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WATERBIRDS OF PEEL-HARVEY ESTUARY  
IN  
**THE MID 1970s**



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WA Department of Conservation & Land Management

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Cover photograph of Banded Stilt (*Cladorhynchus leucocephalus*) by A.G. Wells, AFIAP, ARPS.

The Banded Stilt was the most abundant bird on Peel-Harvey Estuary during 1976-77, with numbers reaching 63,000 in February 1977. Most were found on the extensive shallows of south-eastern Peel Inlet and Creery lagoon. Banded Stilt breed on large inland lakes following exceptional rains and migrate to the coast when these lakes dry. Several years may pass before conditions are again suitable for breeding. "Regular" breeding locations nearest to Peel-Harvey Estuary are Lakes Ballard and Barlee in the Eastern Goldfields.

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## SUMMARY

Peel-Harvey Estuary, 70 km south of Perth, Western Australia, is the largest estuary in south-western Australia and is an important recreation, fishing, tourism and conservation resource.

During the 1960s to 1990s, Peel-Harvey became increasingly eutrophic due to leaching of agricultural fertilizers from its catchment. Public objections to odours emanating from decaying macro-algae and the increasing occurrence of blue-green algae blooms resulted in government and community action to alleviate these problems.

One component of the overall strategy was to increase flushing of the estuary by constructing a second entrance to the ocean. This entrance - the Dawesville Channel - was completed in April 1994.

A condition of government approval of the Channel was that monitoring be undertaken so that impacts could be assessed and, where practicable, managed.

This report relates to one component of the Peel-Harvey Estuary monitoring program - the "Waterbird species, numbers and distributions" project.

Results of waterbird surveys conducted in 1996-97 and 1998-99 have been presented in two previous reports. This report presents data collected two decades earlier, in the mid 1970s.

In 1976-77, Peel-Harvey Estuary supported very large numbers and a wide diversity of waterbirds. More than 170,000 birds of 67 species made use of the estuary during that year. The most abundant species were Banded Stilt (63,000), Grey Teal (25,000), Eurasian Coot (17,000), Red-necked Stint (13,000) and Hoary-headed Grebe (10,000).

In February 1977, the total number of waterbirds on Peel-Harvey Estuary was 150,000. This is the highest reported total for any wetland in south-western Australia.

Black Swans and Australian Pelicans were more abundant in 1976-77 (maxima of 8,100 and 2,100 respectively) than in 1975-76 (2,700 and 1,200 respectively).

During 1975-76 and 1976-77, most birds were found in southern and eastern parts of Peel Inlet, at the southern end of Harvey Estuary and in north-central parts of Peel Inlet.

In 1976 and 1981, the former Department of Fisheries and Wildlife made two submissions to the Environmental Protection Authority's Conservation Through Reserves Committee recommending the establishment of conservation reserves and other measures to protect those parts of Peel-Harvey that were most important for waterbirds. Those recommendations were largely adopted by the EPA and Government and have since been partially implemented.

In 1990, Peel-Harvey Estuary was listed, together with Lakes Mealup and McLarty and the Yalgorup Lakes, as a Wetland of International Importance under the Ramsar Convention. The nomination and listing of Peel-Harvey Estuary was largely based upon data presented in this report.

## 1. INTRODUCTION

Peel-Harvey Estuary, 70 km south of Perth, Western Australia, is the largest estuary in south-western Australia and is recognised as an important recreation, fishing and tourism resource. The estuary is also recognised as one of the most important waterbird habitats in Western Australia and is listed, jointly with Lakes Meallup and McLarty and the Yalgorup Lakes, as a Wetland of International Importance under the Ramsar Convention (Government of Western Australia 1990, 2000; Wetlands International 2002).

Use of agricultural fertilisers has resulted in Peel-Harvey Estuary becoming eutrophic. Complaints during the 1960s and 1970s about the accumulation of decaying algae led to efforts being made to solve the problem. Following lengthy investigation it was decided that a multi-pronged approach should be taken. Key elements were to be modification of fertilizer use in the catchment and excavation of a channel - the Dawesville Channel - to provide a second connection to the sea, thereby increasing tidal exchange (EPA 1988).

The proposal to construct a channel at Dawesville was approved in principle by the Western Australian Government in January 1989. Works began in February 1992 and the Channel was opened in April 1994.

A condition of approval for construction of the Channel was a requirement that monitoring be undertaken so that impacts could be assessed and, where practicable, managed (EPA 1988, PIMA 1994).

One component of the monitoring program was to be an assessment of waterbird use of the estuary following completion of the Channel. This work was to be done by the Western Australian Department of Conservation and Land Management because of its expertise and responsibilities in this area and its significant, pre-Channel, waterbird data sets. Funding arrangements for the Dawesville Channel monitoring program were determined by Government in February 1994, enabling studies to commence later that year.

A progress report (Lane, Pearson & Clarke 1997) completed in September 1997 gave an overview of work undertaken by the Department of Conservation and Land Management following opening of the Channel. Seven projects were described.

In relation to one of these projects - "Waterbird species, numbers and distributions" - the background, rationale and methodology were outlined and some preliminary impressions concerning the status of several waterbird species were presented. Few data were presented, however, as the process of transcribing waterbird survey recordings from audiocassettes to maps and tallying these figures had not been completed.

This work has now been done. Results of the 1996-97 and 1998-99 waterbird surveys have been reported earlier (Lane, Clarke & Pearson 2002a; 2002b). Results of surveys conducted by two of the same authors two decades earlier are presented below. These data will be used to provide a baseline for comparison with the recent, "post-Channel" data.

## 2. PROJECT AIMS

The aims of the "Waterbird species, numbers and distributions" project are:

- To determine the species, numbers and distributions of waterbirds on Peel-Harvey Estuary following construction of the Dawesville Channel.
- To identify significant impacts of construction of the Dawesville Channel on waterbird species, numbers and distributions.
- To determine whether Peel Harvey Estuary continues to meet Ramsar Criteria, relating to waterbirds, for ongoing listing as a Wetland of International Importance.

The aim of this report is to present the baseline data collected in the mid 1970s. Comparisons with the post-Channel data of 1996-97 and 1998-99 will be presented in a subsequent report.

The opportunity is also taken to consider the significance of Peel-Harvey Estuary as a waterbird site in the 1970s and to record conservation recommendations made on completion of the 1970s field work.

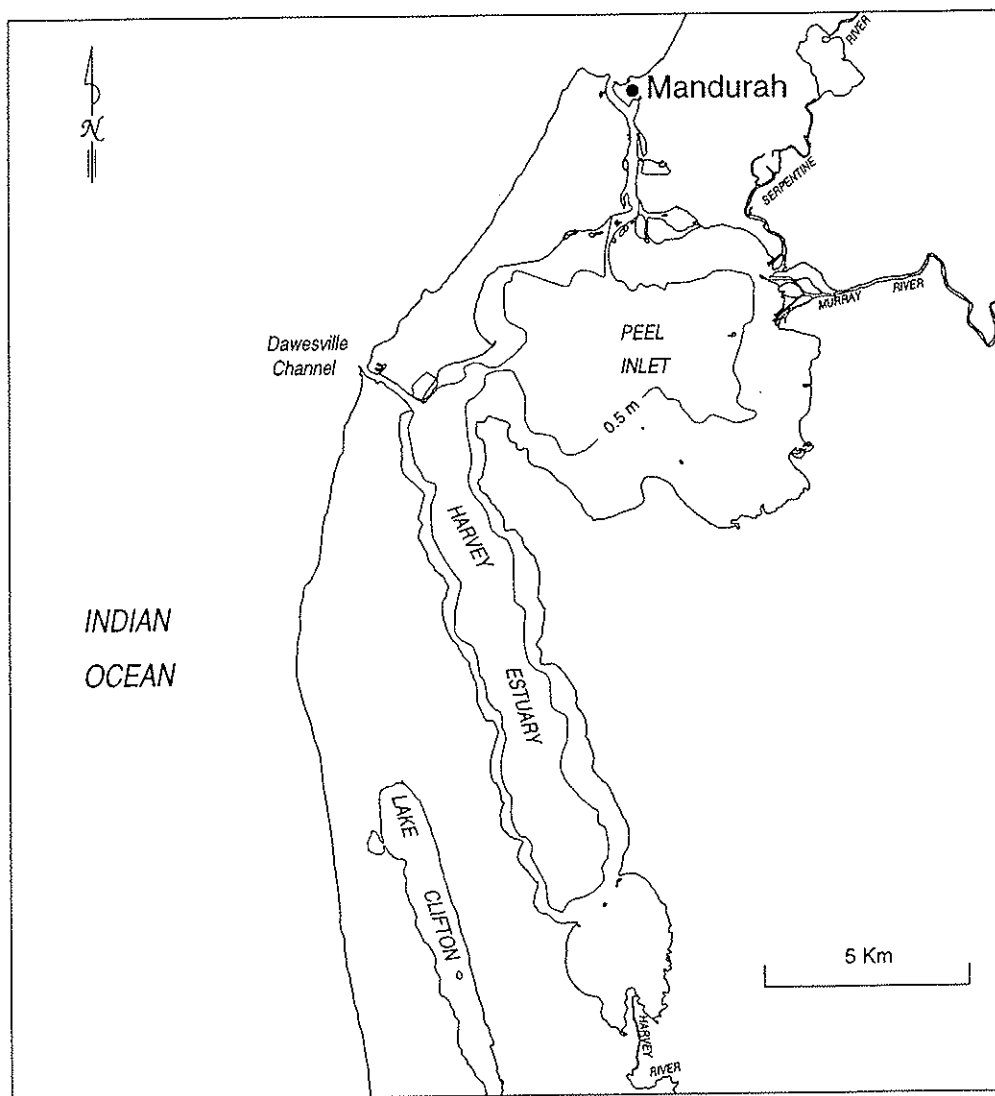


Figure 1. Peel-Harvey Estuary. Note that the Davesville Channel was not constructed until 1994.

### 3. STUDY AREA

The study area was the entire Peel-Harvey Estuary (area c. 136 km<sup>2</sup>, shoreline length c. 75 km) including open waters, shallows, tidal flats, tidal marshes and shorelines (Figure 1). The delta and lower reaches of the Harvey River were also included.

## 4. METHODOLOGY

### 4.1 Waterbird Species

Species typically regarded as waterbirds include swans, ducks, grebes, cormorants, pelicans, herons, egrets, ibis, spoonbills, waterhens, sandpipers, stilts, plovers, gulls and terns (Rose & Scott 1997). Several other bird species not always regarded as waterbirds make substantial use of estuarine and other wetland habitats in south-western Australia. These are the Osprey, Whistling Kite, White-bellied Sea-Eagle, Swamp Harrier, White-fronted Chat and Little Grassbird. These species were, therefore, included as waterbirds in the mid 1970s Peel-Harvey survey program. This approach is consistent with suggestions of Rose & Scott (p4).

### 4.2 Survey Program

Preliminary surveys were undertaken in 1975-76 in order to gain an initial indication of the number, diversity and distribution of waterbirds using Peel-Harvey and to design a suitable program of more-intensive surveys to be undertaken during 1976-77. The methodologies and results of these preliminary surveys are described in Appendix 15.

During 1976-77, surveys of all species of waterbirds throughout most of Peel-Harvey Estuary were conducted in August, October, December, February, April and June. The dates of survey of each sector, and the personnel involved, are detailed in Appendix 14.

The standard approach adopted for the 1976-77 surveys was as follows. On the first day of each survey, a "general air survey" was undertaken to obtain an overview of bird numbers and distributions. These flights were conducted between 1000 and 1215 hrs, with each flight taking approximately 80-100 minutes. A single-engine, high wing, six-seater aircraft, with commercial pilot and one observer, was used.

In the afternoon of the first day, between 1330 and 1510 hrs, a second flight was conducted to accurately determine pelican numbers and distribution on Peel-Harvey. Black Swan numbers and distribution on Harvey Estuary were also determined during this aerial survey.

Swans in south-eastern Peel Inlet could not be effectively surveyed by plane due to the breadth (several kilometres) of the shallows in this part of the estuary, the large number (potentially) and spread of birds and the relative difficulty (compared with pelicans) of seeing the birds against the darkness of the shallows, most of which were covered by abundant submerged aquatic plants. Instead, the swans of Peel Inlet were surveyed by boat, usually a 3.5 metre, flat-bottomed punt with 9.9 horsepower outboard motor operated by a single observer. In February and April 1977 there were too many swans at the southern end of Harvey Estuary to count from the air and this area (sector 10 of Figure 2) was also surveyed by boat.

On the second day, a survey was made by boat of the numbers and distributions of all waterbird species from the old Mandurah Traffic Bridge downstream to the ocean mouth (sector 1). Waterbirds on the northern-eastern side of Peel Inlet upstream from the same bridge to the mouth of the Serpentine River (sectors 2a and 3), including Creery and Channel Islands and the Creery marshes, were also surveyed on day two, by boat and on foot.

On day three, all waterbirds on the north-western side of Peel Inlet, from the old Mandurah Traffic Bridge to Ward Point (sectors 2b and 4), including the samphire islands to the west of Channel Island, were surveyed by boat and on foot. Note that Boundary Island (referred to in Lane, Clarke & Pearson 2002a, 2002b) did not exist in 1976-77. It was constructed, using dredged material, in 1987.

On day four, all waterbirds on the shoreline and the inner and middle shallows of the eastern and



southern side of Peel Inlet, from the artificial lagoon adjoining Yunderup Canals to the west side of Robert Bay (inner and middle sector 6), were surveyed on foot.

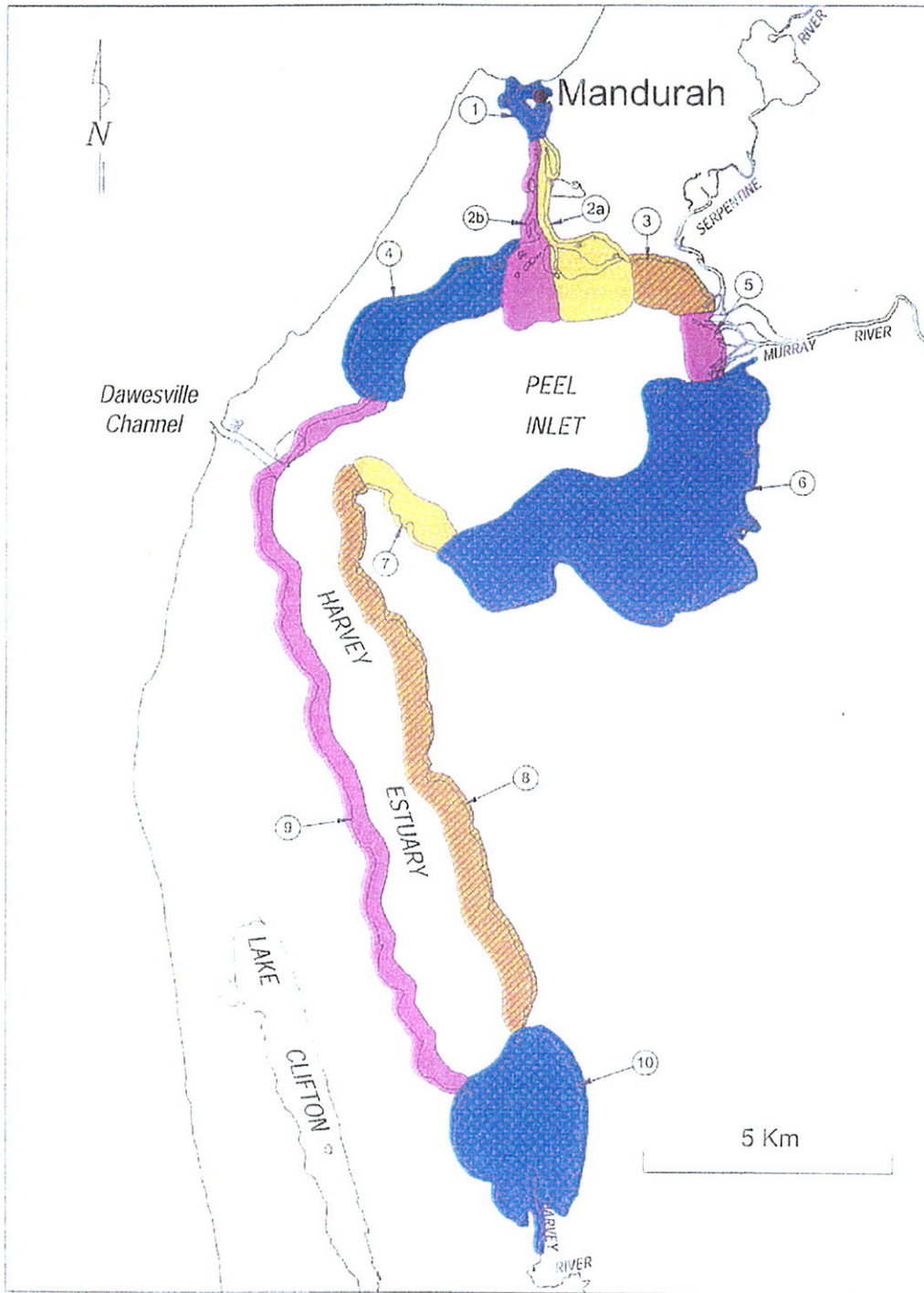


Figure 2. Survey sectors of Peel-Harvey Estuary. Note that the Dawesville Channel was not constructed until 1994.

The western shoreline and adjacent shallows of the Murray River delta (sector 5), plus the middle and outer shallows on the eastern and southern sides of Peel Inlet from Yunderup Canals to Robert Bay

(middle and outer sector 6), were surveyed by boat and on foot on day five. Note that sector 6 included Boodalan Island, which was constructed with dredged material in 1972.

A survey of all waterbirds at the southern end of Harvey Estuary (from Herron Point Ford south), including the lower reaches and delta of the Harvey River, (i.e. sector 10) was conducted by boat and on foot on day six, the last day of the surveys.

In August and October 1976, sectors 1, 2a and 2b were all surveyed in one day. Sectors 3 and 4 were not surveyed in these two months.

The central, deeper-water parts of Peel-Harvey were not systematically surveyed by boat because the aerial surveys conducted on "day one" of each survey period showed they were relatively little used by most species. Waterbirds most likely to have been missed in these parts were cormorants, small numbers of pelicans, and occasional terns, gulls and darters. Hoary-headed Grebes proved to be a notable exception to this general situation. From November 1976 until June 1977, there were many hundreds to thousands in the deeper waters of Peel Inlet (see Appendix 12). There were also more than one hundred Great Crested Grebe in these deeper waters in December 1976.

The far western end (sector 7) of Robert Bay, and the eastern and western shores and shallows (sectors 8 and 9) of Harvey Estuary north of Herron Point Ford, were not surveyed by boat or on foot in 1976-77. Numbers of birds in these sectors were relatively low (as judged by air survey) compared with other sectors and it was thought that ground survey of these areas would be too time-consuming and unrewarding to be worthwhile.

Sectors 3 and 4 were not ground-surveyed in August and October 1976, due to insufficient time being allocated. They were surveyed, however, in December 1976 and February, April and June 1977, when an extra day was allocated to each survey.

Note that the sectors described above were defined on the basis of survey practicalities, primarily the maximum area that could be thoroughly surveyed in a single day by a single observer under varying weather and tidal conditions.

### **4.3 Counting Techniques**

Whenever possible, birds were counted individually. This was usually achievable with flocks of tens or low hundreds of individuals, but rarely achievable with flocks of high hundreds or thousands. In these latter instances, the commonly used technique (Conder 1978, Bibby et al 2000) of counting in tens, twenties or larger estimated groupings was employed. Some very large flocks (thousands, tens of thousands) were broken by eye into a number of equal-sized parts and the number in one of these parts was counted or estimated and then multiplied by the number of parts. Where practicable this process was repeated one or more times to improve the estimate.

On some occasions, flocks were so large and/or spread over such a large area that total numbers were very difficult for one observer to estimate. On these occasions, numbers were recorded at the time as "thousands", "many thousands", "tens of thousands", etc. In order to facilitate comparison with Peel-Harvey data collected by the same observer (JL) in the 1990s, these textual descriptions have been converted (by JL) to numbers as follows. "thousands"=2000; "several thousands"=3000; "many thousands"=5000; "tens of thousands" = 20 000, etc.

Sometimes it was not possible to determine the identity of birds because they were too far away for the observer to discern distinguishing features. On these occasions they were recorded as "unidentified ducks", "unidentified cormorants", etc.

Single, small, vagrant shorebirds in large flocks of similar, common species, could at times have been overlooked. This was not of concern at the time because, while uncommon vagrant shorebirds are of some ornithological interest, they were of little or no significance in terms of identifying important waterbird habitats of Peel-Harvey Estuary.

Flying birds were included in sector counts except for occasions when they were seen flying high above the estuary, e.g. rising on thermals.

Because the ground (boat and foot) surveys were conducted over four (August, October) to six (December) days (see Appendix 14), some movement of birds undoubtedly occurred during the survey periods. Allowance was made for this where possible. During each day's survey a record or mental note was kept of birds seen passing the observer, either ahead or behind, and count figures were adjusted accordingly. Day-to-day movements were more problematic. No measure of these movements was possible. Impressions were gained, however, as some previously surveyed areas were passed on subsequent days while on the way to and from new survey areas. Survey areas were also "revisited" at the margins when adjoining areas were surveyed. Overall impressions of numbers and distributions were also formed during aerial surveys. On this basis, the authors have confidence that most birds present on surveyed portions of the estuary during each survey period were not double-counted or omitted.

As indicated above, Australian Pelicans were counted from an aircraft, with each survey of the entire estuary taking no more than 75-95 minutes. These surveys were undertaken in the middle of the day, when pelicans are often resting and relatively few movements, compared with early morning or evening, are taking place. Flocks too large to count from the air were photographed and numbers later determined from prints as described below. For these reasons there is a high degree of confidence in the accuracy of the pelican count data.

Also as indicated above, Black Swan numbers on Peel Inlet were counted during a single survey by boat, with each survey taking around 3.5 to 6.5 hours to complete. In four of the six survey months, all swans on Harvey Estuary were counted from the air during the pelican survey. In the other two months (February and April 1977), swans at the southern end of Harvey Estuary were counted by boat, either later the same day or next morning, and numbers counted were similar to impressions gained previously from the air. Additionally, the Peel Inlet and Harvey Estuary swan surveys were undertaken during the day, when swans are usually quietly grazing on aquatic plants or resting and little movement is taking place. There is therefore a high level of confidence in the accuracy of the Black Swan data.

It will be seen in following sections that none of the count data have been rounded. This is because the authors consider it more useful, in this first reporting of survey results, to present the raw data rather than rounded figures. However, when these data are put to other uses, for example comparisons of numbers with those of other wetlands, it is suggested that all totals be rounded to two significant figures. This approach is consistent with that taken in Rose & Scott (1997).

The survey methodology was not well-suited to detecting secretive species of waterbirds such as crakes and rails. To be confident of locating these species an observer needs to spend periods of 10 minutes or more quietly observing likely habitats, e.g. rushbeds, from unobtrusive positions. Alternatively, audio-tape recordings or live trapping techniques can be used. These methods were not employed during the 1976-77 surveys due to time constraints. One Spotted Crake was observed at Island Point (Harvey Estuary) in February 1977. It is highly likely that other crakes or rails were present though unrecorded during the 1976-77 survey period.

Although bird behaviours (principally feeding or roosting) were often recorded, this was not done routinely due to the magnitude and, at times, complexity of the survey task. Behaviours are therefore not presented in this report.

#### **4.4 Data Management**

Pelican and swan count data collected on "day one" of each survey were recorded directly onto maps of the estuary or were recorded on audiotapes (hand-held cassette recorder) and later transcribed to maps. A hand-held Hasselblad 500 EL/M electronic motor-driven 2¼" x 2¼" single-lens reflex camera fitted with a 70 exposure magazine, 100 mm lens and yellow light filter was used to photograph pelican flocks

too large to count from the air. The birds were later counted from black & white contact prints examined under a binocular microscope at x8 magnification.

All other waterbird data were recorded on audiotapes or, less frequently, in notebooks. These audiotape recordings were later transcribed onto maps of the estuary. These transcriptions were completed within days to months of the surveys being undertaken. During 2002, the data from these maps were re-worked to facilitate comparison with similar data collected in 1996-97 and 1998-99. This re-working consisted of dividing the estuary into the ten survey sectors used for the 1990s data and totalling the number of birds of each species in each sector. These sector totals were then summed, using Microsoft Excel, to produce totals for Peel Inlet and Harvey Estuary individually and Peel-Harvey Estuary combined. These data are presented in full in Appendix 1.

## 5. RESULTS

### 5.1 Species

#### 1976-77

Sixty seven species of waterbirds were recorded during the 1976-77 surveys. These represented 15 families and 43 genera (Table 1).

19 were transequatorial migratory species with their breeding grounds in the northern hemisphere. All of these migrant species are "shorebirds", also commonly referred to as "waders".

24 of the 67 species are currently listed under the Japan-Australia (JAMBA) or China-Australia (CAMBA) Migratory Bird Agreements (Commonwealth of Australia 1995a, 1995b). 21 species are listed under JAMBA and 22 under CAMBA. 19 species are listed under both agreements.

The numbers of waterbird species recorded in August, October, December 1976 and February, April, June 1977 were 46, 47, 47, 49, 50, 45 respectively (Appendix 1).

Sectors 1, 2, 6 and 10 (Figure 2) were surveyed in all six survey months. The numbers of waterbird species recorded in these four sectors collectively in these six months were 45, 47, 46, 46, 50, 45 respectively (Appendix 2).

Sectors 1-6 and 10 were surveyed in December 1976 and February, April, June 1977. The numbers of species recorded in these seven sectors collectively in these four months were 47, 49, 50, 45 respectively (Appendix 3).

31 species were each recorded in all six survey months; 11 species were recorded in only one survey month (Appendix 1).

In February 1977, one "Black Duck hybrid" (a bird with appearance intermediate between a Pacific Black Duck and the non-indigenous Mallard *Anas platyrhynchos*) was observed on the west side of the entrance channel, south of the old Mandurah Traffic Bridge (sector 2). In April 1977, three "mallards" (feral domestic ducks of Mallard origin) were recorded in a small boat harbour north of the old Mandurah Traffic Bridge (sector 1). In June 1977, two "mallards" (a male and a female) were seen in the same small boat harbour.

Two Sacred Kingfisher *Todiramphus sanctus*, one to the north of the old Mandurah Traffic Bridge (sector 1) and one in Soldiers Cove (sector 2), were observed in August 1976.

On 18 August 1976, two Banded Lapwing *Vanellus tricolor* were observed at the southern end of the Soldiers Cove peninsula and five were on high ground to the north of the Creery marshes (sector 2).

Table 1. Waterbird species and maximum numbers counted on Peel-Harvey Estuary during 1976-77. (Scientific and common names are those of Christidis & Boles 1994. Transequatorial migrants are denoted by <sup>M</sup>, JAMBA species by <sup>J</sup> and CAMBA species by <sup>C</sup>).

Family Name	Group and Scientific Names	Common Name	Max. Count
ANATIDAE	<b>Ducks &amp; allies</b>		
	<i>Biziura lobata</i>	Musk Duck	491
	<i>Cygnus atratus</i>	Black Swan	8057
	<i>Tadorna tadornoides</i>	Australian Shelduck	801
	<i>Chenonetta jubata</i>	Australian Wood Duck	5
	<i>Anas superciliosa</i>	Pacific Black Duck	707
	<i>Anas rhynchotis</i>	Australasian Shoveler	358
	<i>Anas gracilis</i>	Grey Teal	25077
	<i>Anas castanea</i>	Chestnut Teal	2
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	438
	<i>Aythya australis</i>	Hardhead	4
PODICIPEDIDAE	<b>Grebes</b>		
	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	10339
	<i>Podiceps cristatus</i>	Great Crested Grebe	105
ANHINGIDAE	<b>Darters</b>		
	<i>Anhinga melanogaster</i>	Darter	59
PHALACROCORACIDAE	<b>Cormorants</b>		
	<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant	4653
	<i>Phalacrocorax varius</i>	Pied Cormorant	4291
	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	4789
	<i>Phalacrocorax carbo</i>	Great Cormorant	185
PELECANIDAE	<b>Pelicans</b>		
	<i>Pelecanus conspicillatus</i>	Australian Pelican	2097
ARDEIDAE	<b>Hérons, Egrets, Bitterns</b>		
	<i>Egretta novaehollandiae</i>	White-faced Heron	466
	<i>Egretta garzetta</i>	Little Egret	15
	<i>Egretta sacra</i> <sup>C</sup>	Eastern Reef Egret	1
	<i>Ardea alba</i> <sup>CJ</sup>	Great Egret	191
THRESKIORNITHIDAE	<b>Ibises, Spoonbills</b>		
	<i>Plegadis falcinellus</i> <sup>C</sup>	Glossy Ibis	2
	<i>Threskiornis molucca</i>	Australian White Ibis	62
	<i>Threskiornis spinicollis</i>	Straw-necked Ibis	14
	<i>Platalea regia</i>	Royal Spoonbill	2
	<i>Platalea flavipes</i>	Yellow-billed Spoonbill	57
ACCIPITRIDAE	<b>Osprey, Kite, Eagles, Harriers</b>		
	<i>Pandion haliaetus</i>	Osprey	3
	<i>Haliastur sphenurus</i>	Whistling Kite	22
	<i>Circus approximans</i>	Swamp Harrier	7
RALLIDAE	<b>Rails, Crakes, Water hens, Coot</b>		
	<i>Porzana fluminea</i>	Australian Spotted Crake	1
	<i>Porphyrio porphyrio</i>	Purple Swamphen	8
	<i>Fulica atra</i>	Eurasian Coot	17039

Table 1 continued.

Family Name	Group and Scientific Names	Common Name	Max. Count
SCOLOPACIDAE	<b>Sandpipers, Knots, Stint &amp; allies</b>		
	<i>Limosa limosa</i> <sup>CJM</sup>	Black-tailed Godwit	12
	<i>Limosa lapponica</i> <sup>CJM</sup>	Bar-tailed Godwit	431
	<i>Numenius phaeopus</i> <sup>CJM</sup>	Whimbrel	20
	<i>Numenius madagascariensis</i> <sup>CJM</sup>	Eastern Curlew	34
	<i>Tringa stagnatilis</i> <sup>CJM</sup>	Marsh Sandpiper	5
	<i>Tringa nebularia</i> <sup>CJM</sup>	Common Greenshank	388
	<i>Xenus cinereus</i> <sup>CJM</sup>	Terek Sandpiper	1
	<i>Actitis hypoleucos</i> <sup>CJM</sup>	Common Sandpiper	28
	<i>Heteroscelis brevipes</i> <sup>CJM</sup>	Grey-tailed Tattler	20
	<i>Arenaria interpres</i> <sup>CJM</sup>	Ruddy Turnstone	72
	<i>Calidris tenuirostris</i> <sup>CJM</sup>	Great Knot	11
	<i>Calidris canutus</i> <sup>CJM</sup>	Red Knot	1360
	<i>Calidris ruficollis</i> <sup>CJM</sup>	Red-necked Stint	13259
	<i>Calidris melanotos</i> <sup>JM</sup>	Pectoral Sandpiper	2
	<i>Calidris acuminata</i> <sup>CJM</sup>	Sharp-tailed Sandpiper	1972
	<i>Calidris ferruginea</i> <sup>CJM</sup>	Curlew Sandpiper	6260
RECURVIROSTRIDAE	<b>Stilts, Avocets</b>		
	<i>Himantopus himantopus</i>	Black-winged Stilt	2464
	<i>Cladorhynchus leucocephalus</i>	Banded Stilt	63000
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet	2180
CHARADRIIDAE	<b>Plovers, Dotterels</b>		
	<i>Pluvialis fulva</i> <sup>CJM</sup>	Pacific Golden Plover	51
	<i>Pluvialis squatarola</i> <sup>CJM</sup>	Grey Plover	215
	<i>Charadrius ruficapillus</i>	Red-capped Plover	1250
	<i>Charadrius leschenaultii</i> <sup>CJM</sup>	Greater Sand Plover	15
	<i>Eelseyornis melanops</i>	Black-fronted Dotterel	12
<i>Erythrogonys cinctus</i>	Red-kneed Dotterel	2	
LARIDAE	<b>Gulls, Terns</b>		
	<i>Larus novaehollandiae</i>	Silver Gull	1987
	<i>Sterna nilotica</i>	Gull-billed Tern	4
	<i>Sterna caspia</i> <sup>C</sup>	Caspian Tern	139
	<i>Sterna bergii</i> <sup>J</sup>	Crested Tern	100
	<i>Sterna dougalii</i>	Roseate Tern	12
	<i>Sterna nereis</i>	Fairy Tern	84
<i>Chlidonias hybridus</i>	Whiskered Tern	457	
MELIPHAGIDAE	<b>Honeyeaters, Australian Chats</b>		
	<i>Ephthianura albifrons</i>	White-fronted Chat	24
SYLVIDAE	<b>Old World Warblers</b>		
	<i>Megalurus gramineus</i>	Little Grassbird	25
<b>TOTALS</b>		<b>67 species</b>	<b>176 244 birds</b>

One Inland Dotterel *Charadrius australis* was seen on mudflats on the east side of Peel Inlet (sector 6), south of Yunderup Canals, on 20 April 1977. This species and the three preceding (mallard, kingfisher, lapwing) were not regarded as waterbirds for the purposes of this study and have not been included in any Tables, Appendices or analyses of this report.

### 1975-76

Fifty three species of waterbirds were recorded during the preliminary (and incomplete) surveys of 1975-76. Three of these species were *not* recorded during 1976-77. These were the White-necked Heron *Ardea pacifica*, White-bellied Sea-Eagle *Haliaeetus leucogaster* and Pied Oystercatcher *Haematopus longirostris* (Appendix 15). The White-bellied Sea-Eagle is listed under the China-Australia Migratory Birds Agreement.

### Comparison with other estuaries

The number of waterbird species recorded on Peel-Harvey Estuary during 1976-77 may be compared (Table 2) with numbers recorded on two other south-western Australian estuaries (Lane unpublished data; Lane 1976) in earlier years. The total number of species and the highest species count in any month were both greatest on Peel-Harvey.

Table 2. Numbers of waterbird species recorded on Leschenault Inlet, Hardy Inlet and Peel-Harvey Estuary during the 1970s.

Estuary	Study period	Months of this comparison	Total number of species recorded	Highest number of species in any month
Leschenault Inlet	1973-74	Aug, Nov, Dec, Jan, Apr, Jun	48	40
Hardy Inlet	1974-75	Aug, Oct, Dec, Feb, Apr, Jun	51	42
Peel-Harvey Estuary	1976-77	Aug, Oct, Dec, Feb, Apr, Jun	67	50

## **5.2 Abundance**

### 1976-77

The minimum number of waterbirds identified to species that made use of Peel-Harvey Estuary at some time during 1976-77 was 176,244 (Table 1). This is the sum of the maximum monthly count (irrespective of month) of each individual species.

The highest single monthly count of all waterbirds was 150,525 in February 1977. This included 22,035 birds (mainly ducks, waders and cormorants) not identified to species (Appendix 1).

The most abundant species (17 species; each more than 1,000 individuals) were Banded Stilt (63,000), Grey Teal (25,077), Eurasian Coot (17,039), Red-necked Stint (13,259), Hoary-headed Grebe (10,339), Black Swan (8,057), Curlew Sandpiper (6,260), Little Black Cormorant (4,789), Little Pied Cormorant (4,653), Pied Cormorant (4,291), Black-winged Stilt (2,464), Red-necked Avocet (2,180), Australian Pelican (2,097), Silver Gull (1,987), Sharp-tailed Sandpiper (1,972), Red Knot (1,360) and Red-capped Plover (1,250) (Table 1).

The minimum number of identified ducks that made use of Peel-Harvey Estuary during 1976-77 was 27,883 (Table 1). The highest single monthly count of all ducks, including ducks unidentified to species, was 36,253 in February 1977 (Appendix 4). The most numerous (more than 1,000 individuals) was Grey Teal (25,077). The next most abundant (more than 100 individuals) were Australian Shelduck

(801), Pacific Black Duck (707), Musk Duck (491)<sup>1</sup>, Pink-eared Duck (438) and Australasian Shoveler (358).

The minimum number of identified cormorants that made use of Peel-Harvey Estuary during 1976-77 was 13,918 (Table 1). The highest single monthly count of all cormorants, including cormorants unidentified to species, was 12,726 in December 1976 (Appendix 5). The most numerous (more than 1,000 individuals) were Little Black Cormorant (4,789), Little Pied Cormorant (4,653) and Pied Cormorant (4,291). Great Cormorants were not abundant (maximum of 185 in October 1976).

The minimum number of identified terns that made use of Peel-Harvey Estuary during 1976-77 was 796 (Table 1). The highest single monthly count of all terns, including terns unidentified to species, was 617 in June 1977 (Appendix 9). The two most abundant species were Whiskered Tern (457) and Caspian Tern (139).

Difficulty was sometimes experienced in counting individual species within mixed flocks of stint (Red-necked), sandpiper (usually Sharp-tailed and/or Curlew) and plover (usually Red-capped). On these occasions a combined figure for "stint and sandpiper sized waders" (Red-capped Plover are similar in size to stints) was obtained. The minimum number of identified waders of this category (see Appendix 7) that made use of Peel-Harvey Estuary during 1976-77 was 22,758 (Table 1). The highest single monthly count of all birds in this category, including waders unidentified to species, was 21,863 in February 1977 (Appendix 7). The most numerous (more than 1,000 individuals) were Red-necked Stint (13,259), Curlew Sandpiper (6,260), Sharp-tailed Sandpiper (1,972) and Red-capped Plover (1,250). The remaining two identified species in this category (Pectoral Sandpiper and Greater Sand-Plover) were not abundant (counted maxima of two and 15 respectively).

The minimum number of stilt and avocet that made use of Peel-Harvey Estuary during 1976-77 was 67,644 (Table 1). The highest single monthly count of all stilt and avocet, including birds unidentified to species, was 69,115 in February 1977 (Appendix 8). The most abundant species was the Banded Stilt (63,000). Black-winged Stilt and Red-necked Avocet maxima were 2,464 (February 1977) and 2,180 (December 1976) respectively. On one occasion (southern end of Harvey Estuary in February 1977) the numbers of each species in a large gathering (2,800) of stilt and avocet were not determined.

The minimum number of transequatorial migratory shorebirds that made use of Peel-Harvey Estuary during 1976-77 was 24,156 (Table 1). The most numerous (more than 1,000 individuals) of these were Red-necked Stint (13,259), Curlew Sandpiper (6,260), Sharp-tailed Sandpiper (1,972) and Red Knot (1,360). The next most abundant (more than 100 individuals) were Bar-tailed Godwit (431), Common Greenshank (388) and Grey Plover (215). The highest single monthly count of knots was 1,370 (including two unidentified to species) in February 1977 (Appendix 6). The highest counts of Great Knot and Red Knot were 11 (December 1976) and 1,360 (February 1977) respectively.

The minimum number of individuals of bird species listed under JAMBA or CAMBA that made use of Peel-Harvey Estuary during 1976-77 was 24,589 (Table 1). The most numerous (more than 1,000 individuals) of these were Red-necked Stint (13,259), Curlew Sandpiper (6,260), Sharp-tailed Sandpiper (1,972) and Red Knot (1,360). The next most abundant (more than 100 individuals) were Bar-tailed Godwit (431), Common Greenshank (388), Grey Plover (215), Great Egret (191) and Caspian Tern (139).

Fifteen of the total of 67 species recorded during 1976-77 had maximum counts of less than 10 individuals (Table 1).

### 1975-76

Numbers recorded during the preliminary (and incomplete) surveys of 1975-76 were lower than those

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<sup>1</sup> Note however that many more Musk Duck were seen during the June 1977 "general air survey" and the total number on Peel-Harvey during that month was estimated to be c. 1,353 birds (see Appendix 11).



recorded during 1976-77, with only two definite<sup>2</sup> exceptions: Hardhead (c10-20 in July 1975, compared with a maximum of 4 in 1976-77) and Glossy Ibis (3 in July and September 1975, compared with a maximum of 2 in 1976-77) (Appendix 15).

There were substantially fewer swans and pelicans on Peel-Harvey Estuary in 1975-76 than in 1976-77. Black Swan maxima in the two survey years were 2,673 and 8,057 respectively. Pelican maxima were 1,235 and 2,097 respectively. These figures are considered accurate (see section 4.3).

#### Comparison with other estuaries

Waterbird numbers on Peel-Harvey Estuary during 1976-77 may be compared (Table 3) with numbers recorded on two other south-western Australian estuaries in earlier years (Lane unpublished data; Lane 1976). The number of species in high abundance categories (1,000s and 10,000s) and the "highest species abundance" were both greatest on Peel-Harvey.

Table 3. Waterbird abundance on Leschenault Inlet, Hardy Inlet and Peel-Harvey Estuary during the 1970s.

Estuary	Period	Number of Species in each Abundance Category					Highest species abundance
		1-10	11-100	101-1,000	1,001-10,000	>10,000	
Leschenault Inlet	1973-74	na	na	na	4	0	1,900*
Hardy Inlet	1974-75	24	22	10	1	0	1,100
Peel-Harvey Estuary	1976-77	16	20	15	12	5	63,000

Categories are based on counts or estimates of maximum numbers of each species in each study. "Highest species abundance" is the maximum number of the most abundant species in each study. \*The figure of 1,900 should be regarded as provisional, pending further analysis and reporting of Leschenault Inlet survey data. "na" = data not available at this time.

Between February 1975 and March 1977, the authors undertook five coordinated aerial (JL) and boat (GP) surveys of south-western Australian estuaries from Perth to Esperance, censusing swans, pelicans and egrets (Lane & Pearson 2003). In November 1976, 5,400 Black Swans and 1,800 Australian Pelicans were counted on Peel-Harvey Estuary. These were the highest numbers counted on any estuary in any survey. The second highest counts were 3,500 swans and 320 pelicans on Vasse-Wonnerup estuary in November 1976 and March 1976 respectively. Most estuaries supported much lower numbers of swans and pelicans. Egret numbers were also lower on other estuaries (maximum 79 on Vasse-Wonnerup in November 1976) than were commonly recorded on Peel-Harvey Estuary during aerial surveys of other months<sup>3</sup> between February 1975 and August 1976 (maximum 188 in August 1975; refer to Appendices 10, 15).

During the above surveys, some data and many impressions were gained of the abundance of other species of waterbirds. On no occasion did any other estuary from Perth to Esperance appear to support as many waterbirds in total as Peel-Harvey.

#### Comparison with other wetlands

While there is no single, comprehensive data set on waterbird use of south-western Australian wetlands in the mid 1970s, a substantial compilation for the period 1981-92 is available (Jaensch, Merrifield &

<sup>2</sup> Higher maxima of Shelduck and Black Duck were recorded in 1975-76 than in 1976-77, however the 1975-76 figures were obtained by aerial survey and might be significant over-estimates, particularly of the latter species.

<sup>3</sup> Egrets were not routinely counted on Peel-Harvey during the south-west estuaries surveys because the single aerial observer was fully occupied counting pelicans and swans.

Raines 1993). Maximum 1976-77 Peel-Harvey counts of 22 species (Table 4) were equal to or greater than those reported in that compilation.

### 5.3 Distribution

In five of the six survey months, more waterbirds were recorded in south-eastern Peel Inlet (sector 6) than in any other survey sector of Peel-Harvey (Appendix 1). The highest number recorded in this sector was 80,569 in February 1977. The lowest number in this sector was 11,042 in April 1977.

The survey sectors in which waterbirds were generally "next most abundant" were the southern end of Harvey Estuary (sector 10) and north-central Peel Inlet (sector 2). The number of waterbirds counted in sector 10 ranged from 4,785 in August 1976 to 42,826 in February 1977. The number counted in sector 2 ranged from 2,406 in August 1976 to 21,064 in February 1977.

The most abundant species (Banded Stilt) was most numerous in sector 6 (50,000 birds in February 1977) and sector 2 (13,000 birds in February 1977). The second most abundant species (Grey Teal) was most numerous in sector 10 (19,264 in February 1977). Note that there were an additional 10,000 unidentified ducks in this sector in February and most of these were probably Grey Teal. Grey Teal were next most abundant in sector 6 (15,000 in December 1976).

Table 4. The 22 species with counts equal to or higher than those reported for any wetland in south-western Australia in the period 1981-92.

Species	Max. 1976-77 Peel-Harvey Count	Max. 1981-92 SW Wetlands Count	Location of Maximum 1981-92 South-West Wetlands Count
Black Swan	8057	3873	Lake Muir
Grey Teal	25077	16850	Dumbleyung Lake
Hoary-headed Grebe	10339	4900	Bibra Lake
Darter	59	45	West Corio Swamp (near Pinjarra)
Little Pied Cormorant	4653	1000	Carraburnup Swamp (near Peel Inlet)
Pied Cormorant	4291	519	Peel Inlet East & South
Australian Pelican	2097	750	Vasse-Wonnerup Estuary
White-faced Heron	466	455	Dumbleyung Lake
Eastern Reef Egret	1	1	Not given
Osprey	3	2	Not given
Eurasian Coot	17039	10597	Jerdacuttup Lakes
Eastern Curlew	34	23	King River Mouth (Oyster Harbour)
Whimbrel	20	7	Creery Marshes (Peel Inlet)
Common Greenshank	388	213	Peel Inlet East & South
Common Sandpiper	28	18	Peel Inlet Entrance
Grey-tailed Tattler	20	12	King River Mouth (Oyster Harbour)
Ruddy Turnstone	72	24	Lake Warden
Red Knot	1360	542	Peel Inlet East & South
Red-necked Stint	13259	10000	Alfred Cove (Swan River)
Curlew Sandpiper	6260	3000	Lake McLarty
Banded Stilt	63000	44000	Culham Inlet
Caspian Tern	139	60	Peel Inlet

In five of the six survey months, sector 2 had the highest species diversity, ranging from 32 in August 1976 to 38 in October 1976. In June 1977 sector 10 had the highest species diversity with 32.

During the preliminary (and incomplete) surveys of 1975-76, most birds were found in south-eastern and north-central Peel Inlet and at the southern end of Harvey Estuary, as in 1976-77 (Appendix 15).

## **5.4 Breeding**

Four species of waterbirds were recorded breeding during the 1976-77 waterbird surveys. These were Black Swan, Australian Shelduck, Grey Teal and Australian Pelican (Appendix 13).

Three large Black Swan cygnets were seen at the southern end of Harvey Estuary in December 1976.

Twelve Australian Shelduck ducklings were recorded near Herron Point in August 1976. Six large ducklings were seen in the Herron Point Ford area in October and three in December 1976. There were five Australian Shelduck ducklings at Boodalan Island in October 1976.

Two large Grey Teal ducklings were on the lower reaches of the Harvey River in October 1976.

Many hundreds of Australian Pelicans were observed on Boodalan Island in August 1976 and nesting was thought possible. In October 1976, few pelicans were on Boodalan, however there were hundreds of birds and 33 active nests on Nirimba Cay. In December 1976, only 14 nests were found on Nirimba. These were abandoned and partially covered by sand. No indications of recent pelican nesting activity were found during the February, April or June 1977 Peel-Harvey waterbird surveys. In August 1976 and June 1977 Nirimba Cay was under water (due to high tides and/or river flows) and therefore unsuitable for nesting.

During the preliminary (and incomplete) surveys of 1975-76, only two species were recorded breeding. Australian Shelduck ducklings were observed on the estuary in August and September 1975 and Black Swans with cygnets were recorded in October 1975 (Appendix 15).

## **6. DISCUSSION**

### **6.1 Waterbirds on Peel-Harvey prior to construction of Dawesville Channel**

It is apparent from the mid 1970s data that two decades prior to construction of the Dawesville Channel, Peel-Harvey Estuary was one of the most important waterbird habitats in Western Australia, supporting large numbers of a wide diversity of species.

The February 1977 count of 150,526 birds, including 63,000 Banded Stilt, is higher than that reported for any other wetland in south-western Australia (Jaensch, Merrifield & Raines 1993, ANCA 1996). This figure far exceeds the next-highest reported count of 51,613 birds at Lake Muir, near Manjimup, in March 1989 (Halse et al 1990).

The number of waterbird species (67) recorded on Peel-Harvey Estuary during the surveys of 1976-77 is high compared with other south-west wetlands (e.g. those listed in ANCA 1996) and greater than those reported following similar, intensive, twelve-month studies of two other south-west estuaries, namely the Hardy and Leschenault Inlets (see above).

Waterbirds were unevenly distributed within Peel-Harvey Estuary during the 1976-77 surveys, with greatest numbers of birds occurring in south-eastern Peel Inlet (Austin and Robert Bays), the southern end of Harvey Estuary and north-central Peel Inlet. At the time of the surveys, Austin Bay and land adjoining were largely within conservation reserves. Land adjoining the eastern shore at the southern end of Harvey Estuary was also within a conservation reserve. Other areas, however, were unprotected.

### **6.2 Impacts of Dawesville Channel on Waterbirds**

The principal aim of preparing this report has been to collate and present waterbird data that are to be used to provide a pre-Channel baseline for comparison with results of "post"-Channel surveys (Lane, Clarke & Pearson 2002a, 2002b). This aim has been accomplished. Work is now underway in preparing a "comparisons" report in which changes in waterbird numbers and possible impacts of the Dawesville Channel on Peel-Harvey waterbird populations will be considered.

### **6.3 Ramsar Convention Status of Peel-Harvey Estuary**

In 1990 Peel-Harvey Estuary was nominated and listed, jointly with Lakes McLarty, Mealup and the Yalgorup Lakes, as a Wetland of International Importance under the Ramsar Convention (Government of Western Australia 1990; Wetlands International 2002). At that time, the estuary met the following three Ramsar Criteria (note that a site need only meet one Ramsar Criterion to be eligible for listing).

1. It is a particularly good example of a specific type of wetland, characteristic of its region.
- 3a. It regularly supports 20,000 waterfowl.
- 3c. Where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl.

Supportive data presented in the 1990 Ramsar nomination document included figures derived from partial analysis of 1976-77 survey data. Those few statistics should be considered updated and replaced by the data that are presented in this more recent and more comprehensive report.

The current status of Peel-Harvey Estuary in relation to Ramsar Criteria is discussed in Lane, Clarke & Pearson 2002a; 2002b.

### **6.4 Conservation recommendations following the 1976-77 surveys**

The principal aim of conducting the 1976-77 and earlier surveys was to determine which areas of Peel-Harvey Estuary were most important for waterbirds in order that soundly-based recommendations could be made for these areas to be reserved in perpetuity for nature conservation. The data that were gathered revealed the three most important areas to be south-eastern Peel Inlet, north-central Peel Inlet and the southern end of Harvey Estuary.

In 1972 the Environmental Protection Authority (EPA) of Western Australia established a Conservation Through Reserves Committee (CTRC) to assess the adequacy of the reserve system for the whole of the State and make recommendations to Government for a representative set of conservation reserves. For the purposes of the study, CTRC divided the State into 12 regions or "systems". Peel-Harvey Estuary was situated within "System 6", otherwise known as the Darling System. This system extended from Moore River in the north to Blackwood River in the south and included a large portion of the Swan Coastal Plain and forest and agricultural land east to Toodyay, Boddington and Boyup Brook (DCE 1981).

CTRC's study of System 6 was carried out from 1976 to 1983. During this period, the WA Department of Fisheries and Wildlife made two comprehensive submissions (DFW 1976, 1981); recommending reserves and other protective measures for areas of high conservation value within the System, including Peel-Harvey Estuary (see Appendices 18, 19 of this report for relevant extracts). CTRC and EPA largely adopted those recommendations (DCE 1981, 1983a, 1983b) and progressive implementation was subsequently approved by Government. Since 1983, EPA's recommendations for Peel-Harvey Estuary have been partially implemented.

The Peel Inlet Management Authority (PIMA 1992) and Marine Parks and Reserves Selection Working Group (DCLM 1994) have also endeavoured to ensure conservation management of key waterbird sites identified in this report, as have community-based conservation groups and individuals, notably the Peel Preservation Group and the late Mr Len Howard.

During the December 1976 waterbird surveys, the principal author discovered that the banks and vegetation of the lower Harvey River were being bulldozed and drag-lined with the intention of converting this section of the river into a drain. Following inspection and representations to the Under Secretary for Works by the Director of Fisheries and Wildlife, Mr B.K. Bowen, this work was halted and regeneration was allowed to occur. In 1979, "Conservation of Flora and Fauna" was added to the formal purpose of that portion of the lower Harvey River that is within drainage reserve No. 36126.

In February 1990, the Government of Western Australia nominated nine wetland systems for listing as Wetlands of International Importance under the (Ramsar) *Convention on Wetlands of International*

*Importance Especially as Waterfowl Habitat* (now referred to more simply as the *Convention on Wetlands*). One of these nine sites was "Peel-Yalgorup", comprising Peel-Harvey Estuary, Lakes Mealup and McLarty, and the Yalgorup Lakes system. Inclusion of Peel-Harvey in this nomination was largely based on data gathered during the 1976-77 waterbird surveys. These and other data showed that Peel-Harvey Estuary easily met Ramsar Criteria for listing (Government of Western Australia 1990). In November 2002, the State Government recommended seven extensions to the Peel-Yalgorup Ramsar Site (Government of Western Australia 2000). Two of these extensions included significant waterbird habitats in north-central Peel Inlet. Ramsar listing confers additional legal protection under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act*.

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# APPENDICES

APPENDIX 1. Waterbird species and numbers counted in all survey sectors of Peel-Harvey Estuary during 1976-77.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Musk Duck	Aug	0	0				1		1			1	1	2
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	21		21			211	211	232
	Apr	0	0	1	2	0	1		4			179	179	183
	Jun	0	0	0	0	0	0		0			491	491	491
Black Swan <sup>5</sup>	Aug	0	262	0	0	0	4900	217	5379	0	0	43	43	5422
	Oct	0	591	571	390	59	6010	85	7706	0	126	225	351	8057
	Nov	0	774	206	50	20	2776	6	3832	12	15	1512	1539	5371
	Dec	0	321	44	278	0	3250	0	3893	36	96	856	988	4881
	Feb	120	273	0	141	6	319	157	1016	62	18	2660	2740	3756
	Mar	4	272	35	131	0	860	217	1519	0	74	1209	1283	2802
	Apr	2	241	21	269	0	1655	139	2327	12	90	845	947	3274
Jun	0	21	0	0	28	3598	11	3658	0	0	203	203	3861	
Australian Shelduck	Aug	0	15				48		63			25	25	88
	Oct	0	64			2	725		791			10	10	801
	Dec	0	46	5	47	13	296		407			132	132	539
	Feb	0	24	0	1	0	70		95			234	234	329
	Apr	0	13	7	2	3	9		34			251	251	285
	Jun	0	8	0	5	2	14		29			26	26	55
Australian Wood Duck	Aug	0	0						0			0	0	0
	Oct	0	0						0			0	0	0
	Dec	0	0	0	0	0	0		0			5	5	5
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Pacific Black Duck	Aug	4	42		2		2		50		4	73	77	127
	Oct	0	52					118	170			140	140	310
	Dec	0	11	0	3	5	217		236			471	471	707
	Feb	20	88	2	7	0	1		118			318	318	436
	Apr	14	31	3	11	0	4		63			590	590	653
	Jun	8	39	12	14	16	157		246			144	144	390



APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Australasian Shoveler	Aug	0	0				145		145			12	12	157
	Oct	0	0				2		2			6	6	8
	Dec	0	0	0	0	0	3		3			75	75	78
	Feb	0	0	0	0	0	5		5			118	118	123
	Apr	0	0	6	1	0	0		7			22	22	29
	Jun	0	73	0	11	4	114		202			156	156	358
Grey Teal	Aug	0	260				2500		2760		4	476	480	3240
	Oct	0	283				10000		10283			900	900	11183
	Dec	0	42	265	210	278	15000		15795			7499	7499	23294
	Feb	0	83	86	2	154	5488		5813			19264	19264	25077
	Apr	0	220	614	267	33	238		1372		200	8611	8811	10183
	Jun	0	631	213	381	365	1582		3172			991	991	4163
Chestnut Teal	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	1	0	0	0		1			0	0	1
	Apr	0	0	1	0	0	0		1			1	1	2
	Jun	0	0	0	0	0	0		0			0	0	0
Pink-eared Duck	Aug	0	0						0			5	5	5
	Oct	0	0				435		435			3	3	438
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	2		2			53	53	55
	Apr	0	0	0	0	0	0		0			15	15	15
	Jun	0	0	0	0	0	0		0			70	70	70
Hardhead	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	2		2			2	2	4
Hoary-headed Grebe	Aug	0	0				9675	325	10000			339	339	10339
	Oct	0	0				500		500			1035	1035	1535
	Dec	0	0	0	0	0	170		170			7	7	177
	Feb	0	0	0	1	81	970		1052			385	385	1437
	Apr	5	298	1	211	211	3087		3813			54	54	3867
	Jun	3	131	675	278	0	2414		3501			92	92	3593

APPENDIX I. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Great Crested Grebe	Aug	0	0					61	61			0	0	61
	Oct	0	0					0	0			62	62	62
	Dec	0	0	0	0	0		1	1			71	71	72
	Feb	0	0	0	0	0		7	7			98	98	105
	Apr	0	0	0	0	0		0	0			0	0	0
	Jun	0	0	0	0	0		0	0			27	27	27
Darter	Aug	21	18					3	42			12	12	54
	Oct	8	6					1	15			2	2	17
	Dec	2	3	1	1	0		2	9			9	9	18
	Feb	2	1	0	1	0		5	9			7	7	16
	Apr	9	22	0	1	0		0	32			2	2	34
	Jun	22	18	0	12	1		2	55			4	4	59
Little Pied Cormorant	Aug	1	111		10			6	128			16	16	144
	Oct	25	83			35	600		743			36	36	779
	Dec	44	487	0	1	31	1192		1755			12	12	1767
	Feb	49	1141	0	58	390	2277		3915			266	266	4181
	Apr	86	637	0	592	329	240		1884			77	77	1961
	Jun	70	780	11	1242	50	2418		4571			82	82	4653
Pied Cormorant	Aug	275	153						428			0	0	428
	Oct	116	57				1550		1723			0	0	1723
	Dec	339	193	0	0	0	3759		4291			0	0	4291
	Feb	95	113	0	2	0	1389		1599			0	0	1599
	Apr	75	171	0	3	3	820		1072			0	0	1072
	Jun	404	172	0	38	0	9		623			0	0	623
Little Black Cormorant	Aug	0	3					803	806			35	35	841
	Oct	9	4			3	10		26			4763	4763	4789
	Dec	14	42	0	0	0	21		77			4000	4000	4077
	Feb	12	22	0	0	12	12		58			2000	2000	2058
	Apr	28	44	0	1	100	1		174			2879	2879	3053
	Jun	1	7	90	1	200	508		807			2601	2601	3408
Great Cormorant	Aug	1	4						5			22	22	27
	Oct	13	13			35	8		69			116	116	185
	Dec	10	8	0	0	1	1		20			26	26	46
	Feb	5	15	40	0	28	37		125			10	10	135
	Apr	7	1	0	0	66	70		144			20	20	164
	Jun	6	1	0	1	0	2		10			14	14	24

APPENDIX 1. Continued.

Species	Month	PEEL								HARVEY				Grand Total
		1	2	3	4	5	6	7	Total	8	9	10	Total	
Australian Pelican <sup>5</sup>	Aug	5	53	83	42	7	1033	15	1238	6	22	23	51	1289
	Oct	6	337	70	32	139	1141	47	1772	60	19	46	125	1897
	Nov	10	457	87	126	17	893	55	1645	60	25	96	181	1826
	Dec	14	499	36	69	10	1238	60	1926	19	42	110	171	2097
	Feb	6	384	74	61	15	505	153	1198	102	59	184	345	1543
	Mar	6	340	154	191	0	665	57	1413	74	60	140	274	1687
	Apr	23	128	0	50	164	345	5	715	163	35	3	201	916
	Jun	26	130	80	87	2	243	14	582	84	49	45	178	760
White-faced Heron	Aug	1	12						13			13	13	26
	Oct	1	82					45	128			33	33	161
	Dec	3	101	0	8	5	57		174			5	5	179
	Feb	11	82	1	24	1	337		456			10	10	466
	Apr	11	71	0	15	1	76		174			8	8	182
	Jun	0	98	0	12	23	233		366			34	34	400
Little Egret	Aug	0	8						8			0	0	8
	Oct	0	0					0	0			0	0	0
	Dec	0	3	0	0	0	0		3			0	0	3
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	3	0	0	0	0		3			0	0	3
	Jun	0	11	0	0	1	3		15			0	0	15
Eastern Reef Egret	Aug	0	0						0			0	0	0
	Oct	0	0					0	0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	1	0	0	0	0	0		1			0	0	1
	Jun	0	0	0	0	0	0		0			0	0	0
Great Egret	Aug	1	46		1		46		94		1	96	97	191
	Oct	0	8			1	0		9			17	17	26
	Dec	0	18	0	1	0	10		29			10	10	39
	Feb	0	13	0	7	0	3		23			14	14	37
	Apr	6	12	3	7	1	22		51			12	12	63
	Jun	1	14	2	5	22	31		75			39	39	114

APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Glossy Ibis	Aug	0	0				2		2			0	0	2
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Australain White Ibis	Aug	0	0				18		18			44	44	62
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	24		24			0	0	24
Straw-necked Ibis	Aug	0	0						0			0	0	0
	Oct	0	12				0		12			2	2	14
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Royal Spoonbill	Aug	0	0				2		2			0	0	2
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Yellow-billed Spoonbill	Aug	0	0				10		10			0	0	10
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			16	16	16
	Jun	0	0	0	0	0	35		35			22	22	57
Osprey	Aug	0	2						2			0	0	2
	Oct	0	1						1			0	0	1
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	1	0	0		1			0	0	1
	Apr	0	2	0	0	0	0		2			1	1	3
	Jun	0	1	0	0	1	0		2			0	0	2

APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Whistling Kite	Aug	0	4						4			6	6	10
	Oct	0	2			4	4		10			0	0	10
	Dec	0	1	0	0	0	5		6			3	3	9
	Feb	0	1	0	1	4	0		6			1	1	7
	Apr	0	2	0	1	9	5		17			5	5	22
	Jun	0	0	1	0	1	6		8			4	4	12
Swamp Harrier	Aug	0	0						0			3	3	3
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			1	1	1
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	1	0	1	1	1		4			3	3	7
	Jun	0	0	0	0	0	2		2			0	0	2
Australian Spotted Crake	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			1	1	1
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Purple Swamphen	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			8	8	8
	Jun	0	0	0	0	0	0		0			1	1	1
Eurasian Coot	Aug	0	0				6000		6000		114	2480	2594	8594
	Oct	0	0				15125		15125			1914	1914	17039
	Dec	0	0	0	0	0	0		0			145	145	145
	Feb	0	0	0	0	0	0		0			527	527	527
	Apr	0	0	0	0	0	0		0			87	87	87
	Jun	0	0	0	0	18	0		18			137	137	155
Black-tailed Godwit	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	6	0	0	0	0		6			0	0	6
	Feb	0	12	0	0	0	0		12			0	0	12
	Apr	0	0	0	0	0	0		0			1	1	1
	Jun	0	0	0	0	0	0		0			0	0	0

APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Bar-tailed Godwit	Aug	12	81		1				94			0	0	94
	Oct	0	71		60		1		132			61	61	193
	Dec	44	234	20	55	12	2		367			37	37	404
	Feb	14	16	0	2	4	382		418			13	13	431
	Apr	23	31	0	0	0	0		54			26	26	80
	Jun	8	0	0	1	0	0		9			8	8	17
Whimbrel	Aug	0	7						7			0	0	7
	Oct	0	11				0		11			0	0	11
	Dec	0	16	0	4	0	0		20			0	0	20
	Feb	0	10	0	1	0	0		11			0	0	11
	Apr	0	7	0	0	0	0		7			0	0	7
	Jun	0	0	0	0	0	0		0			0	0	0
Eastern Curlew	Aug	0	3		5				8			0	0	8
	Oct	0	22				0		22			0	0	22
	Dec	0	18	0	5	0	0		23			0	0	23
	Feb	0	33	0	1	0	0		34			0	0	34
	Apr	0	4	0	0	0	0		4			0	0	4
	Jun	0	1	0	0	0	0		1			0	0	1
Marsh Sandpiper	Aug	0	0						0			0	0	0
	Oct	0	5				0		5			0	0	5
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Common Greenshank	Aug	0	76		1		11		88			14	14	102
	Oct	0	73				42		115			62	62	177
	Dec	2	169	4	23	1	29		228			37	37	265
	Feb	1	208	6	16	6	57		294			94	94	388
	Apr	1	11	1	3	4	127		147			6	6	153
	Jun	0	19	1	3	0	106		129			15	15	144
Terek Sandpiper	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			1	1	1
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0

APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Common Sandpiper	Aug	2	3						5			0	0	5
	Oct	11	2					0	13			0	0	13
	Dec	11	16	0	0	1	0		28			0	0	28
	Feb	13	9	0	4	0	0		26			0	0	26
	Apr	6	7	0	3	0	0		16			0	0	16
	Jun	0	0	0	0	0	0		0			0	0	0
Grey-tailed Tattler	Aug	0	0						0			0	0	0
	Oct	0	0					0	0			0	0	0
	Dec	0	11	0	1	0	0		12			0	0	12
	Feb	0	13	0	7	0	0		20			0	0	20
	Apr	0	1	0	0	0	0		1			0	0	1
	Jun	0	0	0	0	0	0		0			0	0	0
Ruddy Turnstone	Aug	0	0						0			0	0	0
	Oct	0	55		6			9	70			2	2	72
	Dec	0	0	0	1	0	0		1			0	0	1
	Feb	1	0	0	0	0	0		1			0	0	1
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Great Knot	Aug	0	0						0			0	0	0
	Oct	0	5					1	6			0	0	6
	Dec	0	10	0	1	0	0		11			0	0	11
	Feb	0	8	0	0	0	0		8			0	0	8
	Apr	1	2	0	0	0	0		3			0	0	3
	Jun	0	0	0	0	0	0		0			0	0	0
Red Knot	Aug	0	0						0			0	0	0
	Oct	0	1000					10	1010			6	6	1016
	Dec	0	433	0	24	4	0		461			0	0	461
	Feb	0	1330	0	0	8	22		1360			0	0	1360
	Apr	0	26	0	0	11	0		37			0	0	37
	Jun	0	0	0	0	0	0		0			0	0	0
Red-necked Stint	Aug	0	84						84			0	0	84
	Oct	0	9875		125			3250	13250			9	9	13259
	Dec	20	4194	4200	502	1200	398		10514			318	318	10832
	Feb	1	1569	1400	33	284	4928		8215			49	49	8264
	Apr	0	31	12	57	40	55		195			7	7	202
	Jun	0	3	5	0	0	0		8			3	3	11

APPENDIX I. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Pectoral Sandpiper	Aug	0	0						0			0	0	0
	Oct	0	0					0	0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	2	0	0	0		2			0	0	2
	Apr	0	0	0	0	0	0		0			1	1	1
	Jun	0	0	0	0	0	0		0			0	0	0
Sharp-tailed Sandpiper	Aug	0	0						0			0	0	0
	Oct	0	107					10	117			0	0	117
	Dec	0	646	300	88	0	10		1044			7	7	1051
	Feb	0	326	74	35	0	1534		1969			3	3	1972
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Curlew Sandpiper	Aug	0	0					2	2			0	0	2
	Oct	0	800		200			700	1700			78	78	1778
	Dec	4	1673	1695	2147	499	31		6049			211	211	6260
	Feb	0	1341	74	6	9	2376		3806			3	3	3809
	Apr	0	1	0	0	38	0		39			0	0	39
	Jun	0	4	3	0	0	12		19			0	0	19
Black-winged Stilt	Aug	0	44					120	164			29	29	193
	Oct	0	213					958	1171			251	251	1422
	Dec	0	155	137	48	14	411		765			358	358	1123
	Feb	0	19	106	46	10	2000		2181			283	283	2464
	Apr	1	61	9	58	26	172		327			139	139	466
	Jun	0	46	37	33	0	422		538			114	114	652
Banded Stilt	Aug	0	760						760			1	1	761
	Oct	0	3					1500	1503			0	0	1503
	Dec	0	240	0	0	0	8566		8806			0	0	8806
	Feb	0	13000	0	0	0	50000		63000			0	0	63000
	Apr	0	2524	15	48	1	3345		5933			15	15	5948
	Jun	0	20	0	0	0	7		27			0	0	27
Red-necked Avocet	Aug	0	238					915	1153			967	967	2120
	Oct	0	0					112	112			556	556	668
	Dec	0	0	14	27	46	56		143			2037	2037	2180
	Feb	0	0	0	0	0	350		350			501	501	851
	Apr	0	0	5	0	0	254		259			1168	1168	1427
	Jun	0	366	12	0	0	667		1045			645	645	1690



APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Pacific Golden Plover	Aug	0	0						0			0	0	0
	Oct	0	0				0		0		8	8	8	
	Dec	0	2	0	0	0	0		2		27	27	29	
	Feb	0	9	0	0	0	18		27		24	24	51	
	Apr	0	0	0	0	0	0		0		0	0	0	
	Jun	0	0	0	0	0	0		0		0	0	0	
Grey Plover	Aug	1	32						33		0	0	33	
	Oct	1	104				0		105		0	0	105	
	Dec	22	108	3	9	16	16		174		41	41	215	
	Feb	10	97	0	11	16	2		136		2	2	138	
	Apr	10	1	3	1	5	3		23		0	0	23	
	Jun	30	0	0	0	0	0		30		0	0	30	
Red-capped Plover	Aug	3	7						10		0	0	10	
	Oct	4	22				300		326		100	100	426	
	Dec	4	203	0	0	6	120		333		139	139	472	
	Feb	9	260	0	4	13	918		1204		46	46	1250	
	Apr	2	30	0	2	3	15		52		5	5	57	
	Jun	0	11	0	0	0	0		11		1	1	12	
Greater Sand Plover	Aug	0	0						0		0	0	0	
	Oct	0	15				0		15		0	0	15	
	Dec	1	3	0	0	0	0		4		0	0	4	
	Feb	0	0	0	0	0	0		0		0	0	0	
	Apr	0	0	0	0	0	0		0		0	0	0	
	Jun	0	0	0	0	0	0		0		0	0	0	
Black-fronted Dotterel	Aug	0	0						0		0	0	0	
	Oct	0	0				0		0		0	0	0	
	Dec	0	0	0	0	0	0		0		0	0	0	
	Feb	0	0	0	0	0	0		0		0	0	0	
	Apr	0	0	0	0	0	0		0		0	0	0	
	Jun	0	0	10	0	0	0		10		2	2	12	

APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Red-kneed Dotterel	Aug	0	0						0			0	0	0
	Oct	0	0					0	0		0	0	0	0
	Dec	0	0	0	0	0	0	0	0		0	0	0	0
	Feb	0	0	0	0	0	0	0	0		0	0	0	0
	Apr	0	0	0	0	0	0	0	0		0	0	0	0
	Jun	0	2	0	0	0	0	0	2		0	0	0	2
Silver Gull	Aug	3	17		3		156		179			42	42	221
	Oct	162	59			10	160		391			124	124	515
	Dec	391	239	46	2	0	219		917			123	123	1040
	Feb	658	350	78	299	117	235		1737			250	250	1987
	Apr	425	184	8	149	90	417		1273			73	73	1346
	Jun	129	81	7	15	243	313		788			60	60	848
Gull-billed Tern	Aug	0	2						2			0	0	2
	Oct	0	4					0	4			0	0	4
	Dec	0	4	0	0	0	0	0	4			0	0	4
	Feb	0	0	0	0	0	0	0	0			0	0	0
	Apr	0	0	0	2	1	1		4			0	0	4
	Jun	0	0	0	0	0	0		0			0	0	0
Caspian Tern	Aug	9	1				14		24			0	0	24
	Oct	3	1					4	8			0	0	8
	Dec	10	7	3	0	2	6		28			2	2	30
	Feb	3	79	18	29	1	6		136			3	3	139
	Apr	35	32	0	2	9	8		86			4	4	90
	Jun	40	10	2	1	4	30		87			12	12	99
Crested Tern	Aug	23	14				3		40			2	2	42
	Oct	14	37					3	54			26	26	80
	Dec	65	4	2	0	0	11		82			10	10	92
	Feb	10	53	0	3	1	27		94			6	6	100
	Apr	14	3	0	24	2	10		53			6	6	59
	Jun	27	0	0	18	0	5		50			2	2	52
Roseate Tern	Aug	0	0						0			0	0	0
	Oct	0	0					0	0			0	0	0
	Dec	0	0	0	0	0	0	0	0			0	0	0
	Feb	0	0	0	0	0	0	0	0			0	0	0
	Apr	12	0	0	0	0	0	0	12			0	0	12
	Jun	6	0	0	0	0	0	0	6			0	0	6

APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Fairy Tern	Aug	0	0				12		12			0	0	12
	Oct	0	0				0		0			0	0	0
	Dec	2	80	0	2	0	0		84			0	0	84
	Feb	0	0	0	0	0	20		20			0	0	20
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Whiskered Tern	Aug	0	0				200		200			0	0	200
	Oct	0	0				100		100			0	0	100
	Dec	0	0	0	0	0	88		88			0	0	88
	Feb	0	2	0	0	0	0		2			0	0	2
	Apr	0	0	35	0	90	3		128			0	0	128
	Jun	0	0	0	0	100	357		457			0	0	457
White-fronted Chat	Aug	0	12						12			0	0	12
	Oct	0	9				0		9			0	0	9
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	3	0	0	0	0		3		3	3	3	6
	Apr	0	2	0	0	13	9		24			0	0	24
	Jun	0	7	0	0	0	0		7			0	0	7
Little Grassbird	Aug	0	10						10			6	6	16
	Oct	0	6				0		6			0	0	6
	Dec	0	12	0	2	1	0		15			1	1	16
	Feb	0	14	0	5	0	0		19			3	3	22
	Apr	0	19	0	6	0	0		25			0	0	25
	Jun	0	13	0	2	0	0		15			1	1	16
<b>Sub Total</b>	<b>Aug</b>	362	2384	83	65	7	26627	618	30146	6	145	4785	4936	35082
<b>Sub Total</b>	<b>Oct</b>	373	14094	641	813	288	43434	132	59775	60	145	10594	10799	70574
<b>Sub Total</b>	<b>Dec</b>	1002	10278	6775	3559	2145	35185	60	59004	55	138	16785	16978	75982
<b>Sub Total</b>	<b>Feb</b>	1040	21001	1962	809	1160	74323	310	100605	164	77	27644	27885	128490
<b>Sub Total</b>	<b>Apr</b>	797	4874	745	1789	1254	10993	144	20596	175	325	15140	15640	36236
<b>Sub Total</b>	<b>Jun</b>	781	2718	1161	2160	1081	13316	25	21242	84	49	6048	6181	27423

APPENDIX 1. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Unidentified ducks	Aug	0	0						0			0	0	0
	Oct	0	0			30	0		30		48	48	78	
	Dec	0	10	0	0	0	0		10		0	0	10	
	Feb	0	0	0	0	0	0		0		10000	10000	10000	
	Apr	0	7	0	0	0	38		45		0	0	45	
	Jun	0	10	0	0	0	20		30		0	0	30	
Unidentified cormorants	Aug	0	20						20		0	0	20	
	Oct	0	210				0		210		0	0	210	
	Dec	0	165	0	80	300	2000		2545		0	0	2545	
	Feb	0	28	0	503	0	53		584		2000	2000	2584	
	Apr	2	5	3	253	25	0		288		0	0	288	
	Jun	0	471	0	308	500	1606		2885		0	0	2885	
Unidentified knots	Aug	0	0						0		0	0	0	
	Oct	0	30				0		30		0	0	30	
	Dec	0	56	0	0	0	0		56		0	0	56	
	Feb	1	0	0	0	0	1		2		0	0	2	
	Apr	0	0	0	0	0	0		0		0	0	0	
	Jun	0	0	0	0	0	0		0		0	0	0	
Unidentified waders (stint/sandpiper size)	Aug	0	1						1		0	0	1	
	Oct	0	0				0		0		0	0	0	
	Dec	0	471	0	0	70	3		544		5	5	549	
	Feb	1	30	33	0	0	6120		6184		382	382	6566	
	Apr	0	0	0	0	29	11		40		38	38	78	
	Jun	0	0	0	0	0	1		1		0	0	1	
Unidentified stilt/Avocet	Aug	0	0						0		0	0	0	
	Oct	0	0				0		0		0	0	0	
	Dec	0	0	0	0	0	0		0		0	0	0	
	Feb	0	0	0	0	0	0		0		2800	2800	2800	
	Apr	0	0	0	0	0	0		0		0	0	0	
	Jun	0	0	0	0	0	0		0		0	0	0	

APPENDIX I. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Unidentified terns	Aug	3	1						4			0	0	4
	Oct	0	17			<i>1</i>	0		18			0	0	18
	Dec	2	6	1	0	0	4		13			0	0	13
	Feb	6	5	0	0	0	72		83				0	83
	Apr	5	0	0	0	0	0		5			0	0	5
	Jun	0	0	0	0	0	3		3			0	0	3
<b>Sub Total</b>	<b>Aug</b>	3	22						25			0	0	25
<b>Sub Total</b>	<b>Oct</b>	0	257			<i>31</i>	0		288			48	48	336
<b>Sub Total</b>	<b>Dec</b>	2	708	1	80	370	2007		3168			5	5	3173
<b>Sub Total</b>	<b>Feb</b>	8	63	33	503	0	6246		6853			15182	15182	22035
<b>Sub Total</b>	<b>Apr</b>	7	12	3	253	54	49		378			38	38	416
<b>Sub Total</b>	<b>Jun</b>	0	481	0	308	500	1630		2919			0	0	2919

<b>GRAND TOTAL</b>	<b>Aug</b>	365	2406	83	63	7	26627	618	30171	6	145	4785	4936	35107
<b>GRAND TOTAL</b>	<b>Oct</b>	373	14351	641	813	319	43434	132	60063	60	145	10642	10847	70910
<b>GRAND TOTAL</b>	<b>Dec</b>	1004	10986	6776	3639	2515	37192	60	62172	55	138	16790	16983	79155
<b>GRAND TOTAL</b>	<b>Feb</b>	1048	21064	1995	1312	1160	80569	310	107458	164	77	42826	43067	150525
<b>GRAND TOTAL</b>	<b>Apr</b>	804	4886	748	2042	1308	11042	144	20974	175	325	15178	15678	36652
<b>GRAND TOTAL</b>	<b>Jun</b>	781	3199	1161	2468	1581	14946	25	24161	84	49	6048	6181	30342

<b>TOTAL No. OF SPECIES</b>	<b>Aug</b>	15	32	<i>1</i>	8	<i>1</i>	26	4	44	<i>1</i>	5	26	26	46
<b>TOTAL No. OF SPECIES</b>	<b>Oct</b>	13	38	2	6	9	32	2	44	<i>1</i>	2	30	30	47
<b>TOTAL No. OF SPECIES</b>	<b>Dec</b>	19	38	16	26	19	30	<i>1</i>	44	2	2	32	32	47
<b>TOTAL No. OF SPECIES</b>	<b>Feb</b>	19	36	14	29	20	33	2	47	2	2	34	34	49
<b>TOTAL No. OF SPECIES</b>	<b>Apr</b>	23	36	17	28	26	28	2	44	2	3	34	34	50
<b>TOTAL No. OF SPECIES</b>	<b>Jun</b>	15	29	16	20	18	29	2	41	<i>1</i>	<i>1</i>	32	32	45

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was not surveyed for birds of that species in that month.
2. In this Appendix, a zero in a sector cell indicates that the sector was surveyed in that month, but no birds of that species were found.
3. Some numbers in this Appendix appear in italics and small font. This is intended to show at a glance that, while some birds were counted, the relevant sector was not surveyed for all birds of that species (or, if a subtotal or total, for all birds of all species) in that month.
4. In August 1976, sector 6 was surveyed by boat only, not on foot. Some birds on or near sections of shoreline could therefore have been overlooked.
5. Additional aerial/boat surveys of swans and pelicans on Peel-Harvey were conducted on 16 Nov 1976 and 16 Mar 1977 as part of a larger program of surveying all estuaries Perth-Esperance. Results of these two surveys have been added to this Appendix - see Black Swan and Australian Pelican entries.

**APPENDIX 2. Waterbird species and numbers counted each month in Peel-Harvey survey sectors (1, 2, 6<sup>2</sup> & 10) common to all survey months of 1976-77.**

Species	1976			1977		
	Aug <sup>2</sup>	Oct	Dec	Feb	Apr	Jun
Musk Duck	2			232	180	491
Black Swan	5205	6826	4427	3372	2743	3822
Australian Shelduck	88	799	474	328	273	48
Australian Wood Duck			5			
Pacific Black Duck	121	310	699	427	639	348
Australasian Shoveler	157	8	78	123	22	343
Grey Teal	3236	11183	22541	24835	9069	3204
Chestnut Teal					1	
Pink-eared Duck	5	438		55	15	70
Hardhead						4
Hoary-headed Grebe	10014	1535	177	1355	3444	2640
Great Crested Grebe		62	72	105		27
Darter	54	17	16	15	33	46
Little Pied Cormorant	134	744	1735	3733	1040	3350
Pied Cormorant	428	1723	4291	1597	1066	585
Little Black Cormorant	841	4786	4077	2046	2952	3117
Great Cormorant	27	150	45	67	98	23
Australian Pelican	1114	1530	1861	1079	499	444
White-faced Heron	26	161	166	440	166	365
Little Egret	8		3		3	14
Eastern Reef Egret					1	
Great Egret	189	25	38	30	52	85
Gloss Ibis	2					
Australian White Ibis	62					24
Straw-necked Ibis		14				
Royal Spoonbill	2					
Yellow-billed Spoonbill	10				16	57
Osprey	2	1			3	1
Whistling Kite	10	6	9	2	12	10
Swamp Harrier	3		1		5	2
Australian Spotted Crake				1		
Purple Swamphen					8	1
Eurasian Coot	8480	17039	145	527	87	137
Black-tailed Godwit			6	12	1	
Bar-tailed Godwit	93	133	317	425	80	16
Whimbrel	7	11	16	10	7	
Eastern Curlew	3	22	18	33	4	1
Marsh Sandpiper		5				
Common Greenshank	101	177	237	360	145	140
Terek Sandpiper		1				
Common Sandpiper	5	13	27	22	13	
Grey-tailed Tattler			11	13	1	
Ruddy Turnstone		66		1		
Great Knot		6	10	8	3	
Red Knot		1016	433	1352	26	
Red-necked Stint	84	13134	4930	6547	93	6
Pectoral Sandpiper					1	

APPENDIX 2. Continued.

Species	1976			1977		
	Aug <sup>2</sup>	Oct	Dec	Feb	Apr	Jun
Sharp-tailed Sandpiper		117	663	1863		
Curlew Sandpiper	2	1578	1919	3720	1	16
Black-winged Stilt	193	1422	924	2302	373	582
Banded Stilt	761	1503	8806	63000	5884	27
Red-necked Avocet	2120	668	2093	851	1422	1678
Pacific Golden Plover		8	29	51		
Grey Plover	33	105	187	111	14	30
Red-capped Plover	10	426	466	1233	52	12
Greater Sand Plover		15	4			
Black-fronted Dotterel						2
Red-kneed Dotterel						2
Silver Gull	218	505	992	1493	1099	583
Gull-billed Tern	2	4	4		1	
Caspian Tern	24	8	25	91	79	92
Crested Tern	42	80	90	96	33	34
Roseate Tern					12	6
Fairy Tern	12		82	20		
Whiskered Tern	200	100	88	2	3	357
White-fronted Chat	12	9		6	11	7
Little Grassbird	16	6	13	17	19	14
<b>Sub Total</b>	<b>34158</b>	<b>68495</b>	<b>63250</b>	<b>124008</b>	<b>31804</b>	<b>22863</b>
Unidentified ducks		48	10	10000	45	30
Unidentified cormorants	20	210	2165	2081	7	2077
Unidentified knots		30	56	2		
Unidentified stint/sandpiper sized waders	1		479	6533	49	1
Unidentified stilt/Avocet				2800		
Unidentified terns	4	17	12	83	5	3
<b>Sub Total</b>	<b>25</b>	<b>305</b>	<b>2722</b>	<b>21499</b>	<b>106</b>	<b>2111</b>
<b>GRAND TOTAL</b>	<b>34183</b>	<b>68800</b>	<b>65972</b>	<b>145507</b>	<b>31910</b>	<b>24974</b>
<b>TOTAL N° OF SPECIES</b>	<b>45</b>	<b>47</b>	<b>46</b>	<b>46</b>	<b>50</b>	<b>45</b>

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was surveyed for waterbirds in that month, but no birds of that species were found.
2. In August 1976, sector 6 was surveyed by boat only, not on foot. Some birds on or near sections of shoreline could therefore have been overlooked.
3. The total number of species listed in this Appendix is 67.

**APPENDIX 3. Waterbird species and numbers counted in Peel-Harvey survey sectors (1, 2, 3, 4, 5, 6 & 10) common to December 1976 and February, April and June 1977.**

Species	1976-77			
	Dec	Feb	Apr	Jun
Musk Duck		232	183	491
Black Swan	4749	3519	3033	3850
Australian Shelduck	539	329	285	55
Australian Wood Duck	5			
Pacific Black Duck	707	436	653	390
Australasian Shoveler	78	123	29	358
Grey Teal	23294	25077	9983	4163
Chestnut Teal		1	2	
Pink-eared Duck		55	15	70
Hardhead				4
Hoary-headed Grebe	177	1437	3867	3593
Great Crested Grebe	72	105		27
Darter	18	16	34	59
Little Pied Cormorant	1767	4181	1961	4653
Pied Cormorant	4291	1599	1072	623
Little Black Cormorant	4077	2058	3053	3408
Great Cormorant	46	135	164	24
Australian Pelican	1976	1229	713	613
White-faced Heron	179	466	182	400
Little Egret	3		3	15
Eastern Reef Egret			1	
Great Egret	39	37	63	114
Australian White Ibis				24
Yellow-billed Spoonbill			16	57
Osprey		1	3	2
Whistling Kite	9	7	22	12
Swamp Harrier	1		7	2
Australian Spotted Crake		1		
Purple Swamphen			8	1
Eurasian Coot	145	527	87	155
Black-tailed Godwit	6	12	1	
Bar-tailed Godwit	404	431	80	17
Whimbrel	20	11	7	
Eastern Curlew	23	34	4	1
Common Greenshank	265	388	153	144
Common Sandpiper	28	26	16	
Grey-tailed Tattler	12	20	1	
Ruddy Turnstone	1	1		
Great Knot	11	8	3	
Red Knot	461	1360	37	
Red-necked Stint	10832	8264	202	11
Pectoral Sandpiper		2	1	
Sharp-tailed Sandpiper	1051	1972		
Curlew Sandpiper	6260	3809	39	19
Black-winged Stilt	1123	2464	466	652
Banded Stilt	8806	63000	5948	27
Red-necked Avocet	2180	851	1427	1690



APPENDIX 3. Continued.

Species	1976-77			
	Dec	Feb	Apr	Jun
Pacific Golden Plover	29	51		
Grey Plover	215	138	23	30
Red-capped Plover	472	1250	57	12
Greater Sand Plover	4			
Black-fronted Dotterel				12
Red-kneed Dotterel				2
Silver Gull	1040	1987	1346	848
Gull-billed Tern	4		4	
Caspian Tern	30	139	90	99
Crested Tern	92	100	59	52
Roseate tern			12	6
Fairy Tern	84	20		
Whiskered Tern	88	2	128	457
White-fronted Chat		6	24	7
Little Grassbird	16	22	25	16
<b>Sub Total</b>	<b>75729</b>	<b>127939</b>	<b>35592</b>	<b>27265</b>
Unidentified ducks	10	10000	45	30
Unidentified cormorants	2545	2584	288	2885
Unidentified knots	56	2		
Unidentified stint/sandpiper sized waders	549	6566	78	1
Unidentified stilt/Avocet		2800		
Unidentified terns	13	83	5	3
<b>Sub Total</b>	<b>3173</b>	<b>22035</b>	<b>416</b>	<b>2919</b>
<b>GRAND TOTAL</b>	<b>78902</b>	<b>149974</b>	<b>36008</b>	<b>30184</b>
<b>TOTAL N° OF SPECIES</b>	<b>47</b>	<b>49</b>	<b>50</b>	<b>45</b>

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was surveyed for waterbirds in that month, but no birds of that species were found.
2. The total number of species listed in this Appendix is 62.

APPENDIX 4. Species and numbers of DUCKS (including unidentified ducks) counted in all survey sectors of Peel-Harvey Estuary during 1976-77.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Musk Duck	Aug	0	0				1		1			1	1	2
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	21		21			211	211	232
	Apr	0	0	1	2	0	1		4			179	179	183
	Jun	0	0	0	0	0	0		0			491	491	491
Australian Shelduck	Aug	0	15				48		63			25	25	88
	Oct	0	64			2	725		791			10	10	801
	Dec	0	46	5	47	13	296		407			132	132	539
	Feb	0	24	0	1	0	70		95			234	234	329
	Apr	0	13	7	2	3	9		34			251	251	285
	Jun	0	8	0	5	2	14		29			26	26	55
Australian Wood Duck	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			5	5	5
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Pacific Black Duck	Aug	4	42		2		2		50		4	73	77	127
	Oct	0	52				118		170			140	140	310
	Dec	0	11	0	3	5	217		236			471	471	707
	Feb	20	88	2	7	0	1		118			318	318	436
	Apr	14	31	3	11	0	4		63			590	590	653
	Jun	8	39	12	14	16	157		246			144	144	390
Australasian Shoveler	Aug	0	0				145		145			12	12	157
	Oct	0	0				2		2			6	6	8
	Dec	0	0	0	0	0	3		3			75	75	78
	Feb	0	0	0	0	0	5		5			118	118	123
	Apr	0	0	6	1	0	0		7			22	22	29
	Jun	0	73	0	11	4	114		202			156	156	358

APPENDIX 4. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Grey Teal	Aug	0	260				2500		2760		4	476	480	3240
	Oct	0	283				10000		10283			900	900	11183
	Dec	0	42	265	210	278	15000		15795			7499	7499	23294
	Feb	0	83	86	2	154	5488		5813			19264	19264	25077
	Apr	0	220	614	267	33	238		1372		200	8611	8811	10183
	Jun	0	631	213	381	365	1582		3172			991	991	4163
Chestnut Teal	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	1	0	0	0		1			0	0	1
	Apr	0	0	1	0	0	0		1			1	1	2
	Jun	0	0	0	0	0	0		0			0	0	0
Pink-eared Duck	Aug	0	0						0			5	5	5
	Oct	0	0				435		435			3	3	438
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	2		2			53	53	55
	Apr	0	0	0	0	0	0		0			15	15	15
	Jun	0	0	0	0	0	0		0			70	70	70
Hardhead	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	2		2			2	2	4
Unidentified ducks	Aug	0	0						0			0	0	0
	Oct	0	0			30	0		30			48	48	78
	Dec	0	10	0	0	0	0		10			0	0	10
	Feb	0	0	0	0	0	0		0			10000	10000	10000
	Apr	0	7	0	0	0	38		45			0	0	45
	Jun	0	10	0	0	0	20		30			0	0	30
TOTAL N° OF DUCKS	Aug	4	317		2	0	2696		3019		8	592	600	3619
	Oct	0	399			32	11280		11711			1107	1107	12818
	Dec	0	109	270	260	296	15516		16451			8182	8182	24633
	Feb	20	195	89	10	154	5587		6055			30198	30198	36253
	Apr	14	271	632	283	36	290		1526		200	9669	9869	11395
	Jun	8	761	225	411	387	1889		3681			1880	1880	5561

APPENDIX 4. Continued.

	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
N° OF IDENTIFIED SPECIES	Aug	1	3		<i>1</i>		5		5		2	6	6	6
	Oct	0	3			<i>1</i>	5		5			5	5	5
	Dec	0	3	2	3	3	4		4			5	5	5
	Feb	1	3	3	3	1	6		7			6	6	7
	Apr	1	3	6	4	2	4		6		<i>1</i>	7	7	7
	Jun	0	4	2	4	4	5		5			7	7	7

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was not surveyed for birds of that species in that month.
2. In this Appendix, a zero in a sector cell indicates that the sector was surveyed in that month, but no birds of that species were found.
3. Some numbers in this Appendix appear in italics and small font. This indicates that, while some birds were counted, the relevant sector was not surveyed for all birds of that species (or, if a subtotal or total, for all individuals of all duck species) in that month.

**APPENDIX 5. Species and numbers of CORMORANTS (including unidentified cormorants) counted in all survey sectors of Peel-Harvey Estuary during 1976-77.**

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Little Pied Cormorant	Aug	1	111		10		6		128			16	16	144
	Oct	25	83			35	600		743			36	36	779
	Dec	44	487	0	1	31	1192		1755			12	12	1767
	Feb	49	1141	0	58	390	2277		3915			266	266	4181
	Apr	86	637	0	592	329	240		1884			77	77	1961
	Jun	70	780	11	1242	50	2418		4571			82	82	4653
Pied Cormorant	Aug	275	153						428			0	0	428
	Oct	116	57				1550		1723			0	0	1723
	Dec	339	193	0	0	0	3759		4291			0	0	4291
	Feb	95	113	0	2	0	1389		1599			0	0	1599
	Apr	75	171	0	3	3	820		1072			0	0	1072
	Jun	404	172	0	38	0	9		623			0	0	623
Little Black Cormorant	Aug	0	3				803		806			35	35	841
	Oct	9	4			3	10		26			4763	4763	4789
	Dec	14	42	0	0	0	21		77			4000	4000	4077
	Feb	12	22	0	0	12	12		58			2000	2000	2058
	Apr	28	44	0	1	100	1		174			2879	2879	3053
	Jun	1	7	90	1	200	508		807			2601	2601	3408
Great Cormorant	Aug	1	4						5			22	22	27
	Oct	13	13			35	8		69			116	116	185
	Dec	10	8	0	0	1	1		20			26	26	46
	Feb	5	15	40	0	28	37		125			10	10	135
	Apr	7	1	0	0	66	70		144			20	20	164
	Jun	6	1	0	1	0	2		10			14	14	24
Unidentified cormorants	Aug	0	20						20			0	0	20
	Oct	0	210				0		210			0	0	210
	Dec	0	165	0	80	300	2000		2545			0	0	2545
	Feb	0	28	0	503	0	53		584			2000	2000	2584
	Apr	2	5	3	253	25	0		288			0	0	288
	Jun	0	471	0	308	500	1606		2885			0	0	2885

APPENDIX 5. Continued.

	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
TOTAL N° OF CORMORANTS	Aug	277	291		<i>10</i>		809		1387			73	73	1460
	Oct	163	367			<i>73</i>	2168		2771			4915	4915	7686
	Dec	407	895	0	81	332	6973		8688			4038	4038	12726
	Feb	161	1319	40	563	430	3768		6281			4276	4276	10557
	Apr	198	858	3	849	523	1131		3562			2976	2976	6538
	Jun	481	1431	101	1590	750	4543		8896			2697	2697	11593
N° OF IDENTIFIED SPECIES	Aug	3	4		<i>1</i>		2		4			3	3	4
	Oct	4	4			3	4		4			3	3	4
	Dec	4	4	0	1	2	4		4			3	3	4
	Feb	4	4	1	2	3	4		4			3	3	4
	Apr	4	4	0	3	4	4		4			3	3	4
	Jun	4	4	2	4	2	4		4			3	3	4

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was not surveyed for birds of that species in that month.
2. In this Appendix, a zero in a sector cell indicates that the sector was surveyed in that month, but no birds of that species were found.
3. Some numbers in this Appendix appear in italics and small font. This indicates that, while some birds were counted, the relevant sector was not surveyed for all birds of that species (or, if a subtotal or total, for all individuals of all cormorant species) in that month.

**APPENDIX 6. Species and numbers of KNOTS (including unidentified knots) counted in all survey sectors of Peel-Harvey Estuary during 1976-77.**

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Great Knot	Aug	0	0						0			0	0	0
	Oct	0	5					1	6			0	0	6
	Dec	0	10	0	1	0	0		11			0	0	11
	Feb	0	8	0	0	0	0		8			0	0	8
	Apr	1	2	0	0	0	0		3			0	0	3
	Jun	0	0	0	0	0	0		0			0	0	0
Red Knot	Aug	0	0						0			0	0	0
	Oct	0	1000					10	1010			6	6	1016
	Dec	0	433	0	24	4	0		461			0	0	461
	Feb	0	1330	0	0	8	22		1360			0	0	1360
	Apr	0	26	0	0	11	0		37			0	0	37
	Jun	0	0	0	0	0	0		0			0	0	0
Unidentified knots	Aug	0	0						0			0	0	0
	Oct	0	30					0	30			0	0	30
	Dec	0	56	0	0	0	0		56			0	0	56
	Feb	1	0	0	0	0	1		2			0	0	2
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
TOTAL N° OF KNOTS	Aug	0	0						0			0	0	0
	Oct	0	1035					11	1046			6	6	1052
	Dec	0	499	0	25	4	0		528			0	0	528
	Feb	1	1338	0	0	8	23		1370			0	0	1370
	Apr	1	28	0	0	11	0		40			0	0	40
	Jun	0	0	0	0	0	0		0			0	0	0
N° OF IDENTIFIED SPECIES	Aug	0	0						0			0	0	0
	Oct	0	2					2	2			1	1	2
	Dec	0	2	0	2	1	0		2			0	0	2
	Feb	0	2	0	0	1	1		2			0	0	2
	Apr	1	2	0	0	1	0		2			0	0	2
	Jun	0	0	0	0	0	0		0			0	0	0

**NOTES**

1. In this Appendix, a blank in a sector cell indicates that the sector was not surveyed for birds of that species in that month.
2. In this Appendix, a zero in a sector cell indicates that the sector was surveyed in that month, but no birds of that species were found.

APPENDIX 7. Species and numbers of STINT & SANDPIPER SIZED WADERS (including unidentified species) counted in all survey sectors of Peel-Harvey Estuary during 1976-77.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Red-necked Stint	Aug	0	84						84			0	0	84
	Oct	0	9875		125		3250		13250			9	9	13259
	Dec	20	4194	4200	502	1200	398		10514			318	318	10832
	Feb	1	1569	1400	33	284	4928		8215			49	49	8264
	Apr	0	31	12	57	40	55		195			7	7	202
	Jun	0	3	5	0	0	0		8			3	3	11
Pectoral Sandpiper	Aug	0	0						0			0	0	0
	Oct	0	0					0	0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	2	0	0	0		2			0	0	2
	Apr	0	0	0	0	0	0		0			1	1	1
	Jun	0	0	0	0	0	0		0			0	0	0
Sharp-tailed Sandpiper	Aug	0	0						0			0	0	0
	Oct	0	107					10	117			0	0	117
	Dec	0	646	300	88	0	10		1044			7	7	1051
	Feb	0	326	74	35	0	1534		1969			3	3	1972
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Curlew Sandpiper	Aug	0	0					2	2			0	0	2
	Oct	0	800		200		700		1700			78	78	1778
	Dec	4	1673	1695	2147	499	31		6049			211	211	6260
	Feb	0	1341	74	6	9	2376		3806			3	3	3809
	Apr	0	1	0	0	38	0		39			0	0	39
	Jun	0	4	3	0	0	12		19			0	0	19
Red-capped Plover	Aug	3	7						10			0	0	10
	Oct	4	22					300	326			100	100	426
	Dec	4	203	0	0	6	120		333			139	139	472
	Feb	9	260	0	4	13	918		1204			46	46	1250
	Apr	2	30	0	2	3	15		52			5	5	57
	Jun	0	11	0	0	0	0		11			1	1	12



APPENDIX 7. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Greater Sand Plover	Aug	0	0						0			0	0	0
	Oct	0	15					0	15			0	0	15
	Dec	1	3	0	0	0	0	0	4			0	0	4
	Feb	0	0	0	0	0	0	0	0			0	0	0
	Apr	0	0	0	0	0	0	0	0			0	0	0
	Jun	0	0	0	0	0	0	0	0			0	0	0
Unidentified waders (stint/sandpiper size)	Aug	0	1						1			0	0	1
	Oct	0	0					0	0			0	0	0
	Dec	0	471	0	0	70	3		544			5	5	549
	Feb	1	30	33	0	0	6120		6184			382	382	6566
	Apr	0	0	0	0	29	11		40			38	38	78
	Jun	0	0	0	0	0	1		1			0	0	1
TOTAL N° OF STINT/SANDPIPER SIZED WADERS	Aug	3	92				2		97			0	0	97
	Oct	4	10819		325		4260		15408			187	187	15595
	Dec	29	7190	6195	2737	1775	562		18488			680	680	19168
	Feb	11	3526	1583	78	306	15876		21380			483	483	21863
	Apr	2	62	12	59	110	81		326			51	51	377
	Jun	0	18	8	0	0	13		39			4	4	43

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was not surveyed for birds of that species in that month.
2. In this Appendix, a zero in a sector cell indicates that the sector was surveyed in that month, but no birds of that species were found.
3. Some numbers in this Appendix appear in italics and small font. This indicates that, while some birds were counted, the relevant sector was not surveyed for all birds of that species (or, if a subtotal or total, for all individuals of all stint/sandpiper sized species) in that month.

APPENDIX 8. Species and numbers of STILT & AVOCET (including unidentified species) counted in all survey sectors of Peel-Harvey during 1976-77.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Black-winged Stilt	Aug	0	44				120		164			29	29	193
	Oct	0	213				958		1171			251	251	1422
	Dec	0	155	137	48	14	411		765			358	358	1123
	Feb	0	19	106	46	10	2000		2181			283	283	2464
	Apr	1	61	9	58	26	172		327			139	139	466
	Jun	0	46	37	33	0	422		538			114	114	652
Banded Stilt	Aug	0	760						760			1	1	761
	Oct	0	3				1500		1503			0	0	1503
	Dec	0	240	0	0	0	8566		8806			0	0	8806
	Feb	0	13000	0	0	0	50000		63000			0	0	63000
	Apr	0	2524	15	48	1	3345		5933			15	15	5948
	Jun	0	20	0	0	0	7		27			0	0	27
Red-necked Avocet	Aug	0	238				915		1153			967	967	2120
	Oct	0	0				112		112			556	556	668
	Dec	0	0	14	27	46	56		143			2037	2037	2180
	Feb	0	0	0	0	0	350		350			501	501	851
	Apr	0	0	5	0	0	254		259			1168	1168	1427
	Jun	0	366	12	0	0	667		1045			645	645	1690
Unidentified stilt/Avocet	Aug	0	0						0			0	0	0
	Oct	0	0				0		0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			2800	2800	2800
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
TOTAL N° OF STILT/AVOCET	Aug	0	1042				1035		2077			997	997	3074
	Oct	0	216				2570		2786			807	807	3593
	Dec	0	395	151	75	60	9033		9714			2395	2395	12109
	Feb	0	13019	106	46	10	52350		65531			3584	3584	69115
	Apr	1	2585	29	106	27	3771		6519			1322	1322	7841
	Jun	0	432	49	33	0	1096		1610			759	759	2369

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was not surveyed for birds of that species in that month.
2. In this Appendix, a zero in a sector cell indicates that the sector was surveyed in that month, but no birds of that species were found.
3. Some numbers in this Appendix appear in italics and small font. This indicates that, while some birds were counted, the relevant sector was not surveyed for all birds of that species (or, if a subtotal or total, for all individuals of all three stilt/Avocet species) in that month.

APPENDIX 9. Species and numbers of TERNs (including unidentified terns) counted in all survey sectors of Peel-Harvey Estuary during 1976-77.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Gull-billed Tern	Aug	0	2						2			0	0	2
	Oct	0	4					0	4			0	0	4
	Dec	0	4	0	0	0	0		4			0	0	4
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	0	0	0	2	1	1		4			0	0	4
	Jun	0	0	0	0	0	0		0			0	0	0
Caspian Tern	Aug	9	1					14	24			0	0	24
	Oct	3	1					4	8			0	0	8
	Dec	10	7	3	0	2	6		28			2	2	30
	Feb	3	79	18	29	1	6		136			3	3	139
	Apr	35	32	0	2	9	8		86			4	4	90
	Jun	40	10	2	1	4	30		87			12	12	99
Crested Tern	Aug	23	14					3	40			2	2	42
	Oct	14	37					3	54			26	26	80
	Dec	65	4	2	0	0	11		82			10	10	92
	Feb	10	53	0	3	1	27		94			6	6	100
	Apr	14	3	0	24	2	10		53			6	6	59
	Jun	27	0	0	18	0	5		50			2	2	52
Roseate Tern	Aug	0	0						0			0	0	0
	Oct	0	0					0	0			0	0	0
	Dec	0	0	0	0	0	0		0			0	0	0
	Feb	0	0	0	0	0	0		0			0	0	0
	Apr	12	0	0	0	0	0		12			0	0	12
	Jun	6	0	0	0	0	0		6			0	0	6
Fairy Tern	Aug	0	0					12	12			0	0	12
	Oct	0	0					0	0			0	0	0
	Dec	2	80	0	2	0	0		84			0	0	84
	Feb	0	0	0	0	0	20		20			0	0	20
	Apr	0	0	0	0	0	0		0			0	0	0
	Jun	0	0	0	0	0	0		0			0	0	0
Whiskered Tern	Aug	0	0					200	200			0	0	200
	Oct	0	0					100	100			0	0	100
	Dec	0	0	0	0	0	88		88			0	0	88
	Feb	0	2	0	0	0	0		2			0	0	2
	Apr	0	0	35	0	90	3		128			0	0	128
	Jun	0	0	0	0	100	357		457			0	0	457

APPENDIX 9. Continued.

Species	Month	PEEL							HARVEY				Grand Total	
		1	2	3	4	5	6	7	Total	8	9	10		Total
Unidentified terns	Aug	3	1						4			0	0	4
	Oct	0	17			<i>1</i>	0		18			0	0	18
	Dec	2	6	1	0	0	4		13			0	0	13
	Feb	6	5	0	0	0	72		83			0	0	83
	Apr	5	0	0	0	0	0		5			0	0	5
	Jun	0	0	0	0	0	3		3			0	0	3
TOTAL N° OF TERNS	Aug	35	18				229		282			2	2	284
	Oct	17	59			<i>1</i>	107		184			26	26	210
	Dec	79	101	6	2	2	109		299			12	12	311
	Feb	19	139	18	32	2	125		335			9	9	344
	Apr	66	35	35	28	102	22		288			10	10	298
	Jun	73	10	2	19	104	395		603			14	14	617
N° OF IDENTIFIED SPECIES	Aug	2	3				4		5			1	1	5
	Oct	2	3				3		4			1	1	4
	Dec	3	4	2	1	1	3		5			2	2	5
	Feb	2	3	1	2	2	3		4			2	2	4
	Apr	3	2	1	3	4	4		5			2	2	5
	Jun	3	1	1	2	2	3		4			2	2	4

NOTES

1. In this Appendix, a blank in a sector cell indicates that the sector was not surveyed for birds of that species in that month.
2. In this Appendix, a zero in a sector cell indicates that the sector was surveyed in that month, but no birds of that species were found.
3. Some numbers in this Appendix appear in italics and small font. This indicates that, while some birds were counted, the relevant sector was not surveyed for all birds of that species (or, if a subtotal or total, for all individuals of all tern species) in that month.

**APPENDIX 10. Results of Egret, Spoonbill and Ibis counts during August 1976 aerial survey.**

During the 17 August 1976 aerial survey of pelicans and swans, an attempt was made by both observers (D.Munro and J.Lane) to simultaneously census egrets, ibises and spoonbills. The results are presented below.

Species	By	PEEL								HARVEY				Grand Total
		1	2	3	4	5	6	7	Total	8	9	10	Total	
Egret	DM	2	49	1	5	3	68	1	129	4	8	38	50	179
	JL	0	48	1	-	0	68	1	118	4	5	37	46	164
Australian White Ibis	DM	0	0	0	0	0	0	0	0	0	14	0	14	14
	JL	0	0	0	0	0	0	0	0	0	14	0	14	14
Yellow-billed Spoonbill	DM	0	0	0	0	0	5	0	5	0	0	0	0	5
	JL	0	0	0	0	0	5	0	5	0	0	0	0	5

A notation on JL's field record map from that survey indicates that his egret count was a "partial count" aimed at supporting, not adding to, DM's. The higher figure (179) should therefore be used.

The great majority of egret were undoubtedly Great Egret *Ardea alba*. It is probable, however, that some were Little Egret *Egretta garzetta*. During ground surveys conducted over subsequent days of August 1976, many Great Egret were encountered, whereas only eight Little Egret were observed. White phase Eastern Reef Egret *Egretta sacra* have not been recorded on Peel-Harvey.

Aerial counts of egrets, ibises and spoonbills were not continued in 1976-77 because in subsequent months (Oct, Dec, etc.) only one aerial observer was available and counting of these species would have distracted from what was considered to be the more important task of counting pelicans and swans, which were exceptionally abundant, and therefore more difficult to survey, in 1976-77.

## APPENDIX 11. Results of General Air Surveys of 1976-77.

### Overview

On the first day of the August, October, December 1976 and February, April, June 1977 surveys of Peel-Harvey, J.Lane conducted a "general air survey" to gain a broad overview of bird numbers and distributions prior to conducting ground surveys during subsequent days of areas where birds were most numerous. These air surveys could be conducted "low and slow" because there were relatively few houses adjacent to the estuary and the pilot, Dick Buncher, was particularly skilful. As a result, the data collected are considered to be of reasonable standard, that is, a large proportion of birds present were seen. Nonetheless, many species, particularly those that are small and/or non-descript, are difficult to identify and/or count from a fixed-wing aircraft. The data collected therefore undoubtedly under-represent the total number of species and birds present. Results of the ground surveys conducted during following days are undoubtedly superior. The data obtained from general air surveys should therefore be used to supplement, not supplant, the ground survey data.

### Results

The results of all six general air surveys are presented below, by survey month. All species recorded on Peel-Harvey during the 1976-77 general air surveys were also recorded (together with many additional species) during the corresponding (same month) ground surveys.

The observation of approx. 862 Musk Duck (flocks of c800, c50 and 12) in and adjacent to sector 6 (south-eastern Peel Inlet) during the 13 June 1977 aerial survey is particularly significant because no Musk Duck were seen during subsequent (15-18 June) ground surveys of Peel Inlet. Most (c850) of these birds were near the centre of Peel Inlet and were additional to those in sector 10 (southern Harvey Estuary) which were seen during the same aerial survey (c400 estimated) and during the ground survey (491 counted) of 19 June 1977. A further c60 Musk Duck were observed from the air in sector 9 (west side Harvey Estuary). Allowing (conservatively) for the latter birds' possible movement south to sector 10 by the time the ground survey was conducted, the total number of Musk Duck on Peel-Harvey Estuary in June 1977 was possibly around 1,353 (862+491) birds. Note that these aerial data are not included in other Appendices or Tables of this report.

It could prove interesting to sum the aerial count data of other species or species groups (ducks, cormorants, etc.) for comparison with ground count data. This has not been done in this report as it is not essential to achieving the primary objective of the waterbird monitoring project, which is to compare the 1976-77 ground count data (plus results of pelican and swan aerial surveys) with similarly-obtained and comparable count data from 1996-97 and 1998-99. Comparable general air survey data were not collected during the 1990s surveys due to technical considerations (see Appendix 9 of Lane, Clarke & Pearson 2002a).

### Explanatory Notes

Where "grebe" are referred to below, most or all of these birds were Hoary-headed Grebe. The only other small grebe in Australia, the Australasian Grebe *Tachybaptus novaehollandiae*, was not recorded on Peel-Harvey Estuary by the authors at any time during the 1976-77 survey program or in preceding years. The much larger Great Crested Grebe *Podiceps cristatus* is readily distinguished from the Hoary-headed Grebe and has only been recorded in low numbers (relatively) on Peel-Harvey.

Where "egret" are referred to below, the great majority of these birds were undoubtedly Great Egret *Ardea alba*. It is possible, however, that some were Little Egret *Egretta garzetta*. During ground surveys conducted in 1976-77, small numbers of the latter species were recorded in four survey months (Appendix 1).

The sectors referred to below are those of Figure 2 of this report. Numbers in brackets following each species' name indicate the estimated numbers in each flock or grouping of that species in that sector.

### AUGUST 1976

Conducted general air survey (JL) from 1020-1143hrs on Tuesday 17 August 1976. Results were as follows.

*Sector 1:* Cormorant (c150 roosting), Australian Pelican (c12, 7, 1).

- Sector 2:* Black Swans (3, 150-200, c50), ducks (200, very few, 2), cormorant (100 roosting, 40 fishing), Australian Pelican (35-40, 2), egret (1, 1, 1, 35-40, 4, 1, 1, 1, 2), Common Greenshank (c12, 2 possibly), Banded Stilt (several hundred in Creery lagoon).
- Sector 3:* Australian Pelican (1, 5, c200), stilt or avocet (c40), Silver Gulls (a few).
- Sector 4:* Australian Shelduck (2), Pacific Black Duck (two pairs), cormorant (30, c100, c100, 30), Australian Pelican (30, 60 feeding from fisherman, 25-30, a few), egret (1, 1, 1, 1).
- Sector 5:* Ducks (30-35), cormorant (many, c80; mainly Great, a few Little Black), Australian Pelican c50), egret (1), Red-necked Avocet? (c60), terns (c50).
- Sector 6:* Black Swan (29, many hundreds, thousands, hundreds, 60-80, hundreds, continuous, many hundreds, several hundreds), Pacific Black Duck (some, a few), ducks (200, fewer), Grey Teal (100, 40, 100, groups, several hundred), grebe (150, many hundreds, c300, 150, 800-1000), cormorant (several hundred fishing, hundreds), Australian Pelican (hundreds, c10, 3, c20, 10, 16, 6), egret (1, 6, 2, 1, 24, 30, 2), Yellow-billed Spoonbill (4, 2), Eurasian Coot (c200, c300, 200, masses), stilt? (80-100), stilt or avocet (c100).
- Sector 7:* Black Swan (14), cormorant (several hundred, c500), Australian Pelican (4), egret (1), Silver Gull (200).
- Sector 8:* Australian Shelduck (2), Pacific Black Duck (3), cormorant (c100, 30, 30, 30, c600 black feeding), 30, 25, skein 25, skein 12), Australian Pelican (5, 1), egret (1, 1, 1), Black-winged Stilt (c25), Red-necked Avocet (c20, c20, c35, 25-30, c30, c30), Silver Gull (quite a number).
- Sector 9:* Musk Duck (1, 6), Australian Shelduck (2), Pacific Black Duck (2, 2, 15, 4, 2), Grey Teal (20), Darter (5, 1, 7, 9, 1, 1, 1), cormorant (2, 9, c20, a few, 12; mainly Great, c100 feeding), Australian Pelican (7, 5, c30), egret (2, 1, 1, 1, 1, 1, 1, 1), Whistling Kite (1, 2).
- Sector 10:* Black Swan (1), Australian Shelduck (2, 2), Pacific Black Duck (c250), Grey Teal (c250), ducks (some, c200, scattered), cormorant (100 black), Australian Pelican (7, 3, 7, 4), egret (6, 2, 3, 10, 6, 3, c6, 11), Yellow-billed Spoonbill (3), Whistling Kite (1), Eurasian Coot (4, c300, 200, 200, 2000, several hundred, scattered, 50, c100, c50), Red-necked Avocet (c25, c60, c15, c50, c100).

## OCTOBER 1976

Conducted general air survey (JL) from 1020-1150hrs on Wednesday 13 October 1976. Results were as follows.

- Sector 1:* Little Pied Cormorant (c20), cormorant (c20 resting), Australian Pelican (3), Silver Gull (c80, c80).
- Sector 2:* Black Swan (3-4, c300), Australian Shelduck (10-15, perhaps), Grey Teal (2 flying), ducks (c50, c20), cormorant (c30, 20, 30-40, 100-150), Australian Pelican (c20, 2, 30-40, 10-12, scattered, 31 feeding, 13), White-faced Heron (a few, 5-6, 1, 5+), egret (1, c12), Bar-tailed Godwit (some), Common Greenshank (2, 2, 30), other migratory waders, but possibly including Red-capped Plover (a big mass between Channel Island and chain of sapphire islands to the west; most bigger than stint but smaller than godwit), Banded Stilt (3), Silver Gull (a few, a number), terns (1).
- Sector 3:* Black Swan (hundreds), Australian Shelduck (a few), ducks (c100), cormorant (a few), Australian Pelican (c30, 9, 10-12), Black-winged Stilt (60-70), Silver Gull (c30).
- Sector 4:* Black Swan (a few hundred, many more, c25), cormorant (3, 150), Australian Pelican (c20, 8, 10, 3, c20, 3, 40-50 feeding, 20), Caspian Tern (1).
- Sector 5:* Black Swan (7, c40), Australian Shelduck (c10), Grey Teal (c120), ducks (c15), cormorant (c60 blackish, c20), Australian Pelican (c15, c80, c10, c60 feeding, c25, c6), egret (1).
- Sector 6:* Black Swan (150-200, at least 2000 evenly spread across Austin Bay, a few large cygnets), Australian Shelduck (c20), Pacific Black Duck (c200, a few), Grey Teal (estimate 5000-6000 in eastern part of Austin Bay), ducks (some, 200-300 on banks, scattered), Pied Cormorant (500-600), cormorant (c300), Australian Pelican (10, c60 feeding in tight bunch, c6, 7, c40, c40, 6, 10, hundreds, c50, c20), White-faced Heron (a number feeding, 1), egret (3, c15), Eurasian Coot (400-500, 1000+), migratory waders, but possibly including Red-capped Plover (a few hundred), Black-winged Stilt (a number feeding, scattered), Banded Stilt (tight flock, some), Silver Gull (quite a number, a few).
- Sector 7:* Black Swan (c50), Grey Teal (a few), cormorant (<30, c30, c350), Australian Pelican (4), egret (1), Whistling Kite (1), Common Greenshank (3, 3, 10), Silver Gull (a few).
- Sector 8:* Black Swan (4), Australian Shelduck (7, c20, 1), Pacific Black Duck (1 pair), Darter (3), cormorant (50+, c40, c40, c30, 30-40), Australian Pelican (c45, c30, 4-5, 6, 3, 8, 3, 1), egret (2, 2, 1), Common Greenshank (10), Red-necked Avocet (c50, 40, 1), Silver Gull (a few, c20, 10-12, a few).
- Sector 9:* Black Swan (20, c50), Australian Shelduck (2), Grey Teal (c200), ducks (c10, 10, a few), Darter (2, 2, 2), cormorant (c20, c30, c400, 20, 30, c100, c150, 25, 10, 20, c45, 15-20), Australian Pelican (3, 9, c30 around fishing boat, 1, 1, 2, 6, 13), White-faced Heron (1), egret (1, 1, 1, 1, 2, 1, 1, 1), Common Greenshank (c90, 60-70), Black-winged Stilt (4), Red-necked Avocet (10), Silver Gull (3, 3, 6, 30-40, 15), terns (c20 on posts).

*Sector 10:* Black Swan (7, 3, 10, 14, c30, c50, 9, c70), Australian Shelduck (10), Pacific Black Duck (a few), Australasian Shoveler (<10?), Grey Teal (c150, <20, in river), ducks (c20), grebe (5-6 groups of 20 each, some), cormorant (c30, 8 blackish, odd, <10, 20), Australian Pelican (12-15, 30), White-faced Heron (2), egret (3, 1, 1), Eurasian Coot (c200, c200, c40), Common Greenshank (3), Black-winged Stilt (a few, 20), Red-necked Avocet (c60-70, c100, c60, c120, c10), Silver Gull (a few, c25, some, c15), terns (1-2).

## DECEMBER 1976

Conducted general air survey (JL) from 1004-1128hrs on Tuesday 7 December 1976. Results were as follows.

*Sector 1:* Darter (a few on sandbank), Pied Cormorant (c200 on sandbank), cormorant (c20 on sandbank), Australian Pelican (c15, 1).

*Sector 2:* Black Swan (200 resting, <20, c100), ducks (c80, c20, very few), Darter (c20?, a few?), cormorant (c100, c200 on sandbank, c200 on sandbank), Australian Pelican (5, odd, 5, 1, 8, 2, 5, 2, 100-120 on sandbank, c20 on sandbank, 2, 1, c70 feeding), White-faced Heron (a few), Great Egret (5), egret (3, 1), Common Greenshank (unspecified, some, c60), migratory waders (many hundreds, occasional, c150, many many hundreds, a few), Silver Gull (unspecified, a few hundred, 20-30 on sandbank, groups).

*Sector 3:* Cormorant (300-400; includes 30-40 Great Cormorant), Australian Pelican (c40 resting), migratory waders (500-600, c1000, a few hundred).

*Sector 4:* Black Swan (c150, c60, more, 7), Australian Shelduck (a few), ducks (unspecified, low numbers, small groups, a few), cormorant (c40, 20-30), Australian Pelican (5, 60-70 feeding, c25, 1, c12), Great Egret (1), egret (1), small waders (a few hundred, hundreds, 100, at least 300-400, hundreds, a few hundred, a few hundred, c150), migratory waders (c40), Silver Gull (unspecified).

*Sector 5:* Australian Shelduck (c100+), Grey Teal (c600), cormorant (c100, c400-500, 60-70), Silver Gull (c200).

*Sector 6:* Black Swan (hundreds, unspecified, odd groups, >1000 feeding furiously NE of Point Birch, c300, Australian Shelduck (c20, c25, c100, 1, some), Pacific Black Duck (odd), Grey Teal (300-400, c100, c400), ducks (<100, a few, hundreds, 400-500; mainly Grey Teal, 500-600, very few), Little Pied Cormorant (some), Pied Cormorant (>1000), cormorant (c600), Australian Pelican (6, c200 resting, 700-800, 55?, c40, 8 feeding, 2-3, 15), White-faced Heron (1, unspecified), egret (1, unspecified), migratory waders (a few), Black-winged Stilt (c50, more, 500-600), Banded Stilt (at least 2), stilt (some, c80, 400-500, 500-600), Silver Gull (some, unspecified).

*Sector 7:* Australian Shelduck (some, c20), Grey Teal (70-80), ducks (c100), cormorants (unspecified), Australian Pelican (8), migratory waders (20-30, c50, c100, a few hundred, 600-700, c100), stilt (some).

*Sector 8:* Black Swan (7, c40, 12, unspecified, 15), Australian Shelduck (scattered, c40, small number), Grey Teal (c6), ducks (c50, c50), Little Black Cormorant (c1000), cormorant (a few, some, a few, unspecified, c10), Australian Pelican (3, c15), White-faced Heron (occasional), Common Greenshank (1), waders (few), Black-winged Stilt (unspecified), Red-necked Avocet (unspecified), Silver Gull (a few).

*Sector 9:* Australian Shelduck (c12, 4, some), Grey Teal (10, 120-130, <200), Darter (4), Australian Pelican (6, 5, 1, 6), egret (1, 1, 1, 1), Common Greenshank (c60), other migratory waders (c40, a few hundred), Black-winged Stilt (40-45), Red-necked Avocet (60-70), Silver Gull (25, 20).

*Sector 10:* Black Swan (c35, 10, c30, many hundreds, unspecified, c250), Australian Shelduck (some, a few, 4), Pacific Black Duck (2, some), Grey Teal (c60, <500-600, c200, c700, well over 1000, hundreds, 1, many hundreds), ducks (60, c200, c20, c100, c100, very few, c100, c60, very few, c35), cormorant (500-600 Little Black and Great, <50, c40), Australian Pelican (c60), egret (2, 1, 1), Common Greenshank (10-15, 40), migratory waders (60), Black-winged Stilt (7, several hundred, c100, c50), Red-necked Avocet (c20, c20, c30, c40, c70, c1000, c60, c50).

## FEBRUARY 1977

Conducted general air survey (JL) from 1040-1216hrs on Tuesday 15 February 1977. Results were as follows.

*Sector 1:* Black Swan (c25, 4-5), cormorant (a few, a few, unspecified), Australian Pelican (1, 2, 2), Silver Gulls (a few, unspecified, scattered, a few).

*Sector 2:* Black Swan (c60, 5, 50-60, a few hundred, c30, scattered), grebe (c20), Pied Cormorant (2), cormorant (a few, 2, 1, c50, occasional, c100, more, several hundred, 150, c40), Australian Pelican (4, 3, 1, 7, 1, 15, 5, odd scattered, c100, 8, scattered, c50, 1, 30-40), White-faced Heron (1), egret (1, 2, 1, 1, 1, 4), Eastern Curlew (2), Common Greenshank (1, 3), migratory waders (1000+ in Creery lagoon, c100, 4-5), Black-winged Stilt (1), Banded Stilt (several thousand spread over Creery lagoon, c500), stilt (a lot), Silver Gull (a few, a few, 4, c50).



- Sector 3:* Ducks (c50), Great Cormorant (30), cormorant (c100 including many Great Cormorant), Australian Pelican (5, 6, 21), waders (c20-30), Black-winged Stilt (occasional, 2), Banded Stilt (a few hundred), Silver Gull (scattered, unspecified).
- Sector 4:* Black Swan (c20, c100+, 4), ducks (c40, c10), cormorant (c20, 25, a few, c60), Australian Pelican (c30, 25-30, 2, 5, 9, 9, 15, 1), White-faced Heron (1), egret (1, occasional, 2), Black-winged Stilt (4), Silver Gull (1), terns (c30).
- Sector 5:* Cormorant (c130 including many Great Cormorant), Australian Pelican (1), migratory waders (c175).
- Sector 6:* Musk Duck (c20), Black Swan (c30, 3, 200, c30-40, odd scattered, 3, 2, c40, a few, small numbers scattered, more, c35, c60), Australian Shelduck (some, 10, 4), Pacific Black Duck (40+), Grey Teal (c100, scattered, 3), ducks (c1000 mainly Grey Teal, c400, c50 many are Australian Shelduck), small grebe (several hundred), grebe (small groups, 4, c60, c40, 10, 3), Pied Cormorant (c2500), cormorant (c800, 400-500, 3, 3, unspecified, c3000 Little Pied / Little Black, unspecified), Australian Pelican (c60, c25, 1, 5, c15, 9, c200, c25, 16), White-faced Heron (1), egret (1), migratory waders (a few, c30, c30, c40), Black-winged Stilt (50-60, more, a few, a few, a few, a few), Banded Stilt (many many scattered widely in Austin Bay, c3000, c100, c500+, many hundreds, hundreds), stilt (groups, c50, c30, c50, 4, a group, c30), Silver Gull (50-60, unspecified, unspecified, scattered, scattered, unspecified, 2).
- Sector 7:* Australian Shelduck (5), ducks (c100), Darter (1), Pied Cormorant (2), cormorant (c40, c300), Australian Pelican (8, 6, c80, 10), Common Greenshank (a few), Silver Gull (2).
- Sector 8:* Black Swan (7), Australian Shelduck (2, 2, 1, unspecified), Grey Teal (7, c15, c250, c100, more, c20, c40, c40, c60, c150, c100), ducks (300-400 mixed Grey Teal and Australian Shelduck, 150, c20), Darter (1), Little Black Cormorant (c4000-5000), cormorant (a few hundred, c250, c200, 2, c20, 1), Australian Pelican (c35, 5, 1, 28, 5, 2, 1, 2), White-faced Heron (1, 1), egret (1, 1, 1), Common Greenshank (1), migratory waders (c2, 1, 1, c30, more, 150, c600, c150, c30, c30, 100+, more in flocks up to 30, c120), Black-winged Stilt (3), Red-necked Avocet (c25, c20, c50, 2, 1), Silver Gull (unspecified, occasional, c200, scattered, more, some).
- Sector 9:* Black Swan (5, 5, c100), Australian Shelduck (2, 1), Grey Teal (c120, more, 10, 3, 25, 110, 50, small groups), grebe (20), cormorant (2, c30), Australian Pelican (2, c20, 5, c25, 2, 10, 2, 15, 10), White-faced Heron (2, 1), egret (1, 1, 1, 1, 1, 1), Common Greenshank (a few, 3, a few, 3), Black-winged Stilt (1, c80, c100, 10, 13, 1), stilt (8, a few), Red-necked Avocet (some, c100), Silver Gull (small group, a few), terns (1, 9).
- Sector 10:* Black Swan (c2500, c15, 40-50, c100, 2), Australian Shelduck (a few), Pacific Black Duck (probably 1000), Australasian Shoveler (unspecified), Grey Teal (c400, c100, c1000, c600, c1100, c200, c400, c1300, c1400, many thousands, c200), ducks (c30+), cormorant (unspecified, c25, c150, c1000 mainly Little Black flying up Harvey River delta, c100 on fence line), Australian Pelican (2, c25, 1, 1, c100), Common Greenshank (unspecified, 1), migratory waders (50-60, c50, c50, more, some), Black-winged Stilt (occasional, some, 3), stilt (a few hundred), Red-necked Avocet (c60, a few, c25, unspecified, c50, c60, a few), Silver Gull (some).

#### APRIL 1977

Conducted general air survey (JL) from 1010-1143hrs on 17 April 1977. Results were as follows.

- Sector 1:* Ducks (50-60), Pied Cormorant (15-20), cormorant (a few), Australian Pelican (1, c5, c10), Silver Gull (c50, some).
- Sector 2:* Black Swans (c10, 7, 3, c200, c60), Australian Shelduck (c12), Grey Teal (c30), grebe (a few), Little Pied Cormorant (2), cormorant (a few, unspecified, more, 400-500, a few hundred), Australian Pelican (6, c10, c40, 4), White-faced Heron (c20), egret (1, 1), migratory waders (a few), Black-winged Stilt (1), Banded Stilt (c2000 in Creery lagoon, 70), stilt (c50+), Silver Gull (a few, scattered, c60).
- Sector 3:* Black Swan (12, c6), Grey Teal (c100), Great Cormorant (c25), cormorant (c200 black & white), Australian Pelican (c20, 4, 2, 12, 15, 1).
- Sector 4:* Black Swan (scattered in groups of 20-30, c100, 13, 40-50, 60-70, c20, unspecified), Grey Teal (some, some), ducks (c10, c20, parties of 50), Hoary-headed Grebe (c70), cormorant (c30, c40), Australian Pelican (3, <20, 1, c70, 1, 3), egret (1), Black-winged Stilt (1), Banded Stilt (10), Silver Gull (2).
- Sector 5:* Grebe (c20), cormorant (hundreds), Australian Pelican (6, c150), migratory waders (a few), Silver Gull (1).
- Sector 6:* Black Swan (several hundred, hundreds, 5, occasional, unspecified, unspecified, c30, hundreds), ducks (a few, c150), grebe (groups, c50, c35, c15, more, several hundred, more and more), cormorant (c200, c200, c200), Australian Pelican (unspecified, 2, occasional, 7, 6), White-faced Heron (c180, c30), egret (1, 3, 2), Bar-tailed Godwit (c10), small waders (unspecified), Black-winged Stilt (unspecified), Banded Stilt (c50, c80, unspecified, c150, scattered, several hundred), stilt (a group, scattered, pockets, 10, c40, c200), Silver Gull (c150, c100).

- Sector 7:* Black Swan (several hundred), Australian Shelduck (4), grebe (groups), cormorant (hundreds, c1000, groups fishing, several hundred), Australian Pelican (3, 5), Black-winged Stilt (2).
- Sector 8:* Musk Duck? (party), Black Swan (4), Australian Shelduck (unspecified, 2, c10), Grey Teal (some, scattered, c50, c60, c30, c40, c50-60, c150, c30, c30, c50, several hundred), cormorant (unspecified, c20, c200), Australian Pelican (2, c40, 24, c25), White-faced Heron (1), egret (1, 1, 1), migratory waders (possibly, a few), small waders (unspecified), Red-necked Avocet (c12).
- Sector 9:* Musk Duck (c50), Black Swan (c60, c10, c6, 4), Grey Teal (c80, c10, c10, 2), ducks (a few, c20, c10, c10), grebe (c20), Darter (2, 2, 6), cormorant (c10, c15, unspecified, c20, c20, c25, c40, a few), Australian Pelican (4, c15, 21, 3, 7, 1, 2, 6, c10, 2), egret (1, 2, 1, 1, 1, 2), Red-necked Avocet (occasional).
- Sector 10:* Musk Duck (c200), Black Swan (2, 300-400, unspecified, unspecified, unspecified, c20), Australian Shelduck (20), Grey Teal (c150, a few, a few, c200, unspecified, unspecified, several hundred), ducks (c35, occasional, other, c20 mainly Australian Shelduck, scattered, c2000, a few, several thousand ducks along river, a few), grebe (scattered), Little Black Cormorant (3000-4000 resting on Herron Point Ford near Egg Island), cormorant (a few, occasional), Australian Pelican (c15, 1), egret (4, 1, 1, 1), Red-necked Avocet (5, 4, several hundred, c200, c150, a few, scattered).

## JUNE 1977

Conducted general air survey (JL) from 0958-1126hrs on Monday 13 June 1977. Results were as follows.

- Sector 1:* Cormorants (unspecified), Australian Pelican (17), Silver Gull (unspecified).
- Sector 2:* Black Swan (7, 2, c25, 6, 15-20), Grey Teal (c150), ducks (c200, a few), Pied Cormorant (c40), cormorant (c15, unspecified, unspecified, c100, c45, c40, a few, 3, c150, unspecified, occasional), Australian Pelican (2, 3, 1, 5, 1, c45, 1, 2, c20, 3, 2, 10, 1), Great Egret (1, 1, 1, 2), stilt (a lot, c100), Silver Gull (unspecified), terns (2).
- Sector 3:* Pacific Black Duck 92), ducks (<40), cormorant (small group, a few), Australian Pelican (8-10, 1, 1, 1, 1), White-faced Heron (3), Great Egret (2), Black-winged Stilt (1), Silver Gull (c150), terns? (c100).
- Sector 4:* Australian Shelduck (1 pair), Grey Teal (10, 360), ducks (a few), Hoary-headed Grebe (30-40, c400-500, c30, c700-800, c300-400), cormorant (c100, c40, c400-500 mainly Pied, c40, scattered, c100 including Little Pied, scattered), Australian Pelican (8, c25, unspecified, scattered, 12, scattered, 6, 2), Great Egret (2, 1, 1), Silver Gull (unspecified, scattered).
- Sector 5:* Black Swan (c12), ducks (c30), Australian Pelican (3, 3), Eurasian Coot (c35, c30).
- Sector 6:* Musk Duck (c800, 50, 12), Black Swan (hundreds, c25, scattered, scattered, cc1500, scattered, 10, c700-1000, 10, a few, c200, 10, 40, 15, 3), Pacific Black Duck (c20), Grey Teal (c40, c100, 3), ducks (c100, c150, 4-5, c40), Hoary-headed Grebe (several hundred, 400-500), grebe (some), cormorant (hundreds, c300, hundreds, c30 in trees, c1000 mainly Pied, a few, c300-400), Australian Pelican (1, 6, 6-7, 9, c25, occasional, occasional, 20, 1, scattered, 3), White-faced Heron (c80 in pasture near Austin bay, c20), egret (unspecified, 4), Australian White Ibis (6), Yellow-billed Spoonbill (10, 7), Black-winged Stilt (3), Red-necked Avocet (c200, 2), stilt or Avocet (c50), Silver Gull (unspecified, 2, 60-70).
- Sector 7:* Australian Shelduck (2), Grey Teal (300), cormorant (c30, c200 black & white, a few hundred, c500-600), Australian Pelican (1, c45), Great Egret (1, 1).
- Sector 8:* Grey Teal (c40), ducks (c10, few, 3), Little Pied Cormorant (c10), cormorant (c500, c15, 6, a few, c8, 3-4, c10, c300, 11), Australian Pelican (c50, 2, 1, 2, 1), White-faced Heron (1, 1), Red-necked Avocet (1), Silver Gull (1).
- Sector 9:* Musk Duck (c55, 5), Australian Shelduck (1 pair), Pacific Black Duck (1 pair), Grey Teal (2, 6), ducks (c6, c6), grebe (c25, c30), Darter (1, 2), Little Black Cormorant (c1000), cormorant (6, c15, 5, scattered, c12, c50, a few, c60), Australian Pelican (2, 2, 4, c65, 5, 2, 4, 8, c20, 18, 1), Silver Gull (2, 1), terns (1).
- Sector 10:* Musk Duck (c100, several hundred), Black Swan (1, scattered, occasional, 1), Australian Shelduck (1 pair), ducks (c150 mainly Grey Teal, c130 Pacific Black Duck and Grey Teal, c450 including many Australasian Shoveler and possibly Eurasian Coot), grebe (c10), cormorants (a few, c130, several hundred, unspecified), Australian Pelican (3, 1, 16, 5), White-faced Heron (1), Great Egret (1, 1, 1, 1), Yellow-billed Spoonbill (8, 5), Red-necked Avocet (c60-70, c40, c70-80), Silver Gull or terns (c30).

## **APPENDIX 12. Significant observations made during Black Swan surveys on Peel Inlet in 1976-77.**

While surveying Black Swan numbers by boat in 1976-77, G. Pearson made observations concerning some other species he encountered. These observations corroborate or add to data collected during routine surveys. Significant observations are as follows. Note that these data are not included in other Appendices or Tables of this report. All species referred to in this Appendix were also recorded during corresponding (same month) ground surveys.

### **16 November 1976**

"40-50 grebe" were encountered in the deeper waters of Peel Inlet south of Creery Island (adjacent to sector 2). There were "a few Coot" with hundreds of ducks at the northern end of sector 6. Five Ruddy Turnstone were seen in Austin Bay (sector 6). [*Note that November 1976 was not a routine Peel-Harvey survey month*].

### **7 December 1976**

A total of 116 Great Crested Grebe were encountered in the deeper waters of Peel Inlet. These birds were adjacent to sectors 2a, 3, 4 and 6 (totals of 13, 38, 5 and 60 birds respectively). [*Note that only one Great Crested Grebe was encountered on Peel Inlet during the routine "all waterbirds" surveys of 8-11 December 1976. An additional 71 were recorded in sector 10 (southern Harvey Estuary) on 13 December 1976*].

### **15 February 1977**

"Flights of Hoary-headed (or Little) Grebe were seen over most of the Estuary, a flock of several hundred between the Greenlands drain and Yunderup". A map accompanying the 15 February 1977 report shows that these birds were in waters adjacent to, and outer shallows of, Sector 6. Also indicated on this map are "50 grebe" in waters adjacent to Sector 7.

### **16 March 1977**

"40 grebe" were recorded in sector 3. Hundreds of "grebe" were found in the outer shallows of sector 6, south of the Yunderup canals entrance channel. Thousands of "stilts, grebe" were east of Point Birch (sector 6). Hundreds of "stilt" were seen in Robert Bay (sector 6). [*Note that March 1977 was not a routine Peel-Harvey survey month*].

### **17 April 1977**

The swan survey map shows "200 grebe" in waters adjacent to Sector 4. Across the shallows of Sectors 2a and 3 were hundreds of Hoary-headed Grebe "in groups". There were also hundreds of Hoary-headed Grebe over shallows and waters adjacent to Sectors 6 and 7.

At the southern end of Harvey Estuary (Sector 10) were "100-200 Musk Duck".

### **13 June 1977**

"Several hundred Grebe, presumably Hoary-headed Grebe, were seen in flocks of 50-100 from Creery Island to Yunderup Canals". The map shows these birds were on the outer shallows and deeper waters adjacent to Sectors 2a and 3.

"Further groups of Grebe sometimes up to 500 were noted over most of the area from Yunderup to Point Grey and from Falcon to the Sticks area". The map shows these birds were widely scattered over the deeper waters adjacent to Sectors 6, 7 and 4.

### APPENDIX 13. Breeding waterbirds of Peel-Harvey Estuary in 1976-77.

The following evidence of waterbird breeding activity was recorded during the 1976-77 Peel-Harvey Estuary waterbird surveys. All observations were made by J.Lane (JL) or G.Pearson (GP) unless otherwise indicated.

#### **Black Swan *Cygnus atratus***

Three large cygnets were seen by JL at the southern end of Harvey Estuary (sector 10) on 13 Dec 76.

#### **Australian Shelduck *Tadorna tadornoides***

Twelve (there were possibly several more) ducklings were seen by JL near Herron Point (sector 10) on 21 Aug 76.

Five ducklings were seen by JL at Boodalan Island (sector 6) on 16 Oct 76. "Two large young" and "four large young" were seen by JL near the Herron Point Ford (sector 10) on 17 Oct 76.

Three large young were seen by JL south of Herron Point Ford (sector 10) on 13 Dec 76.

#### **Grey Teal *Anas gracilis***

"Two large young (flightless)" were seen by JL on the lower reaches of the Harvey River (sector 10) on 17 Oct 76.

#### **Australian Pelican *Pelecanus conspicillatus***

During the 17 Aug 76 pelican air survey there were 857 pelicans (counted from photographs) on Boodalan Island and 10 on Nirimba Cay (note that the Cay was shallowly covered by water during general air survey that morning). JL observed Boodalan Island from a position tens of metres off shore on 19 Aug 76 and recorded approximately 700 pelicans, noting: "Island covered by pelicans, most standing, nesting possible". Nirimba Cay was also viewed from a distance; no pelicans were seen.

During the 13 Oct 76 pelican air survey there were 24 pelicans on Boodalan Island and 680 (most counted from photographs) on and near (mainly near) Nirimba Cay. JL visited these islands on 16 October 76. There were no pelicans on Boodalan and "hundreds" on Nirimba Cay. After most moved off the Cay, there were "23 pelicans left standing on or over nests. Further 10 nests unattended".

During the 7 Dec 76 pelican air survey there were 8 pelicans on Boodalan Island and 778 (counted from photographs) near Nirimba Cay. GP inspected Boodalan Island on 7 Dec 76 during the swan survey. There was no nesting activity. On Nirimba Cay GP found "14 abandoned nests quite well made from feathers (primaries or secondaries) and weed but covered by a considerable amount of sand". JL visited the Island and Cay on 11 Dec 76 while conducting surveys of all waterbird species. He found only two pelicans and no signs of nesting on Boodalan, however there were 800 pelicans on Nirimba Cay.

[A note dated 12 January 1977 in JL's "Pelican nesting - Peel Inlet" file reads as follows. "Bert Wells visited Nirimba cay sometime during the last 3 days. There was a large number of pelicans on the cay however no sign of nesting - no scrapes, no eggs, chicks or eggshell remains"]

During the 15 Feb 77 pelican air survey there were no pelicans on Boodalan or Nirimba. GP inspected Boodalan Island on 15 Feb 77 during the swan survey. There were no indications of recent nesting activity. JL visited these sites on 19 Feb 77 while conducting surveys of all waterbird species. He found no pelicans on Boodalan and approximately 100 on Nirimba. There was no nesting activity.

During the 17 Apr 77 pelican air survey there were no pelicans on Boodalan Island, however there were 213 (counted from photographs) on Nirimba Cay. JL visited these sites on 21 Apr 77 while conducting surveys of all waterbird species. He found no pelicans on Boodalan and 51 on Nirimba. There was no nesting activity.

GP inspected Boodalan Island and Nirimba Cay on 13 June 77. There were no indications of recent nesting activity. Nirimba Cay was 100-150mm under water. JL visited the same sites on 18 Jun 77 while conducting surveys of all waterbird species and made similar observations.

APPENDIX 14. 1976-77 Peel-Harvey Estuary waterbird survey program.

TYPE /AREA OF SURVEY	AUG 76	OCT 76	DEC 76	FEB 77	APR 77	JUN 77
General aerial	Tu 17, JL	W 13, JL	Tu 7, JL	Tu 15, JL	Su 17, JL	M 13, JL
Pelicans aerial	Tu 17, JL	W 13, JL	Tu 7, JL	Tu 15, JL	Su 17, JL	M 13, JL
Egrets aerial	Tu 17, DM	-	-	-	-	-
Swans aerial (Harvey only)	Tu 17, JL	W 13, JL	Tu 7, JL	Tu 15, JL	Su 17, JL	M 13, JL
Swans by boat (Peel only)	Tu 17, GP	W 13, GP	Tu 7, GP	Tu 15, GP	Su 17, GP	M 13, GP
Swans by boat (Sector 10 only)	-	-	-	W 16, GP	Su 17, GP	-
Sector 1	W 18, JL	Th 14, JL	W 8, JL	W 16, JL	M 18, JL	W 15, JL
Sector 2a	W 18, JL	Th 14, JL	W 8, JL	W 16, JL	M 18, JL	W 15, JL
Sector 3	-	-	W 8, JL	W 16, JL	M 18, JL	W 15, JL
Sector 2b	W 18, JL	Th 14, JL	Th 9, JL	Th 17, JL	Tu 19, JL	Th 16, JL
Sector 4	-	-	Th 9, JL	Th 17, JL	Tu 19, JL	Th 16, JL
Inner Sector 6 (on foot)	-	F 15, JL	F 10, JL	F 18, JL	W 20, JL	F 17, JL
Outer Sector 6 (by boat)	Th 19, JL, GP	Sa 16, JL	Sa 11, JL	Sa 19, JL	Th 21, JL	Sa 18, JL
Sector 5	-	-	Sa 11, JL	Sa 19, JL	Th 21, JL	Sa 18, JL
Sector 10	Sa 21, JL	Su 17, JL	M 13, JL	Su 20, JL	F 22, JL	Su 19, JL

Notes

1. Cells in the above Table contain the day and date on which each sector was surveyed and the initials of the personnel who conducted each survey. DM=D.R. Munro, GP=G.B. Pearson, JL=J.A.K. Lane.
2. Rows have been arranged in chronological order to show the sequence of survey.
3. See section 4.2 of this report for descriptions of the Types and Areas of survey.

## APPENDIX 15. Results of Preliminary Surveys undertaken in 1975-76.

In 1975-76, J.Lane and G.Pearson conducted a number of preliminary surveys of the waterbirds of Peel-Harvey Estuary. The results of these surveys are presented below, together with results of two earlier air surveys (December 1974 and February 1975) of swans, pelicans and egrets.

Note that where "grebe" are referred to, most or all of these birds were Hoary-headed Grebe. The only other small grebe in Australia, the Australasian Grebe *Tachybaptus novaehollandiae*, was not recorded on Peel-Harvey Estuary at any time during the 1975-76 survey program or in preceding years (Appendices 16, 17). The much larger Great Crested Grebe *Podiceps cristatus* is readily distinguished from the Hoary-headed Grebe and has only been recorded in low numbers (relatively) on Peel-Harvey.

### JULY 1975

#### W 23 July 1975, Peel-Harvey

Conducted air survey (JL) of pelicans and egrets 1055-1205hrs. See Tables 2 and 3 below for results.

Conducted air survey (JL) of swans (except SE Peel Inlet) and other species 1205-...hrs. See Table 1 for swan results. Some significant observations of other species as follows: Photographed flock of 291 Eurasian Coot on west side of Harvey Estuary, level with tip of Harvey River delta (compare with ground count of 320 on 25 July 1975). Flock of 29 large white birds (believed to be 24 Australian White Ibis and 5 Yellow-billed Spoonbill) in Austin Bay. Approx 600 Grey Teal on east side of Peel Inlet and 450 at southern end of Harvey Estuary.

Table 1. Black Swan numbers on Peel-Harvey Estuary from December 1974 to April 1976. All numbers were obtained from coordinated boat and/or aerial surveys.

Date	Peel Inlet							Total	Harvey Estuary				Grand Total
	1	2	3	4	5	6	7		8	9	10	Total	
19 Dec 74	-	*	-	-	-	>78*	-	>78*	1	0	14	15	>94*
24 Feb 75	0	308	81	244	156	62	0	851	42	32	193	267	1118
23-4 Jul 75	0	5	0	0	0	446	0	451	0	0	29	29	480
29 Aug 75	0	61	0	0	0	1010	0	1071	3	0	0	3	1074
23 Sep 75	0	144	0	9	0	1896	0	2049	0	0	16	16	2065
22 Oct 75	0	0	16	220	0	2383	0	2619	0	0	54	54	2673
11 Nov 75	0	20	25	70	0	2179	0	2294	0	0	233	233	2527
16 Dec 75	0	315	0	102	0	1539	6	1962	12	0	114	126	2088
23 Jan 76	0	174	103	203	283	396	17	1176	127	40	552	719	1895
20 Feb 76	13	285	160	159	22	533	5	1177	85	218	695	998	2175
10 Mar 76	50	258	286	163	131	172	80	1140	0	111	500	611	1751
28 Apr 76	0	392	124	11	141	1392	33	2093	0	0	1500	1500	3593

\* Notes on the 19 December 1974 swan survey maps read: "Large concentrations of swans (total several thousands) seen in Robert Bay, Austin Bay, Yunderup [all sector 6] over extensive weed areas. No other concentrations elsewhere in Peel Inlet. Some swans here [Creery Lagoon - sector 2]. Didn't fly up channel [natural entrance channel to Peel-Harvey]". "Low number of swans [in Harvey Estuary] was surprising". "Both [Harvey Estuary pelican and swan counts] are accurate figures".

#### Th 24 July 1975, Peel Inlet (Field Notebook Extract)

Canoe survey of SE Peel Inlet by JL to count swans. See below and Table 1 for results. Also recorded some other species.

Point Birch, 1400-1505hrs: Black Swan (260), Swamp Harrier (1), Glossy Ibis (3), Great Egret (1), White-faced Heron (>1).

Robert Bay: Black Swan (186), Australasian Shoveler (male, female) at 1430hrs.

Coolup Drain mouth, 1600hrs: Yellow-billed Spoonbill (7), "thousands of grebe" nearby.

#### F 25 July 1975, Harvey Estuary

Survey of Harvey Estuary (south of Herron Point Ford) and lower Harvey River by JL by canoe from 1010-1420hrs:

Flock of 320 Eurasian Coot in bay on west side of Harvey River delta (compare with aerial count of 291 on 23 July 1975). Also a few coot in lowest 0.5km of Harvey River.

Ducks seen were: Grey Teal (estimate 800-900 in whole area surveyed), Musk Duck (single flock of 230 birds on west side of estuary; c20 just south of Herron Point, a few others scattered), Pacific Black Duck (c100-200), Australian Shelduck (c50-60), Australasian Shoveler (c20-30 mixed with teal and Black Duck), Hardhead (c10-20 mixed with teal and Black Duck on east side of estuary), Pink-eared Duck (one seen, could have been a few more), Black Swan (a few). Main duck concentrations were in shallows on east side of estuary (sedge islands providing sheltered waters) and in bays on either side of Harvey River delta.

Other waterbirds seen included: Red-necked Avocet (flock of 48 south of Herron Point), Purple Swamphen (one seen in Harvey River delta), Hoary-headed Grebe (a few), Little Grassbird (heard in rushbeds on west side of estuary), pelicans, cormorants, egrets, heron, Whistling Kite.

#### **Sa 26 July 1975, Peel Inlet**

Ground survey of east side of natural entrance to Peel Inlet, from old Mandurah traffic bridge to Creery Island by JL. Records included Common Greenshank, Little Egret (4 at north end of Creery marshes), White-bellied Sea-Eagle (one immature flying from Creery to Channel Island at 1200hrs).

#### **23-26 July 1975, "Peel/Harvey" (Field Notebook Extract)**

Species (34) list only: 23&24 July 75: "grebe", Australian Pelican, Little Black Cormorant, Great Cormorant, Little Pied Cormorant, Pied Cormorant, White-faced Heron, Great Egret, Australian White Ibis, Pacific Black Duck, Grey Teal, Hardhead?, Australian Shelduck, Musk Duck, Eurasian Coot, Black Swan, Silver Gull, Whistling Kite, Red-necked Avocet, Whiskered Tern ("c90 at 1610hrs"), Darter, Caspian Tern, Australasian Shoveler, Glossy Ibis, Yellow-billed Spoonbill (note that Swamp Harrier seen at Point Birch on 24/7 missing from this list, presumably by oversight). 25 July 75: Pink-eared Duck, Little Grassbird, Eastern Reef Egret, Purple Swamphen. 26 July 75: Common Greenshank, Little Egret, Crested Tern, White-bellied Sea-Eagle, Eastern Curlew.

### **AUGUST 1975**

#### **F 29 August 1975**

Conducted air survey of pelicans (JL) and egrets (GP) from 0855-1055hrs. Conducted air survey of swans (JL) on Peel Inlet only from 1025-1105hrs. Conducted air survey of pelicans (JL) and swans (JL; Harvey Estuary only) from 1206-1304hrs. Conducted air survey of pelicans (JL) and egrets (GP) from 1605-1705hrs. See Tables 1-3 for results. Some significant observations of other species as follows: Flocks of 14 and 5 Australian White Ibis and 7 Yellow-billed Spoonbills in Austin Bay during 1025-1105hrs survey. "Quite a few" Common Greenshank at north end of Channel Island during 1206-1304hrs survey.

### **SEPTEMBER 1975**

#### **M 22 September 1975**

Conducted air survey of pelicans (JL) and egrets (GP) at 0920-1045hrs, 1200-1325hrs and 1602-1725hrs. See Tables 2 and 3 for results. Some significant observations of other species as follows: Group of 3 White-necked Heron in bay on west side of Harvey River delta during 1200-1325hrs survey (JL).

Note that the 22 September 1975 (sector 10) White-necked Heron record is particularly significant as this species was not recorded during the 1976-77 Peel-Harvey surveys. This species was also recorded on 22 October 1975, again in sector 10.

#### **Tu 23 September 1975**

Conducted air survey (JL; 0925-1030hrs) of waterfowl and waders. Conducted survey on horseback (GP; 0930-1530hrs) of swans from Yunderup to Point Birch (and return). See Table 1 for results. Significant observations of other species by GP as follows: Group of 3 Glossy Ibis in Austin Bay.

Results of 0925-1030hrs air survey of waterfowl and waders were as follows.

- Sector 1:* No observations.
- Sector 2:* Australian Shelduck (<100), Grey Teal (c300) in Creery Lagoon. Banded Stilt (7) in lake of Creery Island.
- Sector 3:* Grey Teal (200-300 near mouth of Serpentine River).
- Sector 4:* No observations.
- Sector 5:* Australian Shelduck (2 adults plus ducklings).
- Sector 6:* Australian Shelduck (tens, c1000, tens), Pacific Black Duck (tens), Grey Teal (hundreds, c1000, hundreds), ducks (hundreds), Eurasian Coot (c1000), Red-necked Avocet (tens).

- Sector 7: Grey Teal (tens).  
 Sector 8: Australian Shelduck (26, 30).  
 Sector 9: No observations.  
 Sector 10: Australian Shelduck (10, tens, 15), Pacific Black Duck (tens), Grey Teal (tens).

General comments regarding results of this air survey: Noted only the most abundant species. Black Swan, Grey Teal and Australian Shelduck were the most abundant waterfowl species. Occasional pairs of Australian Shelduck with ducklings were seen, however far fewer than during August 1975 survey. The only waders seen during the entire air survey were seven Banded Stilt, tens of Red-necked Avocet, and some Common Greenshank, mainly around the Creery Island lagoon.

Table 2. Australian Pelican numbers on Peel-Harvey Estuary from December 1974 to June 1976. All numbers were obtained by aerial census.

Date	Start	Peel Inlet							Total	Harvey Estuary			Grand Total	
		1	2	3	4	5	6	7		8	9	10		Total
19 Dec 74	1400	-	-	-	-	-	-	16	>16	36	21	54	111	>127
24 Feb 75	1345	0	152	22	8	4	294	3	483	8	33	18	59	542
23 Jul 75	1055	0	68	57	62	3	322	1	513	2	23	2	27	540
29 Aug 75	0855	2	133	10	94	1	304	0	544	1	5	1	7	551
29 Aug 75	1206	1	58	1	141	0	412	0	613	0	1	2	3	616
29 Aug 75	1605	0	77	4	16	0	503	2	602	0	2	5	7	609
22 Sep 75	0920	6	62	6	220	50	268	16	628	0	21	10	31	659
22 Sep 75	1200	9	37	12	144	9	361	0	572	0	12	6	18	590
22 Sep 75	1602	8	68	4	79	28	425	7	619	1	16	7	24	643
22 Oct 75	1205	8	177	0	22	0	314	11	532	8	52	27	87	532
22 Oct 75	1605	9	167	3	2	3	441	7	632	0	21	24	45	677
11 Nov 75	1205	15	107	25	4	20	402	5	578	46	27	10	83	661
11 Nov 75	1600	6	84	0	3	30	498	0	621	12	8	25	45	666
15 Dec 75	1155													?
15 Dec 75	1600													?
16 Dec 75	0910	10	45	7	151	7	517	0	737	22	136	84	242	979
22 Jan 76	1221	0	42	2	22	17	629	35	747	15	88	83	186	933
22 Jan 76	1600	0	90	0	0	105	617	2	814	46	21	205	272	1086
19 Feb 76	1155	1	134	5	83	32	388	90	733	14	43	135	192	925
19 Feb 76	1555	0	216	11	16	16	439	112	810	0	19	168	187	997
10 Mar 76	1045	3	63	33	113	195	406	40	853	102	8	45	155	1008
27 Apr 76	1203	0	508	7	7	10	594	71	1197	3	10	25	38	1235
27 Apr 76	1603	0	273	33	0	36	428	0	770	0	0	19	19	789
17 Jun 76	1200	3	26	278	26	89	322	12	756	11	71	239	321	1077
17 Jun 76	1550	2	15	74	9	136	612	5	853	0	11	235	246	1099

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**W 24 September 1975**

Boat survey (JL) of natural entrance channel to Peel-Harvey from ocean mouth to Creery Island. Significant observations as follows: Greater Sand Plover (14), Grey Plover (1 with traces of breeding plumage), Red-necked Stint (1), Red-capped Plover (2) resting among rocks at entrance to new boat harbour at 0930hrs. Australian Shelduck (2 adults plus 6 downy ducklings), Osprey (1 roosting in dead tree) on east side of channel at 0950hrs. White-bellied Sea-Eagle (1 adult plumage roosting in tree) on east side at 1000hrs. Terek Sandpiper (1), Common Sandpiper (2) on edge of east shore. Little Egret (1) near south end of channel.

Canoe survey (JL) from west to east end of Creery lagoon: Whimbrel (5), Bar-tailed Godwit (some), Red-necked Stint (several hundreds), Sharp-tailed Sandpiper (flock of 25), Great Knot (some; possibly Red Knot also), Curlew Sandpiper (100), Banded Stilt (7). No further survey due to inclement weather.

**Th 25 September 1975**

Horseback survey (JL) from Yunderup to Coolup Drain and return during AM: Only waders seen were small group of Grey Plover on eastern shore. Tide high.

Horseback survey (JL) from Serpentine River to NW shore of Creery lagoon. Among many ducks near Serpentine River mouth were Australasian Shoveler (a few), Pied Oystercatcher (2). Finished 1600hrs.



## OCTOBER 1975

### **W 22 October 1975**

Conducted air survey (JL) of swans, other waterfowl and waders from 0935-1100hrs. Horseback survey (GP) of swans from Yunderup to Robert Bay (and return to Boggy Bay) from 0900-1400hrs. Conducted air surveys (JL) of pelicans from 1205-1310hrs and 1605-1720hrs. See Tables 1 and 2 for results. Some significant observations were: Four pairs of swans with cygnets in Harvey Estuary, south of Herron Point Ford, during 0935-1100hrs swan survey.

Results of 0935-1100hrs survey of other waterfowl and waders were as follows.

- Sector 1:* Not surveyed.  
*Sector 2:* Australian Shelduck (c40 in Creery lagoon). Waders were seen in two areas: northern samphire cove on west side of entrance channel; vicinity of Creery and Channel Islands.  
*Sector 3:* Australian Shelduck (a few), Grey Teal (c200), ducks (c50).  
*Sector 4:* Pacific Black Duck (c200, c25), Grey Teal (a few).  
*Sector 5:* Ducks (c50).  
*Sector 6:* "1000-2000 [mixed] Australian Shelduck, Grey Teal and Pacific Black Duck", Australian Shelduck (1000 at mouth of Coolup drain), ducks (three groups of unspecified size), waders (unspecified).  
*Sector 7:* No observations  
*Sector 8:* Australian Shelduck (10, 46).  
*Sector 9:* Australian Shelduck (12, 6), ducks (6).  
*Sector 10:* Australian Shelduck (7), White-necked Heron (1), Straw-necked Ibis (1), Red-necked Avocet (c50).

General comments regarding results of this air survey: Once again the major swan and duck concentrations were in Austin Bay. Most abundant ducks were Australian Shelduck, Grey Teal and Pacific Black Duck. Harvey Estuary was almost completely devoid of waterfowl. Flocks of waders were seen around the mudflats and shallows near Channel and Creery Islands, further down the channel, and around the saltmarsh just south of Yunderup. No waders at all were seen in Harvey Estuary (except some Common Greenshank).

Note that the 22 October 1975 (sector 10) White-necked Heron record is particularly significant as this species was not recorded during the 1976-77 Peel-Harvey surveys. This species was also recorded on 22 September 1975 in sector 10.

Table 3. Egret numbers on Peel-Harvey Estuary from February 1975 to June 1976. All numbers were obtained by aerial census.

Date	Start	Peel Inlet							Total	Harvey Estuary				Grand Total	
		1	2	3	4	5	6	7		8	9	10	Total		
24 Feb 75	1345	-	-	-	-	-	-	-	-	-	4	50	0	54	>54
23 Jul 75	1055	0	9	0	2	0	25	1	37	2	1	47	50	87	
29 Aug 75	0855	0	39	3	19	0	20	7	88	12	8	49	69	157	
29 Aug 75	1605	0	56	0	15	0	37	11	119	16	9	44	69	188	
22 Sep 75	0920	0	17	7	7	0	34	1	86	2	1	57	60	146	
22 Sep 75	1200	0	19	4	7	1	43	1	75	8	4	50	62	137	
22 Sep 75	1602	0	9	3	5	0	59	2	78	4	7	45	56	134	
15 Dec 75	1155	0	6	0	3	0	4	3	16	9	10	10	29	45	
22 Jan 76	1215	0	6	0	1	0	1	1	9	0	4	41	45	54	
22 Jan 76	1600	0	14	0	1	0	2	1	18	5	2	46	53	71	
23 Jan 76	0915	0	19	0	1	0	2	1	23	3	21	37	61	84	
19 Feb 76	1145	0	7	0	2	0	1	0	10	13	18	39	70	80	
19 Feb 76	1550	0	15	0	1	1	1	0	18	17	15	50	82	100	
17 Jun 76	1550	0	46	1	2	1	11	2	63	4	5	61	70	133	

The great majority of egret were undoubtedly Great Egret *Ardea alba*. It is probable, however, that some were Little Egret *Egretta garzetta*. Four Little Egret were encountered during ground surveys on 26 July 75; one on 24 September 75. White phase Eastern Reef Egret *Egretta sacra* have not been recorded on Peel-Harvey.

## NOVEMBER 1975

### **Tu 11 November 1975**

Conducted air survey (JL) of pelicans and swans from 1205-1335hrs. Horseback survey (GP) of swans from Yunderup to Robert Bay. Conducted air survey (JL) of pelicans from 1600-1710hrs. See Tables 1 and 2 for results.

### **Tu 18 November 1975**

Conducted air survey (JL) of waterfowl (other than swans) and waders from 0915-1030hrs.

- Sector 1:* c100 waders (probably Bar-tailed Godwit) on sand island.  
*Sector 2:* Thousands of waders in area between Channel Island and chain of samphire islands to the west. Australian Shelduck (c30), Pacific Black Duck (20) in Creery lagoon. Approx 20 waders near eastern entrance to Creery lagoon.  
*Sector 3:* Australian Shelduck (20), Grey Teal (c200), duck (30) near Serpentine River entrance.  
*Sector 4:* Pacific Black Duck (c100, c40), Grey Teal (flocks of c40, 50, 50).  
*Sector 5:* Pacific Black Duck (c30), waders (c50).  
*Sector 6:* Australian Shelduck (hundreds), Pacific Black (c1000, thousands), Grey Teal (c1000, thousands, c1000), waders (100s, c1000, unspecified), Banded Stilt (c200 in tight bunch), Red-necked Avocet (20, c200).  
*Sector 7:* Hundreds of Grey Teal and Pacific Black Duck.  
*Sector 8:* Australian Shelduck (24, 20, 12, 13, 6), Pacific Black Duck (20, 18, 4, 20, 10, 15), Grey Teal (c50, 5, 20), waders (c20).  
*Sector 9:* Grey Teal (8), ducks (c50), Common Greenshank (c30).  
*Sector 10:* Australian Shelduck (15, 10), Pacific Black Duck (c20, 15, c50), Grey Teal (c50, c500), ducks (20), Purple Swamphen (1), waders (c100), waders (c60; mainly Bar-tailed Godwit), Red-necked Avocet (c50, c70).

General comments regarding results of this air survey: Greatest duck concentrations were in Austin Bay, thousands of Pacific Black Duck and Grey Teal spread over whole bay, very shallow. The only large group of ducks in Harvey Estuary was 500 Grey Teal near Herron Point. The term "waders" refers to wader species other than stilt or avocet.

### **DECEMBER 1975**

#### **M 15 December 1975**

Conducted air survey of pelicans and egrets (GP) from 1155-... hrs. Conducted air survey of pelicans from 1600-... hrs. Results of pelican surveys missing. See Table 3 for results of egret survey.

#### **Tu 16 December 1975**

Conducted air survey (GP) of pelicans and swans from 0910-1050hrs. See Tables 1 and 2 for results.

### **JANUARY 1976**

#### **22 January 1976**

Conducted air survey of pelicans (GP) and egrets (GP) from 1221-1345hrs and 1600-... hrs. See Tables 2 and 3 for results. Some significant observations during 1221-1345hrs survey were: Bar-tailed Godwit (100+) near Stony Point (Harvey Estuary); thousands of ducks at Coolup Drain mouth.

#### **23 January 1976**

Conducted air survey of swans (GP) and egrets (GP) from 0920-1120hrs. See Tables 1 and 3 for results.

Some observations of other species were made by GP during 0920-1120hrs air survey. These are as follows.

- Sector 1:* Not surveyed.  
*Sector 2:* No observations.  
*Sector 3:* No observations.  
*Sector 4:* No observations.  
*Sector 5:* No observations.  
*Sector 6:* Ducks (400-500, unspecified). Three groups of hundreds of stilt (Pied?)  
*Sector 7:* No observations.  
*Sector 8:* Ducks (200-300).  
*Sector 9:* No observations.  
*Sector 10:* Grey Teal (1000), Eurasian Coot (200-300).

### **FEBRUARY 1976**

#### **19 February 1976**

Conducted air survey of pelicans (JL) and egrets (GP) from 1155-1300hrs and 1555-1720hrs. See Tables 2 and 3 for results.

## **20 February 1976**

Conducted air survey (JL) of swans on Peel-Harvey from 1030-1155hrs and boat survey (GP) of swans on Peel Inlet only from 1000-... hrs. See Table 1 for results.

Some significant observations during air survey were: Two groups of stilt (mixed Banded and Black-winged) totalling 1,873 birds (counted from photographs) and a third group of stilt estimated to contain 8-10x the number in the photos (thus 14,984-19,730 birds), in Austin Bay. Total of all three groups therefore estimated to be 16,857-20,603 stilt. Total of 6,475 ducks (mainly Grey Teal; counted from photographs) at mouth of Harvey River delta.

Some significant observations during boat survey were: Two groups (104 & 79) of White-faced Heron (total 183) in western parts of Creery marshes and entrance to Creery lagoon. Red-necked Avocet (30) and Bar-tailed Godwit (25) at Murray River delta.

## **APRIL 1976**

### **Tu 27 April 1976**

Conducted air surveys (JL) of pelicans from 1203-1321hrs and 1603-1705hrs. See Table 2 for results.

### **W 28 Apr 1976, Harvey Estuary**

Conducted air survey (JL) of swans and other waterbirds of Peel Inlet, eastern side and southern end of Harvey Estuary from 1015-... hrs. Counted swans at southern end of Harvey Estuary by boat at 1500-... hrs. See Table 1 for swan results. Other significant observations were: Two Royal Spoonbills feeding in shallows at edge of samphire island in Sticks Channel (Peel Inlet) at 0910hrs (not clear whether seen from ground or air).

Observations of other species made by JL during air survey were as follows.

- Sector 1:* No observations.
- Sector 2:* Single flock of Banded Stilt (1,475) photographed in shallows just east of eastern entrance to Creery lagoon.
- Sector 3:* Ducks (100; probably Pacific Black Duck), Red-necked Avocet (100, 100).
- Sector 4:* No observations.
- Sector 5:* Grey Teal (200), Red-necked Avocet (250).
- Sector 6:* Ducks (250, 100), Hoary-headed Grebe (1000s), stilt (50, 1000), stilt/avocet (500, 100), Red-necked Avocet (50).
- Sector 7:* No observations.
- Sector 8:* Grey Teal (350), ducks (50, 20, 70), Red-necked Avocet (20).
- Sector 9:* No observations.
- Sector 10:* Grey Teal (800, 60, c2000), ducks (1000, 40), Red-necked Avocet (200, 50, 20).

Field Notebook Extract: 1500hrs. Bay on west side of Harvey River delta: Black Swan (1,000), Great Crested Grebe (>50). Bay on east side of Harvey River delta: Black Swan (500). "Counted from boat".

## **JUNE 1976**

### **Th 17 June 1976**

Conducted air survey (JL) of pelicans from 1200-1316hrs and air survey (JL) of pelicans and egrets from 1550-1700hrs. See Tables 2 and 3 for results.

## **APPENDIX 16. Miscellaneous observations of Peel-Harvey waterbirds from 1971 to 1974.**

The following miscellaneous observations made by J.A.K. Lane have been extracted from his field notebooks and are reported here to make them readily accessible for future reference. The only observations (from those notebooks) not reported here are some of pelican nesting attempts on islands of Peel Inlet during this period (1971-74). They will be presented in a later report on pelican nesting. All species in this Appendix were also recorded in 1976-77.

### **9 February 1971, Peel Inlet**

Commencing 1500hrs, proceeding southwards along the eastern side of Peel-Harvey's [natural] entrance channel. Darter, Little Pied Cormorant (4+), Great Cormorant, Little Black Cormorant, White-faced Heron (4) in dead trees (casuarinas) at edge of samphire marsh. Grey Teal (2), White-faced Heron (1) in marsh. Common Greenshank (1), Grey Plover (3), Common Sandpiper (2), Great Egret (1) at edge of channel. Also Caspian Tern (3). Black Swans (70) feeding and loafing on water between northern tip of Channel Island and mainland.

White-faced Heron (28), Common Greenshank (120) in western entrance channel to Creery lagoon. Black-winged Stilt (50), Sharp-tailed Sandpiper (600), Red-capped Plover (15), Common Greenshank (1), White-faced Heron (1) along shoreline/shallows from (and partly including) Creery Island to mouth of Serpentine River. Black Swan (>1200), Grey Teal (100), Australian Pelican (100) over shallows extending south of this shoreline.

Australian Pelican (150), Little Black Cormorant (500), Grey Teal (20) on point at mouth of Serpentine River. Black Swan (5), Pacific Black Duck (4), Great Egret (1), Red-necked Stint (400), Sharp-tailed Sandpiper (14), Red-necked Avocet (30), Red-capped Plover (2) nearby (west). Red-necked Avocet (140), Red-necked Stint (150), Sharp-tailed Sandpiper (a few), Silver Gull (few hundred) on sand flats of Serpentine River delta.

Red-necked Avocet (350), Red-necked Stint (100), Sharp-tailed Sandpiper (4), Curlew Sandpiper (2), Red-capped Plover (30), Darter (1), Great Egret (1), White-faced Heron (2), Grey Plover (2), Banded Stilt (1), Black Swan (18), Caspian Tern (10), Common Greenshank (2), cormorant on western shoreline/shallows of Murray River delta. Hundreds of cormorant in trees of Murray River delta.

### **10 February 1971, Peel Inlet**

Commencing 1700hrs. Grey Teal (500), Australian Shelduck (100), Pacific Black Duck (40), Great Egret (2), Common Greenshank (1), Banded Stilt (at least 350), Black-winged Stilt (130) in Boggy Bay. Black Swan (80), Australian Pelican (42), Silver Gull (800), Australian Shelduck on delta at mouth of Coolup Drain. Black Swan (140), ducks (many) east of Coolup Drain.

### **15 February 1971, Harvey Estuary**

1030hrs. Mealup Point: Grey Teal (100), Red-necked Avocet (40), Maned Duck? (4), "waders" (2), Common Greenshank (1), Little Pied Cormorant (2), Little Black Cormorant (1), Pacific Black Duck (4), Red-necked Stint (3), White-faced Heron (1), Eurasian Coot (10), Great Egret (1).

1200hrs. "1/3 mile north of hut at position 1": Common Greenshank (8).

1230hrs. Bay south of Stony Point: Grey Teal (200), Australian Shelduck (1), Red-necked Stint (30), Common Greenshank (8).

Stony Point: Australian Pelican (4), Caspian Tern (4), Crested Tern (2), Red-necked Stint (10), cormorants.

1630hrs. "Canal" [presumably the drain] south of Mealup Point: Grey Teal (300), Australian Shelduck (5), Red-necked Avocet (30), Black-winged Stilt (5), Common Greenshank (7), Caspian Tern (1).

1700hrs. White Point: Grey Teal (many), Red-necked Avocet (300), Black-winged Stilt (20), Black-tailed Godwit (20), White-faced Heron (2), Australian Shelduck (4), Common Greenshank (8).

### **16 February 1971, Harvey Estuary**

1100hrs. North side of Herron Point: Red-necked Avocet (44), Common Greenshank (1).

Along the edge of the marshes north of Herron Point: Red-necked Avocet (20), Greenshank (9), Sharp-tailed Sandpiper (1), White-faced Heron (1).

"North Edge": Red-necked Avocet (30), Black-winged Stilt (20), Red-necked Stint.

### **17 February 1971, Peel Inlet or Harvey Estuary**

Location unspecified: Sharp-tailed Sandpiper (4), Grey Teal (2), Black Swan (4), Little Pied Cormorant (1), Silver Gull (25).

### **1 April 1972, Peel Inlet**

Inspected (by canoe) islands (3) being created by dredging of entrance channel to Yunderup Canals. Birds on these islands were: Silver Gull, Crested Tern, Caspian Tern, Fairy Tern. "Also seen on Peel Inlet" were: Red-necked Stint, Australian Pelican, Grey Plover, Little Pied Cormorant, Little Black Cormorant, Black Swan, Common

Greenshank, Sharp-tailed Sandpiper, Curlew Sandpiper, Black-winged Stilt, Red-capped Plover, White-faced Heron, Grey Teal, Pacific Black Duck.

**14 October 1972, Peel Inlet**

Visited the natural entrance channel south of the [old] Mandurah traffic bridge, Creery and Channel Islands, Boggy Bay, Robert Bay, "Placid Waters". Recorded: "6 Whistling Kites flying up and down Creery Island", Straw-necked Ibis (2), Great Egret, Pacific Black Duck, Australian Shelduck, Black Swan ("very many"), Red-capped Plover, Little Black Cormorant, Great Cormorant, Little Pied Cormorant, Pied Cormorant, White-faced Heron, Silver Gull and "note that no other species of waders were seen".

**June 1973, Peel Inlet**

Australian Pelican (c12), Whistling Kite ("10-20"), Osprey (1), Common Greenshank (7) recorded at Creery Island.

**30 June 1973, Peel Inlet**

Australian Pelican, Black Swan, Grey Teal, Silver Gull recorded at Nirimba Cay at 1625hrs.

**25 July 1973, Peel Inlet**

"At least 3,000 Eurasian Coot were in huge flock in water of Point Birch area. Also saw Black Swan, Pacific Black Duck, some Hoary-headed Grebe and at least one Great Crested Grebe out in the Inlet. Small flock of Hoary-headed Grebe feeding on surface of water close to shore. Appeared to be darting about catching insects on the surface of the water".

**22 August 1973, Peel Inlet**

Australasian Shoveler (6), Black Swan, Australian Pelican, Caspian Tern (26), Crested Tern (1), Silver Gull (63) and 110 terns (Fairy/Whiskered) at Nirimba Cay at 1230hrs.

**25 August 1973, Peel Inlet**

Great Knot (6) on Nirimba Cay at 1045hrs – "some had traces of breeding plumage".

**19 September 1973, Peel Inlet**

Visited Nirimba Cay at 1300hrs. Recorded Common Greenshank (2), Red-necked Stint (7), Caspian Tern, Fairy Tern, Whiskered Tern, Silver Gull, Australian Pelican.

**23 October 1973, Peel Inlet**

"Thousands of stint and sandpiper feeding in pools of decaying weed in Boggy Bay. A number of Sharp-tailed Sandpiper were seen in the flocks".

**12 March 1974, Harvey Estuary**

Grey-tailed Tattler (3) feeding and roosting near shoreline at Dawesville at 1320hrs.

## APPENDIX 17. Preliminary observations of Peel-Harvey waterbirds in 1969-1970.

In December 1969 and January 1970, J.A.K. Lane (as a Cadet Research Officer with the Department of Fisheries and Fauna) visited several locations around Peel-Harvey Estuary making bird observations. These visits were made on 10-11 December and 4-6 January. A three page report, titled "Preliminary survey of Peel Inlet and Harvey Estuary", dated 17 April 1970, was prepared. Two extracts follow below. Currently accepted (Christidis & Boles 1994) bird names have been substituted for names used at that time. Words in square brackets have been added for explanation. Note that all species referred to in this Appendix were also recorded during 1976-77.

"A chain of these [samphire] islands extends along the edge of reserves 4990 and 24036 [south-eastern Peel-Inlet]". "These samphire islands are very important feeding and roosting grounds for short-beaked waders. Large flocks of Red-necked Stint, Red-capped Plover and Sharp-tailed Sandpiper gather on the islands in the late afternoon. They feed along the waters edge and at dusk, gather amongst the samphire clumps to roost for the night. Estimates of bird numbers as they ran through the samphire were impossible. There were however several thousands. Further out into the inlet from these islands flocks of at least nine hundred Black Swans gather to feed and roost in the shallow water. The shoremost 50-100 yards [from Yunderup to Point Grey] which are permanently exposed [impression based on Dec 1969 / Jan 1970 visits] are almost completely barren of bird life, small groups of Red-necked Stint and Red-capped Plover feeding occasionally along the waters edge".

"The area [sub-littoral sandflats offshore from the Murray River delta] is ... a feeding ground for the long-beaked waders (Red-necked Avocet, Black-winged Stilt, Banded Stilt, Bar-tailed and Black-tailed Godwits and Common Greenshanks), hundreds of Red-necked Avocets feeding there regularly. Short-beaked waders also feed along the shores edge".

Selected field data collected during the December 1969 and January 1970 visits are as follows.

### 10 December 1969, Peel Inlet

Robert Bay: Red-capped Plover, Red-necked Stint, Banded Stilt.

### 4 January 1970, Peel Inlet

1715hrs. "red sands" south of Yunderup: Red-capped Plover (large number), Greater Sand Plover (3), Sharp-tailed Sandpiper (large number) all "resting on samphire island". Red-necked Stint (100) at "edge of island". Black Swans (900) "resting in leg depth water". Australian Pelican (54) "resting on south island". Australian Shelduck (5) "resting".

### 6 January 1970, Harvey Estuary

0645-0745hrs. Mealup Point: Black-winged Stilt, Sharp-tailed Sandpiper, Bar-tailed Godwit.

1115-1145hrs. From Herron Point to the south: Sharp-tailed Sandpiper (13), Red-capped Plover, Red-necked Stint (20), Common Greenshank (c3), Black-winged Stilt (c15), Red-necked Avocet (c5), Grey Plover (4).

1240hrs. Bay on east side of Harvey River delta: Black Swan (184), ducks (c200), Great Egret (3).

1600hrs. Warrungup Spring, west bank of Harvey Estuary: Black-winged Stilt (33), Bar-tailed Godwit (5), Sharp-tailed Sandpiper (25), Red-necked Avocet (1), White-faced Heron (1).

[Department of Transport 1:25,000 hydrographic chart WA 848 of October 1996 shows Warrungup Spring located south of Dawesville townsite and bears the notation: "The water which breaks from the limestone on the foreshore runs undiminished into the estuary all year round. A taste of this water will convince the most sceptic of its palatable quality, though it goes a little brackish in summer months. At times it gushes out from the hillside"].

APPENDIX 18. Extract from Department of Fisheries and Wildlife's 1976 recommendations to the EPA's Conservation Through Reserves Committee concerning "System 6".

Comment 21

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PEEL-HARVEY ESTUARY

Peel-Harvey Estuary supports large populations of a wide diversity of waterbird species. As a conservation area for waterbirds it is probably the most important estuary in South-Western Australia.

To date more than 60 species of waterbirds have been recorded on the estuary. Of these, 17 are summer migrants from the northern hemisphere. The remainder have their breeding grounds within Western Australia.

Some of the most outstanding features of the Peel-Harvey's birdlife are:

1. Pelicans. Peel Inlet is the only estuary in Western Australia which has a breeding colony of Pelicans (*Pelecanus conspicillatus*). This colony is one of only 9 which are known to exist in W.A., and is the only colony occurring south of Shark Bay. Peel-Harvey Estuary has the largest pelican population of any estuary in the south-west of the state; in January 1976 more than 1 000 birds inhabited the estuary. The Peel-Harvey population represents approximately 60% of the total number of pelicans known to occur on all estuaries of the south west.
2. Waterfowl. (Ducks and Swans.) On a regular basis, the Peel-Harvey estuary supports larger waterfowl populations than any other estuary in the south-west. Grey Teal (*Anas gibberifrons*), Black Duck (*Anas superciliosa*) and Mountain Duck (*Tadorna tadornoides*), are the most abundant duck species, and during the summer of 1975-76 their numbers reached a peak estimated at 8-10 000 birds.

Black Swan (*Cygnus atratus*) are also abundant. A 3-day aerial survey of all south-west estuaries in November 1975 revealed that the Peel-Harvey Estuary, with a population of more than 2 500 birds, supported 41% of the total south-west estuaries swan population.

The most important areas of waterfowl habitat are the extensive shallows around the southern and eastern shores of Peel Inlet, and Harvey Estuary south of Herron Point. The Harvey River Delta area is of particular importance during late summer as many thousands of ducks congregate on its banks. The shallows of the northern shore of Peel and the eastern shore of Harvey are also significant as waterfowl habitats.

3. Wading Birds. Many thousands of resident and migratory wading birds inhabit the Peel-Harvey Estuary. Migratory species are present in large numbers from October to April and resident species from midsummer to late autumn.

Peel Inlet supports larger populations of Banded Stilt (*Cladorhynchus leucocephalus*) and Pied Stilt (*Himantopus himantopus*) than any other estuary in the south-west. Total numbers were estimated (from aerial photographs) at 15-20 000 in February 1976. Most of the stilts were in Austin Bay.

Though accurate surveys of migratory wader populations have not been made, Peel-Harvey Estuary appears to support larger numbers of these birds than any other estuary in the south-west, with the possible exception of Wonnerup-Vasse.

The most important areas of wader habitat are the extensive shallows and marshes of the northern, eastern and southern shores of Peel and the eastern shoreline of Harvey Estuary.

CONFLICTING LAND USE

The Peel-Harvey Estuary's great value to waterbirds is threatened by increasing pressures of human useage and development. Shoreline subdivisions and increased boating will both reduce the area's value for conservation.

This conflict may be largely overcome by reserving suitable areas of shoreline and estuary, under the Land Act and Section 30 of the Fisheries Act.

RECOMMENDATIONS

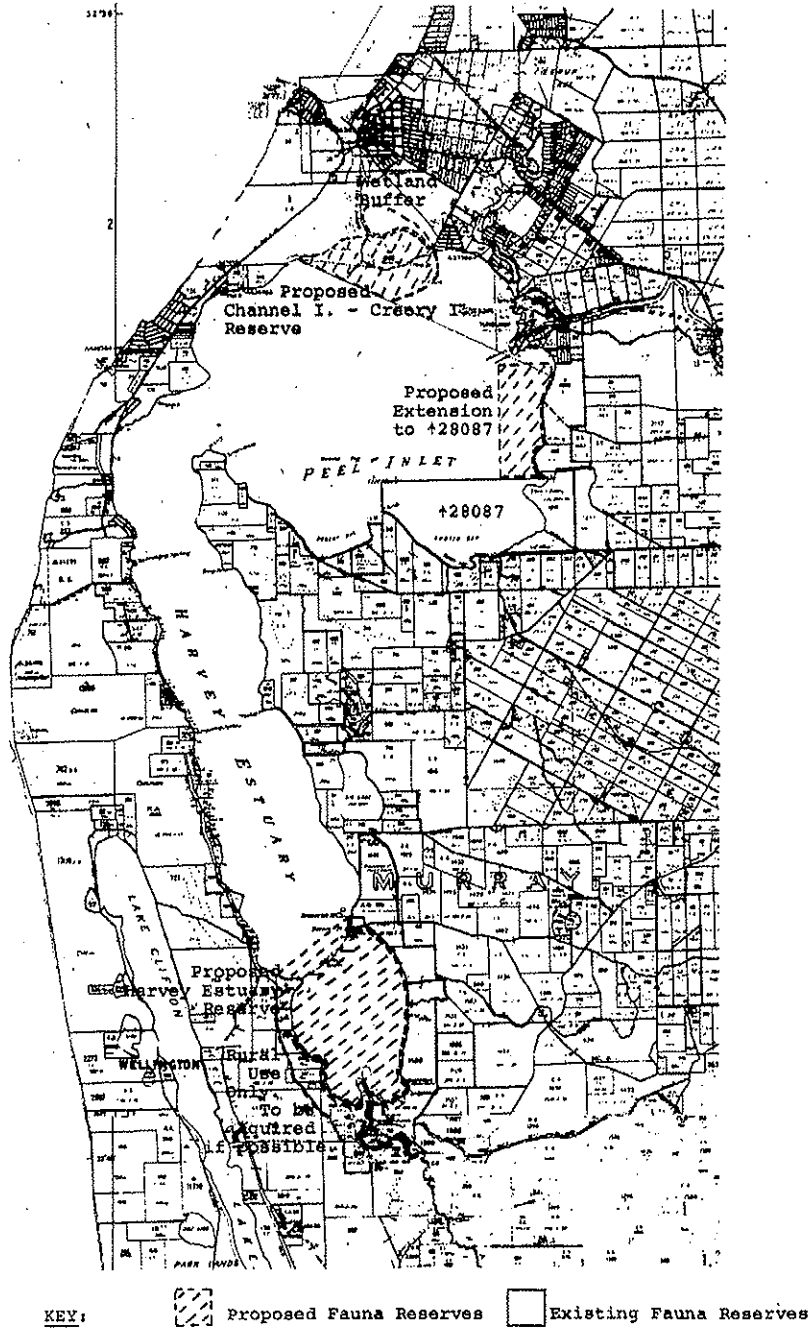
1. The area surrounding Channel and Creery Islands, as outlined in the map, should be reserved for Conservation of Flora and Fauna and as an aquatic reserve. The reserve should be classified as Class A and vested in the Western Australian Wildlife Authority.
2. If the private property (presently rural) to the north of Creery Island is subdivided, the wetland portion should be retained in its natural state to act as a buffer between the development and the proposed fauna sanctuary.
3. Reserve No. 28087 should be regazetted as a Class A aquatic reserve and its boundaries should be extended to include that part of the eastern shore of Peel Inlet which adjoins Reserve No. 4990 (see map).
4. An aquatic reserve should be created to include the southernmost waters of Harvey Estuary below and including Heron Point Ford. The reserve should be for the purpose Conservation of Flora and Fauna and vested in the Western Australian Wildlife Authority.
5. Part of Reserve No. 2990 (on the western side of the Estuary) should have its purpose changed from Recreation and Camping to Conservation of Flora and Fauna and should also be vested in the Western Australian Wildlife Authority.
6. Uses other than rural of freehold properties adjoining the western shore of the proposed reserve on Harvey Estuary should not be permitted; the land should be acquired if possible and reserved for Conservation of Flora and Fauna.



APPENDIX 18. Continued.

Comment 21: PEEL INLET AND HARVEY ESTUARY

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APPENDIX 19. Extract from Department of Fisheries and Wildlife's 1981 response to the System 6 "Green Book". C50 is a reference to the Green Book recommendations for Peel Inlet.

Attachment 4  
(Refers to C50)

Importance of Channel and Creery Islands and Surrounds,  
and the Channel (C50)

The area is of great value to wildlife and is considered to be one of the three most important parts of the Peel and Harvey estuaries as waterbird habitat.

Because of their shallow and extensive nature, the pools, lakes and lagoons of the Creery Island area are particularly important as feeding-grounds for wading birds. Flocks of 60 white egret and more than 180 white-faced heron have been recorded. A small population of little egret, a species rarely recorded south of the Kimberley, also inhabits the area. Thousands of migratory and non-migratory waders of many species utilise the area for feeding. Banded stilt frequent the shallows in flocks up to 12 000 birds. On present knowledge, Peel Inlet is the most important site in south-western Australia for this species.

Waterfowl (mainly grey teal, black duck, mountain duck and black swan) make use of the area and flocks of thousands occur at various times of the year.

Pelicans have also nested on Creery Island in the past and may well do so again, as the two other sites on Peel Inlet where breeding has occurred are now unsuitable. Peel Inlet is the only pelican breeding-place in the southern half of Western Australia.

The salt marshes and lagoons of the channel area are the only place in south-western Australia that are known to be regularly frequented by the two largest species of migratory wader: eastern curlew and whimbrel. Other uncommon waders can also be seen here.

APPENDIX 19. Continued.

