

# DISTRIBUTION AND ABUNDANCE OF WHITE-BELLIED SEA-EAGLES IN SOUTH AUSTRALIA

T. E. DENNIS<sup>1</sup> and A. F. C. LASHMAR<sup>2</sup>

<sup>1</sup>P.O. Box 232, Kingscote, Kangaroo Island, South Australia 5223

<sup>2</sup>Deceased, formerly of Penneshaw, Kangaroo Island

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A survey conducted between 1988 and 1994 located 55 occupied territories of White-bellied Sea-Eagle in South Australia. Survey methods included: information from the literature; systematic survey in the Great Australian Bight region, southern Eyre Peninsula and Kangaroo Island; opportunistic survey elsewhere; and contact with other people.

Eighteen (33%) of these territories were found on the mainland, including three from inland river systems on Coopers Creek and the Murray River. The majority of the breeding population (67%) was found on offshore islands, including Kangaroo Island where 17 occupied territories are known. The remaining 20 occupied territories were found throughout the island groups off the far west coast, Eyre Peninsula, and through Investigator Strait.

Extensive areas of typical coastal habitat in the south-east region of the State, on Yorke Peninsula and around Spencer Gulf and Gulf St Vincent were found to be vacant despite historical records of White-bellied Sea-Eagles breeding in those regions. This suggests that the distribution of the breeding population and the abundance of this species has declined in South Australia.

Many of the occupied territories on the mainland and on Kangaroo Island are regarded as vulnerable to further decline unless residential and tourism development and particularly coastal recreation, are carefully managed.

The South Australian population was found to be physically isolated with the nearest occupied territories 860 km to the west, and 700 km to the east.

## INTRODUCTION

The White-bellied Sea-Eagle *Haliaeetus leucogaster* (Gmelin 1788) is a large, strikingly attractive eagle, with a wingspan of between 1.8 and 2.2 m. Typical of the genus, the tarsi are bare, making it a closer relative to the kite family than to true eagles.

In Australia the White-bellied Sea-Eagle occupies a range of coastal environments and is also found breeding inland on many river and lake systems, including ephemeral lakes (Blakers *et al.* 1984; Marchant *et al.* 1993). Globally, its range extends from southern Australia, including Tasmania, to New Guinea, Indonesia, the Philippines, through south-east Asia to Sri Lanka, continental India; and southern China (Blakers *et al.* 1984; Newton *et al.* 1990).

On the Australian mainland, the White-bellied Sea-Eagle population appears to be stable in the largely uninhabited northern and remote tropical areas (Hollands 1984). However, over the southern extent of its range including Tasmania, New South Wales and Victoria, there is evidence of a population decline in historical times (Mooney 1986; Marchant *et al.* 1993). This is particularly so where human habitation, recreational activities and industries, such as mining, tourism, forestry and agriculture, encroach into and disturb the species habitat (Bilney *et al.* 1983; Mooney 1986; Wickham 1988). Much of South Australia's coastline is now disturbed or degraded by these processes (Nance *et al.* 1986). With increasing demand for further tourism development and recreational access to coastlines on Kangaroo Island, where a significant population of the

White-bellied Sea-Eagle is located, the integrity and security of habitat there is also under some threat.

The aims of this study were:

- (i) to determine the current distribution and abundance of the White-bellied Sea-Eagle in South Australia; and
- (ii) to compare these findings to historical records of the species in South Australia.

## STUDY AREA AND METHODS

### *The study area*

The coastline of South Australia, including offshore island groups, was divided into regions (Fig. 1) and information on the current and past status of the White-bellied Sea-Eagle was sought for each. These regions are described in Table 1. In addition, an attempt was made to establish the current and past status of White-bellied Sea-Eagles for the wetlands of the south-east region and for the state's major river systems and associated lakes, such as the Murray River, Coopers Creek and Lake Eyre Basin. The proximity of the South Australian population to other populations in Western Australia and those of the eastern states was also considered.

### *Current distribution and abundance*

The current distribution and abundance for this species was determined by several methods:

1. A literature search was carried out, extracting breeding records and observational data from many sources, including: the *South Australian Ornithologist* (SAO); the *Atlas of Australian Birds* (Blakers *et al.* 1984), and the associated database of the Royal Australasian Ornithologists Union (RAOU) for South Australia; unpublished records from the South Australian Ornithological Association (SAOA); unpublished records from the South Australian Museum (SAM); unpublished records from the South Australian National Parks and Wildlife Service (SANPWS), including records from a biological survey of offshore islands (Robinson *et al.* 1995); records of the Australian Bird and Bat Banding Scheme (ABBBS).
2. Contact with regionally based ornithologists, SANPWS staff, Department of Primary Industries Fisheries officers, fishermen and naturalists, from all areas of the state to obtain information on active White-bellied Sea-Eagle breeding sites, or locations where regular sightings were made. Responses indicating recently active breeding sites were carefully assessed, compared with other records, and verified in the field when necessary.
3. The authors' breeding records for the West Coast and western Eyre Peninsula (including off-shore island groups), 1977–83; Kangaroo Island 1960–94.

4. Systematic ground survey of the Bunda Cliffs in the Great Australian Bight region during the 1994 breeding season, from Twin Rocks at the head of the Great Australian Bight to Wilson Bluff on the Western Australian border.
5. Systematic ground, sea and air surveys of all occupied breeding territories on Kangaroo Island between 1984 and 1988; these were subsequently monitored each season from 1988 up to and including, 1994.
6. Collection of distribution data from all off-shore islands throughout South Australia in 1990 during a survey of fur seal and sea lion populations.

The information from all these sources was carefully screened and collated (Table 1). In this study, current occupied territory status was assigned to a location (for the period 1988–94) when any one of the following criteria were met:

- a recently prepared or active nest was found or reported
- a juvenile (bird in first year plumage) was seen with adults during October–December
- courtship flights were observed
- strong territorial behaviours were observed, during June–October
- a pair was regularly seen in an area where breeding had previously been recorded.

For the reason of nest security the exact locations of nest sites have deliberately not been given.

### *Historical distribution and abundance*

In this study, historical records are those made before 1970. The historical distribution and abundance of White-bellied Sea-Eagles was determined using the same resources and contacts referred to in the previous section.

An estimate of the pre-European White-bellied Sea-Eagle population for South Australia was attempted by adding the historical nest records to the known population. Historical records were added only when they referred to unoccupied locations that had been recorded as active prior to 1970 (Table 1). In addition, abandoned territories located during the survey were included when it could be concluded that the breeding birds were not simply using an alternate nest and that the territory had been occupied between 1970 and 1988.

### *Terminology*

The widely accepted raptor research terminology developed by Postupalsky (1974) is used throughout:

- *territory* — area of the home range, usually around the current nest site which is defended from conspecifics and in some cases, other species
- *occupied territory* — where two adult birds appeared together in the vicinity of the nest(s) in the breeding season, with or without observation of courtship behaviour or copulation

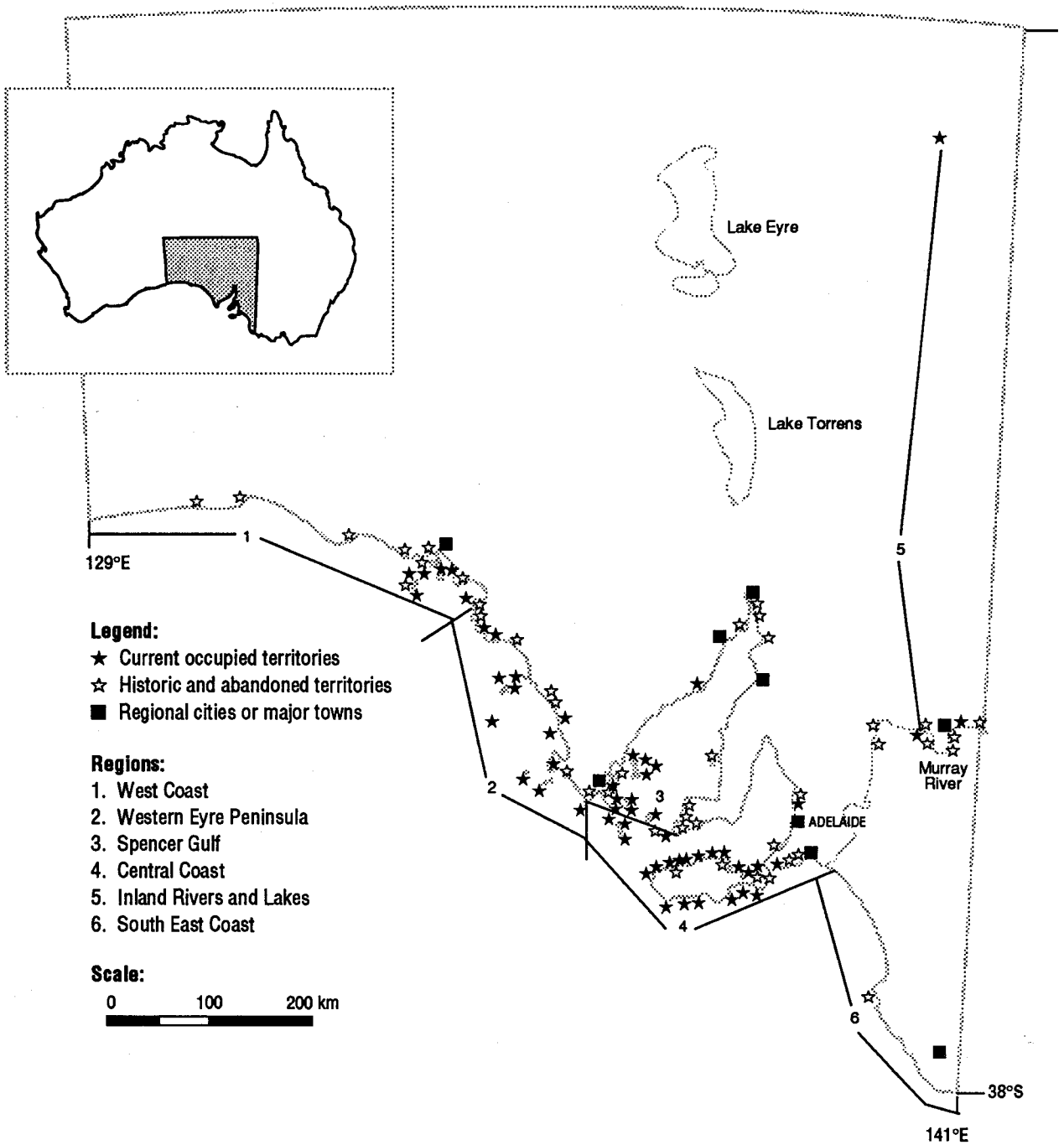


Figure 1. Map of South Australia showing current and former distribution of the White-bellied Sea-Eagle population in South Australia.

TABLE 1

Current and historical distribution and abundance of the White-bellied Sea-Eagle in South Australia. The historically active territories were found to be vacant or abandoned during this survey. The decline for each region is expressed as a percentage of the former population size (obtained from the sum of recently occupied, abandoned and historical territories).

Region	Occupied territories (1988–1994)	Historical (pre 1970) and abandoned territories (1970–1985)	Decline (%)
<b>West Coast</b> — Western Australian border to Cape Bauer; offshore islands, including Nuyts Archipelago.	6	8	57
<b>Western Eyre Peninsula</b> — Cape Bauer to West Point; offshore islands, including the Investigator and Whidbey Groups.	12	7	37
<b>Spencer Gulf</b> — West Point to Roysten Head; offshore islands, including the Sir Joseph Banks Group.	10	10	50
<b>Central Coast</b> — Investigator Strait, Gulf St. Vincent, Backstairs Passage and Encounter Bay; Kangaroo Island and other offshore islands, including the Neptune Islands and Gambier Group.	24	9	27
<b>Inland Rivers and Lakes</b> — including Coopers Creek, Lake Eyre drainage system, the River Murray and associated lakes.	3	7	70
<b>South East Coast</b> — Lake Alexandrina to the Victorian border, including islands.	0	1	100
Totals	55	42	43*

\*Weighted average, calculated from the totals of occupied and historical + abandoned territory columns.

- *active territory/nest* — a nest site where eggs were laid, often determined from incubation behaviour only
- *alternate nest* — one of sometimes several nest structures within the home range of one pair of birds
- *abandoned nest/territory* — one not used/occupied in previous five years
- *nest site* — situation of the most frequently used nest within a territory.

## RESULTS

### *Current distribution and abundance*

Fifty-five occupied White-bellied Sea-Eagle territories were located in South Australia during the intensive survey period, 1988–94 (Table 1). Of these, 18 were found on the mainland, 17 were on Kangaroo Island, and 20 were on other more remote offshore islands (Fig. 1).

The current breeding range for this species in South Australia was found to extend from the islands of Nuyts Archipelago, in the West Coast region, to southern Fleurieu Peninsula, with two breeding sites on the upper River Murray and a single pair on Coopers Creek in the far north-east of the state, some 650 km from the sea (Fig. 1). No recent evidence was found of White-bellied Sea-Eagles breeding west of Nuyts Archipelago or south-east of the Murray River mouth (Fig. 1).

The South Australian population of White-bellied Sea-Eagles was found to be disjunct from other populations. The nearest recorded breeding territory in Western Australia is from near Point Culver (Storr 1987), 420 km from the South Australian–Western Australia border and 860 km from the nearest occupied territory in South Australia (Fig. 1). To the east along the coast, the

nearest breeding territories to those in the Investigator Strait region (Fig. 1) are around 700 km away, on French Island east of Melbourne in Westernport Bay (R. Bilney, pers. comm.). Offshore, in the same general direction, the nearest territories are on King Island 720 km, and Tasmania 820 km away (N. Mooney, pers. comm.). Inland, along the River Murray, the nearest occupied territory to those in South Australia is near Wentworth, almost 100 km from the most easterly territory in South Australia.

The highest densities of occupied territories were found to occur on Kangaroo Island and on some offshore island groups. The 17 active nest sites on Kangaroo Island averaged 29 km apart. More than half of these were on the relatively sheltered north coast of the island where the distance between sites averaged 11 km (range 5.5–20 km). On the less developed but more exposed south and west coasts, territories were more widely spaced, averaging 49 km apart (range 22–64 km). On Eyre Peninsula nest sites averaged 84 km apart (range 6–170 km), and on off-shore island groups they were 17 km apart (range 6–37 km).

#### *Historical changes in distribution and abundance*

The first recorded observation of the White-bellied Sea-Eagle in South Australia was made by Matthew Flinders on 21 February 1802, on an island he named the same day as Thistle Island. While he and his crew were ashore to find fresh water, they observed "... a white eagle with fierce aspect and outspread wing, was seen bounding toward us ... Another bird of the same kind discovered himself by making a motion to pounce down on us as we passed underneath; and it seemed evident that they took us for kangaroos ..." (Flinders M., Vol. 1 p.133, 1814). From then on there are few recorded references to the species until formal egg collections were made for the South Australian Museum in the latter part of last century (Table 2).

Published information and records held by the South Australian Museum clearly suggest that White-bellied Sea-Eagles were formerly more abundant in all regions of South Australia (Table 2). During this survey, we located 24 abandoned nests or territories from most regions (Table 2). From the sum of this information we determined there were at least a further 42 areas used historically for breeding that were not

currently occupied (Table 1). This suggests a possible population decline of 43%, with the greatest declines in the most developed or environmentally modified regions of the state: the agricultural areas of the West Coast and Eyre Peninsula; upper Spencer Gulf; Yorke Peninsula; Fleurieu Peninsula and the South East region (Table 1). No historical records were found of White-bellied Sea-Eagles breeding west of Fowlers Bay or south of Cape Jaffa, or from the Lake Eyre region (Fig. 1).

## DISCUSSION

### *Distribution*

Considering the comparative length of coastlines, the number of occupied White-bellied Sea-Eagle territories (55) in South Australia is small when compared to the Tasmanian population estimate of 80–100 breeding pairs (Mooney 1986). Principally located in the central regions of the state, the South Australian population appears isolated from populations to the east and to the west. However, because White-bellied Sea-Eagles are capable of long distance movements (ABBBS data) genetic isolation is unlikely; also, interaction between populations to the east is likely along the River Murray (Fig. 1).

The majority of the population (67%) in South Australia was found on offshore islands, including Kangaroo Island, where a considerable proportion (31%) of the population was found to occur. The remainder of island-based territories were uniformly dispersed throughout the more remote island groups. Limits to population size in these environments are likely to be spatial rather than resource limited as prey species, such as breeding sea birds, are abundant.

The information presented in Tables 1 and 2 indicates a decline in the breeding range of White-bellied Sea-Eagles in South Australia concomitant with the extent of agricultural development, the spread of human habitation, and the subsequent proliferation of recreational activities on the coastline.

The situation in the south-east region, where only a single breeding event is described in the literature, is similar to that in western Victoria where White-bellied Sea-Eagles are conspicuously absent, despite what appears to be suitable habitat. This situation is not well understood. The

TABLE 2

Summary of historical breeding records of the White-bellied Sea-Eagle in South Australia and including reference to the location of territories found to be abandoned in recent times (1970–1994).

Region	Breeding Records
Far West Coast	<ul style="list-style-type: none"> <li>no historical breeding records were found</li> <li>territories found vacant during this survey: Bunda Cliffs, Point Fowler, Davenport Creek, Point Bell, Point Brown, St. Peter and St. Francis Islands</li> </ul>
Western Eyre Peninsula	<ul style="list-style-type: none"> <li>active nest at Wanna<sup>A</sup> 1969 (SAO 26, 16)</li> <li>territories found vacant during this survey: Cape Bauer, Cape Blanche, Anxious Bay, Halls Bay, Point Avoid, Cape Carnot</li> </ul>
Spencer Gulf	<ul style="list-style-type: none"> <li>nest on small island in Spencer Gulf 1898 (SAM egg collection record)</li> <li>nest at Yatala Harbour 1899 (SAM egg collection record)</li> <li>nest in mangroves near Port Augusta 1901 (SAM egg collection record)</li> <li>nest at Mambray Creek, late 1800s (SAM species records; T. Brandon, in litt.)</li> <li>nest at Point Lowly 1919 (RAOU Aust. Atlas Scheme database)</li> <li>nest near Daly Head in 1930s and 40s (SAM species records)</li> <li>territories found vacant during this survey: Cape Catastrophe, Boston Island, Roysten head</li> </ul>
Central Coast	<ul style="list-style-type: none"> <li>nest in mangroves Point Gawler 1898 (SAM collection record)</li> <li>breeding near Stenhouse Bay 1901 (RAOU Aust. Atlas Scheme database)</li> <li>breeding at West Cape 1901 (RAOU Aust. Atlas Scheme database)</li> <li>breeding at West Cape 1916 (RAOU Aust. Atlas Scheme database)</li> <li>pair nesting on island in Pondalow Bay 1916 (SAO 2, 148)</li> <li>possible breeding event near Carackalinga Head 1938 (RAOU Aust. Atlas Scheme database)</li> <li>nesting record from Encounter Bay 1950 (Condon 1969)</li> <li>near Newland Head late 1950s (T. Joy, pers. comm.)</li> <li>active tree nest 3 km north of Victor Harbour 1966 (T. Joy, pers. comm.)</li> <li>tree nest at The Bluff near Kingscote mid 1950s (V. Ward, pers. comm.)</li> <li>territories found vacant during this survey: Western River and Cape St. Albans on Kangaroo Island</li> </ul>
Inland Rivers and Lakes	<ul style="list-style-type: none"> <li>breeding event near Cobdogla 1951 (RAOU Aust. Atlas Scheme database)</li> <li>nest near Morgan 1965 (SAO 24, 102)</li> <li>nest in dead eucalypt near Morgan 1968 (SAO 25, 224)</li> <li>nest near Moorook 1957 and 1966 (SAO 22, 47; Condon 1969)</li> <li>nest at Lake Merreti with 2 young 1966 (SAO 25, 32)</li> <li>nest with 2 young, Beda Arm Lake Torrens<sup>B</sup> 1948 (Condon 1969; SAO 23, 100; Emu 49, 100)</li> <li>territories found vacant during this survey: near Chowilla, near Murbko and near Paringa</li> </ul>
South East Coast	<ul style="list-style-type: none"> <li>occupied nest on island off Cape Jaffa 1840s (SAO 17, 85; RAOU Aust. Atlas Scheme database)</li> </ul>

<sup>A</sup>This record is regarded as a probable mis-identification as only Osprey have been recorded breeding at Wanna in recent decades.

<sup>B</sup>This breeding record is regarded as an ephemeral event and is not included here as a former occupied territory.

possible paucity of surface fish species, which may also have historically limited the distribution of the Osprey *Pandion haliaetus cristatus* through Victoria, may also limit White-bellied Sea-Eagle distribution (R. Bilney, pers. comm.).

It is known that some White-bellied Sea-Eagle nest sites are used for long periods of time, even over several decades (Hollands 1984; Bilney *et al.* 1986). These preferred sites are likely to be in use

through many generations, and once territories are established will often be strongly defended. Territories are used by the paired adults to some extent throughout the year (Bilney *et al.* 1986; T. Dennis, unpubl. data). Therefore, the occasional White-bellied Sea-Eagle sightings at considerable distances (>50 km) from known breeding territories, are most likely either nomadic immatures or transitory non-territorial adults.

East of Eucla in the Great Australian Bight White-bellied Sea-Eagles are occasionally observed by employees of the Western Australian Agriculture Protection Board (L. Gurney; pers. comm.), who work in the region controlling Common Starling *Sturnus vulgaris* along the Nullarbor cliffs. They are also sighted in Western Australia within the Bight region (Storr 1987; RAOU records — Eyre Bird Observatory). West of the western most territories in South Australia, the nearest known territory is 860 km distant (Storr 1987). Despite the area's remoteness, suitable terrain and likely availability of prey species, such as sea birds (including large numbers of Little Penguins *Eudyptula minor*, a major diet item on Kangaroo island; T. Dennis, unpubl. data), only two abandoned nest sites (Fig. 1) were found during the systematic survey of the region and no occupied territories or historical records were found from the Great Australian Bight.

#### Population decline

White-bellied Sea-Eagles were probably never common in South Australia and, due to the paucity of suitable lakes and rivers, largely confined to coastal habitats (Fig. 1). The information presented indicates a decline in the abundance of the population of at least 43% in historical times (Table 1). The population declined in all regions of the state, particularly where the coastal or riverine environment has been highly modified by agricultural development and with large centres of human population.

White-bellied Sea-Eagles no longer breed on: the mainland of the West Coast region; Yorke Peninsula; northern Spencer Gulf; the majority of St Vincent Gulf; or in the south-east region (Fig. 1). The number of occupied territories along the River Murray has declined substantially in the last few decades, from around six to two (Tables 1 and 2). The late Shane Parker, when revising SAM Species Records in the early 1980s, recorded that "... the species has declined over the last few decades. Especially the Eyre Peninsula and Spencer Gulf populations through illegal shooting. The defunct breeding population of upper Spencer Gulf used to nest in mangroves, the last breeding record from near Pt. Augusta in 1901..." (unpubl. SAM records).

The high number of abandoned territories on Eyre Peninsula and the West Coast were located in areas developed *ad hoc* for tourism access to coastal vantage points, or where regularly used four-wheel drive tracks access remote sections of the coastline for fishing or off-road vehicle recreation. The abandoned nest sites on the Bunda Cliffs also were found to have vehicle tracks above them on the edge of the cliffs. Most of these tracks have been opened since the early 1970s, coincident with the proliferation of four-wheel drive vehicle ownership in South Australia. The clearance of native vegetation and the subsequent increase in agricultural activity near nests may also be implicated in breeding site failures (Bilney *et al.* 1984; T. Dennis, unpubl. data).

These trends follow the global situation for large eagle species whose populations have decreased markedly in many countries in the last 50 years (Bijleveld 1974). Bijleveld saw increasing tourism to remote areas as detrimental to the survival of some raptors in Europe and gave examples illustrating that recreational pursuits can form a serious threat to several species, particularly at critical times of the breeding season.

Most large eagle species use the same nest in consecutive years and are renowned as being sensitive to disturbance there (Brown 1976), although reaction to disturbance varies considerably between pairs of a species (Scott 1985). On Kangaroo Island, pairs of White-bellied Sea-Eagles are present in the breeding territory throughout the year. Even when foraging widely in non-breeding years the birds continue to use favoured roosting points and feeding platforms, many of which are situated near or within sight of the nest. Typically, the nests are large and contain weathered or even rotting sticks at their base, suggesting long term use. Some nest sites on Kangaroo Island are known to have been used for more than 30 years, and the single remaining nest located in mangroves in Spencer Gulf (Fig. 1), was first reported in 1967 (SAO 25, pp 32). It is assumed from these observations that this is typical behaviour. Therefore, the abandoned nest structures in apparent former territories located in this study are interpreted to reflect a real decline rather than a spatial or temporal irregularity in territory occupation.

The White-bellied Sea-Eagle is known to take a wide range of prey, including small mammals, but mainly birds, fish and some carrion (Calaby 1976; Hollands 1984; T. Dennis, unpubl. data; Marchant *et al.* 1993). Because of this ability to diversify and the lack of contrary evidence, diminishing food resources are unlikely to be implicated in the species' decline in South Australia.

The impact of introduced predators, such as the European fox *Vulpes vulpes* or the feral cat *Felis catus*, on White-bellied Sea-Eagle nestlings must also be considered on the mainland, even though most nests are located on relatively inaccessible cliff-face or arboreal situations. Foxes do not occur on Kangaroo Island.

Lake Bonney, formerly a fresh water lake with abundant fish life and almost 100 sq km in area, has for several decades been severely polluted from a nearby paper mill (V. McClaren, pers. comm.), and may have contributed to the decline of White-bellied Sea-Eagles in the south-east region.

Pesticide contamination has been implicated in population declines of raptors elsewhere (Newton 1979; Marchant *et al.* 1993). A recent study in South Australia found low to moderate levels of organochlorine pesticide residue in coastal raptors, including White-bellied Sea-Eagles, and high levels in some prey (Falkenberg *et al.* 1993). Because the application of DDT continued legally in South Australia until October 1987, levels of contamination are unlikely to have peaked before that investigation. They concluded however, that the levels of contamination detected were unlikely to seriously affect the reproduction of White-bellied Sea-Eagles in South Australia.

#### *Nest disturbance*

In South Australia few (<10%) White-bellied Sea-Eagle nests are in trees; most are situated on coastal cliffs, invariably below the cliff rim. Like many other raptors, White-bellied Sea-Eagles display acute sensitivity to disturbance from above the nest (Walsh 1978; Olsen *et al.* 1978; Mooney 1988; Mooney *et al.* 1991). They will readily abandon the nest if disturbed during the nest repair/building stage, during incubation, or when the young are small (Hollands 1984; Bilney *et al.* 1986; Mooney 1986). In years following

direct or prolonged disturbance, White-bellied Sea-Eagles are likely to resort to a sub-optimal alternate nest within the territory, with a resultant reduction in productivity (Emison *et al.* 1982; T. Dennis, unpubl. data).

Coastal bushwalking can be an unintended but constant source of disturbance during the breeding season. Recreational disturbance adversely affecting a nest site occurs for example, at the single remaining White-bellied Sea-Eagle territory on Fleurieu Peninsula, which is now frequently disturbed by hikers following an extension of the Heysen Trail along the south coast of the Peninsula in 1989, without regard for the vulnerability of the nest site. (The Heysen Trail is a major public walking trail system in South Australia extending for several hundreds of kilometres, on both private and public lands, from the Fleurieu Peninsula in the south to the Flinders Ranges in the north of the state.) A similar situation occurred on Kangaroo Island in 1990, when a walking track to facilitate activities from a youth-camp was cut illegally through scrub along a section of coastline and directly under a White-bellied Sea-Eagle nest tree. The nest was subsequently abandoned.

Results from a reproductive study of White-bellied Sea-Eagles on Kangaroo Island indicate that disturbed territories fledge fewer young and experience higher nest failure rates than nests in territories experiencing low disturbance levels (T. Dennis, unpubl. data). Many nests being disturbed by walkers are sited in National Parks or other Reserves. This dilemma has yet to be addressed adequately by management agencies.

#### *Management*

The continuing growth and increased mobility of the human population invariably leads to modification of wildlife habitat. As it is unlikely that these trends will be reversed, it is of paramount importance that remaining White-bellied Sea-Eagle habitats be managed to maximize the security of space and prey resources, and to minimize inappropriate coastal recreation and development. This applies particularly to those habitats remaining on the mainland and on Kangaroo Island.

Studies elsewhere on declining populations of large raptors have consistently recommended increased levels of protection at nesting sites: the



White-bellied Sea-Eagle in Victoria (Bilney *et al.* 1983; Bilney *et al.* 1986) and Tasmania (Mooney 1986); the White-tailed Sea-Eagle *H. leucocephalus* in northern Europe (Helander 1975); the Bald Eagle *H. albiflora* in Canada (Mathison 1968;) and the United States of America (McEwan *et al.* 1979; Andrew *et al.* 1982); the Golden Eagle *Aquila chrysaetos* in Scotland (Watson *et al.* 1992); the Tasmanian Wedge-tailed Eagle *A. audax fleayi* (Mooney 1988; Mooney *et al.* 1991; Gaffney *et al.* 1992); and the Osprey *Pandion haliaetus* in the United States of America (Van Daele *et al.* 1982; Levenson *et al.* 1984; Poole 1989) and in Australia (Llewellyn 1991; Clancy 1991).

In North America and parts of Europe, accommodation of raptor breeding sites has become common in land use planning and development, with legal provisions banning modification of an area, or limiting increased human presence (Lincer 1981). An example was the zoning of sensitive areas during construction of the Alaskan oil pipeline in the mid 1970s (Newton 1979). This excluded development and restricted access within raptor breeding territories.

To halt the evident decline in the White-bellied Sea-Eagle population, agencies with management responsibilities for the coastline will need to develop and apply appropriate species management plans if future generations of South Australians are to share the exhilaration of watching a sea eagle soar over a wild coast.

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## DATA EXCHANGE

### COMPARATIVE MEASUREMENTS OF THE GRACEFUL AND YELLOW-SPOTTED HONEYEATERS

The data presented here is for the Wet Tropics subspecies of the Graceful Honeyeater *Meliphaga gracilis imiatrix* and the Yellow-spotted Honeyeater *Meliphaga notata mixta*. These species are separable in the field by their different calls. In addition *M. gracilis imiatrix* is smaller and appears to be more nervous; also its wing flicks are more noticeable than for *M. notata mixta*. This size difference is not always obvious in the low light of the rainforest habitat they both occupy.

The data presented here for the Graceful Honeyeater *Meliphaga gracilis imiatrix* and the Yellow-spotted Honeyeater *Meliphaga notata mixta* complements previous data presented by Hardy and van Gessel (1994). This previous data was collected on the almost identical subspecies, *M. gracilis*

*gracilis* and *M. notata notata* which occur on Cape York Peninsula.

A total of 39 Graceful Honeyeaters and 57 Yellow-spotted Honeyeaters were captured, using mist nets, in Cairns, Queensland over a 4½ year period. The site was in a suburban garden adjacent to a disturbed rainforest area of the Mt Whitfield Range.

The adult birds in breeding condition were positively sexed by cloacal examination and their morphometrics are as shown in the tables. The previous finding, by Hardy and van Gessel (1994) that weight is a reliable measurement for separating the two species is confirmed. The Graceful Honeyeaters' weight ranged from 13 to 19 grams (n = 33) and the Yellow-spotted Honeyeaters 23 to 30 grams (n = 53).

Considerably more samples were analysed than those shown by Hardy and van Gessel; however, their data included wing span and bill width which were not recorded by us.

This data, along with Hardy and van Gessel's, should be a useful guide in future studies of these poorly known tropical species.