Island (Dennis and Detmar 2018);
- currently occupied territories on the mainland, Kangaroo Island and on some offshore islands are in need of ongoing conservation protection and, in many locations, specific management actions; and,
- currently-abandoned territories and/or prospective 'new' territories that occur away from major human disturbances, or where human disturbances may be managed, afford the greatest opportunities for increasing the overall population size through targeted site management.

White-bellied Sea Eagles at nest. Photo: Dan Easton

Part C: Reasons for Listing and for Conservation Action for Eastern Osprey and White-bellied Sea Eagle

The South Australian population sizes of the Eastern Osprey (up to about 60 breeding pairs) and the White-bellied Sea Eagle (ca. 70-80 breeding pairs) are both very small and have declined over the last 50-100 years (Dennis and Detmar 2018; Detmar and Dennis 2018).

Since European settlement, the Eastern Osprey breeding population in South Australia has undergone both a range contraction and a decline in numbers of breeding pairs. While there is no estimate of the likely 19th century breeding population size, recent surveys (Detmar and Dennis 2018) have confirmed the continued absence of osprey from former breeding areas in upper Spencer Gulf and along the River Murray, as well as the rarity of breeding activity in suitable habitats in both Spencer Gulf and Gulf St Vincent. Comprehensive surveys conducted between 2008 and 2010 recorded 58 occupied osprey territories in South Australia (Dennis et al. 2011). These surveys were repeated in 2015-17 when only 43 occupied territories were identified (Detmar and Dennis 2018). This represented an overall decline of 26% in the number of occupied breeding territories in seven to eight years.

The likely 19th century White-bellied Sea Eagle breeding population in South Australia is conservatively estimated to have been at least 124 pairs (Dennis and Detmar 2018). When this estimate is compared with the extant population determined in recent surveys (n = 73), it represents a likely level of overall decline of around 40% (Dennis and Detmar 2018). However, even more significant is the level of likely decline in mainland habitats, from a probable 52 occupied territories to 14 confirmed in recent surveys; a very concerning decline of around 73% (Dennis and Detmar 2018).

Photo: Sharie Detmar

Part D: Current Threats to Populations

Threats identified in the literature, on departmental file notes and highlighted by members of the South Australian Eastern Osprey and White-bellied Sea Eagle Recovery Team are summarised below. Note that multiple threats can be acting on individual birds/territories.

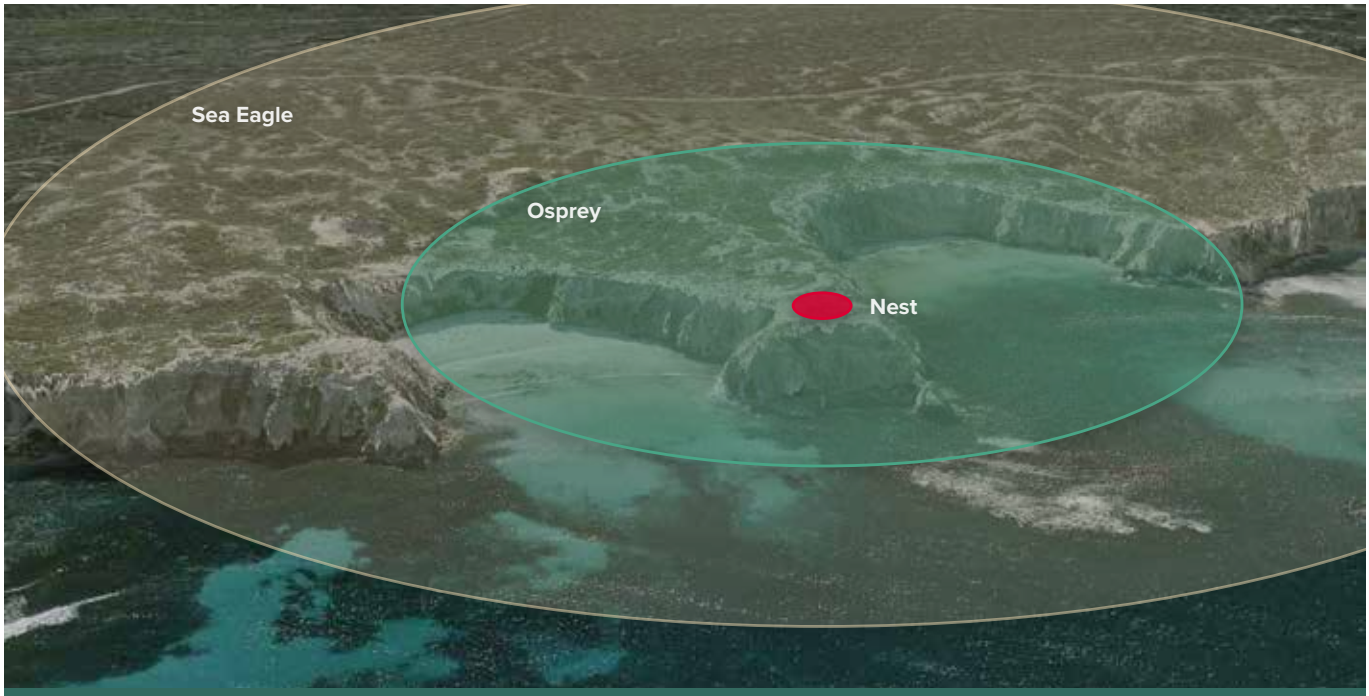
1. Disturbance

In South Australia's open coastal landscapes, osprey and sea eagle nest sites are particularly vulnerable to disturbance, especially from human approach or activity during the breeding season. This can often occur at a long distance, frequently in line-of-sight from a nest guard-roost location and sometimes the nest. Such disturbance frequently occurs from sites above nest level (e.g. cliff tops), rather than below.

In ospreys, sea eagles and other large raptor species, an elevated approach in open landscapes triggers an earlier and stronger response from breeding birds than would occur from disturbance below nest-level in forested terrain, invariably causing the breeding pair to loft sooner (Olsen 1998; Romin and Muck 2002). This may leave nest contents exposed to ambient conditions (heat, cold, rain) for longer and also to scavengers and nest predators, such as the Pacific Gull, *Larus pacificus*, and Australian Raven, *Corvus coronoides*, in South Australia (Dennis 2007a). With sea eagles in particular (and other *Haliaeetus* spp.), close approach to the nest from above can cause advanced-age young to fledge prematurely, resulting in mortalities from drowning (landing in the sea) or parental abandonment (T Dennis pers comm.; U.S. Fish and Wildlife Service 2007; Audubon Centre for Birds of Prey 2021).

Frequent disturbance can cause interrupted feeding cycles and provisioning that can adversely affect the development of nestlings and contribute to a higher rate of nest failure. Consequent reductions in population recruitment may eventually lead to a reduction in the total number of breeding pairs.

Juvenile White-bellied Sea Eagle. Photo: Andrew Brooks



Refuge Buffer Zones

To improve productivity outcomes in threatened raptor population conservation and recovery programs worldwide, the implementation of empirically defined temporal and spatial (breeding refuge) buffer zones is widely adopted as a key habitat management strategy to minimise disturbance during sensitive phases of the breeding cycle.

In South Australia's open coastal landscapes, default breeding refuge zones have been defined as the area within a 2000 m radius of the nest in White-bellied Sea Eagle territories; and 1000 m radius in Eastern Osprey territories (Dennis et al. 2012; Detmar and Dennis 2018; Coast Protection Board Policy 2020). However, refuge dimension flexibility could apply where a site-specific assessment is undertaken by a suitably qualified expert; for example an Eastern Osprey territory where a high level of habituation has occurred (eg. urban/peri-urban nest sites) may have a significantly reduced refuge dimension recommendation.

Graphical representation of refuge buffer zones in South Australia's open coastal landscapes

Cause: 1 (a) Coastal land division, development and changes in land use

In recent decades, increased development and change of land use in coastal areas of South Australia has emerged as a significant threat to the refuge quality of sea eagle and osprey habitat. This occurs through subdivision of agricultural properties into smaller holdings with development of houses in previously undeveloped areas. There has also been an increase in development and change of land use for commercial developments, such as tourism accommodation, golf courses and wind farms. This in turn, increases the level of human activity and associated impacts in coastal landscapes. This can lead to an increase in the frequency and intensity (proximity and duration) of disturbances to sea eagles and ospreys and to the desertion and even abandonment of breeding territories. For example, a study of nest productivity outcomes associated with human disturbance factors in sea eagle habitat on Kangaroo Island found that pairs in disturbed territories produced eggs less often, had higher nest failure rates and fledged significantly fewer young compared with pairs in more isolated locations (Dennis, McIntosh and Shaughnessy 2011b). Similar outcomes were found in a study of sea eagles exposed to disturbance during the breeding season in northern New South Wales, with nests being abandoned and pairs displaced to sub-optimal nesting habitat (Debus et al. 2014).

Sea eagles are, in general, more prone to nest desertion than ospreys when disturbed, especially during early- to mid-stages of the breeding cycle (Dennis & Lashmar 1996; Dennis, Fitzpatrick and Brittain 2012).

Coastal land use and coastal developments are expanding in extent. In many instances, this is leading to decreased habitat quality for coastal raptors as a result of increased disturbance. These pressures are likely to increase the risk that breeding pairs, especially sea eagles, will abandon their breeding territories.

Cause: 1 (b) Coastal access

Formal access

Poorly-sited tourism infrastructure such as buildings, roads, walking trails and lookouts can all channel people into remote locations within sea eagle and osprey breeding territories and lead to significant levels of disturbance during breeding seasons. Location and proximity of such access trails and viewing points to nests and guard-roosts is therefore a critical consideration for future conservation management.

Informal access

In remote coastal areas on Eyre Peninsula and in the Far West of South Australia (where many abandoned territories have been recorded), there has been a longstanding practice of gaining access to almost every beach and many other coastal features by four-wheel drive vehicles (largely by fishermen and surfers to view fishing areas and surf breaks), including in National Parks and Wildlife reserves. This has resulted in the formation of informal tracks, causing vegetation damage and serious erosion with many of these tracks closely following the cliff-edge in direct line-of-sight of osprey and sea eagle nests and guard roosts. This causes disturbance, degrades habitat quality and greatly increases the risk of nest failures and territory abandonment (Dennis and Detmar 2018; Detmar and Dennis 2018).

Seasonal track closures

Poorly-sited walking trails and lookouts can all channel people into remote locations where sea eagle and osprey are nesting on cliff-faces or stacks below the clifftop. People appearing above them during the breeding season, along cliff edge trails or at view-points, can cause sea eagles and ospreys to leave the nest. Eggs can get broken, nestlings can get exposed to predators and/or die from exposure or lack of food. Persistent disturbance during breeding season could lead to abandonment of territory.

On Kangaroo Island, relevant sections of walking trails in three National Parks and Wildlife Reserves (Cape Torrens Wilderness Protection Area (WPA), Cape Gantheaume WPA and Vivonne Bay Conservation Park) are closed seasonally to protect occupied breeding territories.

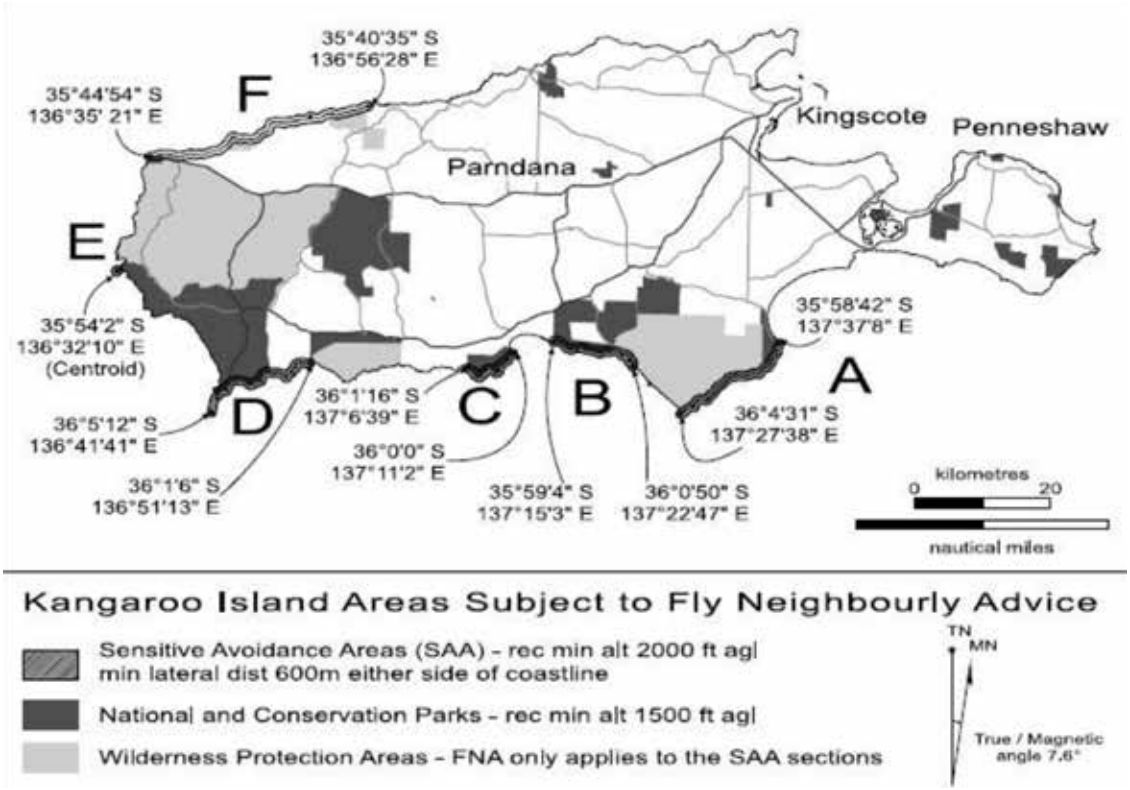
Seasonal track closure sign, Scott Cove Kangaroo Island (Photo: Heiri Klein)

Cause: 1 (c) incidental disturbance: ill-timed research, land management, recreational and commercial activities

Ill-timed research (e.g. biological surveys and marine mammal research), land management activities (e.g. pest plant and animal control, prescribed burning and other fire management-related activities, nature-based tourism and other tourism activities, recreational and commercial activities (e.g. offshore fishing, four-wheel driving, bushwalking, photography) on National Parks & Wildlife reserves and other remote areas, including islands, can cause unintended disturbances to ospreys and sea eagles during their breeding seasons. Additionally, the use of drones for pursuits such as nature photography, may also lead to serious injuries to coastal raptors if the drone enters its core territory at inappropriate times, triggering a defensive response by attacking the 'intruder' drone. The scale of recreational activities such as nature photography is increasing in South Australia and has resulted in both Birdlife Australia and Birds SA updating their respective Ethical Birding policies and guidelines for members, in an effort to raise awareness of, and to limit, potential impacts.

Cause: 1 (d) Disturbance due to low-flying aircraft over-flying breeding territories of sea eagles and/or ospreys

Low-flying overflight of territories by private, commercial, emergency response and military aircraft can cause unintended disturbances to sea eagle and osprey breeding pairs resulting in nest failures.



Fly Neighbourly Agreement areas on Kangaroo island

Fly Neighbourly Advice

In normally remote undisturbed areas, low flying aircraft can severely disrupt breeding sea eagles and ospreys. The sudden appearance overhead and noise, can cause adults to leave the nest in panic, risking damage to eggs or nestlings, or older young to prematurely fledge. Also, even temporary absences from the nest expose eggs and small young to predators and prevailing weather.

To protect sensitive breeding areas, Fly Neighbourly Advice (FNA) have been developed detailing the sensitive areas, minimum flight heights, engine noise management (rpm/pitch), offset distances around those areas and landing restrictions. All pilots are expected to fly in accordance with the FNA, which have been approved by the Civil Aviation Safety Authority. An example of an area where FNA has been developed is over the cliffs in Dhilba Guuranda - Innes National Park and Althorpe Islands Conservation Park on southern Yorke Peninsula. Other FNA areas to protect sea eagles and ospreys are on Kangaroos Island and the Waitpinga Cliffs on Fleurieu Peninsula.

2. Other Sources of Disturbance

Cause: 2 (a) Inter-specific competition for breeding territories / nest sites

Paradoxically, in some areas (e.g. Kangaroo Island), inter-species kleptoparasitism and spatial conflict between Eastern Ospreys and White-bellied Sea Eagles may cause breeding disruption and territory displacement of ospreys by sea eagles (Dennis and Baxter 2006; Dennis 2007a). Sea eagle territories and nests are occasionally also usurped by Wedge-tailed Eagles, *Aquila audax* (Dennis and Detmar 2018). Competition for resources between these two species may have an adverse effect on some White-bellied Sea Eagle pairs (Spencer & Lynch 2005). Competition between the White-bellied Sea Eagle and the Wedge-tailed Eagle has also been recorded in Tasmania and has led to breeding failures in both species (Threatened Species Section 2006).

Cause: 2 (b) Extreme weather during nesting (climate change)

Extreme weather, which includes strong winds and tidal storm surges, can disturb breeding pairs of sea eagles and ospreys through damage to nests and through limiting the birds' abilities to hunt and to feed their young. These effects may be exacerbated by sea level rise and the increases in extreme weather events, including extreme heat events, that are expected to occur under most modelled climate change scenarios.

3. Osprey and Sea Eagle Mortality Events

Both species are long-lived and can be reproductively active for about 10 to 15 years. Therefore each pair has the capacity to produce several times their replacement numbers. In South Australia the fate of fledglings is unknown.

The causes of mortality recorded for these coastal raptor species include:

- Illegal persecution
- Poisoning / bio-accumulation of pesticide residues and heavy metals
- Collisions with, and/or electrocutions by electricity infrastructure
- Marine pollution through entanglements in fishing tackle and boating infrastructure
- Marine pollution through ingestion of plastics
- Marine pollution through oil spill
- Predation
- Extreme weather events
- Disease and parasites

For further explanation of causes of mortality refer to Appendix 1.

White-bellied Sea Eagle. Photo: Nicholas Birks

Part E: Objectives, Goals, Performance Criteria and Actions

Recovery goals & objectives

Overarching Goal:

By 2030, to secure, stabilise and ultimately increase the number of breeding pairs of Eastern Osprey and White-bellied Sea Eagle in South Australia from 2021/22 levels.

Objectives:

1. To protect all known breeding territories.
2. To identify and address critical knowledge gaps.
3. To increase the number of breeding territories over former and potential habitat.

Performance criteria for objectives

Short-term (five years):

- No known loss of breeding territories of White-bellied Sea Eagle and Eastern Osprey as a result of human disturbance.
- Site-based threats to nests/territories identified, prioritised and priority actions implemented as appropriate.
- Habitat/species distribution model developed.
- Measure and report on productivity (number of young fledged) at sites subject to annual monitoring.
- Risks posed by electrical and other built infrastructure identified and mitigated where practical.
- Colour-banding and satellite tracking studies established.
- Subsample(s) of breeding territories monitored annually using traditional tools and emerging technology.

Medium-term (5-10 years):

- No known loss of breeding territories of White-bellied Sea Eagle and Eastern Osprey as a result of human disturbance.
- Establishment of breeding pairs at previously abandoned or new nest sites.
- A higher rate of fledging success recorded for monitored nests.
- Inter-annual variability in breeding activity and population instability investigated.
- A statewide population survey and threat assessment for ospreys and sea eagles is undertaken every five years.

Long-term (10-15 year):

- No known loss of breeding territories of White-bellied Sea Eagle and Eastern Osprey as a result of human disturbance.
- An increase in population size (number of breeding pairs) for both White-bellied Sea Eagle and Eastern Osprey in South Australia.
- Spatially-explicit demographic model developed
- A statewide population survey and threat assessment for ospreys and sea eagles is undertaken every five years.

Classic example of osprey habituation – artificial nest platform at Ballina Rugby Club with players training below nesting birds, north coast of NSW. Photo: Pete Henwood

Photo: Dan Easton

Recovery Actions

1. Reduce disturbance to breeding territories

1.1 Adopt and implement the 'breeding refuge buffer zone' disturbance mitigation concept as a primary habitat management model in South Australia:

1.1.1 Seek amendment to the Statewide Planning and Design Code to include a Critical Habitat Overlay to afford greater protection to critical habitat from development.

1.1.2 Develop DEW policy/guidelines for infrastructure development, land management and research activities on the reserve and Crown Lands estate.

1.1.3 Develop guidelines for all land managers (eg. Landscape Boards, councils) and research organisations consistent with current Coast Protection Board Policies and actively work with them to adopt them.

1.1.4 Identify and implement legislative and/or policy or other mechanisms (e.g. formal protection) to afford greater protection to currently occupied sites and extend protection to formerly occupied sites and potential habitat.

1.1.5 Working with industry and stakeholder groups, develop guidelines for commercial and recreational fishers and boating enthusiasts (including self-propelled vessels) to minimise disturbance of coastal raptors at sensitive times of year.

The guidelines and DEW policy will be developed in order to prevent and/or minimise disturbance resulting from:

- infrastructure development, including development of visitor management infrastructure (e.g. interpretive facilities, walking trails, lookouts), and associated activities;
- maintenance of infrastructure, roads and trails and /or land management activities (e.g. pest plant or animal control) during sensitive phases of the breeding season;
- ill-timed research projects;
- fire management operations; and,
- recreational or commercial activities (including tourism activities).

1.2 Identify threats to current and past breeding territories.

1.2.1 Identify and record known and potential disturbances and threats to breeding territories on a site-by-site basis.

1.2.2 Prioritise sites for protection and management.

1.2.3 Undertake an inventory of the vulnerability of all current nest sites to tidal storm surges.

1.3 Manage the access of people and vehicles to occupied breeding territories, particularly during sensitive phases of the breeding cycle, through the implementation of site-specific breeding refuge buffer-zones.

1.3.1 Where access to nest sites is identified as an existing or potential threat, where practical, impose restrictions on access to these sites through the legal and/or physical closure and/or re-routing of roads, tracks and walking trails. This may include:

- maintaining or implementing seasonal closures of walking trails and vehicle tracks (e.g. KI, YP, EP etc.) to protect occupied breeding territories (including nests and guard roosts), particularly in NPWS parks and reserves;
- trails and tracks that have the potential to impact on nest sites and guard roosts identified, prioritised and rerouted wherever practical; and,
- seasonal closures and rerouting trails and tracks away from sensitive breeding refuge areas for both species to be addressed (consistently & statewide) in NPWS Reserve management plans.

1.4 Manage disturbance threat posed by low-level Aircraft:

1.4.1 Review and revise existing Fly Neighbourly Advices and consider developing new advices through the Civil Aviation Safety Authority (CASA) where particular breeding territories are considered vulnerable.

1.4.2 Generate a brochure of Fly Neighbourly Advice areas and conditions in South Australia and provide to stakeholders.

1.5 Manage disturbance threat presented by coastal and inland rivers nature-based tourism, (including vessel or canoe-based tourism) via the development and implementation of guidelines

for coastal and wetland sightseeing tourism activities to avoid all breeding territories for both species within the breeding season, including for proposals and permits issued for scenic flights within protected areas in SA.

1.6 Develop and implement visitor management signage (where nest sites are obvious from formal coastal access points).

1.7 Restore osprey and sea eagle sites (including inland river sites) abandoned due to previous disturbance, where feasible:

1.7.1 Remove or significantly reduce sources of regular disturbances.

1.7.2 Installation of artificial nest platforms for ospreys where nest sites are known to have been recently abandoned or to have low fledgling success due to disturbance and or predation.

2. Investigate and address causes of direct mortality in Eastern Osprey and White-bellied Sea Eagle

2.1 Ensure coastal raptor mortalities are reported and investigated in collaboration with relevant experts to understand causes.

2.2 Identify preventable mortalities or potential negative interactions with infrastructure and develop appropriate mitigation actions in collaboration with industry and other key stakeholders.

2.2.1 Develop a risk management and mitigation plan for electricity infrastructure for priority sites, along with a specific industry engagement plan for electricity providers.

2.3 Follow-up all inexplicable nest failures (including predation of eggs or nestlings, particularly by introduced predators) to develop remedial actions or ensure compliance investigations are implemented as appropriate.

3. Develop and undertake a monitoring and research program

3.1 Determine the current 2021/22 baseline for occupied breeding territories of Eastern Ospreys and White-bellied Sea Eagles in South Australia against which recovery can be measured.

3.2 Develop a conceptual model (flow chart) of threatening processes to osprey and sea eagle populations in South Australia, documenting assumptions and visually demonstrating the relative impact of threats.

3.3 Develop and implement a statewide nestling colour-banding project to enable demographic studies of the osprey and sea eagle population.

3.4 Develop a habitat/species distribution model for osprey and sea eagle in South Australia.

3.5 Undertake a statewide population survey and threat assessment for ospreys and sea eagles every five years.

3.6 Monitor subset(s) of osprey and sea eagle territories annually to determine inter-annual variability in breeding activity and investigate breeding productivity and territory instability, noting that annual monitoring efforts will be targeted towards areas where there has been observed instability; or where particular issues of concern have been identified; or where there is active community support.

3.7 Implement a satellite tracking study to better understand dispersal and habitat selection in newly independent osprey.

3.8 Train observers, including community members, in survey and data collection, including protocols to avoid disturbance during sensitive phases of the breeding cycle.

3.9 Install and operate stationary nest cameras (without disturbance) with the aim of measuring:

- fecundity and fledgling survival rate;
- composition of and trends in diet and in nest provisioning rates; and,
- predator/scavenger activity.

3.10 Develop inter-agency linkages (e.g. SARDI) to investigate/advise on influences on marine foodchain fluctuations and availability in relation to coastal raptor habitat occupancy, productivity and to forecast potential effects of climate change.

3.11 Collect feathers and other DNA material for future genetic studies.

3.12 Document knowledge gaps and develop an associated monitoring and research framework and implementation plan.

4. Establish data management protocols and processes

4.1 Develop and implement appropriate data management protocols to capture and store breeding territory data, including protocols regarding access to and supply of sensitive data.

4.1.1 Encourage use of (and provide training in) appropriate data collection apps for smart phones (e.g. BioCollect, Birdata) for incidental records, alongside the further development of a dedicated app for breeding/occupancy survey and monitoring.

4.2 Further develop and maintain a database to capture and manage breeding activity and sighting data including a mechanism and screening capability for community inputs vide 6.5 below.

4.3 Ensure data is maintained and updated.

4.4 Maintain an up-to-date spatial layer of breeding refuge buffer zones around breeding territories across South Australia.

5. First Nation Cultural Significance

5.1 Engage with First Nations people to recognise and respect cultural significance of osprey and sea eagles within indigenous communities along the coastline of SA.

5.2 Investigate options for First Nations community involvement in recovery actions, including training opportunities.

6. Increase community awareness of, support for and involvement in the implementation of White-bellied Sea Eagle and Eastern Osprey recovery actions.

6.1 Develop a communication and community engagement plan for South Australian osprey and sea eagle conservation, including:

6.1.1 A coastal raptor conservation information webpage so that it can be used, via hyperlinks, to connect with national, state and regional conservation, development planning and tourism websites. This site should:

- provide background about the biology and conservation status of both ospreys and sea eagles in South Australia;
- describe the consequences of the various forms of disturbance on breeding pairs of ospreys and sea eagles;
- include policies, guidelines and codes of conduct with respect to the prevention / minimisation of disturbance to breeding pairs;
- explore the use of satellite tracking tags to explore local habitat utilisation and support community bonding with resident osprey and sea eagles
- make nest camera footage available to the public to raise awareness of the management and recovery actions needed and underway for White-bellied Sea Eagle and Eastern Osprey: and,
- moderate website to provide context around such issues as siblicide and inter-specific competition.

6.1.2 A strategy to engage media around specific White-bellied Sea Eagle and osprey conservation projects.

6.2 Develop community guidelines and codes of conduct with respect to the prevention / minimisation of disturbance to coastal raptors.

6.3 Actively engage with community stakeholders (land managers, developers, local primary schools, environmental groups) to alert them to the presence of these birds, their nesting habitat and their vulnerability to disturbance.

6.4 Establish, coordinate and maintain a network of volunteers and coastal raptor champions (Friends of Coastal Raptors or NestWatch) to support the recovery program actions, including monitoring and site-based protection and conservation measures.

6.5 Encourage members of the public to report sightings to state and national agencies and/or to submit records to Biological Databases of South Australia (BDBSA) or Birdata (Birdlife Australia) (refer action 4.1.1).

6.6 Communicate to stakeholders and the broader community that it's an offense to deliberately interfere with or harass a protected animal under the *National Parks and Wildlife Act 1972*.

7. Maintain and facilitate the Recovery Team and support recovery actions

7.1 Maintain a recovery team that:

- includes representation of community interest in coastal raptor conservation issues;
- coordinates, reviews and reports on recovery process and progress; and,
- ensures that recovery actions are prioritised and reviewed in a timely manner using the best available information and expert input.

7.2 Adequately resource the recovery actions outlined in this plan, including a Recovery Project Officer to undertake, implement, coordinate and support the recovery actions and aspects of recovery team administration.

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Terminology

(modified from Dennis et al. 2012)

- Coastal raptor - for the purpose of this recovery plan this term refers only to White-bellied Sea Eagle and Eastern Osprey.
- Breeding refuge zone – the area within a territory centred on the nest and associated guard-roosts, within which raptors are most sensitive/responsive to disturbance.
- Occupied territory – a site where an adult pair observed together during the breeding season in the vicinity of nest(s) and repairing the nest or defending the territory.
- Active nest or territory – a site where incubation behaviour suggests that eggs are present, or young are recorded.
- Successful nest or territory – fledglings are observed away from the nest.
- Failed nest or territory – where eggs fail to hatch, or where all eggs or young are lost.
- Core territory – the area around a nest site defended against intrusions by other eagles.
- Viewshed - the total area within view from a nesting site and associated guard roosts.
- Guard-roosts – strategic vantage points within the core territory used as day-roosts by the non-incubating bird.
- Primary nest – the most frequently used nest within a territory.
- Alternative nest – one of sometimes several nest structures within a territory.

Additional Terms

- Colour-banding study – nestlings are fitted with unique colour bands that enable biologists and the community to resight these birds over time and gather information about their movements within and between regions, along with generating information about survival, pairing and breeding etc. (refer also spatially-explicit demographic model).
- Spatially-explicit demographic model – by implementing the colour-banding study at scale and over a protracted period (in conjunction with other monitoring data like number of young per nest), resight information can be used to develop mark-resight and other models. Modelling techniques can be used to estimate survival, emigration and immigration rates etc. and potentially help understand causes of decline. These in turn will help target future recovery efforts.
- Habitat/species distribution model – using data from current and historical breeding territories, modelling techniques can be used to determine the relative importance of a range of parameters (such as coastline geomorphology, wave energy exposure, bathymetry of adjacent nearshore environment, coastal development etc.), in driving coastal raptor occupancy. For species like osprey and sea eagle, the models may be used identify potential new habitat and assist in estimating the total number of territories available.

Appendix 1 – Osprey and Sea Eagle Mortality Events

Deaths due to Illegal persecution

Occasional illegal shooting of White-bellied Sea Eagles and Eastern Ospreys has continued to occur across Australia since their legal protection (Debus 2015; Manning, et al. 2008; O'Brien and Lacey 2016; Spencer and Lynch 2005). For example, low population numbers of the Eastern Osprey in New South Wales in the latter part of the 20th century were attributed, in part, to shooting (Clancy 2005; Clancy 2006). Shooting is claimed to be the cause of loss of some local South Australian populations (Dennis & Lashmar 1996). However, due to the nature of the threat, statistics and impacts of illegal shooting of either species in South Australia are poorly known.

Deaths due to poisoning / bio-accumulation of pesticide residues

Environmental contamination by pesticide residues has affected the breeding success of many bird species. These compounds are known to take decades to break down and even at very low concentrations (of only a few parts per million wet weight) can reduce egg viability (Poole 1989). Top order predators are particularly vulnerable due to bio-accumulation of pesticides up through the food chain (Tudge 1992). In a study conducted on Kangaroo Island by Dennis (2007a), the irregular breeding activity and low productivity levels found for Eastern Osprey were noted as consistent with raptor populations affected by accumulated pesticide residue found in their prey (Newton 1979; Poole 1989). In support of this observation, low to moderate levels of organochlorines (DDE and DDT) had been found in both White-bellied Sea Eagle and Eastern Osprey eggs with mean levels of DDT measured at 1.07 mg kg^{-1} and 0.11 mg kg^{-1} respectively (Falkenberg et al. 1994). The same study also found concerning levels of DDT in some sea eagle prey species from Kangaroo Island; namely, feral pigeon (37.46 mg kg^{-1}) and silver gull (3.06 mg kg^{-1}). These pesticide residues have been shown to lead to lower fertility rates and thinning of eggshells with consequent cracking and failure of eggs to hatch. Similarly, DDE and other organochlorines have been found in ospreys from northern New South Wales (Clancy 2005) and levels of polychlorinated dibenzo-p-dioxins and furans (PCDD/PCDFs) found in White-bellied Sea Eagles from Homebush Bay in Sydney appeared to be high enough to impact on the birds' breeding success (Manning et al. 2008). This inference was supported by observational data indicating that the birds had laid eggs but only one nestling had been successfully hatched in fifteen years at the Homebush Bay nest site.

The banning of such pesticides as DDT in many countries (e.g. Argentina, Australia, Bulgaria, Canada, Colombia, Cyprus, Ethiopia, Finland, Hong Kong, Japan, Lebanon, Mozambique, Norway, Switzerland, USA) has lessened these problems through time, though break down products such as the DDE still persist in the environment. Clancy (2005) postulates that other pesticides and heavy metals may well have replaced organochlorines as potential contaminants of the Osprey's food. There has been no recent investigation to determine if these, or similar contaminants, are still prevalent in coastal or marine environments in South Australia, or in the species that frequent them.

Management practices for controlling pest animals such as rabbits, rats and mice may also risk exposure of sea eagles to secondary poisoning (Dennis and Detmar 2018). This may occur through the ingestion of baits intended for other animals (e.g. 1080 meat baits for cats and foxes) or, more likely, through the ingestion of poisoned prey such as rabbits or rats. For example, Pindone-affected rabbits may be consumed as either prey or as carrion (McLeod and Saunders 2013). The consumption of poisons can lead to direct mortality or to reduced breeding success.

Deaths due to collisions with, and/or electrocutions by electricity infrastructure

The frequencies of reported collisions of sea eagles and ospreys with power-lines and wind turbines in South Australia are very low, largely because flight-paths of these raptors intersect infrequently with electricity infrastructure and because there has been very little documented monitoring and reporting of such collisions in the State. However, some work has been done interstate. For example, Smales (2005) modelled cumulative impacts of wind farms on the White-bellied Sea Eagle across the species' Australian range. Similarly, Moloney et al. (2019) investigated existing post-construction mortality monitoring at Victorian wind farms to assess its utility in estimating mortality rates.

At present, in South Australia, the risk of collisions of sea eagles and ospreys with wind turbines located on the coast occurs on Eyre Peninsula, Yorke Peninsula and Fleurieu Peninsula. Windfarms are increasing in number and size within South Australia. Collisions with power-lines are more likely to occur due to their proximity to many stretches of coastline but, once again, the frequencies of reporting are very low.

In Tasmania, local raptor expert Nick Mooney reported that between 2013 and 2019, 11 Wedge-tailed Eagle and one White-bellied Sea Eagle death had been recorded at one wind farm since it was constructed (https://www.abc.net.au/news/2019-07-04/wildlife-expert-nick-mooney-calls-for-windfarm-eagle-death-study/11274334). In addition, he noted that in 2017-18, twenty-nine (29) Wedge-tailed Eagles were killed through collisions with, and electrocutions by, powerlines.

Raptor-power-line collisions, and the potential for electrocution, are most frequent when lines intersect raptor home ranges, particularly if they are in areas of core use by the raptor, or if lines span regularly used flight paths between nesting and foraging grounds (Slater et al. 2020). While there have been mortalities in the recent past caused by electricity distribution infrastructure in SA, the risks posed by this infrastructure to sea eagles (and ospreys) are unknown and this requires further investigation.

Most raptor species large and small perch on high points to search for prey, and power poles provide a perfect vantage point in landscapes that don't have high vegetation. Larger raptors such as ospreys and sea eagles are at increased risk of electrocution when using power poles as perching points owing to their large wingspans (P. Wilkins pers. comm.).

Deaths due to marine pollution through entanglements in fishing tackle & boating infrastructure

White-bellied Sea Eagles have occasionally been recorded being entangled in fishing nets while diving for fish near the water's surface (Clunie 2003; Favaloro 1944). Entanglements in marine debris, such as fishing tackle (e.g. discarded fishing lines with floats and hooks attached) may also impact sea eagles in a similar manner (unpublished data; Debus 2017; Thomson et al. 2020).

There are currently no formal records of Eastern Osprey being affected by entanglement in SA. However, they may be affected in a similar way to the sea eagles, as in other states (see Thomson et al. 2020).

Deaths and morbidity due to marine pollution through ingestion of plastics

Marine birds commonly ingest marine debris, which is known to pose both direct and indirect impacts on surface-feeding marine birds (Roman et al. 2016). Potential direct impacts include strangulation, suffocation, physical damage to the digestive tract (Carey 2011) and obstruction of the digestive tract which may result in starvation and death (Pierce 2004). Indirect risks include transfer of pollutants (Besseling et al. 2013) and bioaccumulation of plastic-derived chemicals in body tissues (Tanaka et al. 2013). The extent of ingestion of plastics by ospreys and sea eagles in South Australia is, however, unknown.

Deaths due to marine pollution through oil spill

The potential for gas and oil exploration in SA waters poses the risk for potential widespread environmental contamination within near-shore feeding habitats of ospreys and sea eagles should an oil spill occur. The chemical contaminants of oil spills have the potential to reduce fertility and food supplies of both species (Dennis and Detmar 2018; Dennis et al. 2011). Relatively small spills from shipping accidents may also have more localised and short-term effects because they can usually be contained more readily. Large 'spills' such as that from undersea extraction drill-holes may have much more serious, direct and indirect, effects on large areas of coastal environments, on fish and seabird populations and consequently, the coastal raptors that feed on them. Oiling may also occur at commercial fish offal dumps (Debus 2017).

At present, such risks in South Australia are minor.

Deaths due to predation

Many Eastern Osprey nest sites in South Australia are accessible to terrestrial predators such as foxes (recent video evidence of fox taking both eggs from osprey nest on Tumby Island). Feral cats and Sand Goannas have also been sighted scavenging around active nests on KI; however the evidence for their predation on eggs and nestlings is equivocal. Studies in North America show that ospreys produce more successful fledglings on islands free of mammalian predators or where predator-proof artificial nesting platforms have been provided (Poole 1989).

Osprey and sea eagle eggs and/or nestlings may occasionally also be preyed upon by other eagles (Schokman 1991 in HANZAB).

In addition, scavengers such as ravens and Pacific Gulls are likely to prey on osprey and sea eagle eggs or young nestlings when the parent birds are disturbed from their nests for sustained periods. Camera or video footage recently provided evidence of *Corvus* sp. harassing ospreys and young on Thistle Island (pers. comm. I. Falkenberg).

Deaths due to extreme weather events

Globally, raptor populations are known to be limited by food supply, nest-site availability, weather extremes and individual bird experience; and at a population level, can be influenced by the body condition of the female (Tapia and Zuberogoitia 2018).

Onset of breeding in ospreys and sea eagles is primarily seasonal (day-length) but may be influenced by prevailing food and weather conditions (e.g. Perrins 1970; Immelmann 1973; Drent and Daan 1980; Newton 1998). The effects of weather are largely indirect and often connected with, or veiled by, other factors, including those concerning the availability of food (e.g. Grubb 1977).

Extreme weather events linked to climate change appear to be increasing in their influences on breeding ospreys and sea eagles in South Australia. These include extended windy, cold and wet periods; storm surges associated with sea level rise; extreme high temperatures; extended heat waves; and increased risks of more frequent and severe bushfires. These types of events have resulted in nest damage and observed distress to nesting birds and are likely to result in losses of eggs, nestlings and fledglings in some situations.

Deaths due to disease and parasites

Mortalities and morbidities due to diseases and/or parasites are seldom recorded in wild ospreys and/or sea eagles. However, a range of health issues may present themselves in captive and/or ‘rescued’ raptors. As a consequence, the SA Department for Environment and Water has prepared “Recommended Guidelines for the Captive Management of Raptors Accipitriformes, Falconiformes & Strigiformes in South Australia”. These guidelines identify several health conditions that can occur in captive raptors and most of these can be expected to be present in the wild populations.

These conditions include:

- Trichomoniasis/Frounce
- Nematode/Throat worms
- Avian pox
- Aspergillosis
- Chlamydiosis
- Salmonellosis
- Giardia
- Coccidiosis
- Other parasites
- Viral beak and feather disease

See Appendix 2 for an overview of these health conditions.

Appendix 2 – Some Health Conditions of Captive Raptors

Trichomoniasis/Frounce

This is a devastating protozoan infection of birds that is common in raptors. It is characterised by large cheesy masses in the upper and lower oesophagus. A raptor often becomes infected after feeding on an infected prey bird. Wild birds are often near death before found making this disease difficult to treat. It has not been reported to infect humans.

Nematode/Throat worms

These can occur in the mouth and crop of raptors and can often be identified by the stringy slimy appearance of the inside of the mouth. The small lumps on the membrane inside the mouth will have a tiny white wriggling thread-like worm protruding. There are no reports of these nematodes infecting humans.

Avian pox

Pox virus is related to the herpes virus but it is not zoonotic. Pox virus is transmitted via blood sucking insects, such as mosquitoes, mites, and biting flies. The lesions begin as small white or yellow lumps that resemble pimples which rapidly grow. It is commonly seen as a raised, warty-looking nodular crusty lesion on non-feathered areas of the skin, particularly the feet, legs and head and around the eyes and sometimes in the mouth. Bacteria can attack lesions where the skin is broken, causing secondary infection, which can complicate treatment.

Aspergillosis

A fungal infection affecting the respiratory tract that is often associated with stress. Poor ventilation and large numbers of fungal spores released into the environment from moist rotting/decomposing vegetation (compost heaps, wood chips, hay, and straw) contribute to disease outbreak. Siting the aviary appropriately can lower exposure to the spores. (Note: see Zoonotic diseases referred to in the DEW guidelines)

Chlamydiosis

Transmission of the organism between individuals is primarily through inhalation of contaminated faecal or feather dust. The risk of infection is increased by close contact with infected birds, and birds that are stressed have a greater tendency to shed the organism. Infected birds may shed the organism even if no clinical signs of disease are observed. (Note: see Zoonotic diseases referred to in the DEW guidelines.)

Salmonellosis

Salmonella infection can be picked up through contaminated food (usually avian) and symptoms are difficult to spot in time. It is difficult to avoid, but providing a non-avian diet for captive raptors can minimise the risk. It is a significant but not great problem, largely controlled by acquisition of quality food, correct storage and good hygiene. (Note: see Zoonotic diseases referred to in the DEW guidelines.)

Giardia

Giardia is a protozoan parasite that lives inside the intestines of a range of species. Individuals become infected through ingesting the parasite or coming into contact with contaminated food, soil, water or other surface that have been tainted by the faeces of an infected animal. (Note: see Zoonotic diseases referred to in the DEW guidelines.)

Coccidiosis

Coccidiosis is caused by Coccidia, a microscopic protozoan parasite which infects the intestinal tract of a range of animal species. The disease spreads from one animal to another by contact with infected faeces or ingestion of infected tissue. Diarrhoea, which may become bloody in severe cases, is the primary symptom. Most animals infected with coccidia may show no clinical signs of the disease, however young or stressed animals may suffer severe symptoms, including death.

Source: DEW (no date) Recommended Guidelines for the Captive Management of Raptors *Accipitriformes, Falconiformes & Strigiformes* in South Australia. Last Updated 22/06/2020 - https://www.environment.sa.gov.au/topics/plants-and-animals/animal-welfare under ‘Related links’ “Guidelines for the Captive Management of Raptors in SA” (pdf)

NB there are documented cases of Bald Eagle mortalities in the USA attributed to Toxoplasmosis caused by the parasite known as *Toxoplasma gondii*.

For further information please contact:

Department for Environment and Water. Phone Information Line (08) 8204 1910, or see SA White Pages for your local Department for Environment and Water office.

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